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VOLUMES I & II OF II

Final Technical Memorandum

Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California

Volume I

Contract No. N62467-98-D-0995
Task Order 0065

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June 2009

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Final Technical Memorandum:
Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity,
Former Mare Island Naval Shipyard, Vallejo, California
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June 2009

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June 19, 2009

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Subject: **Contract No. N62467-98-D-0995, Contract Task Order (CTO) 0065**
Final Technical Memorandum: Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated June 2009
Document Control Number: HILL-0995-0665-0024

Dear Ms. Silva:

CH2M HILL Constructors, Inc. (CCI) is pleased to submit for your Administrative Record the Final Technical Memorandum: Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated June 2009.

In accordance with the requirements specified in NAVFAC SW Environmental Work Instruction EVR.4 (May 2007), we are submitting one (1) bound hardcopy each of Volume I and Volume II, one (1) unbound hardcopy of each volume, and two (2) CDs, each containing the original source files in their native applications along with a PDF version of the combined Volumes I and II. The Document Control Number is indicated on the covers of the hardcopies and the CDs, and also on the CD labels.

Please contact me at 425-233-3415 if you have any questions or concerns.

Sincerely,

CH2M HILL CONSTRUCTORS, INC

Jim Boone, P.E.
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Executive Summary

This Technical Memorandum (TM) addresses the nature, extent, and mobility of free-phase petroleum hydrocarbons in soil at the former Defense Reutilization and Marketing Office (DRMO) Site and vicinity within the former Mare Island Naval Shipyard (MINS), Vallejo, California. This TM was prepared by CH2M HILL for the U.S. Department of the Navy (Navy).

This TM is the updated version of the *Draft Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard (MINS), Vallejo, California*, which was issued by the Navy in April 2007. A Follow-on Investigation, which consisted of two field investigations and a geophysical survey, has been completed since the Draft TM was published, and the activities and findings of these investigations have been incorporated into this Final TM.

The Draft TM reviewed the activities and findings of nine historical investigations that included petroleum-related components and were conducted from 1995 through early 2007. Findings relevant to petroleum contamination at the DRMO Site and in the vicinity were reviewed; gaps in information and data needed to establish the nature, extent, and mobility of free-phase petroleum hydrocarbons in soil were identified; and the Follow-on Investigation was conducted in 2007 and 2008. In late 2007, a field investigation was performed primarily to provide information about the occurrence of free-phase petroleum hydrocarbons in subsurface soil along Azuar Drive, Dump Road, and the western portion of the Eastern Early Transfer Parcel (EETP) owned by Lennar Mare Island (LMI). The purpose of this field investigation was to establish whether a contiguous layer of free-phase petroleum hydrocarbons extends across the roads and into the EETP. Free-phase petroleum hydrocarbons were found on both sides of the EETP boundary along sections of Azuar Drive. A separate area of free-phase petroleum hydrocarbons was also found on both sides of Dump Road.

A geophysical survey was conducted early in 2008 to gather information about the hypothesis that scrap metal debris forms preferential migration pathways. A map developed during the survey shows the gross accumulations and lateral extents of metallic debris in subsurface soil along and adjacent to Azuar Drive and Dump Road. The survey indicated that scrap metal layers observed in subsurface soil along the roads are not laterally contiguous. This finding was later confirmed by additional direct observations of subsurface soil in 2008.

The final phase of the Follow-on Investigation was conducted later in 2008 to meet objectives for five field data collection categories: forensic chemistry analysis, the vertical extent of free-phase petroleum hydrocarbons, the lateral extent of these hydrocarbons, confirmation of the 2008 geophysical survey results, and potential migration pathways.

The findings of this investigation were used to define the vertical and lateral extent of free-phase petroleum hydrocarbons for this TM. The conceptual site model (CSM) of the DRMO Site and the vicinity was updated based on this information. As discussed below, free-phase

petroleum hydrocarbons have been observed in bulk metal debris and coarse-grained geologic material, as well as within fractures and root structures of fine-grained geologic material. It should be noted that the future designation of removal areas may differ from the vertical and lateral extent of free-phase petroleum hydrocarbons presented in this TM when factors such as fine-grained soil fractures, vegetative structures, and incidental occurrences are included in removal action evaluations.

The physical characteristics of the free-phase petroleum hydrocarbons found beneath the DRMO Site and vicinity have been generally consistent. The material is visually apparent as a black, viscous liquid. It is typically observed in the spaces surrounding buried metal debris and coarse-grained geologic material, and is also found within fractures and root structures of fine-grained geologic material. The chemical signature is that of a heavy fuel oil (HFO) such as Bunker C fuel oil. The dynamic viscosity, or internal resistance to flow, of HFO is approximately 5 orders of magnitude greater than that of water. High viscosity, lack of driving pressure, and the fine-grained nature of silts and clays at depths where HFO has been observed indicate low mobility in soil. This supports the predominant occurrence of HFO in layers of subsurface scrap metal debris, where pore spaces are significantly more extensive than in fine-grained soil.

Historical and other documents proposed the perforated piping (also referred to as the oil discharge line) formerly connected to the Oil Sump Box (OSB) to be the probable source of HFO contamination at the DRMO Site and in the vicinity on both Navy and LMI property. The OSB was located within the Azuar Drive HFO. Evaluation of visual observations, geophysical data, and forensic chemistry data indicates that the previous OSB source hypothesis is incorrect. The former OSB was not the source of HFO found along Dump Road according to the information obtained during the Follow-on Investigation. The Dump Road HFO and the Azuar Drive HFO are physically separate and chemically distinct. Preferential migration pathways between the Azuar Drive and Dump Road HFO are not present. No remaining indications of a source of the HFO along Dump Road were found. This could mean that HFO found in this area was the result of intermittent and separate spills and releases.

Findings indicate that the former OSB was a source of HFO contamination on the Navy side of Azuar Drive. The OSB was not found to be the origin of HFO at two locations on the LMI side of Azuar Drive southeast of the OSB. Findings were inconclusive as to the OSB being the origin of HFO found at a third point to the southeast. The CSM of the DRMO Site and the vicinity was revised to illustrate site conditions and the distribution of HFO in soil based on the findings and conclusions presented in this TM.

HFO in soil was not found to be mobilizing through exposure pathways to known human or ecological receptors. The results of an historical human health risk assessment conducted for the DRMO Site showed that although occurrences of motor-oil-range total petroleum hydrocarbons (TPH-motor oil) and TPH-diesel are extensive in soil at the site and in the vicinity at concentrations above comparison criteria, they are not associated with significant potential risk because TPH-motor oil and TPH-diesel do not contribute significantly to the total estimated cancer risk or hazard index for the site. The findings of an historical ecological risk assessment were that the DRMO Site is paved, covered with gravel, and contains buildings, and therefore does not provide habitat for ecological receptors. As this

area is designated for future commercial use per the Mare Island Final Reuse Plan, the DRMO Site will not provide such habitat in the future.

The information presented in this TM will be used to develop a Petroleum Corrective Action Program for a removal action. The Navy will continue to work cooperatively and concurrently with LMI as the corrective action process moves forward. Current plans call for a petroleum removal action on the Navy DRMO Site later in 2009.

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G Documentation from the 2008 Geophysical Survey

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I Analytical Data Validation Reports for the 2007-2008 Follow-on Investigation

J Chemical Forensic Evaluation Report for the 2007-2008 Follow-on Investigation

K Stakeholder Review Comments on the Draft Final Technical Memorandum (March 2009) and Navy Responses

Acronyms and Abbreviations

ASTM	American Society of Testing and Materials
bgs	below ground surface
BRAC	Base Realignment and Closure
BTEX	benzene, toluene, ethylbenzene, and xylenes
Cal/EPA	State of California Environmental Protection Agency
CAM	California Assessment Manual
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COC	chain of custody
COPC	Chemical of Potential Concern
CPT	cone penetrometer test
CSM	conceptual site model
CTA	Crane Test Area
DCC	data collection category
DHS	Department of Health Services
DRMO	Defense Reutilization and Marketing Office
DRO	diesel-range organics
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
EETP	Eastern Early Transfer Parcel
EM	electromagnetic
EPA	Environmental Protection Agency
ESL	Environmental Screening Level
FS	Feasibility Study
FSA	Fenced Scrapyard Area

FS/RAP	Feasibility Study/Remedial Action Plan
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectometry
GMS	U.S. Department of Defense Groundwater Modeling System
GPR	ground-penetrating radar
gpm	gallon(s) per minute
HFO	heavy fuel oil
HI	hazard index
IA	Investigation Area
IDW	investigation-derived waste
IR	Installation Restoration (site)
IRMS	Isotope Ration Mass Spectrometry
IRP	Installation Restoration Program
LIF	laser-induced fluorescence
LMI	Lennar Mare Island
MDL	method detection limit
MEC	Munitions and Explosives of Concern
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MINS	Mare Island Naval Shipyard
MSL	Mean Sea Level
NIRIS	Naval Installation Restoration Information Solution
NTCRA	Non-Time-Critical Removal Action
OSB	Oil Sump Box
OU	Operable Unit
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, comparability, and completeness
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl

PMO	Program Management Office
POL	petroleum, oil, or lubricants
PRC	PRC Environmental Management
PWCSD	U.S. Department of the Navy Public Works Center San Diego
QA	quality assurance
QC	quality control
RAP	Remedial Action Plan
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent deviation
RWQCB	California Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SCAPS	Site Characterization and Analysis Penetrometer System
SDG	sample delivery group
SIM	Selected Ion Monitoring
SOW	scope of work
SOW	Statement of Work
STLC	Soluble Threshold Limit Concentration
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TCG	Target Cleanup Goal
TCLP	Toxicity Characteristic Leaching Procedure
TM	Technical Memorandum
TPH	total petroleum hydrocarbons
TPH-diesel	diesel-range total petroleum hydrocarbons
TPH-gasoline	gasoline-range total petroleum hydrocarbons
TPH-motor oil	motor-oil-range total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
TtEMI	Tetra Tech EM Inc.
TTLC	Total Threshold Limit Concentration

U.S. EPA	U. S. Environmental Protection Agency
UV	utility vault
VMG	vertical magnetic gradient
VOC	volatile organic compound
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter

1.0 Introduction

This Technical Memorandum (TM) addresses the nature, extent, and mobility of free-phase petroleum hydrocarbons in soil at the former Defense Reutilization and Marketing Office (DRMO) Site and the vicinity within the former Mare Island Naval Shipyard (MINS), Vallejo, California. This TM was prepared by CH2M HILL for the U.S. Department of the Navy (Navy).

This TM is the updated version of the *Draft Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard (MINS), Vallejo, California*, which was issued by the Navy in April 2007. A Follow-on Investigation, which consisted of two field investigations and a geophysical survey, has been completed since the Draft TM was published, and the activities and findings of these investigations have been incorporated into this Final TM.

This section provides an introduction to the TM by presenting the purpose for its development, reviewing the DRMO Site's background and characteristics, summarizing historical investigations and cleanup actions, and describing how the TM is organized. These topics are discussed in the subsections listed below:

- Section 1.1, Purpose
- Section 1.2, DRMO Site Background
- Section 1.3, Site Development History
- Section 1.4, Site Characteristics
- Section 1.5, Overview of Historical Investigations and Cleanup Actions
- Section 1.6, Organization of this Technical Memorandum

1.1 Purpose

Portions of subsurface soil in areas beneath the DRMO Site and in the vicinity are contaminated by free-phase petroleum hydrocarbons. The purpose of this TM is to describe the nature, extent, and mobility of those free-phase petroleum hydrocarbons.

The Navy is currently conducting a Remedial Investigation/Feasibility Study (RI/FS) to address contaminants regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Navy is addressing petroleum contamination in soil separately from CERCLA investigations and cleanup actions at the DRMO Site. These petroleum-related cleanup actions are regulated by the State of California Environmental Protection Agency (Cal/EPA), acting through the Department of Toxic Substances Control (DTSC), and the California Regional Water Quality Control Board (RWQCB), San Francisco Bay Region.

1.2 DRMO Site Background

The DRMO Site is located in the north-central portion of Mare Island and is a trapezoid of approximately 8 acres located in the southwest corner of the intersection of Azuar Drive (formerly Cedar Avenue) and Dump Road (see Figure 1). An asphalt-paved area is to the south of the site, and an unpaved grassland area with a dirt access road to a former truck maintenance area is to the west; these areas are currently Navy property.

A 4.6-acre area within the DRMO Site was formerly used as a scrapyard and is referred to as the Fenced Scrapyard Area (FSA; see Figure 1). The remainder of the DRMO Site consists of land along the northern, western, and southern boundaries of the FSA. Historical uses of the DRMO Site included storage of transformers, batteries, metal scrap, and pesticides for maintenance purposes; paper bailing; and handling of petroleum and waste oils. Sixteen scrap storage bins were formerly located in the southern portion of the scrapyard, and a demilitarization storage area was located north of the bins. The scrapyard, which began operation in the early 1940s, also handled surplus material and scrap from MINS and other military facilities until mid-1995, when the remaining inventory was removed and the scrapyard was closed.

No underground storage tanks or petroleum distributions systems were located within the DRMO Site. Underground utilities of various types have been and are present in the area as discussed in Section 1.4.

A variety of investigations and cleanup actions have been conducted at the DRMO Site and in the vicinity since 1981. As described in the later sections of this TM, ten of the investigations (nine historical investigations and the Follow-on Investigation in 2007 and 2008) have included activities and findings related to petroleum contamination.

1.3 Site Development History

The area occupied by the DRMO Site and the vicinity was originally submerged land offshore of the original shoreline of Mare Island. Filling of these areas began in the early 1900s with the construction of dikes; the areas between the dikes were later filled with dredge spoils from San Pablo Bay in order to raise the land surface to an elevation above the tidal range of the Bay. Historical fill and disposal areas used to enlarge the original island to its current peninsula configuration are designated under the Navy's Installation Restoration Program (IRP) as Installation Restoration Site IR01 (IR01; see Figure 2). This area occupies approximately 100 acres. The Navy used historical aerial photographs to categorize portions within IR01 according to the locations and time periods of historical fill activities. The DRMO Site is located within the "IR01 Undeveloped Area", as shown in Figure 2. The original Mare Island boundary, prior to filling, and the historical fill sequence within the overall IR01 Undeveloped Area are also shown in Figure 2. A detailed fill history of the DRMO Site and the vicinity, based on historical maps and aerial photographs of fill operations, is presented in Appendix A.

Based on this research, dredge spoils and possibly other fill were placed at the DRMO Site and in the area south of the site between 1925 and 1930. The area was identified as a non-waste fill area.

1.4 Site Characteristics

1.4.1 Topography and Surface Water

The ground surface at the DRMO Site is generally flat, with elevations ranging from approximately 12 to 14 feet above Mean Sea Level (MSL). No permanent surface water features are present within the DRMO Site, but the site is prone to flooding during periods of heavy precipitation. Surface water runoff from the DRMO Site discharges to storm sewers located near the northern corner of the site, which in turn discharge to a stormwater main.

1.4.2 Geology

Three principal geologic units have been identified at the site (see Figure 3). From top to bottom stratigraphically, these units are artificial fill material, unconsolidated natural deposits (Younger Bay Mud), and bedrock (the Cretaceous Panoche Formation). Based on boring logs and test pits advanced in the area during historical investigations, the artificial fill material consists of two layers:

1. Sand, gravel, silty clay, and debris from the ground surface to approximately 2 to 5 feet below ground surface (bgs), although debris is also found at deeper locations. Debris is primarily either metal or brick, but asphalt, concrete, timber, sawdust, wire, pipe, cable, and glass have also been found. This uppermost fill was placed between 1940 and the later construction of the DRMO Site (Appendix A, Figures A-5 and A-6). Aerial photographs dating from the late 1940s and early 1950s, also provided in Appendix A, show that the DRMO Site and vicinity had been fully developed by the 1950s.
2. Fine-grained silts and clays, which are most likely dredged material that was placed between 1911 and 1920. This fill material is approximately 4 to 7 feet thick and is found from approximately 2 to 10 feet bgs.

Beneath the fill material is a thick sequence of naturally deposited, unconsolidated silty clay with interbedded sandy layers (commonly referred to as Younger Bay Mud) and extends to at least 28 feet bgs. The bedrock below these deposits consists of steeply dipping brown, orange, and tan arkosic sandstone, siltstone, and micaceous shale.

1.4.3 Hydrogeology

A single, shallow, unconfined water-bearing zone has been identified beneath the DRMO Site, extending from the water table at 2 to 6 feet bgs to a depth of at least 28 feet bgs. The water-bearing zone extends through the fill layer and into the underlying Younger Bay Mud. Groundwater flow is to the northwest and annual fluctuations of up to 3 feet have been observed. Groundwater does not appear to be influenced by tidal fluctuations.

Two distinct water-bearing zones have been identified beneath the former Crane Test Area (CTA) north of the DRMO Site, which is shown in Figure 4. One zone lies within a shallow soil debris layer, and a deeper zone lies within the Younger Bay Mud. The two zones are separated by a layer of silty clay ranging from 6 to 8 feet thick. Groundwater flow in the two zones is to the northwest.

1.5 Overview of Historical Investigations and Cleanup Actions

Environmental conditions at the former MINS have been formally studied since at least 1981. Nine historical investigations conducted between 1995 and early 2007 were reviewed to identify activities and findings relevant to the occurrence of petroleum contamination at the DRMO Site and in the vicinity (see Sections 2.0 and 3.0). Gaps in information and data needed to establish the nature, extent, and mobility of free-phase petroleum hydrocarbons in soil were then identified, and a Follow-on Investigation was conducted in 2007 and 2008 (see Sections 4.0 and 5.0).

During the historical investigations, free-phase petroleum hydrocarbons, as well as elevated concentrations of total petroleum hydrocarbons (TPH) as diesel, motor oil, and gasoline were detected in soil and groundwater to depths of 20 feet bgs within and adjacent to the DRMO Site. The specific locations included the following areas shown in Figure 4 and discussed later in this TM:

- The vicinity of railroad tracks that were formerly located in the Railroad Track Corridor in the northern portion of the FSA
- The Oil Sump Box (OSB), a subsurface concrete vault formerly located on the west side of Azuar Drive approximately 50 feet north of Building 661 (the OSB, shown in historical drawings provided as Figures B-1 and B-2 in Appendix B, was removed in 2006 along with associated piping and contaminated soil as described in Sections 2.8 and 3.8)
- Utility vault UV-1 located near the northwest corner of Building 661

As described in Sections 2.7 and 3.7, the FSA portion of the DRMO Site underwent a CERCLA Non-Time-Critical Removal Action (NTCRA) from August 2005 to February 2007. The NTCRA included the removal of Munitions and Explosives of Concern (MEC) and soil contaminated with Chemicals of Potential Concern (COPCs) not associated with petroleum contamination. The sampling grids established within the FSA during the NTCRA are shown in Figures 4 and 5. Details of the NTCRA activities and findings are provided in the *Removal Action Plan, Non-Time-Critical Removal Action for the Fenced Scrapyard Area of the Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2005a), and the *Interim Closure Report, Non-Time-Critical Removal Action for the Fenced Scrapyard Area of the Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2006).

Buildings 661 and 679 still remain in the FSA. Other site features including structures, pavement, scrap storage bins, railroad tracks, and utilities have been removed. Some buried pipelines and stormwater lines have been removed, capped, or re-routed as described below.

Current and former buried pipelines within the DRMO Site and the surrounding area are shown in Figure 5. A summary of the re-routing and abandonment of buried pipelines and stormwater lines during the NTCRA is provided below:

- The sanitary sewer line from former Building 691 was removed to the eastern fenceline of the FSA (Grid FS-38 shown in Figure 5). A grout plug was placed in the remaining section of pipe where it exited the FSA.

- Most of the saltwater pipelines remain in place following the NTCRA and are shown in Figure 5.
- Stormwater lines exiting the western portion of the FSA (Grids FS-53 and FS-27 shown in Figure 5) were plugged with grout at the catch basins, outside the FSA fenceline. Also, the stormwater line exiting the FSA along the eastern fenceline was plugged with grout (Grid FS-38).
- Two catch basins located adjacent to the northeastern boundary of the FSA (Grid FS-3) were raised in elevation. These are in-line with the main stormwater line that runs along Azuar Drive and were left operational.
- A secondary stormwater line, which runs out of one of the above catch basins (Grid FS-3), was plugged. This line runs northwesterly and exits the FSA (Grid FS-1).
- In the northern corner of the FSA, a section of an active 6-inch ductile iron water line was re-routed outside the northern limits of the FSA fenceline (Grids FS-2 and FS-3). Approximately 80 feet of new 6-inch ductile iron pipe was installed on the outside of the FSA fenceline (east of Grids FS-3 and FS-8). The new section of water line was re-connected to the existing line within Azuar Drive. The section of pipe within the FSA was removed during NTCRA soil excavation.

1.6 Organization of this Technical Memorandum

This TM is presented in two volumes. The remainder of Volume I is organized as follows:

- Section 2.0 describes the objectives of and activities completed for nine historical investigations conducted at the DRMO Site and in the vicinity between 1995 and early 2007.
- Section 3.0 presents the petroleum-related findings of the historical investigations described in Section 2.0.
- Section 4.0 describes the objectives of and activities completed for the Follow-on Investigation conducted in 2007 and 2008.
- Section 5.0 presents the findings of the Follow-on Investigation.
- Section 6.0 presents conclusions regarding the nature, extent, and mobility of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity.
- Section 7.0 lists the references cited in the sections above.

Supporting figures and tables are provided following Section 7.0.

In Volume II, the following appendices provide supplemental information and data:

- Appendix A contains historical maps and aerial photographs that provide information about the fill history of Mare Island in IR01, including the DRMO Site.
- Appendix B contains historical Navy documentation regarding the OSB and the possible extent of free product at the DRMO Site and in the vicinity.

- Appendix C contains supporting documentation from an investigation using the Site Characterization and Analysis Penetrometer System (SCAPS) that was conducted in 1999 and 2000 at Installation Restoration Site 02 (IR02), an area with former waste oil disposal sumps that is located southwest of the DRMO Site.
- Appendix D contains supporting documentation from an OSB Investigation that was conducted in 2005 and 2006 at the DRMO Site and in the vicinity.
- Appendix E contains supporting documentation from a groundwater investigation that was conducted in 2006 and 2007 at the former CTA in Investigation Area B.1, north of the DRMO Site.
- Appendix F contains supporting documentation from the field investigation conducted in late 2007 as part of the Follow-on Investigation, and from investigation and removal action activities performed by Weston Solutions, Inc. in 2007.
- Appendix G contains supporting documentation from the geophysical survey that was performed early in 2008 as part of the Follow-on Investigation.
- Appendix H contains supporting documentation from the field investigation conducted later in 2008 as part of the Follow-on Investigation.
- Appendix I contains the data validation reports for the analytical data that were collected during the Follow-on Investigation.
- Appendix J contains a report describing the activities and results of a forensic chemistry evaluation that was performed in 2008 as part of the Follow-on Investigation.
- Appendix K contains stakeholder comments on a Draft Final version of this TM that was submitted for stakeholder review in March 2009, and the Navy's responses to those comments. Where applicable, changes resulting from those comments and responses have been incorporated into this Final TM.

2.0 Summary of Historical Investigations

Between 1995 and early 2007, the nine investigations were conducted at the DRMO Site and in the vicinity that included petroleum-related components. This section summarizes the objectives and activities of those historical investigations, which included:

- A basewide Preliminary Assessment/Site Inspection (PA/SI) performed in 1995 at the former MINS and which included the DRMO Site (Section 2.1)
- A Site Characterization and Analysis Penetrometer System (SCAPS) investigation conducted in 1999 and 2000 at IR02, an area that contains former waste oil disposal sumps (Section 2.2)
- An RI conducted in 1999 and 2000 at Investigation Area H2 (IA H2), which includes the DRMO Site and vicinity (Section 2.3)
- The Navy's follow-up to the RI of IA H2 in 2001 (Section 2.4)
- An RI conducted from 2002 through 2004 at Investigation Area B (IA B), located to the east and north of the DRMO Site (Section 2.5)
- An investigation conducted in 2004 at the Railroad Track Corridor formerly located within the DRMO Site (Section 2.6)
- The NTCRA conducted between August 2005 and February 2007 at the FSA within the DRMO Site (Section 2.7)
- An OSB Investigation conducted in 2005 and 2006 along Azuar Drive and Dump Road (Section 2.8)
- A groundwater investigation conducted in 2006 and 2007 at the former Crane Test Area north of the DRMO Site, which occupies most of subarea IA B.1 located within IA B (Section 2.9)

Section 3.0 summarizes the petroleum-related findings from the investigations listed above.

2.1 Preliminary Assessment/Site Inspection (1995)

The PA/SI addressed 95 Solid Waste Management Units (SWMUs) and 34 other sites at the former MINS. This investigation, which was conducted by PRC Environmental Management (PRC), provided information requested by DTSC and the U.S. Environmental Protection Agency (EPA). The DRMO Site was one of the sites included in the investigation. The site was designated SWMU 129 and referred to variously as DRMO Storage Facilities, the DRMO Storage Area, and the DRMO Scrapyard. When the PA/SI was conducted, the DRMO facilities were still in operation.

The objectives of the PA/SI were to assess whether the sites being addressed were potentially contaminated and required further investigation, and to make recommendations

for future action. A visual inspection of the DRMO Site was conducted. No environmental samples were collected.

The PA/SI findings related to potential petroleum contamination at the DRMO Site are summarized in Section 3.1 of this TM. The report entitled *Mare Island Naval Shipyard, Vallejo, California, Preliminary Assessment/Site Inspection Final Summary Report, Nonradiological Sites* (PA/SI Report; PRC Environmental Management [PRC], 1995) provides complete details of the PA/SI activities and findings.

2.2 Site Characterization and Analysis Penetrometer System Investigation at IR02, Former Waste Oil Disposal Sumps Area (1999-2000)

In June 1999, the Navy Public Works Center San Diego (Navy PWCSD) used the SCAPS to conduct an assessment of petroleum hydrocarbons in and around four former waste oil disposal sumps within IR02, located approximately 1,600 feet west of the DRMO Site (see the inset in Figure 4). The objectives of this investigation were "to thoroughly assess and delineate the extent and distribution of residual and free-phase petroleum hydrocarbon contamination in the vicinity of the former waste oil sumps and to estimate the mass of the hydrocarbon contamination." The methodology and findings of the investigation are described in the *Site Characterization Summary Report, Mare Island Naval Shipyard, Installation Restoration Site 02, Former Waste Oil Disposal Sumps* (Navy PWCSD, 2000, referred to as the SCAPS Report in this TM).

According to the SCAPS Report, records indicated that "almost all solid wastes generated at Mare Island (including hazardous wastes and petroleum oils) were disposed of on Mare Island in various unlined pits and on low-lying terrain in the dredge disposal areas. In addition, waste oil [from operations at MINS] was discharged to the four unlined oil sumps (Sumps 1, 2, 3, and 4) shown on the inset in Figure 4. These sumps reportedly received approximately 4.5 million gallons of waste oil and solvents before disposal there ended in the late 1960s." The Navy had previously completed a draft RI and human health risk assessment under CERCLA for Operable Unit 3 (OU 3) at Mare Island, which contains Sumps 1 through 4 within IR02. Many of the samples collected for these efforts were obtained from within and near the sumps. "As a result," the SCAPS Report states, "the nature and extent of contamination has been partially characterized in the vicinity of the sumps. This contamination includes a significant volume of light nonaqueous phase liquid (free product) which consists of viscous, heavy and weathered hydrocarbons and which, when exposed, are visible in the soil void spaces." Although other contaminants had been detected in soil and groundwater in and around the former sumps, the SCAPS Investigation only addressed "residual and free-phase petroleum hydrocarbon contamination."

One hundred seventy-three SCAPS laser-induced fluorescence (LIF) pushes were completed within IR02 during the investigation. Due to the presence of debris, the LIF probe met shallow refusal (less than 5 feet bgs) at many locations within the sumps, especially in the western half of Sump 3; there was significantly less evidence of subsurface debris outside the sump boundaries, where the site consisted primarily of flat, bare ground with sparse vegetation and scattered surface debris. LIF pushes were completed only where shallow

refusal was not encountered. A GeoVis (video microscope) tool was used at three locations, each within 1 lateral foot of LIF pushes, to supplement and confirm LIF and cone penetrometer test (CPT) soil classification data for these locations and the entire site. The SCAPS Report also noted that based on the CPT data, the soils at the site "consisted predominately *[sic]* of soft, unconsolidated silts and clays with occasional sandy to gravelly lenses…. Permeabilities of the contaminated soils are thus expected to be relatively low."

Small (3/4-inch-diameter) microwells were installed within 1 lateral foot of four LIF push locations, with each well screened from 3 to 13 feet bgs. "A small diameter interface probe was used to check free product and groundwater levels in each well. However, reliable readings could not be obtained…even though a highly viscous oil was found on the probe upon removal from all four of the wells."

Seventeen soil samples were collected "to supplement, evaluate and confirm LIF data…based on the assumption that the contaminant concentrations would have a 'bulls-eye' pattern centered on the sumps." The samples were analyzed for purgeable and extractable TPH using EPA Method 8015 (Department of Health Services [DHS]-modified). The TPH results were reported as gasoline, JP-5, diesel, and diesel-range organics (DRO, to designate hydrocarbons "heavier" than the diesel carbon range of C9 to C24).

For the purposes of this TM, the findings of the SCAPS Investigation were reviewed to evaluate whether IR02 may be contributing to the observed free product along Dump Road or Azuar Drive. The findings are summarized in Section 3.2 of this TM, and supporting figures are provided in Appendix C. The SCAPS Report (Navy PWCSD, 2000) contains complete details of the investigation findings and results.

2.3 Investigation Area H2 Remedial Investigation (1999-2000)

The Navy conducted this RI to characterize conditions at IA H2, which in 1999-2000 included portions of Mare Island generally west of Azuar Drive from the IR01 storage yard and the former Crane Test Area (see Figure 4) along Dump Road southward to about 5th Street. This area included the DRMO Site, which was referred to in the RI as the DRMO Scrapyard Area. The overall objectives of the RI were to determine whether releases from potential sources within these areas had occurred, identify the nature and extent of contamination associated with any releases, and conduct baseline human health and ecological risk assessments in order to determine whether an FS was necessary at any of the specific sites within IA H2.[1]

The investigative approach to the DRMO Site and vicinity during the RI included the collection and analysis of environmental samples as well as the incorporation of analytical results from previous investigations and sampling efforts. Overall, the RI evaluated analytical results obtained from samples collected as described below:

[1] Since the RI was conducted for IA H2, the configuration of the area has changed significantly because various portions of it have been transferred by the Navy to the City of Vallejo. Therefore, the boundaries of IA H2 are not shown on a figure in this TM.

- The IR16-Subsite 715 area (see Figure 4) during the RI for IA H2: two surface soil samples, samples from five direct-push borings, and five asphalt samples
- The remainder of the DRMO Site, during the RI for IA H2:
  - Four discrete asphalt chip samples, samples from 53 direct-push borings, five vacuum excavations, 70 surface soil samples, and 39 grab groundwater samples
  - Four residue samples (one from utility vault UV-1 and three from catch basins)
  - Three petroleum product samples (one from UV-1 and two from direct-push borings)
  - One standing water sample from UV-1
  - Samples from three groundwater monitoring wells within the DRMO Site and two adjacent wells
- The IR01 Developed Area: samples from 22 soil borings, two surface soil samples, one vacuum excavation, and 14 grab groundwater samples collected during a previous investigation
- IR02 (the former waste oil disposal sumps area): samples from four direct-push borings installed during a previous investigation

The RI findings related to petroleum and TPH contamination at the DRMO Site and in the vicinity are summarized in Section 3.3 of this TM. The report entitled *Internal Draft, Investigation Area H2 Remedial Investigation, Mare Island, Vallejo, California* (Tetra Tech EM Inc. [TtEMI], 2000) provides complete details of the RI activities and findings.

2.4 Follow-up to the Investigation Area H2 Remedial Investigation (2001)

Following preparation of the RI Report discussed in Section 2.3, the Navy issued an addendum to that report. The purpose of the addendum was to describe "the nature and extent of the area of residual petroleum hydrocarbon nonaqueous-phase liquid (free product)" in subsurface soil at the DRMO Site and in the IR16-B4/Building 455 Area to the east of Azuar Drive (see Figure 4), and underlying portions of both Investigation Areas H2 and B. "[D]istinctive and easily identifiable" free product had been observed in soil borings advanced in these areas during the RI.

The addendum did not present new data but provides additional discussion of the physical nature of the free product, the vertical and lateral extent of the product, and possible sources of the product at the DRMO Site.

The addendum findings are summarized in Section 3.4 of this TM. The addendum itself, *Addendum to the Internal Draft Investigation Area H2 Remedial Investigation Dated December 1, 2000, Mare Island, Vallejo, California* (TtEMI, 2001), provides complete details.

2.5 Investigation Area B Remedial Investigation (2002-2004)

IA B is located in the western portion of the Eastern Early Transfer Parcel (EETP) and occupies approximately 90 acres. It is bounded to the north by G Street; to the east by Railroad Avenue; to the south by Connolly Street; and to the west by Azuar Drive, non-tidal wetlands, and former industrial areas. Based on the fill history and remedies considered for various portions of IA B, the area has been subdivided into two subareas. One subarea is IA B.1 (7 acres), most of which is occupied by the former CTA as discussed in Section 3.5. The other is IA B.2 (83 acres), most of which is located east of Azuar Drive. Figure 4 shows both IA B.1 (including the former CTA) and a portion of IA B.2 to the east of Azuar Drive. IA B.2 is not discussed further in this TM as it is not a part of the DRMO Site and the vicinity.

Building on field investigations performed by the Navy prior to 2002, the overall goal of the RI (conducted under a Consent Agreement between Lennar Mare Island [LMI], the City of Vallejo, and DTSC) was to collect additional information at four areas of environmental concern within IA B to address remaining data gaps and conclude the site characterization phase for IA B. The specific objectives of the RI were to characterize the nature and extent of soil and groundwater contamination in those areas, and to quantify potential risks posed to human health and the environment. One of the areas, IRP Site IR01 (historical fill areas), contains the DRMO Site and is discussed in Section 2.5.1. A second area, known as the IR16-B4/Building 455 Area, is located adjacent to the DRMO Site, east of Azuar Drive, and is discussed in Section 2.5.2. Additional RI work was conducted at the former CTA/IA B.1 north of the DRMO Site, as discussed in Section 2.5.3.

From June to October 2002, CH2M HILL conducted a field investigation at IA B in accordance with the *Draft Sampling and Analysis Plan for Investigation Area B*, *Lennar Mare Island*, *Vallejo*, *California* (CH2M HILL, 2002) and subsequent agency comments. The *Final Investigation Area B Remedial Investigation Report, Former Mare Island Naval Shipyard, Vallejo, California* (RI Report for IA B; CH2M HILL, 2004c) describes the physical characteristics of IA B and provides complete details of the methodology and findings of the RI. The findings are summarized in Section 3.5 of this TM.

2.5.1 IR01 Historical Fill Areas

The RI Report presents a detailed analysis of historical fill activities at IA B because the area also contains portions of IR01. IR01 occupies approximately 100 acres and, as noted in Section 1.3, comprises the historical fill and disposal areas in the west-central portion of Mare Island that enlarged the island to its current peninsula configuration. Using historical aerial photographs, the Navy has categorized portions of IR01 according to the locations and time periods of historical fill activities, which may have contributed to contamination in IA B.

One of the portions of IR01 includes the DRMO Site and the former CTA. Another portion includes the IR16-B4/Building 455 Area. The findings of the RI Report for IA B with specific reference to the historical fill areas at the DRMO Site and in the vicinity are presented in Section 3.5.

2.5.2 IR16-B4/Building 455 Area

The IR16-B4/Building 455 Area occupies approximately 8 acres adjacent to the DRMO Site, east of Azuar Drive (see Figure 4). The area was used as a scrap metal salvage yard from approximately the early 1920s through the early 1990s. Observations of debris (wood chips, brick fragments, asphalt fragments, glass, and metallic materials) made in boring logs and during removal actions in the IR16-B4/Building 455 Area are consistent with the historical use of the area as a salvage yard. Portions of the area were also historically used for submarine and forklift lead-acid battery storage and disposal, mixing and storage of pesticides, and management of mercury waste. Figure 4.4-1 in the RI Report for IA B presents a conceptual site model (CSM) of the area's historical uses and physical conditions. Because of its proximity to the DRMO Site, the geological and hydrogeological conditions at the IR16-B4/Building 455 Area are very similar to those described in Section 1.4 of this TM.

Removal actions were conducted in the area to address contamination by lead in 1993 and 2003, and by lead and pesticides in 1998-1999. During the RI for IA B the remaining vertical and lateral extent of chemicals in the area was evaluated, including free-phase petroleum hydrocarbons present in soil and groundwater. The evaluation also addressed the possibility that the DRMO Site was one of the historical sources of this contamination. The RI findings are summarized in Section 3.5.2.

2.5.3 Former Crane Test Area/IA B.1

Additional RI work was conducted specifically at the portion of IA B referred to as IA B.1, most of which consists of the former CTA north of the DRMO Site and Dump Road (see Figure 4). This work included an evaluation of the fill material placed within the former CTA between 1925 and 1942. In addition, a groundwater investigation was conducted at the former CTA in late 2006 and early 2007. Both the RI activities and those conducted during the 2006-2007 groundwater investigation are summarized in Section 2.9.

2.6 Railroad Track Corridor Investigation (2004)

A number of railroad lines formerly ran along what was referred to as the "Railroad Track Corridor" between the northwestern portion of the DRMO Site and Dump Road, immediately outside the FSA boundary (Figure 4). Sampling and analysis to characterize conditions in the Railroad Track Corridor were historically very limited. Therefore, when a removal action to address MEC and COPCs was being planned for the FSA in 2003 (see Section 2.7), the Navy determined that further characterization of the Railroad Track Corridor was necessary for the removal action planning process for shallow soil in the FSA (CH2M HILL, 2004a).

Soil sampling and analysis were conducted in January and February 2004 with the objective of evaluating the extent of removal action activities required, if any, within the Railroad Track Corridor. A total of 35 soil samples and 11 quality assurance/quality control (QA/QC) samples were collected from various depths at 12 locations in the Corridor. The samples were analyzed for a variety of constituents including TPH-diesel, TPH-gasoline, metals, and volatile and semivolatile organic compounds (VOCs and SVOCs).

The investigation findings related to petroleum contamination in the former Railroad Track Corridor are summarized in Section 3.6 of this TM. The *Railroad Track Corridor Investigation Report, Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2004b) contains complete details of the investigation activities and findings.

2.7 Non-Time-Critical Removal Action at the Fenced Scrapyard Area within the DRMO Site (2005-2007)

From August 2005 to February 2007, a NTCRA was completed by the Navy at the FSA within the DRMO Site. The removal of MEC and soil contaminated with COPCs above Target Cleanup Goals (TCGs) specified by CERCLA was conducted to reduce the risks posed by the FSA to human health and the environment. The COPCs targeted during the removal action included lead, polynuclear aromatic hydrocarbons (PAHs), pesticides, and polychlorinated biphenyls (PCBs).

As noted in Section 1.2, the FSA is a 4.6-acre former scrapyard area located within the 8-acre DRMO Site (see Figure 1). The remainder of the DRMO Site was not addressed during the NTCRA. As discussed in Section 1.1, the Navy is addressing petroleum contamination in soil separately from other investigations and cleanup actions at the DRMO Site; therefore, neither petroleum nor TPH was addressed during the NTCRA. During the implementation of the removal action, however, the Navy decided that additional petroleum- and TPH-related investigation within the FSA should be performed for informational purposes, as a TCG for TPH has not yet been identified for the DRMO Site. Two kinds of investigation were conducted:

- Sampling and analysis for TPH, specifically TPH-diesel as requested by DTSC. As the excavation of contaminated soil progressed within the FSA, confirmation samples were collected and analyzed to verify that the TCGs for the COPCs at the FSA were being achieved. The samples were collected from the bottoms of one hundred (100) 50-by-50-foot grids as well as from grid-related sidewalls along the FSA boundary. Most of the samples were collected from 1.5 feet bgs, with a few samples collected from 3 to 5 feet bgs. At approximately 50 percent of the NTCRA sampling locations, a total of 71 confirmation soil samples (of which three were field duplicates) were collected and analyzed for TPH-diesel.
- Qualitative petroleum observations. These included observations of site conditions throughout the duration of the fieldwork, from pre-excavation demolition activities to post-excavation soil sampling, in order to record the possible presence of petroleum-related contamination.

The findings from these specific activities are presented in Section 3.7 of this TM. Details of the overall NTCRA activities and findings are provided in the *Removal Action Plan, Non-Time-Critical Removal Action for the Fenced Scrapyard Area of the Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2005a), and the *Interim Closure Report, Non-Time-Critical Removal Action for the Fenced Scrapyard Area of the Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2006).

2.8 Oil Sump Box Investigation (2005-2006)

This section describes the purpose of the Navy's OSB Investigation and the activities performed, which included the installation of soil borings and investigative trenches and the removal of the OSB and associated piping. This work was conducted in late 2005 and early 2006; a Work Plan was prepared (CH2M HILL, 2005b), but the findings of the OSB Investigation have not been formally documented elsewhere. As shown in Figure 4, the OSB was located immediately outside the FSA to the north of Building 661 and adjacent to Azuar Drive.

2.8.1 Purpose

The purpose of the OSB Investigation was to obtain field information to (1) confirm the existence of the OSB, and (2) aid in understanding the nature and extent of free product potentially originating from the OSB and migrating from the DRMO Site. A CSM had been developed to identify the specific data gaps listed in Section 2.2 of the Work Plan (CH2M HILL, 2005b) and formed the basis of the technical approach for the investigation described in Section 2.3 of the Work Plan. The CSM was based on a review of existing information, including soil boring information and analytical results from soil samples collected by the Navy and CH2M HILL during previous investigations. The key elements of the CSM were used to focus the future investigation work.

The OSB Investigation focused primarily on the OSB itself, a subsurface concrete vault located approximately 50 feet north of Building 661 (Figure 4). According to an undated historical Navy drawing (see Figure B-1 in Appendix B; when this drawing was developed, Azuar Drive was called Cedar Avenue), a 6-inch perforated pipe was thought to extend from the bottom (or near the bottom) of the OSB and was interpreted as a mechanism to allow the discharge of materials from inside the OSB to the subsurface. No formal design drawings showing the construction of the OSB have been located to date. Visual observations by Navy and CH2M HILL personnel during project planning reported a thick, viscous, black product that appeared to be floating on the water surface within the OSB. A similar material was also reported by the Navy to have been present in a utility vault (possibly UV-1) on the north side of Building 661. In addition, the CSM developed in anticipation of the investigation suggested an accumulation of free product along the surface of water table (see Figure B-2 in Appendix B). This CSM was based on areas of observed petroleum contamination that had been reported along portions of Azuar Drive and the south side of Dump Road, as determined during previous investigations (see Figure B-3).

2.8.2 Data Gaps

Based on the CSM and other available information, the data gaps identified in the Work Plan and addressed in the OSB Investigation included:

- The existence of the OSB and possible connection to UV-1
- The lateral and vertical extent of free product originating from the OSB and UV-1
- The lateral and vertical extent of free product on the northern side of the DRMO Site along Dump Road, as well as along Azuar Drive

- The chemical character (e.g., the petroleum hydrocarbon fraction[s]) of the free product
- Potential impacts, if any, of petroleum contamination on groundwater in the area of the OSB and UV-1, and along Dump Road

2.8.3 Investigation Activities

The following sections summarize the activities performed during the OSB Investigation.

2.8.3.1 Soil Borings along Azuar Drive

Direct-push soil borings were installed at seven locations along Azuar Drive as shown in Figure 6: OSBGB01 through OSBGB03, and OSBGB09 through OSBGB12. The original objective of the soil borings planned for the project was to investigate the extent of potential free product at locations along Azuar Drive and Dump Road. However, based on observations during the initial phase of boring installation and based on the fact that the OSB was located and confirmed to exist, it was determined that borings were of limited value in achieving the investigation objectives. Therefore, only seven of the 12 planned borings identified in the Work Plan (CH2M HILL, 2005b) were installed. In addition, as discussed in Section 2.8.3.3, it was decided to install trenches rather than soil borings along Dump Road.

The primary purpose of installing the borings along Azuar Drive was to allow subsurface soil to be visually inspected for the possible presence of free product and/or fuel-saturated soil. The borings extended to a depth of 9 to 16 feet bgs to elevations below the water table. The borings were advanced using a hand auger from the ground surface to 5 feet bgs. From 5 feet bgs to the total depth of each boring, continuous cores were collected using a direct-push drill rig. Logs for all seven borings are provided in Appendix D1.

Samples were collected from all the borings for visual examination. Laboratory analyses were performed on four soil samples, collected at depths ranging from 7 to 12 feet bgs from borings OSBGB01 and OSBGB09 through OSBGB11, and on three samples of free product that were collected from depths ranging from 3 to 7 feet bgs for fuel fingerprint analyses (OSBGB09-S07P, OSB-FP-ETN15-S6, and OSB-FP-ETN47-S3). Table D2-1 in Appendix D2 lists the analyses that were performed on these soil and free product samples. Analyses were not performed on samples from borings OSBGB02, OSBGB03, and OSBGB12 because it was decided, following sample collection, that additional analytical data were not necessary to meet the investigation objectives.

2.8.3.2 Exploratory Trench and Removal Activities along Azuar Drive

Three exploratory trenches were originally planned around the OSB to examine the subsurface structure of the OSB and confirm the presence of perforated pipes extending north and south along Azuar Drive. Confirming the presence of a pipeline extending between the OSB and UV-1 near Building 661 was also desired. After the installation of one 80-foot-long trench in the field, the project scope of work (SOW) was modified to remove the OSB and perforated pipe. Following the excavation and removal activities, the area was backfilled with crushed rock to above the groundwater level and then with pit run soil to establish the final grade.

2.8.3.3 Exploratory Trenches along Dump Road

The original SOW for Dump Road included the installation of five soil borings and collection of 15 soil samples (three from each boring) for chemical analysis. The purpose of this sampling and analysis was to determine the chemical characteristics of petroleum hydrocarbons in soil at representative locations along Dump Road. Based on information collected along Azuar Drive, the five soil borings were replaced with five exploratory trenches (OSBTR13 through OSBTR17, shown in Figure 6). Trenches were considered to be of greater value in understanding the vertical distribution of free-phase hydrocarbons and the amount and type of metal debris in the shallow subsurface because more detailed observations could be made. The trenches were approximately 9 feet long and 2 feet wide and extended to depths of between 7 and 9 feet bgs. Logs for the trenches are provided in Appendix D1.

Samples of free product for fuel fingerprint analyses were collected from all the trenches except OSBTR13, where free product was not found. The samples were collected at depths ranging from 6 to 7.5 feet bgs. Table 1 lists the analyses performed on the free product samples obtained from the trenches along Dump Road.

2.9 Groundwater Investigation at the Former Crane Test Area (2006-2007)

In late 2006 and early 2007, LMI conducted a groundwater investigation at the former CTA, which is located adjacent to Dump Road to the north of the DRMO Site. The former CTA occupies the majority of IA B.1 (see Figure 4) which, as discussed in Section 2.5, is one of the two subareas of IA B where field investigations were performed as part of the RI for IA B (CH2M HILL, 2004c). The former CTA is currently being addressed as part of a Feasibility Study/Remedial Action Plan (FS/RAP), currently entitled *Draft Report, Investigation Area B.1 Feasibility Study/Remedial Action Plan, Lennar Mare Island, Vallejo, California* (FS/RAP Report; CH2M HILL, 2008b).

The objective of the 2006-2007 groundwater investigation was to understand the hydrogeology and the nature and extent of groundwater contamination related to the two groundwater-bearing zones described above. In November 2006, five pairs of monitoring wells were installed in the former CTA at the locations shown in Figure 4. At each location, one well was constructed in the debris layer (the shallow zone), and the other in the Younger Bay Mud layer (the deep zone).

A backhoe was used to excavate a trench at each location to clear debris that would obstruct drilling and to map the vertical extent of the debris layer. One shallow well was completed within each trench. Then a drill rig was used to collect core samples from the bottom of the trench to bedrock. Based on observations from the core samples, one deep well was drilled using a hollow-stem-auger drill rig within the vicinity of the trench. Water levels in the monitoring wells were measured to calculate groundwater elevations, and a total of nine groundwater samples were collected from these wells and analyzed for TPH-diesel and TPH-motor oil as well as pH, alkalinity, cations (calcium, magnesium, strontium, sodium, and potassium), and anions (nitrogen as NO_3, nitrogen as NO_2, sulfate, chloride, fluoride, and bromide).

According to the FS/RAP Report, the resulting groundwater data were evaluated along with soil and groundwater data presented in the RI Report for IAB (CH2M HILL, 2004c) and other historical investigations of the former CTA. The evaluation included a total of 42 soil samples collected from 22 different locations at depths ranging from 0.5 to 11.5 feet bgs, and analyzed for TPH-gasoline, TPH-diesel, TPH-motor oil, and total recoverable petroleum hydrocarbons (TRPH). The evaluation also included one grab groundwater sample collected in 1999 from boring IR01GB107, on the southwestern boundary of the former CTA as shown in Figure 4, and analyzed for TPH-gasoline, TPH-diesel, and TPH-motor oil.

The findings from the 2006-2007 groundwater investigation at the former CTA, including findings in that area from the RI for IA B and other historical investigations, are summarized in Section 3.9. Boring and trench logs recorded during the 2006-2007 investigation are provided in Appendix E.

3.0 Findings of Historical Investigations

This section presents the petroleum-related findings from each of the historical investigations described in Section 2.0.

3.1 Preliminary Assessment/Site Inspection (1995)

The PA/SI Report (PRC, 1995) presents the findings from the visual inspection of SWMU 129, the DRMO Site (referred to variously in the report as DRMO Storage Facilities, the DRMO Storage Area, and the DRMO Scrapyard). As noted in Section 2.1, the DRMO facilities were still in operation at the time of the inspection. The following findings are reported with regard to petroleum:

- "Some oil" was stored at the scrapyard.
- During the inspection, utility vault UV-1 (referred to in the PA/SI Report as a "utility access box" and located adjacent to Building 661 as shown in Figure 4 of this TM) contained standing water with "black, thick oil floating on top of the water." The oil "was determined to be the result of floating product on the water table that may have saturated nearby soils."
- Although no evidence for these findings is cited, the report states that "[u]tility lines between IR02 [the former waste oil disposal sumps area located approximately 1,600 feet west of the DRMO Site; see Figure 4 and Sections 2.2 and 3.2 in this TM] and the DRMO Scrapyard area are the primary conduits of contamination between the two areas. Although there is uncertainty about the source of the contamination observed at the DRMO Scrapyard area, the two primary sources are the transportation shops (Buildings 637 and 639, located approximately 650 feet southeast of Building 661[in the EETP]) and the oil sumps (IR02)."

Based on the "evidence of release of metals and hydrocarbon contamination" and the identification of "petroleum, metals, and PCBs" as contaminants of concern, the PA/SI Report recommends the following actions:

- Review of a utility map of the area in the vicinity of IR02 to evaluate whether IR02 (i.e., the waste oil disposal sumps) may be the source of the oil observed in the utility access box (i.e., UV-1);
- Additional CERCLA investigation of the DRMO Site for "contamination attributable" to the SWMU, and "to locate the source of free product detected during the PA"; and
- Collection of soil samples and analysis for a variety of constituents including VOCs and TRPH.

3.2 Site Characterization and Analysis Penetrometer System Investigation at IR02, Former Waste Oil Disposal Sumps Area (1999-2000)

Sections 3.2.1 through 3.2.4 summarize the findings of the SCAPS Investigation of IR02 as documented in the SCAPS Report (Navy PWCSD, 2000). The findings are summarized in detail because this information has helped address hypotheses in other documents that the former waste oil disposal sumps may have been a significant source of free-phase petroleum hydrocarbons migrating as far east as the DRMO Site and the IR16-B4/Building 455 Area (e.g., see Section 3.5.2). Section 3.2.5 includes the conclusions that are presented in the SCAPS Report.

3.2.1 Results from LIF Push Locations

Of the 173 LIF push locations, 139 had elevated fluorescence intensities indicating impacts from petroleum, oil, or lubricants (POL). "Clipped" fluorescence responses indicating very high POL impacts were observed in 32 pushes.

The SCAPS Report notes: "Two distinct peak wavelengths with corresponding spectra were observed in the LIF data", indicative of a "heavy, oil-like product" and diesel fuel. "Inspection of the push logs…indicates no readily discernible spatial pattern in the occurrence of these two characteristic wavelengths. This suggests that the contamination is a complex and essentially random mixture of oil and diesel fuel, with oil forming the bulk of the plume."

The report continues, "fluorescence intensity indicates the relative concentration of petroleum in soil. To assess the distribution of contamination we must therefore look at the three-dimensional distribution of LIF intensity. This was accomplished by performing a three-dimensional interpolation of the LIF data set. This interpolation was then used to generate a set of four, three-dimensional iso-surfaces of equivalent LIF intensity. Four iso-surfaces representing values of 50, 100, 150, and 200 thousand counts were specified…. The iso-surfaces were generated using the Department of Defense Groundwater Modeling System (GMS) to perform a three-dimensional interpolation of the entire LIF data set," and thereby to provide "a generalized depiction that allows for rapid visualization of the approximate distribution of contamination."

Figures C-1 and C-2 in Appendix C of this TM are Figures 3 and 4 in the SCAPS Report, and are preceded by the legend that is included in that report as Figure 2. Figure C-1 shows the LIF data and analytical results obtained from soil samples collected during the SCAPS Investigation, including the iso-surfaces described above. The contours shown in Figure C-1 indicate the iso-surface outlines. Figure C-1 "also shows a stippled area representing the lateral extent of contamination. This area was drawn by a simple visual inspection of the maximum LIF intensity for each push. The shape of this area generally mimics the shape of the iso-surface contours. Some significant discrepancies between the stippled area and the contours occur where there are few, or no pushes with low LIF intensities bounding pushes with high intensities, such as near the northern tip of sump 3. The lack of low intensity data points causes the iso-surfaces to be extended outward towards the edge of the interpolation

grid. This is an artifact of the interpolation process. The stippled area is considered a more accurate estimate of the true extent of petroleum contamination."

Figure C-2 "shows the results of laboratory analyses of soil samples collected for previous investigations. An examination of these results shows that there are very few samples collected outside the stippled area having petroleum concentrations greater than 200 mg/kg [milligrams per kilogram]. These data suggest that the stippled area shown in Figures 3 and 4 [i.e., Figures C-1 and C-2 in Appendix C of this TM] represents a reasonably accurate approximation of the lateral extent of petroleum contamination greater than a few hundred mg/kg. The pattern of the contours should be expected to show the highest concentrations centered on the source of contamination, the sumps, with observed concentrations decreasing as the distance away from the sumps increases with some elongation of the plume in the downgradient (i.e., northeast) direction…. [T]he intensities within the sump boundaries, while generally high, are for the most part somewhat lower than the intensities observed just outside the sump boundaries…. The vertical distribution of petroleum contamination, as indicated by significant fluorescence intervals,…shows the majority of the contamination is generally found at elevations ranging from approximately 1.5 to 8.5 feet above MSL. POL fluorescence is observed both above and below this interval, but these occurrences are relatively rare and appear to be localized. Furthermore, the intensities outside this vertical interval tend to be relatively low. It should also be noted that, based on the water levels measured on May 26, 1999, a majority of the contamination was found below the water table."

3.2.2 Debris Observations

The SCAPS Report notes that "evidence of buried debris (i.e., shallow refusals) occurred mostly within the sumps, and the pushes within the sumps tend to have a lower LIF response than might be expected." The results from the GeoVis pushes indicated that the buried debris accounted for the unexpectedly low fluorescence intensities found in selected LIF pushes. "Pushes located outside the sump boundaries, however, encountered shallow refusal relatively infrequently, and exhibited LIF responses more consistent with expectations. Pushes close to the sump boundaries, particularly along the downgradient side of the sumps, typically have maximum intensities above 200,000 counts, and have relatively thick intervals of very high fluorescence intensities (150,000 counts or more). Fluorescence intensities then fall off with increasing distance from the sumps (refer to Figure 3 [i.e., Figure C-1 in this TM]). Based on this evidence, it is our opinion that:

1. Relativity large void spaces occur primarily in the presence of buried debris.
2. Buried debris occurs mostly within the sumps and is probably due to incorporation of debris in the material used to backfill the sumps upon closure.
3. Some of the LIF intensity data collected within the sump boundaries may underestimate actual hydrocarbon concentrations.
4. LIF intensity data collected outside the sumps, for the most part at least, accurately depicts relative petroleum concentrations."

3.2.3 Sampling and Analysis for TPH

As described in Section 2.2, 17 soil samples were collected and analyzed for purgeable and extractable TPH using EPA Method 8015 (DHS-modified). The SCAPS Report presents the following results: "No gasoline or JP-5 was detected in any of the samples. No petroleum contamination of any kind was detected in three of the samples…. The remaining fourteen samples were found to contain varying proportions of diesel fuel and/or heavier oil-like hydrocarbons…. [T]he carbon range of the oily product is approximately C11 to C30. This overlaps most of the C9 to C24 carbon range of diesel fuel. These overlapping carbon ranges make it impossible to accurately quantify the two products separately. In the initial laboratory report the reported carbon range for DRO (i.e., oily product) varied from sample to sample."

3.2.4 Estimation of the Total Mass of Petroleum Contamination

Also as described in the SCAPS Report, estimates of the total mass of petroleum contamination were calculated using the following three-step process:

1. "The first step was to determine the volumes of a set of three-dimensional solids representing soil masses with similar petroleum concentrations based on the normalized LIF data."
2. "The second step is to assign a specific, average concentration to each solid."
3. "The final step entails multiplying the volume of each solid by it's *[sic]* assigned concentration and appropriate conversion factors to give a mass of contamination for each solid. These individual masses are then summed to give the total mass of contamination in the plume."

Using this process, "[t]wo estimates of the contaminant mass were calculated. The first estimate used the procedures described above, and yielded a total of approximately 168,000 cubic yards of soil contaminated with approximately 960,000 gallons of petroleum. This is considered a reasonably conservative estimate based on the data presented in this report. The second estimate was done as a "worst-case" scenario. This was done in a fashion nearly identical to the first estimate, except that the area within the sump boundaries was assumed to have a layer of free product 6 feet thick. This corresponded to measurements of free product in monitoring well 02W01, which has the largest free product layer measured in any of the monitoring wells at the site. This 6 feet thick layer was further assumed to have a porosity of 40% with an average petroleum saturation of 50% of porosity.

The area occupied by the sumps roughly coincides with the area occupied by the 150,000 count solid, so the contaminant mass calculated for the assumed free product layer was substituted for the combined mass of the 150,000 and 200,000 count solids from the first estimate. Additionally, the soil volumes of the non-detect solid and the 50,000 and 100,000 count solids from the first estimate were increased by 10 percent. The average contaminant concentrations of these three solids were also assumed to be greater than those used in the first estimate. This worst case estimate yields a total of approximately 209,000 cubic yards of soil contaminated with approximately 2.7 millions gallons of petroleum."

3.2.5 Conclusions

The following petroleum-related conclusions are presented in the SCAPS Report:

- Petroleum contamination at the site is a mixture of oil and lesser amounts of diesel fuel.
- Most of the petroleum contamination is found between 1.5 and 8.5 feet above MSL.
- Approximately 168,000 to 209,000 cubic yards of soil are contaminated with approximately 960,000 to 2,700,000 gallons of petroleum.
- The contaminant plume extends over an area of approximately 490,000 square feet.
- A large part of the contamination lies within the "smear zone" defined by the typical seasonal fluctuations of the water table.
- The contaminated soils consist predominantly of very soft silts and clays.
- The petroleum contamination is highly viscous.
- Continuing migration of the plume is greatly limited by the fine-grained soil, the high viscosity of the plume, and the presence of groundwater in the contaminated zone.

The report further concludes: "Based on the data presented in this report, including data from previous investigations, it is our opinion that petroleum contamination at the site has been adequately characterized."

For the purposes of this TM, as noted in Section 2.2, the findings of the SCAPS Investigation were reviewed to evaluate whether IR02 may be contributing to the observed free product along Dump Road or Azuar Drive. These findings indicate that the mapped eastern lateral extent of free product at IR02 is approximately 500 to 700 feet west of the western side of the DRMO Site. (Figure 4 shows the locations of IR02 and the DRMO Site.) Continuing migration of the plume of petroleum contamination at IR02 is greatly limited by the high viscosity of the plume, the fine-grained soil in the area, and the presence of groundwater in the contaminated zone. It is therefore highly unlikely that IR02 is contributing to the observed free product along Dump Road or Azuar Drive.

3.3 Investigation Area H2 Remedial Investigation (1999-2000)

The RI Report documenting this investigation (TtEMI, 2000) describes conditions at the DRMO Site; summarizes the history of the site and investigations prior to 1999; presents the RI findings (including the results of sampling and analysis of environmental media); and provides conclusions and recommendations based on those findings. The focus of the discussion in this section is TPH, often referred to in the RI Report as "petroleum indicators". This section summarizes the findings of the RI related to the nature and distribution of TPH, particularly free-phase hydrocarbons in the subsurface at the DRMO Site and in the immediate vicinity.

Section 3.3.1 discusses the RI findings with respect to potential TPH sources, release mechanisms, and migratory pathways. The TPH-specific findings and conclusions presented in the RI Report are summarized in Sections 3.3.2 and 3.3.3, respectively.

3.3.1 Potential TPH Sources, Release Mechanisms, and Migration Pathways

As noted in Section 2.3, the RI incorporated the results obtained from several previous investigations conducted at the DRMO Site and in the vicinity, and included the development of a CSM based on those results. Using the CSM, the RI Report identifies potential sources of contamination at the DRMO Site based on historical activities and operations. The sources reported as possible candidates for the TPH observed at the DRMO Site and in the vicinity are as follows:

- Activities formerly associated with the scrap bin storage and disposal operations
- Historical transformer and demilitarization storage activities in and adjacent to the northern portion of the DRMO Site
- Electrical transformer and substation operations in the former Building 715 and the vicinity (the IR16-Subsite 715 area located within the FSA; see Figure 4)
- Activities in Building 661 (formerly used primarily for glass and paper recycling and containing a large bundling press; see Figure 1), and potential contaminant migration along the utility lines between the building and adjoining areas
- Utility vaults UV-1 (Figure 4) and UV-2 near Building 661 (although not discussed in detail, the RI Report states that activities in Building 661 may have contributed to the oily contamination observed in UV-1 during the PA/SI, discussed in Section 3.1)
- An oil discharge pipeline located at 6 feet bgs and running parallel to Azuar Drive to approximately 50 feet north of Building 661 (see Figure 5)
- The storm sewer line and possible storm drain outfall(s) or drain field(s) southwest of the former scrap storage bins in the southern portion of the DRMO Site
- Storm drain lines, vaults, and outlets
- Railroad tracks (see Figure 4)

The RI Report states that potential release mechanisms for all contaminants included handling and disposal practices used during scrapyard operations, spills and leaks from hazardous materials stored at various locations at the DRMO Site, and leaks or releases from the sanitary and storm sewer drain systems. Based on these potential sources, the RI Report also identifies several potential contaminant migration pathways. The pathways possibly related to the migration of TPH in the subsurface at and immediately surrounding the DRMO Site are identified as:

- Infiltrations of spills and leaks
- Transport through groundwater
- Transport through storm, sanitary, and industrial sewers
- Transport through subsurface soil to groundwater
- Oil dumped into the oil discharge pipeline running parallel to Azuar Drive and near Building 661, and released to subsurface soil (This pipeline, shown in Figure 5, is

discussed with reference to the DRMO Site and the IR16-B4/Building 455 Area in Section 3.5.2.)

3.3.2 TPH in Environmental Media

Using the analytical results obtained during the RI and previous investigations, the RI Report also presents the findings for "petroleum indicators" (TPH-motor oil, TPH-diesel, and TPH-gasoline) in soil and groundwater. The report states that, in general, "petroleum indicators and free product were detected in soil and groundwater throughout Investigation Area H2" (including the DRMO Site).

In soil, TPH-motor oil, TPH-diesel, and TPH-gasoline were all detected at and near the DRMO Site at concentrations exceeding Mare Island-specific soil comparison criteria of 400 mg/kg for TPH-diesel and TPH-motor oil and 150 mg/kg for TPH-gasoline, with TPH-gasoline exceeding the criterion in only one sample. The RI Report findings for the various TPH fractions in soil are summarized below.

3.3.2.1 TPH-Motor Oil in Soil

TPH-motor oil concentrations exceeded the comparison criterion of 400 mg/kg in 129 of 312 soil samples with the highest concentration, 90,000 mg/kg, detected in a sample collected from 8.0 to 8.5 feet bgs in a boring located in the northwestern corner of Building 661 (near the location of UV-1 shown in Figure 4), approximately 75 feet west of the centerline of Azuar Drive. Elevated concentrations of TPH-motor oil in shallow soil (less than 2 feet bgs) were detected across the entire DRMO Site. Elevated concentrations of TPH-motor oil in deeper soil (greater than 2 feet bgs) were generally detected along the eastern and western borders of the DRMO Site. The RI Report states that the most likely source of elevated TPH-motor oil in shallow soil is the waste oil historically stored at the DRMO Site, released via surface spills.

The report also notes that the highest concentrations of TPH-motor oil in soil are considered to be associated with this free product present along Azuar Drive. Based on boring logs, the free product appears to extend along Azuar Drive from the south side of the former demilitarization storage area, south under Building 661 to the location of former Building 275, and 150 feet west of Azuar Drive into the DRMO Site. The free product was also mapped as far as 200 feet east of Azuar Drive. The depth of the free product ranges between 5 and 19 feet bgs. The report states that the most likely source of the free product is the oil discharge line running parallel to Azuar Drive and located approximately 50 feet north of Building 661. However, the RI results show that free-phase hydrocarbons are located on both sides of Azuar Drive and Dump Road.

It should also be noted that in a "residue" sample from UV-1, the concentration of TPH-motor oil (13,000 mg/kg) exceeded the soil comparison criterion of 400 mg/kg. According to the RI Report, this exceedance is likely associated with the oily contamination in the utility vault.

3.3.2.2 TPH-Diesel in Soil

TPH-diesel concentrations exceeded the comparison criterion of 400 mg/kg in 33 of 311 samples with the highest concentration, 47,000 mg/kg, detected in a sample collected from

8 to 8.5 feet bgs in a boring within Building 661 (again in the vicinity of UV-1). Elevated concentrations of TPH-diesel in shallow soil were generally detected in the scrap storage bins area (located along the southern boundary of the FSA). Elevated concentrations of TPH-diesel in deeper soil were generally detected within Building 661 and in the area west of the fence that encloses the DRMO Site. The RI Report states that the most likely source of elevated TPH-diesel in shallow soil is the waste oil historically stored at the DRMO Site, released via surface spills; the most likely source in deeper soil is the free product present along Azuar Drive.

3.3.2.3 TPH-Gasoline in Soil

A TPH-gasoline concentration exceeded the comparison criterion of 150 mg/kg in only one of 158 samples, which was collected from 1 to 1.5 feet bgs in a boring located in the southeast corner of the DRMO Site, about 40 feet west of the centerline of Azuar Drive. The report states that the most likely source of this occurrence of elevated TPH-gasoline in shallow soil is a release via surface spill(s) at the DRMO Site.

3.3.2.4 Summary of TPH in Soil

The RI Report summarizes the TPH-related analytical results obtained from soil samples as follows:

- Elevated concentrations of TPH-motor oil and TPH-diesel were detected throughout the DRMO Site and at all depths.
- TPH in shallow soil is likely associated with the waste oil historically stored at the DRMO Site, released via surface spills.
- TPH in deeper soil is likely associated with the free product detected along Azuar Drive.

3.3.2.5 TPH in Groundwater

In groundwater, the RI Report states that "TPH-motor oil/diesel" was detected at the DRMO Site at concentrations exceeding the groundwater comparison criterion of 1.4 milligrams per liter (mg/L) in 18 of 70 samples. The highest concentration, 2,390 mg/L, was detected in a sample from a location approximately 80 feet north of Building 661 and 40 feet west of the centerline of Azuar Drive.

It should also be noted that "TPH-diesel/motor oil" was detected at a concentration of 51 mg/L in a standing water sample collected from utility vault UV-1, exceeding the groundwater comparison criterion of 1.4 mg/L.

3.3.3 RI Report Conclusions and Recommendations

The following sections discuss the RI Report's conclusions related to human and ecological risks and contaminant fate and transport, as well as the report's overall recommendations for subsequent site activities.

3.3.3.1 Risk Assessment for Soil and Groundwater

According to the RI Report, the results of the human health risk assessment for the DRMO Site showed that although occurrences of TPH-motor oil and TPH-diesel are extensive in

soil at the site and in the vicinity at concentrations above comparison criteria, they are not associated with significant potential risk because TPH-motor oil and TPH-diesel do not contribute significantly to the total estimated cancer risk or hazard index (HI) for the site. The findings of the ecological risk assessment were that the DRMO Site is paved, covered with gravel, or contains buildings, and therefore does not provide habitat for ecological receptors. Based on the expectation that the site will be reused for commercial purposes, the RI Report concludes that the DRMO Site will not likely provide such habitat in the near future.

With regard to groundwater, the report states that "potential human health cancer risks are below the risk management range and the HI for potential non-cancer adverse health effects do not exceed 1" (the CERCLA criterion for determining significant potential risk). The report further concludes that "[n]o chemicals detected in groundwater contribute to the total human health or ecological risk."

3.3.3.2 Contaminant Fate and Transport

In its fate and transport analysis, the report states that although TPH concentrations exceeded soil and groundwater comparison criteria, "the fate of TPH contaminants detected in soil in the DRMO Scrapyard Area is largely controlled by adsorption reactions with soil mineral surfaces or soil organic matter, volatilization and diffusion to the atmosphere or groundwater, and microbial degradation. The concentrations of TPH in soil will likely diminish over time because of natural attenuation processes such as volatilization, biological degradation, and dispersion."

3.3.3.3 RI Report Recommendations

The RI Report's Decision Summary for the DRMO Site concludes that "soil and groundwater contamination is adequately characterized", and that "additional sampling is not required" for decisionmaking purposes.

Therefore, while the RI Report recommends that an FS be conducted at the DRMO Site, this would only be for the purpose of evaluating alternatives for remediating potentially unacceptable risks associated with lead and PCBs—not for remediating TPH contamination, which the report concludes is unnecessary.

3.4 Follow-up to the Investigation Area H2 Remedial Investigation (2001)

The following is a summary of the observations and conclusions related to the presence of free product at the DRMO Site as presented in the addendum to the RI Report for IA H2 (TtEMI, 2001).

As noted in Section 2.4, free product was observed in soil borings advanced during the RI at the DRMO Site (west of Azuar Drive) and in the IR16-B4/Building 455 Area east of Azuar Drive (see Figure 4). The addendum presents a discussion of the lateral and vertical extent of the free product based on the borings on both sides of Azuar Drive.

The lateral extent of the area where RI soil borings encountered free product (Figure B-3 in Appendix B of this TM, which is Figure 1 in the addendum) indicates two areas of free product at depth within the DRMO Site and east of Azuar Drive. According to the addendum, the free-product areas are bounded by borings where free product was not encountered. Soil from several borings at the west end of the DRMO Site was also stained with free product (Figure B-3). Based on the boring logs provided in Appendix A of the addendum, free product is typically encountered in soil in a zone from 5 to 15 feet bgs. The depth of the free product along Azuar Drive (as deep as 17 feet bgs) is greater than in the northwest portion of the DRMO Site, where the maximum depth is 7.5 feet bgs. The vertical distribution of free product is illustrated in geologic cross-sections (Figures 1-10 through 1-12 in the addendum**),** and the depth to groundwater ranges from 2 to 12 feet bgs.

The free product is described as being "black and tar-like, having a strong odor. It was observed as immiscible fluid droplets partially saturating the pore space in soils above and below the water table, not as a distinct layer of immiscible fluid floating on the water table." The addendum concludes that the free product "is a dense, black, viscous oily liquid and is believed to be relatively immobile on account of its high viscosity contributing to a very low permeability. This low mobility is evidenced by the trapping of the free product several feet below the groundwater table. The free product consists of weathered petroleum hydrocarbons not contaminated with significant concentrations of PCBs or other chemicals. The free product was detected at the site in subsurface soils and is more likely the result of discharge of oil from the sump or potentially from the discharge of oily waste into the dredge spoil ponds before the area was filled. The free product appears to be relatively immobile because of its high fluid viscosity and because it us *[sic]* surrounded by low-permeability, clayey soils. The current lateral extent of free product may be the result of migration from the oil discharge line, although this seems unlikely considering the current highly viscous nature of the free product. The current extent of the free product may alternatively be the result (at least in part) of disposal of waste oil in the vicinity of the DRMO Scrapyard and the IRI6-B4 and Building 455 Area prior to the placement of dredge spoils and artificial fill."

3.5 Investigation Area B Remedial Investigation (2002-2004)

As discussed in Section 2.5, the areas of potential environmental concern addressed during the RI for IA B included IR01 (historical fill areas), the IR16-B4/Building 455 Area, and the former CTA/IA B.1 in the EETP. The findings from these areas (see Figure 4) are presented in full in the RI Report for IA B (CH2M HILL, 2004c) and summarized in Sections 3.5.1 through 3.5.3.

3.5.1 IR01 Historical Fill Areas

As discussed in Section 2.5.1, the RI Report describes historical fill activities at IA B in detail because the area also contains portions of IR01. The report states that in general, "the nature and extent of contamination in soil and groundwater in IR01 have been adequately characterized for the purposes of evaluating potential risks to human health and the environment." The report also states that petroleum hydrocarbons are "not associated with IR01 fill material based on infrequent detection." The RI evaluated the results of more than 400 historical analyses for TPH (as diesel, motor oil, gasoline, or TRPH) that had been

performed on more than 120 soil samples collected from approximately 50 locations in IR01. Approximately 5 percent of these samples contained detectable levels of TPH that exceeded 250 mg/kg, but 95 percent of the samples did not. The RI Report states: "Based on this information, TPH is not a parameter associated with IR01 fill."

With reference to historical fill areas at the DRMO Site and in the vicinity, the RI Report for IA B presents the following findings:

- The DRMO Site lies within the IR01 Undeveloped Area, also known as the IR01 Fill Area (Undeveloped Portion), which consists of fill and disposal areas to the west of Azuar Drive that generally have not contained buildings and structures (although the DRMO Site is an exception). As stated in Section 1.3 and indicated in Figure 2, filling of the DRMO Site and the area south of the site with dredge spoils was conducted from 1925 to 1930. Appendix A contains historical maps and aerial photographs of fill operations at the DRMO Site and in the vicinity. The area was identified as a non-waste fill area, and although the RI Report notes that free-phase hydrocarbons have been detected at the DRMO Site and in the IR16-B4/Building 455 Area (as discussed in Section 3.5.2), the report's overall conclusion that petroleum hydrocarbons are not associated with the IR01 fill material applies to the DRMO Site.

- The EETP east of Azuar Drive is part of the IR01 Developed Area, also known as the IR01 Fill Area (Developed Portion), which contains fill areas that have accommodated the construction of buildings and structures. Figure 2 indicates the portion of this area adjacent to the DRMO Site, which was filled between 1910 and 1920 and contains the IR16-B4/Building 455 Area discussed in Section 3.5.2. The RI Report's overall conclusion that petroleum hydrocarbons are not associated with the IR01 fill material applies to this area.

- The former CTA (Figure 4) in the EETP, most of which occupies Investigation Area B.1 as noted previously, was filled between 1925 and 1942 and is part of the IR01 Undeveloped Area. The RI Report's overall conclusion that petroleum hydrocarbons are not associated with the IR01 fill material applies to the former CTA, which is discussed further in Sections 3.5.3 and 3.9.

3.5.2 IR16-B4/Building 455 Area

As discussed in Section 2.5.2, following removal actions to address contamination by lead and pesticides in this area (located in the EETP as shown in Figure 4), the RI for IA B evaluated the remaining vertical and lateral extent of chemicals in the area, including free-phase petroleum hydrocarbons present in soil and groundwater. Based on this evaluation, the RI Report (CH2M HILL, 2004c) concludes that soil and groundwater contamination in the IR16-B4/Building 455 Area have been adequately characterized and mitigated. Closure without further activity is recommended.

The RI Report proposes the hypothesis that free phase petroleum hydrocarbons present at IR16-B4/Building 455 to be from a source within the DRMO Scrapyard. Other potential sources identified in the RI Report include utility lines running along Azuar Drive (via backfill for the utility lines), surface spills within the area, and the historical waste oil disposal sumps in IR02 that are shown in Figure 4 and discussed in Sections 2.2 and 3.2 of this TM.

The RI also found that the lateral extent of free-phase hydrocarbons in the IR16-B4/Building 455 Area was larger than previously established, although not contiguous. The free-phase hydrocarbons in this area were described as relatively immobile regions of isolated non-aqueous phase liquid globules dispersed within inter-granular pore spaces that act to reduce the overall permeability of soils with respect to water.

3.5.3 Former Crane Test Area/IA B.1

As noted in Section 2.5.3, additional RI work was conducted at the portion of IA B referred to as IA B.1, most of which consists of the former CTA located north of the DRMO Site and Dump Road (see Figure 4). As noted in Section 3.5.1, this work included an evaluation of the fill material placed within the former CTA between 1925 and 1942; the former CTA is part of the IR01 Undeveloped Area, and the RI Report's overall conclusion that petroleum hydrocarbons are not associated with the IR01 fill material applies to the former CTA. In addition, a groundwater investigation was conducted at the former CTA in late 2006 and early 2007. The findings of both the RI activities and those conducted during the 2006-2007 groundwater investigation are summarized in Section 3.9.

3.6 Railroad Track Corridor Investigation (2004)

During the sampling activities at the former Railroad Track Corridor, described in Section 2.6 and documented in the investigation report (CH2M HILL, 2004b), gravel railroad ballast material was found to be predominant in the first 1 to 2 feet of each boring. Sandy clay and clayey sand mixed with minor gravel were encountered from 2 to 4 feet bgs throughout the Railroad Track Corridor. The soil from 4 to 6 feet bgs generally consisted of clayey gravel or sand. Groundwater was encountered at seven of the 12 sampling locations at depths ranging from 1.5 to 6 feet bgs, and was shallowest at the western edge of the Corridor. (The location of the former Railroad Track Corridor is shown in Figure 4 of this TM.)

Periodic readings recorded using a photoionization detector indicated that no organic vapors were detected at most of the sampling locations, except in areas where there was evidence of petroleum contamination. A petroleum odor, sheen, and staining were noted in soil samples collected from 2 and 3 feet bgs at the approximate mid-point of the Railroad Track Corridor, and one adjoining sample had a slight petroleum odor. At these locations, total TPH concentrations ranged from 1,400 to 2,600 mg/kg.

TPH-motor oil was detected in all the samples, at concentrations ranging from 7 to 2,600 mg/kg, and the investigation report attributes this to railroad operations. TPH-diesel was also detected in nine of the samples at concentrations ranging from 4.7 to 920 mg/kg. Nearly half of the TPH-diesel detections were found in samples collected from 4 to 6 feet bgs. There was only one detection of TPH-gasoline, at the extremely low concentration of 0.37 mg/kg. The highest total TPH concentration was 3,420 mg/kg, at 5 feet bgs immediately west of the former Building 675. "Free-phase petroleum product" with a diesel/oily odor was observed at the groundwater interface at this location.

Based on the findings of the investigation, the Railroad Track Corridor was included in the overall removal action for the FSA portion of the DRMO Site, described in Sections 2.7 and 3.7. Prior to the removal action, the railroad tracks were decommissioned and removed from the area.

3.7 Non-Time-Critical Removal Action at the Fenced Scrapyard Area within the DRMO Site (2005-2007)

As described in Section 2.7, the Navy decided that activities related to petroleum and TPH should be conducted for informational purposes during the implementation of the NTCRA. These activities included the collection and analysis of confirmation soil samples for TPH-diesel, and the recording of visual observations noting the presence and nature of petroleum-related contamination in the excavated areas within the FSA.

Seventy-one confirmation soil samples from grid bottom and boundary sidewall locations were analyzed for TPH-diesel. Most of the samples were collected from 1.5 feet bgs, with a few samples collected from 3 to 5 feet bgs. Thirteen of these samples had detections of TPH-diesel between 100 and 500 mg/kg; one sample had a detection between 500 and 1,000 mg/kg; three samples had detections above 1,000 mg/kg; and the remaining samples had TPH-diesel concentrations lower than 100 mg/kg. The average concentration of TPH-diesel calculated from the samples (with nondetects calculated at 50 percent of the reporting limit) was 180 mg/kg. The grids that yielded sample results greater than 100 mg/kg were FS-2/3, FS-10/11, FS-15, FS-17/18, FS-25/26, FS-38, FS-40, FS-52, FS-60, FS-66, FS-68/81, FS-74, FS-98, and FS-100. (All the NTCRA grids are shown in Figure 4.)

The three highest concentrations of TPH-diesel were detected in bottom and sidewall samples from grids FS-17 and FS-18 (1,000 and 6,000 mg/kg, respectively) and in the sample from grid FS-98 (1,600 mg/kg). Grids FS-17 and FS-18 were located on the western boundary of the FSA near the Railroad Track Corridor. The sample from grid FS-98, located on the southern boundary of the FSA, had no indications of stained ground surface or malodorous conditions. Other elevated concentrations of TPH-diesel were grouped in the area near Azuar Drive where strong TPH odors were observed and oil seeps were observed on the ground surface. These samples were from grids FS-38 (290 mg/kg), FS-52 (130 mg/kg), and FS-66 (290 mg/kg). Some locations of visual TPH observations (see below) correlated with locations with olfactory impacts. PAHs were not detected at concentrations above the cleanup goals at grids where there were elevated TPH-diesel concentrations.

There are no known or potential sources for the TPH-diesel found at the locations identified above, and the occurrences are perhaps related to surface spills that occurred prior to the closure of the DRMO facilities.

During demolition activities, the product observed at numerous locations was a thick, viscous, black, opaque liquid with a vitreous luster. The product was nearly solid at air temperatures below 60° F and became less viscous with rising temperatures. It was commonly observed as small surface accumulations on freshly cut soil. It was first observed in and below railroad ballast in the freshly-cut soil surface beginning in the eastern portion of the FSA (grid FS-51) and trending southwesterly to the south-central portion of the FSA (grid FS-74) along the double railroad spur that formerly paralleled the southern boundary of the FSA.

A prominent product occurrence manifested itself near the northeastern boundary of the FSA (grid FS-24) when a large "void" developed in the ground surface after being tracked over by heavy equipment. The void dimensions were approximately 4 feet by 7 feet and

more than 3 feet deep. A 4-inch-thick accumulation of viscous product formed on the surface of water in the void. As the water level subsided in the void, the product coated the sidewalls of the void and solidified over time.

Upon the completion of NTCRA soil excavation activities, scattered occurrences of petroleum-related contamination were observed across the FSA in the form of seeps to the ground surface that formed small mounds of oil globules or rings of viscous product on the surface. Soil types appeared not to control the occurrence of these seeps. The density of the seeps increased over the winter and through the spring concomitant with rising ground-water levels. A majority of the grids north of grid line FS-53 through FS-66 had one or more seeps at the surface; the most significant surface seeps were found near the eastern boundary of the FSA in the vicinity of the former OSB and utility vault UV-1 (grids FS-51, FS-52, and FS-64 through FS-66).

The qualitative observations of free-product occurrences during the NTCRA suggest that the product is related more to the heavier TPH-range organics found during the OSB Investigation, described in Sections 2.8 and 3.8, than to site-wide TPH-diesel spills or leaks at the DRMO Site. The occurrences of petroleum-related contamination in the form of a viscous product on the ground surface from oil seeps, which were concentrated along the eastern boundary of the FSA as described above, correspond to the location of the OSB and its associated horizontal appurtenances near the FSA boundary, and to the occurrence of large accumulations of free product in the subsurface void spaces formed by large amounts of metallic debris beginning at about 4 feet bgs. The surface seeps found at the DRMO Site were similar in appearance and location to the petroleum "reservoir" found in the subsurface during the OSB Investigation. The free product may be laterally widespread in the subsurface or found in distinct interstices.

3.8 Oil Sump Box Investigation (2005-2006)

The OSB Investigation confirmed the existence of the OSB and associated piping and identified the presence of free-phase petroleum hydrocarbons along the portions of Azuar Drive and Dump Road that were investigated. As discussed in Section 2.8, based on site conditions encountered during field activities, the project SOW was modified to eliminate some borings and replace others with trenches. Figure 6 shows the locations of the borings and trenches installed during the investigation, and boring and trench logs are provided in Appendix D1. The following sections discuss the findings of the OSB Investigation in the two areas investigated.

3.8.1 Findings along Azuar Drive

As described in Section 2.8.3, the OSB Investigation along Azuar Drive included the installation of seven soil borings and an 80-foot-long trench. Tables D2-2 through D2-10 in Appendix D2 present the analytical results from the soil and free product samples collected. Appendix D2 also contains fingerprint chromatograms of the free product samples. Appendix D3 contains photographs showing site conditions at the time the OSB and associated piping were removed. The findings of the activities conducted along Azuar Drive during the OSB Investigation are presented below. Figure 7 shows a cross section of the OSB and the adjacent areas, oriented parallel to Azuar Drive, based on the investigation findings.

3.8.1.1 Oil Sump Box Excavation and Removal

Prior to removal of the OSB, visual inspection of its interior showed that there were several feet of standing water and what appeared to be four openings in the north and south walls. Two of the openings appeared to be rectangular, located at approximately 3 to 4 feet bgs, and about 12 inches wide and 6 inches high. The edges of these upper openings appeared to have been chipped with a chisel, and rebar was visible near the left and right edges of the openings. The lower openings appeared to be 6-inch-diameter holes through the wall; however, water was entering only through the southern lower opening at a rate of about 1 to 3 gallons per minute (gpm). No water was entering through the upper openings in either wall. The OSB was pumped out prior to its removal.

Inspection of the OSB, after it was removed, showed that the deeper openings were once connected to a perforated, galvanized metal pipe approximately 6 inches in diameter. The pipe was located at approximately 8 feet bgs. At the time of excavation, the pipe on the southern side was still connected to the OSB, but on the northern side, the pipe had been previously disconnected and the opening plugged with concrete. The upper openings of the OSB were not connected to a pipeline and were found to be covered with a steel grate with openings of about 1/2 inch. The metal grate and the rest of the OSB were installed in coarse gravel backfill. Water observed flowing through the southern opening was entering through the perforated pipe. Water was not entering through the northern opening because the pipe had been disconnected and the opening plugged with concrete. Water was not flowing through the upper openings because they were slightly above the water table. These observations and the frequent measurements of the depth to groundwater in this area of Mare Island suggest that the perforated pipe was constructed below the average depth of groundwater at that location. Based on visual observations and the commonly observed depth to groundwater, it is clear that the depth of the original discharge line was below the water table in this area of Mare Island.

3.8.1.2 Perforated Pipe Features

As shown in photographs in Appendix D3, the perforated pipe was constructed in coarse gravel backfill (with a grain size of approximately 2 to 3 inches in diameter) extending from about 2 feet bgs, immediately below surface concrete and road base material, to a depth of about 12 feet bgs with a thick layer (up to 5 feet) of metal debris, but also including some wood debris between approximately 4 and 12 feet bgs. The metal debris was mixed with fine-grained soil, but contained large "void" spaces that were filled with free product. The top and bottom surfaces of the debris layer were irregular, resulting in the variability of the depths to the top and bottom of the layer. Metal debris consisted of a wide range of metal objects including wire cable (about 1/2 inch thick), sheet metal, crushed metal file cabinets, ship bulkheads, and a variety of metal bolts and other items. The metal debris layer extended across the top of the perforated pipe leading from the OSB, which indicates that the metal debris was probably part of the backfill material placed at the time the OSB and pipeline were constructed. Alternatively, the metal debris could have been part of a later backfilling event, but this seems unlikely considering that the OSB was probably constructed following the start of DRMO operations. It is not clear why the fill above the pipe contained significant metal debris, nor is the lateral extent of the debris known. Appendix D3 contains photographs of the metal debris in the OSB trench installed along Azuar Drive.

3.8.1.3 Fill and Groundwater

Fine-grained backfill was found to extend about 1/2 to 1 foot on all sides of the OSB. Water was not immediately encountered during excavation, but entered the excavation overnight. The water in the excavation was present at about 4 feet bgs, roughly corresponding to the bottom of the shallow opening in the northern wall of the OSB. Free product was encountered within about 3 feet of ground surface and was initially found directly associated with the metal debris layer. Photographs in Appendix D3 show that during the initial phase of excavation, the fill material was relatively dry and the first visual occurrence of free product was as coatings on pieces of metal debris. As the excavation deepened, the occurrence of free product increased and then abruptly ended when the bottom of the debris layer was encountered. The metal debris layer was visible in the sidewalls of the trench and extended laterally away from the trench for an unknown distance. At shallow depths, the sidewalls of the trench were generally free of product. As depths increased, oil was observed to exist primarily in the metal debris or as occasional thin layers in voids or cracks in the soil above or within the depth interval of the metal debris layer. In general, free product was not found in significant quantities in the fine-grained soil above or below the metal debris.

The metal debris observed in the trench excavation was not noted in the soil borings installed along Azuar Drive. This is likely the result of the small diameter of the direct-push sampling equipment. Alternatively, it is possible that the metal debris observed in the trench was not present or was less significant at the boring locations. However, the observations of the distribution of free product in the trench and its presence in the borings strongly suggest that the debris layer is present at the locations of the borings, but was not recognized because of the limitations of the drilling method.

3.8.1.4 Analytical Results from Samples Collected

Four soil and three free product samples were submitted for analysis, as discussed in Section 2.8.3.1 and listed in Table D2-1 in Appendix D2. Tables D2-2 through D2-10 in Appendix D2 present the analytical results; Appendix D2 also contains fingerprint chromatograms for two of the free product samples (OSB-FP-ETN15-S6 and OSB-FP-ETN47-S3) and for an investigation-derived waste (IDW) sample, OSB-IDW-SE-001. The results of the sample analyses showed that the free product contained "heavy-end" hydrocarbons in the motor oil range. The laboratory reported that the samples did not indicate the presence of diesel or any other specific fuel type. The hydrocarbon range for these product samples was approximately C12 to at least C40. According to the laboratory report, based on the surrogates used in the analyses, the hydrocarbon pattern for these four samples were similar and most closely resembled a No. 6 (Bunker C) fuel oil, which is a typical fuel type found at many subsurface locations at Mare Island because of its historical use on ships.

The PAHs chrysene, naphthalene, phenanthrene, and pyrene were the most commonly detected constituents in the samples collected. Except for sample OSB-IDW-SE-001, in which the PCB Aroclor-1260 was detected at a concentration of 0.15 mg/kg, pesticides and PCBs were not detected in any of the samples. In addition, neither chlorinated VOCs nor benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected in any samples.

3.8.2 Findings along Dump Road

As discussed in Section 2.8.3, the five trenches OSBTR13 through OSBTR17 were installed along the south side of Dump Road. The locations of the trenches are shown in Figure 6, and trench logs are provided in Appendix D1. Tables D2-3 through D2-10 in Appendix D2 present the analytical results from the free product and soil samples that were collected from the trenches, and Appendix D3 contains photographs of the trenches. The results of the activities conducted along Dump Road during the OSB Investigation are presented below.

As described in Section 2.8.3.3 and shown in the trench logs in Appendix D1, the trenches were approximately 9 feet long and 2 feet wide and extended to depths of between 7 and 9 feet bgs. The most common lithologies encountered in the trenches were silt and clay. Gravel was commonly encountered in the upper 1 foot of each trench and is considered to be associated with rail ballast. A few thin layers of silty sand or sand were observed in trench OSBTR15. The depth to water in the five trenches varied only slightly, from 4 to 5 feet bgs.

Free product was encountered within approximately 4 feet of the ground surface and was generally found directly associated with the metal debris layer, although oil was also found in small soil partings, laminations, or in voids associated with buried plant stems (possibly former mud flat deposits buried by dredge spoils).

A layer of metal debris was observed in trenches OSBTR13 through OSBTR16. The debris layer, which was up to 2 feet thick in trench OSBTR16, consisted of a wide range of metal objects including wire cable (about 1/2 inch thick), sheet metal, angle iron, metal shavings, and a variety of metal bolts and other items mixed with fine-grained soil. Similar to the observations along Azuar Drive, the metal debris layer contained large void spaces that were filled with free product in four of the five trenches. Free product was not observed in trench OSBTR13. The observations that the metal debris was visible in all four walls of the four trenches in which it was encountered suggests the metal debris was part of the backfill material placed at the time this area was developed, and predated the construction of the railroad tracks that were formerly located in the area.

Appendix D3 contains photographs of the metal debris in trenches installed along Dump Road. As shown in the photographs and described in the trench logs in Appendix D1, the occurrence of free product was largely related to the presence of the debris layer. At shallow depths (less than about 4 feet bgs), the sidewalls of the trenches were generally free of product. Outside the metal debris, free product was limited to small cracks or root structures in the fine-grained soil encountered in the trenches. The metal debris layer was visible in the sidewalls of the four trenches, as noted above, and extended laterally away from these trenches for an unknown distance.

All the samples collected from the trenches contained visible free-phase hydrocarbons. The results of the analyses of the free product and soil samples showed that the free-phase hydrocarbons are “heavy-end” hydrocarbons in the motor oil range, as previously identified along Azuar Drive. The laboratory reported that the samples did not indicate the presence of diesel or any other specific fuel type. The hydrocarbon range was approximately C12 to at least C40. According to the laboratory report, based on the surrogates used in the analyses, the hydrocarbon pattern for the samples were similar and most closely resembled

a No. 6 (Bunker C) fuel oil. As noted previously, based on historical investigations at Mare Island, this is considered a typical fuel type at many subsurface locations at Mare Island.

3.8.3 Summary of Investigation Findings

The OSB was located in the field and removed. Free-phase hydrocarbons were observed in soil borings and trenches installed along Azuar Drive and Dump Road. The laboratory reports show that samples did not indicate the presence of diesel or any other specific fuel type. The hydrocarbon range for these product samples was approximately C12 to at least C40, similar to No. 6 (Bunker C) fuel oil.

Based on visual observations, free product is largely confined to the metal debris layer commonly encountered in trenches installed along Azuar Drive and Dump Road, as well as at other locations along Dump Road. The free product encountered in the trenches associated with the OSB was largely limited to the metal debris layer, with significantly smaller amounts observed in cracks of the fine-grained soil above or below the metal debris layer.

3.9 Groundwater Investigation at the Former Crane Test Area (2006-2007)

The findings of the groundwater investigation at the former CTA are summarized in Sections 3.9.1 (hydrogeology) and 3.9.2 (nature and extent of contamination).

3.9.1 Hydrogeology

Groundwater elevations identified at the former CTA were based on the five well pairs installed in November 2006 during the groundwater investigation (Figure 4). At each location, as described in Section 2.9, one well was constructed in the debris layer (the shallow zone) and the other in the Younger Bay Mud (the deep zone).

Two of the five shallow wells installed in the debris layer were dry. The average groundwater elevation in the remaining three wells was approximately 6 feet above MSL, while in the five deep wells the average elevation was approximately 4.4 feet above MSL. According to the FS/RAP Report, the inorganic geochemistry results from samples collected in the shallow and deep wells indicate that "in general, groundwater cation and anion concentrations are typically much higher in the deep zone compared to the shallow zone.… Total dissolved solids concentrations are significantly greater in the deeper wells…. These inorganic data strongly support that the hydrogeologic conceptual site model for the CTA consists of two distinct groundwater-bearing units that do not appear to be hydraulically connected, although the units may be hydraulically connected in some localized areas of the CTA."

3.9.2 Nature and Extent of Contamination

As described in Sections 2.5.1 and 3.5, the RI Report for IA B (CH2M HILL, 2004c) presents a detailed analysis of historical fill operations in the former CTA, which is located in the IR01 Undeveloped Area. The major source of fill at the former Crane Test Area in 1925-1942 was dredge material from the Mare Island Strait. Although metallic, ceramic, and glass debris

have been observed in the shallow subsurface at the former CTA, the report attributes this debris not to the fill material but instead to the CTA's historical uses as a vehicle storage area, classification yard, and lumber salvage area from the mid-1940s through the 1980s, and as a crane testing area in the 1980s. The area is identified as a "non-waste fill area" in the report, which also concludes that petroleum hydrocarbons are not associated with the IR01 fill material because of infrequent detection. This conclusion applies to the former CTA.

The FS/RAP Report (CH2M HILL, 2008b) evaluates the data obtained from groundwater samples during the 2006-2007 groundwater investigation at the former CTA, along with (a) data from soil and groundwater samples that had been obtained during historical investigations in the area, and (b) data obtained from quarterly monitoring of the wells in the area in 2007 and 2008.

In soil, TPH-diesel was detected in 18 of 42 samples, seven of which had concentrations exceeding the Tier 1 Environmental Screening Level (ESL) for TPH-diesel in soil of 150 mg/kg (RWQCB, San Francisco Bay Region, 2007). Four of these seven samples were collected from the southwestern portion of the former CTA between 0.5 and 9.5 feet bgs, and had concentrations ranging from 1,100 to 2,469 mg/kg. The other three samples, from the northern and southern portions of the site, contained much lower TPH-diesel concentrations (210 to 350 mg/kg). TPH-motor oil was detected in 22 of 42 samples at concentrations ranging up to 1,000 mg/kg, but none of these exceeded the Tier 1 ESL for TPH-motor oil in soil of 2,500 mg/kg.

Similarly, free product was observed and the highest concentrations of TPH-diesel and TPH-motor oil in groundwater were detected in the southwestern portion of the former CTA. Specifically:

- In soil boring IR01GB107, installed in November 1999 on the southwestern boundary of the CTA (Figure 4), free product was observed during drilling and one grab groundwater sample was collected and analyzed for TPH-gasoline, TPH-diesel, and TPH-motor oil. TPH-diesel and TPH-motor oil were detected at concentrations of 2,800 micrograms per liter (µg/L) and 1,700 µg/L, respectively, while TPH-gasoline was not detected above laboratory reporting limits. The TPH concentrations detected in the sample were greater than the Tier 1 ESL for TPH-diesel and TPH-motor oil in groundwater of 640 µg/L (RWQCB, 2007). Concentrations of the constituents known to make up fuels and oils (PAHs) were not detected in the sample.

- During the installation and purging of monitoring wells as part of the 2006-2007 groundwater investigation at the former CTA, free product was observed at one location, where the well pair CTAMW0104 and CTAMW0105 was installed (Figure 5). These observations supported earlier records of free product and petroleum staining and odors in soil borings installed immediately west of the EETP boundary.

  TPH-motor oil was not detected above laboratory reporting limits in any of the groundwater samples collected during the 2006-2007 investigation, but in the shallow monitoring well CTAMW0104, TPH-diesel was detected above the reporting limit at a concentration of 736 µg/L, which exceeded the Tier 1 ESL of 640 µg/L. TPH-diesel was not detected in the co-located deeper well CTAMW0105, and this was the only one of nine groundwater samples in which a TPH component exceeded the ESL during the

2006-2007 investigation. However, well CTAMW0104 is located approximately 55 feet southeast of boring IR01GB0107, discussed above and shown in Figure 5, where elevated concentrations of TPH-diesel and TPH-motor oil were detected in 1999. It is also of note that well CTAMW0104 had the most frequent occurrences of PAHs detected in any of the groundwater samples collected during the 2006-2007 investigation.

The RI Report attributes the TPH-diesel and TPH-motor oil detected in the sample from boring IR01GB0107 to the following potential source areas located offsite from the former CTA: the DRMO Site, the IR02 former waste oil discharge sumps area to the southwest of the CTA (see Figure 4 and Sections 2.2 and 3.2), or a sanitary sewer pipeline located near the southern edge of the CTA, along which a manhole was observed to contain free product in 2006.

4.0 Follow-on Investigation Activities

This section describes the Follow-on Investigation conducted in 2007 and 2008. The Follow-on Investigation included a field investigation in late 2007, a geophysical survey in early 2008, and another field investigation in late 2008. Review of the historical investigations described in Sections 2.0 and 3.0 identified the additional information and data needed to determine the nature and extent of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity, establish the extent of metal debris layers, and determine whether the contamination is a single layer of petroleum product.

The 2007 Field Investigation (Section 4.1) was conducted to determine whether the free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity are present in layers across Azuar Drive and Dump Road, and whether the petroleum product extends across the roadways and into the eastern portion of the EETP. The 2008 Geophysical Survey (Section 4.2) was performed to provide information to evaluate the hypothesis that scrap metal debris forms preferential migration pathways. The 2008 Field Investigation (Section 4.3) was conducted to gather data about the lateral and vertical extent of contamination, the lateral extent of scrap metal layers, the presence of free-phase petroleum hydrocarbons in utility corridor backfill, and the chemical nature of the petroleum product at numerous locations at the DRMO Site and in the vicinity.

The findings of the Follow-on Investigation are presented in Section 5.0.

4.1 2007 Field Investigation

This section describes the objectives of and work completed for the 2007 Field Investigation. Full documentation of the methodology and activities for this field investigation is provided in the *Final Work Plan, Follow-on Total Petroleum Hydrocarbons Investigation, Fenced Scrapyard Area and Vicinity, Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California,* and Revision No. 1 (CH2M HILL, 2007b and 2007c, respectively). The findings of the 2007 Field Investigation are presented in Section 5.1 of this TM. Investigation soil boring and trench locations are shown on Figure 6.

4.1.1 Objectives

The objectives established for the 2007 Field Investigation are listed below.

- Assess the interrelationship between the various potential origins and locations of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity**.**
- Determine whether free-phase petroleum hydrocarbons are present in the soil along the abandoned sanitary sewer line north of Dump Road and west of the former CTA, and whether this pipeline and its backfill could represent a preferential pathway of migration.

- Remove a small pipeline and associated features known as the Wooden Sump Box from within the FSA.
- Gather additional information about the composition of petroleum product present at the DRMO Site and in the vicinity.

4.1.2 Work Completed

The 2007 Field Investigation included work in four investigation areas: Azuar Drive, Dump Road, the area along the sanitary sewer line, and the FSA. Work in these areas consisted of the activities listed below and described in detail in Sections 4.1.2.1 through 4.1.2.4:

- Excavation and visual inspection of two trenches running parallel to Azuar Drive (extensions of the 80-foot-long trench excavated during the OSB Investigation as described in Sections 2.8 and 3.8)
- Excavation and visual inspection of three trenches across Azuar Drive
- Excavation and visual inspection of three trenches across Dump Road
- Excavation and visual inspection of three trenches along the abandoned sanitary sewer line
- Excavation and visual inspection of additional trenches as needed based on observations from those listed above
- Excavation, investigation, and removal of petroleum-contaminated soil and debris (an estimated 30 lineal feet of piping) within the FSA that was identified by Weston Solutions, Inc. during work within Grids FS-38, FS-25, and FS-24 conducted following the NTCRA at the FSA. These grids are shown on Figures 4 and 5 in this TM.
- Waste profiling and disposal (asphalt, trench spoils, free product, and contaminated waters)
- Trench backfilling and road and site restoration
- Laboratory data QA review under Sampling and Analysis Plan (SAP) Addendum No. 2, which was provided as Appendix D in the Final Work Plan and Revision No. 1 (CH2M HILL, 2007b, 2007c))

The work completed during the 2007 Field Investigation was executed in accordance with the above-referenced Final Work Plan and Revision No. 1. Additional work items included further trenching based on observations in planned trenches along Azuar Drive, additional trenching along the sanitary sewer line, and the disposal of surface water unrelated to the investigation.

Similar methods were used to excavate each trench. Trench locations were typically prepared by using a concrete saw to create a clean surface cut. Paving was removed using a pneumatic jackhammer and a backhoe. Trenches were then excavated using a backhoe and a trailered vacuum excavator, which was used near utilities where observations of the condition of utilities were of interest. Photographs were taken and visual observations recorded on trench log forms during the course of excavation.

Trench logs and photographs documenting the 2007 Field Investigation are included in Appendices F1 and F2, respectively. Trench backfill varied based on the physical locations of the trenches. Trenches in roadways were backfilled with lightweight concrete to help prevent future differential settlement. Trenches outside the roadways, but not within the FSA, were backfilled using drain rock and angular backfill. Within the FSA, excavated soil was placed back into the excavation. The surface of completed trenches located within roadways was paved with asphalt patch material. The other trenches were finished with similar surrounding material (i.e., soil or gravel).

Soil and free product samples were collected, analyzed, and reviewed in accordance with analytical data QC procedures established for the project in the SAP Addendum No. 2 provided as Appendix D in the Final Work Plan and Revision No. 1 (CH2M HILL, 2007b, 2007c). The results of the analytical data QA reviews performed on the samples are provided in Section 5.4. IDW was accumulated, secured, characterized, and disposed of in compliance with applicable regulatory requirements.

The subsections below provide details of the work conducted in each of the four investigation areas.

4.1.2.1 Azuar Drive Investigation Area

From November 15 through December 3, 2007, two trenches paralleling Azuar Drive were extended north (AD-1) and south (AD-2) from the existing 80-foot-long trench that was installed during the OSB Investigation. Both of the new trenches, shown in Figure 6, were excavated in multiple sections and are located east of the FSA along Azuar Drive and west of the EETP boundary.

The starting points for these trenches were the northern and southern ends of the existing long trench, where varying amounts and types of metal debris and free product had been encountered during the OSB Investigation. The new trench locations were designed to specifically investigate the lateral extent of the metal debris containing product, starting at the ends of the long trench and moving northward and southward along the west side of Azuar Drive, within Navy property.

Logs for these two new trenches are presented in Appendix F1. Details of the trench installation are provided below.

- Trench AD-1 was excavated in three segments (stations 0 to 42.5 to a depth of 4 feet bgs, 0 to 15 subsequently to a depth of 8 feet bgs, and 40 to 55 to a depth of 6 feet bgs) covering a total length of 55 feet.
- Trench AD-2 was excavated in four segments (stations 0 to 22.5, 50 to 70, 97.5 to 117.5, and 140 to 162.5) covering a total length of 162.5 feet to a depth that varied from 9 to 14.5 feet bgs.

From November 26 through December 4, 2007, three trenches (AD-3, AD-4, and AD-5) were installed roughly perpendicular to trenches AD-1 and AD-2 (see Figure 6). These three trenches were extended eastward where varying amounts and types of metal debris and free product were encountered during the OSB Investigation. The trench locations were designed to specifically investigate the lateral extent of the metal debris containing product starting at trenches AD-1 and AD-2 and moving eastward toward the western boundary of

the EETP along Azuar Drive. During trenching, free product was observed in the vicinity of the road centerline; therefore, the Navy's Access Agreement with LMI allowed the trenches to be extended across the EETP boundary to the eastern side of Azuar Drive.

Trenches AD-3, AD-4, and AD-5 were extended eastward where varying amounts and types of metal debris were encountered during the OSB Investigation. The trench locations were designed to specifically enable investigation of the lateral extent of the metal debris containing product starting at the long trenches (AD-1 and AD-2) and moving eastward toward the western boundary of the EETP along Azuar Drive. Again, when free product was observed in the vicinity of the road centerline, the Navy's Access Agreement with LMI allowed the trenches to be extended across the EETP boundary.

On December 10, 2007, based on observations in trenches AD-3, AD-4 and AD-5, four additional trenches (AD-6 through AD-9) were excavated on the eastern side of Azuar Drive (Figure 6). Logs for these trenches are also presented in Appendix F1. Trenches AD-6 (station 0 to 12) and AD-7 (station 0 to 11) were installed in the fenced area between Azuar Drive and Building 455. Trench AD-8 (station 0 to 8) was installed on the shoulder of Azuar Drive along the fenceline, east of trench AD-4. Trench AD-9 (station 0 to 8) was installed along the railroad tracks near trench AD-5.

During the Azuar Drive Investigation, one free product sample (FTPH-FP-AD-4) was collected from trench AD-4 from a depth of 5.5 feet bgs. The purpose of collecting this sample was to characterize the product found in the trench. As shown in Table 1, this sample was analyzed for TPH-diesel, TPH-motor oil, TPH-gasoline, VOCs, PAHs, chlorinated pesticides, and PCBs.

Three soil samples were collected for laboratory analysis. One of these samples (FTPH-TS-AD2-S13.5) was collected from below the observed free-product-saturated interval in trench AD-2 (station 97.5 to 117.5) at a depth of 13.5 feet bgs. The other two soil samples were collected from the bottom of trenches AD-6 (FTPH-TS-AD6-S6.5) and AD-7 (FTPH-TS-AD7-S7) at depths of 6.5 and 7.0 feet bgs, respectively. The purpose of collecting these samples was to gather information about the type(s) of free-phase petroleum hydrocarbons present. As shown in Table 1, these soil samples were analyzed for TPH-diesel, TPH-motor oil, TPH-gasoline, VOCs, PAHs, metals, and cyanide.

Logs for trenches AD-3, AD-4, and AD-4 are presented in Appendix F1. Details of the trench installation are provided below:

- Trench AD-3 (stations –12.0 to 0, 0 to 25, and 30 to 45) was installed in three segments in a southwest-to-northwest direction across Azuar Drive.
- Trench AD-4 (station 0 to 20) started at trench AD-2 and extended eastward across the EETP boundary to the eastern edge of Azuar Drive.
- Trench AD-5 (station 0 to 22) started at trench AD-2 and extended eastward across the EETP boundary to the eastern edge of Azuar Drive.

4.1.2.2 Dump Road Investigation Area

Work in the Dump Road Investigation Area included the installation of three trenches (DR-1, DR-2, and DR-3) roughly perpendicular to Dump Road adjacent to the FSA (see

Figure 6). The trench locations were designed to specifically enable investigation of the lateral extent of the metal debris containing product, starting on the southern side of Dump Road and moving northward toward the boundary with the EETP along Dump Road.

Free product was observed in the vicinity of the road centerline during trenching, and the trenches were extended across the EETP boundary to the northern side of Dump Road under the Navy's Access Agreement with LMI. Trench logs for these locations are presented in Appendix F1.

Trenches DR-1, DR-2, and DR-3 were extended eastward along Dump Road where varying amounts and types of metal debris were encountered during the OSB Investigation (in trenches OSBTR16, OSBTR14, and OSBTR13 shown in Figure 6). Each trench was approximately 30 feet in length, and the maximum depth of the trenches ranged from 5 to 7.5 feet bgs.

One free product sample (FTPH-FP-DR1-6.5) was collected from trench DR-1. As shown in Table 1, this sample was analyzed for TPH-diesel, TPH-motor oil, TPH-gasoline, VOCs, PAHs, chlorinated pesticides, and PCBs.

4.1.2.3 Sanitary Sewer Line Investigation Area

The three trenches installed in the Sanitary Sewer Line Investigation Area west of the former CTA (trenches SSL-1, -2, and -3, shown in Figure 6) were designed to: (a) assess whether free-phase petroleum hydrocarbons were present in the fill immediately outside the pipeline's outer diameter or specifically in the pipeline backfill, (b) examine the pipe to see if it was rusted or broken, and (c) evaluate whether observed conditions indicated the likelihood of free-phase hydrocarbons entering or exiting the pipeline. Logs for these trenches are presented in Appendix F1.

Trenches SSL-1, SSL-2, and SSL-3 were 19, 21, and 17 feet long, respectively. Each of these trenches was oriented in a north-south direction and centered on the co-located sanitary sewer line and two IR14 Industrial Wastewater Pipelines.

On December 11 and 12, 2007, based on observations of free-phase petroleum hydrocarbons in trenches SSL-1 through SSL-3, additional trench SSL-4 with five segments (stations 0 to 20, 68 to 80, 99 to 110, 150 to 158, and 205 to 217.5) was installed on the eastern side of the EETP boundary and north of the alignment for trenches SSL-1 through SSL-3. Trench logs for these locations are presented in Appendix F1.

For trench SSL-4, stations 0 to 20 and 68 to 80 were excavated in the fenced area west of the former CTA. Stations 99 to 110, 150 to 158, and 205 to 217.5 were excavated within the former CTA. No samples were collected from these trenches in accordance with the Final Work Plan and Revision No. 1 (CH2M HILL, 2007b, 2007c).

4.1.2.4 FSA Investigation Area

During NTCRA work at the FSA, a clay/wooden pipeline containing a heavy oil product was discovered running through Grid FS-38 shown in Figure 4. The pipeline appears to have entered from Azuar Drive through Grid FS-38 and then terminated in the Wooden Sump Box located in Grid FS-25, also shown in Figure 4. The pipeline was reported to contain thick viscous oil, and was removed during the NTCRA.

On November 15 and 19, 2007, the Wooden Sump Box was removed and the surrounding area was excavated to remove visible free product. The approximate excavation dimensions were 22 feet by 17 feet by 7.5 feet bgs. After excavation, free product remained present in the four sidewalls. The area was backfilled with fine-grained soil from material stockpiled in the FSA.

On December 6, 2007, three trenches were excavated within the FSA (FSA-1 through FSA-3, shown in Figure 6). Trench logs are presented in Appendix F1. Details of the trench installation are provided below:

- Trench FSA-1 was excavated in three segments (stations 0 to 10, 32.5 to 43.5, and 69.5 to 80) along the east side of the FSA west of Azuar Drive to depths ranging from 9 to 9.5 feet.
- Trench FSA-2 (station 0 to 12.5) was excavated within the south-central portion of the FSA to a depth of 9 feet.
- Trench FSA-3 (station 0 to 10) was excavated on the north side of the FSA south of Dump Road to a depth of 7.5 feet.

One free product sample (FTPH-FP-FSA-1-3) was collected from the Wooden Sump Box excavation at a depth of 3 feet bgs. The purpose of collecting this sample was to characterize the free product found in this area. As shown in Table 1, this sample was analyzed for TPH-diesel, TPH-motor oil, TPH-gasoline, VOCs, PAHs, chlorinated pesticides, and PCBs.

4.2 2008 Geophysical Survey

This section describes the objectives of and work completed for the 2008 Geophysical Survey. Full documentation of the methodology and activities for this survey is provided in the *Field Operating Procedure: Surface Geophysical Survey, Follow-on Total Petroleum Hydrocarbons Investigation, Fence Scrapyard Area and Vicinity, Defense Reutilization and Marketing Office Site, Former Mare Island Naval Shipyard, Vallejo, California* (CH2M HILL, 2008a). The findings of the survey are presented in Section 5.2 of this TM.

4.2.1 Objectives

The purpose of the 2008 Geophysical Survey was to develop a map to show the lateral extent of large accumulations of metallic debris in the subsurface along and perpendicular to Azuar Drive and Dump Road. Accumulations of metallic debris were observed during exploratory trenching during the 2007 Field Investigation. Conventional geophysical methods were selected to obtain further information about the extent of metallic debris so that the possible role of this material as a preferential migration pathway for free-phase petroleum hydrocarbon migration could be evaluated.

The geophysical study area was established as an L-shaped semi-continuous area extending to both sides of and 1,450 feet along Azuar Drive and 1,030 feet along Dump Road. This parcel included the intersection of the roads and selected adjacent areas as shown on Plate 1 in Appendix G. Along Dump Road the survey area extended approximately 150 feet from the road to the north and approximately 150 feet to the south, except for areas retaining surface water not compatible with this type of survey. On the west side of Azuar Drive the

survey area extended to approximately 130 feet from the centerline of the road. The boundary on the eastern side of Azuar Drive is irregular and discontinuous due to limited access and surface obstacles such as fences and buildings.

4.2.2 Work Completed

Two principal methods were employed for mapping subsurface conditions. These included a magnetometer survey using a magnetic gradiometer, and an electromagnetic terrain conductivity survey using a frequency domain electro-magnetometer. A third tool, ground-penetrating radar (GPR), was used to help identify or confirm the presence of specific subsurface anomalies, but was not required to meet the survey objectives. QC methods specified for the work included specific equipment warm-up periods, establishing positioning system accuracy over known points, personnel response tests, vibration tests, static background and static spike operations, magnetometer azimuth tests, magnetometer octant tests, and repeat data tests. Documentation requirements were also established to ensure that adequate supporting information was procured during the survey and provided for QA review.

The survey was performed between March 13 and March 24, 2008. A survey grid was established to provide horizontal position control for data acquisition. The grid extended 1,450 feet parallel to Azuar Drive and 1,030 feet parallel to Dump Road, and was established using a fiberglass measuring tape and marking paint. The grid was based on a rectangular coordinate system with the origin located in the southwest corner of the survey area. In order to keep all grid values positive, the grid origin was placed approximately 1,270 feet south and 850 feet west of the center of the intersection of Azuar Drive and Dump Road.

Data were acquired through a series of traverses offset on 10-foot centers, with measurements taken along intersecting grid lines at approximately 5-foot intervals. Along Azuar Drive and adjacent areas the traverses were parallel to the northing grid lines, and along Dump Road and adjacent areas the traverses were parallel to the easting grid lines. Due to the large grid size and many fences, the data were acquired in smaller blocks and concatenated for gridding, contouring, analysis, and interpretation.

The data were evaluated, edited, and contoured as vertical magnetic gradient (VMG) and electromagnetic (EM) maps for review and interpretation. The VMG map was then assessed for magnetic variations not explained by known magnetic sources. Unexplained variations in the magnetic field were interpreted as potential areas for further exploration. The EM contour map was generated based on variations in measured values and the potential causes for these variations. A third map, an Anomaly Map, was produced that showed magnetic anomalies not explained by mapped metallic features. The findings of the survey are discussed in Section 5.2 and Appendix G.

4.3 2008 Field Investigation

This section describes the objectives of and work completed for the 2008 Field Investigation. Full documentation of the methodology and activities for this field investigation is provided in the *Final Work Plan Revision No. 2: Follow-on Total Petroleum Hydrocarbons Investigation, Fenced Scrapyard Area and Vicinity, Defense Reutilization and Marketing Office Site, Former Mare*

Island Naval Shipyard, Vallejo, California (CH2M HILL, 2008c). The findings of the 2008 Field Investigation are presented in Section 5.3 and Appendices H through J of this TM.

4.3.1 Objectives

The objectives for the final phase of the Follow-on Investigation were to gather information needed to determine the lateral and vertical extent of free-phase petroleum hydrocarbons, the nature of scrap metal layers, the presence of free-phase hydrocarbons in utility corridor backfill, and the chemical nature of the petroleum product throughout the DRMO Site and the vicinity. These objectives were developed after examination and discussion of the results of the 2007 Field Investigation and the 2008 Geophysical Survey.

Investigation locations were designated following review of information of record through September 2008. This information included formally reported observations, informal reference observations, and analytical results documented in Figures 1A and 1B in Final Work Plan Revision No. 2 (CH2M HILL, 2008c). Informal reference observations included photographic observations of test pits excavated by Weston Solutions along Dump Road.

The 2008 Field Investigation included work in locations throughout the DRMO Site and in the vicinity that was intended to meet objectives for five specific data collection categories (DCCs):

1. Forensic chemistry analysis, to determine the types and possible sources of free product found at the DRMO Site and in the vicinity
2. Vertical extent of free-phase petroleum hydrocarbons
3. Lateral extent of free-phase petroleum hydrocarbons
4. Confirmation of results from the 2008 Geophysical Survey (also referred to as "confirmation of non-impact areas")
5. Potential migration pathways

4.3.2 Work Completed

Work conducted to address the investigation objectives for the above DCCs consisted of the activities listed below and described in detail in Sections 4.3.2.1 through 4.3.2.5:

- Installation and visual inspection of 55 direct-push soil borings for extent observations, confirmation of geophysical survey results, and collection of samples of free product for forensic chemistry analysis
- Analysis of the free product samples for use in the forensic chemistry evaluation was performed using the following laboratory analyses and methods:
  - Gas Chromatography/Mass Spectometry (GC/MS) Full Scan using American Society of Testing and Materials (ASTM) D5739-06, Standard Practice for Oil Spill Source Identification by Gas Chromatography and Positive Ion Electron Impact Low Resolution Mass Spectrometry
  - Extended PAHs using U.S. EPA Method 8270 SIM [Selected Ion Monitoring]

  - Bulk stable isotopes of carbon and hydrogen using Isotope Ration Mass Spectrometry (IRMS)

- Definition of the usability of PAH data generated by the forensic chemistry evaluation for in any future risk assessment calculations that the Navy might decide to perform in the future
- Evaluation of the free product analytical results by an experienced practitioner in forensic chemistry and environmental geology under methods established by industry standard organizations or in the literature
- Installation and visual inspection of 19 vacuum borings to inspect utility corridor backfill and scrap metal layer pathways and to confirm the absence of free product at direct-push boring locations where no free product was observed
- Excavation of nine trenches to the determine the extent of free product as well as possible migration pathways through buried debris and utility corridor backfill
- Waste disposal (asphalt/concrete, soil cuttings, and decontamination water)
- Borehole abandonment and road and site restoration

Detailed sampling procedures are provided in SAP Addendum No. 3, which is Appendix E in Final Work Plan Revision No. 2 (CH2M HILL, 2008c).

The locations of direct-push borings, vacuum borings, and trenches were selected, observed, and sampled to supplement information from the trenching activities conducted during the 2007 Field Investigation and from the 2008 Geophysical Survey. The boring locations and methods were designed to aid in understanding the lateral and vertical extent of free-phase petroleum hydrocarbons above and below the metal debris.

The work was executed in accordance with Final Work Plan Revision No. 2 (CH2M HILL, 2008c), and the objectives for the five DCCs listed in Section 4.3.2 were achieved. Figures 6 and 8 together show all the sampling and observation locations during the 2008 Field Investigation; Figure 8 is specific to the samples collected for the forensic chemistry evaluation. The subsections below describe the work activities conducted to meet the objectives for each of the five DCCs.

Many of the sampling location identifiers shown on Figure 6 include one or more of the five DCCs. In these cases, the DCC numbers (1 through 5) are incorporated into the sampling location identifier as a numerical suffix following the alphabetical location code (AAA, UU, etc.) At location "AAA3,4", for example, data were collected to determine the lateral extent of contamination (DCC 3) and to confirm the result obtained during the 2008 Geophysical Survey at this location (DCC 4). This example also illustrates that many such sampling locations fulfilled multiple DCCs, and therefore have multiple numerical suffixes. Exceptions to this nomenclature for sampling locations shown in Figure 6 are (a) the trenches and borings installed during the OSB Investigation, which are shown in green, and (b) the trenches excavated during the 2007 and 2008 Field Investigations, which are shown in magenta and orange respectively.

4.3.2.1 Forensic Chemistry Analysis

The 20 locations shown in Figure 8 were selected to provide free product samples for forensic chemistry analysis using direct-push soil boring equipment. These locations are also shown on Figure 6 and are indicated by a DCC suffix of 2. Free product samples were also collected directly from utility manholes. Utility vault samples were collected by removing the vault covers and taking free product samples with hand bailers. Samples were typically collected from elevations 3 to 5 feet below those of the vault covers, and were processed using the laboratory methods listed in Section 4.3.2. Additional details regarding these samples are presented in Table 2. Utility vault samples are designated with a "UT" prefix in this table, as in "FTPH-FP-UT-BB".

Sample location WWW was a geotechnical boring being installed by ENGEO for LMI during the investigation. When ENGEO encountered free-phase hydrocarbons, CH2M HILL requested a sample of the free product. The sample was collected with a disposable bailer. The depth of the boring and the presence or absence of free product were not recorded.

As indicated in Table 2, sample volumes at seven locations were insufficient for PAH analyses because of limited availability of free product. The highly viscous nature and reduced immediate presence of the material limited the amount of product that could be recovered at depth at these seven points. Sufficient sample volume was also unavailable at utility vault location N1 located in the southwesterly portion of the EETP along Dump Road. The planned location of this sample is shown on Figure 6.

A California Professional Geologist and Certified Engineering Geologist experienced in applied forensic chemistry evaluated the analytical data in accordance with established review methods. As indicated in Section 4.3.2, the analytical methods included GC/MS Full Scan using ASTM D5739–06, extended PAHs using U.S. EPA Method 8270 SIM, and stable isotope evaluation of carbon and hydrogen using IRMS.

Detailed descriptions of the evaluation methodologies, findings, and conclusions are provided in Appendix J. The findings of the evaluation are summarized in Section 5.3.

4.3.2.2 Vertical Extent of Free-Phase Petroleum Hydrocarbons

Thirty locations (shown on Figure 6 with a DCC of 2) were selected to provide information regarding the vertical extent of free-phase petroleum hydrocarbons. Free-phase hydrocarbons were already known to be present in these locations, but their vertical extent had not yet been observed. Continuous soil cores were collected with direct-push soil boring equipment, and soil cores were visually examined to determine the vertical extent of free-phase hydrocarbons in the subsurface.

4.3.2.3 Lateral Extent of Free-Phase Petroleum Hydrocarbons

Thirty-two locations (shown on Figure 6 with a DCC of 3) were selected to provide additional information regarding the lateral extent of free-phase petroleum hydrocarbons. The locations identified to provide this information were adjacent to areas where free product had been observed during previous trenching, or where historical soil sample concentrations of TPH suggested the presence of free-phase petroleum hydrocarbons. Soil cores at these locations were visually examined for the presence of free product.

At locations where free product was not observed, a step-out soil boring location was identified, and a confirmatory trench was excavated to allow for more rigorous examination of the subsurface and verification that the location did not contain free product. A total of nine trenches designated as A, DDD-1, DDD-2, EE, GGG, H, JJJ, RRR, and UU were excavated to confirm the lateral extent of free-phase petroleum hydrocarbons.

One soil sample (FTPH-FP-TR-DDD2-S2.5) was collected from trench DDD-2 at 2.5 feet bgs for forensic chemistry analysis and conventional laboratory analysis. This sample was collected because free product was encountered at this location, which had been excavated to confirm the absence of contamination suggested by nearby direct-push samples. As indicated in Table 2, this soil sample was analyzed for TPH-diesel, TPH-gasoline, VOCs, and SVOCs.

4.3.2.4 Confirmation of Results from the 2008 Geophysical Survey

Six locations (shown on Figure 6 with a DCC of 4) were selected to confirm the absence of bulk metallic debris suggested by the results of the 2008 Geophysical Survey. Continuous soil cores were collected using direct-push borings to test the hypothesis regarding the co-location of metal debris/free product, confirm the results of the geophysical survey, and verify whether free product was present. Visual observations of the soil cores were made and the soil cores were geologically logged.

4.3.2.5 Potential Migration Pathways

Nineteen locations (shown on Figure 6 with a DCC of 5) were investigated using vacuum borings to allow for visual inspection of utility corridor backfill thought to be a potential migration pathway for free-phase petroleum hydrocarbons. Specifically, vacuum boring locations were selected to meet the objectives listed below:

- Assess whether free-phase petroleum hydrocarbons are present in the fill around the pipeline or specifically in the pipeline backfill.
- Examine the pipe to determine whether it is intact.
- Evaluate whether conditions observed could present an avenue for free-phase hydrocarbons to enter or exit the pipeline.

A trailer-mounted portable vacuum excavator was used for advancing the vacuum boreholes. These were excavated to be as small as possible, yet sufficiently to expose the areas of interest.

5.0 Follow-on Investigation Findings

This section describes the findings of the Follow-on Investigation described in Section 4.0. The findings presented here are supported by photographs, field notes, and trench logs documenting subsurface conditions, as well as geophysical data, analytical results, and forensic chemistry interpretations as detailed in Appendices F through J.

Findings of each phase of the Follow-on Investigation are presented in Sections 5.1 through 5.3. Section 6.0 presents conclusions drawn from all the investigations documented in this TM.

5.1 2007 Field Investigation

The objectives of and work completed for the 2007 Field Investigation are described in Section 4.1. As stated there, the work was executed in accordance with the Final Work Plan and Revision No. 1 (CH2M HILL, 2007b, 2007c). Additional work items included further trenching based on observations in planned trenches along Azuar Drive, additional trenching along the sanitary sewer line, and the disposal of surface water unrelated to the investigation. The information obtained during the 2007 Field Investigation is presented in the sections below and grouped by the investigation areas designated for this effort: Azuar Drive, Dump Road, the sanitary sewer line area north of Dump Road and west of the former CTA, and the FSA.

5.1.1 Azuar Drive Investigation Area

Nine trenches, AD-1 through AD-9, were excavated along Azuar Drive on both sides of the EETP boundary. A total of 15 segments were excavated because trenches AD-1 and AD-2 were completed in multiple segments. The locations of the trenches are shown on Figure 6. Appendix F1 includes the trench logs, and Appendix F2 contains photographs taken during the investigation. Detailed information about the occurrence of free product and metal debris is provided in Table 4. The findings in these trenches are described below.

- Ten of the 15 trench segments (AD-1 station 0 to 42.5, AD-1 station 0 to 15, AD-2 station 0 to 22.5, AD-2 station 50 to 70, AD-2 station 97.5 to 117.5, AD-3 station 0 to 25, AD-3 station –12.5 to 0, AD-4, AD-5, and AD-6) contained both free product and bulk metal debris. Trench segment AD-1 station 0 to 42.5 was advanced on November 20, 2007 to a depth of 4 feet bgs. On November 21, 2007, trench segment AD-1 station 0 to 15 was further excavated to a depth of 8 feet bgs. As a result, trench AD-1 segments overlap from station 0 to 15. Free product was encountered at depths ranging from 3.5 feet bgs (AD-1 station 0 to 42.5) to 13.5 feet bgs (AD-2 station 97.5 to 117.5). Bulk metal debris was encountered at depths ranging from 3.0 feet bgs (AD-3) to 9.5 feet bgs (AD-4). Isolated occurrences of metal debris were observed in three trenches (AD-1 station 40 to 55, AD-2 station 97.5 to 117.5, and AD-6). Free product encountered in the trenches consisted of black, viscous, oily liquid with low to negligible odor.

- One trench segment (AD-2 station 140 to 162.5) did not contain metal debris but did contain free product from 5 to 13 feet bgs. The free product was present in fractures and root structures within clay soil.
- The remaining three trench segments (AD-3 station 30 to 45, AD-7, and AD-9) did not contain free product or bulk metal debris.
- Sheen was observed on water that accumulated in two trenches (AD-6 and AD-8).

LMI excavated eight trenches on the EETP side of Azuar Drive during a separate investigation conducted in February and March 2008. These trenches were designated T-1 through T-5 and T-7 through T-9, and are shown in Figure 6. Appendix F1 contains trench logs provided from LMI for use in this TM. Detailed information about the occurrence of free product and metal debris is provided in Table 4, and the findings from these LMI trenches are described below.

- Three trenches (T-2, T-5, and T-7) contained both free product and bulk metal debris.
- Two trenches (T-3 and T-4) contained free product but not bulk metal debris.
- The remaining three trenches (T-1, T-8, and T-9) did not contain free product or bulk metal debris.
- Free product was encountered at depths from 3 feet bgs (in trench T-7) to 12.5 feet bgs (in trench T-4).
- Bulk metal debris was encountered at depths from 5 feet bgs (in trench T-2) to 12 feet bgs (in trench T-5).

One free product sample from trench AD-4 (FTPH-FP-AD-4) and three soil samples from trenches AD-2 (FTPH-TS-AD2-S13.5), AD-5 (FTPH-TS-AD6-S6.5), and AD-7 (FTPH-TS-AD7-S7) were collected and analyzed at an environmental laboratory. The analytical results for these samples are presented in Table 7.

5.1.2 Dump Road Investigation Area

Three trenches, DR-1 through DR-3, were excavated in perpendicular alignments across Dump Road (Figure 6). These trenches crossed the EETP boundary. At approximately 30 feet east of trench DR-1, the EETP boundary turns north across the western edge of the former CTA. Trench DR-1 did not cross the EETP boundary. Appendix F1 includes the trench logs and Appendix F2 contains photographs taken during the investigation. Detailed information about the occurrence of free product and metal debris is provided in Table 4. The findings from these trenches are described below.

- All three trenches contained both free product and bulk metal debris.
- Free product was encountered at depths from 1 foot bgs (in trench DR-3) to 7.5 feet bgs (in trench DR-1). The deepest vertical extent of free product was not reached.
- Bulk metal debris was encountered at depths from 1 foot bgs (in trenches DR-1 and DR-3) to 7.5 feet bgs (in trench DR-1). The deepest vertical extent of metal debris was not reached.

One free product sample (FTPH-FP-DR1-6.5) was collected from trench DR-1. The analytical results for this sample are presented in Table 7.

5.1.3 Sanitary Sewer Line Investigation Area

Four trenches, SSL-1 through SSL-4, were excavated along the north side of Dump Road near the western edge of the CTA (see Figure 6). Appendix F1 includes the trench logs and Appendix F2 contains photographs taken during the investigation. Detailed information about the occurrence of free product and metal debris is provided in Table 4. The findings from the eight trench segments from these four trench excavations are described below.

- Six (SSL-2, SSL-3, SSL-4 station 0 to 20, SSL-4 station 68 to 80, SSL-4 station 99 to 110, and SSL-4 station 150 to 158) contained both free product and bulk metal debris.
- One (SSL-1) contained free product but did not contain metal debris.
- One (SSL-4 station 205 to 217.5) contained bulk metal debris but did not contain free product.
- Free product was observed at depths from 3 feet bgs (SSL-2 and SSL-3) to at least 9 feet bgs (SSL-1 and SSL-4 station 99 to 110). The vertical extent of free product was not determined at locations SSL-1, SSL-2, SSL-3, SSL-4 station 0 to 20, and SSL-4 station 99 to 110.
- Bulk metal debris was encountered at depths from 3 feet bgs (SSL-2, SSL-3, and SSL-4 station 0 to 20) to 8.5 feet bgs (SSL-4 station 150 to 158). The deepest vertical extent of metal debris (8.5 ft bgs) was encountered at SSL-4 station 150 to 158. The deepest vertical extent of metal debris was not observed in trench SSL-2 at the final depth of 8.5 feet bgs. The metal debris in trench SSL-2 at 8.5 feet bgs did contain free product, although the deepest extent also was not observed.

No soil or free product samples were collected during the excavation of these four trenches.

5.1.4 FSA Investigation Area

The work within the FSA included excavation and removal of the Wooden Sump Box and excavation of three trenches, FSA-1 through FSA-3 (see Figure 6). Appendix F1 includes the trench logs and Appendix F2 contains photographs taken during the investigation photographs. Detailed information regarding the occurrence of free product and metal debris is provided in Table 4.

Findings during the removal of the Wooden Sump Box are described below.

- Free product was encountered from 1 foot to 7 feet bgs.
- No metal debris was found.
- Free product was present in all four sidewalls of the 22-foot-by-17 foot, 7.5-foot-deep excavation.
- Free product was encountered at 7 feet bgs and extended to depths beyond the vertical limit of the excavation.

The Wooden Sump Box was connected to a 4-inch-diameter clay pipe that was later removed from the northeastern portion of the FSA. The pipe contained free product, led to a catch basin in Azuar Drive, and was capped where it was exposed during the excavation of trench AD-1. Excavation of the area revealed woody debris that appeared to have been a small wood structure before it was excavated. The appearance of the excavation sidewalls was consistent with observations during the OSB Investigation. No visible indications were identified of a significant source of free-phase petroleum hydrocarbons related to this structure.

Trenches FSA-1 through FSA-3 were excavated in a total of five segments. The findings from these segments are described below.

- Two trench segments (FSA-1 stations 0 to 10 and 69.5 to 80) contained both free product and bulk metal debris. Station 0 to 10 contained free product at 4.5 to 9 feet bgs (the deepest extent was not encountered) and a trace of metal debris at 4.5 feet bgs. Station 69.5 to 80 contained free product at 2 to 9 feet bgs (the deepest extent was not encountered) and a trace of metal debris at 4.5 feet bgs.
- Two trench segments (FSA-1 station 32.5 to 43.5 and FSA-3) contained free product but did not contain metal debris.
- One trench segment (FSA-2) contained neither free product nor bulk metal debris.
- Free product was encountered at depths from 2 feet bgs (FSA-1 station 69.5 to 80) to 9.5 feet bgs (FSA-1 station 32.5 to 43.5).
- The maximum vertical extent of free product was encountered at 5 feet bgs in trench FSA-3. The vertical extent of free product in trench FSA-1 was not determined.
- Traces of bulk metal debris were encountered in trench segments FSA-1 station 0 to 10 and FSA-1 station 69.5 to 80 at a depth of 4.5 feet bgs.

No free product or soil samples were collected from trenches FSA-1, FSA-2, or FSA-3 for laboratory analysis. During excavation of the Wooden Sump Box, one free product sample (FTPH-FP-FSA-1-3) was collected for laboratory analysis. The analytical results for this sample are presented in Table 7.

Visible free product unrelated to CH2M HILL's removal and investigation work for the Wooden Sump Box was observed at a nearby portion of the FSA. Sheen, globules, and strings of free product were observed in standing surface water to the east of the Wooden Sump Box area. The location of this surface water was in portions of Grids FS-25 and FS-38 shown in Figure 4. CH2M HILL was directed by Navy staff to remove the contaminated material, as equipment and labor to address the issue was immediately available. Gross accumulations of free oil and sheen were removed to the extent possible with absorbent pads and booms. Standing water was then pumped into a mobile tank for storage, characterization, and offsite disposal. Approximately 12,000 gallons of water were disposed of. Photographs taken during this activity are included in Appendix F2.

At the Navy's direction, other parties completed backfilling in this area during a separate mobilization as part of corrective measures to prevent recurrence.

5.2 2008 Geophysical Survey

The 2008 Geophysical Survey was conducted as described in Section 4.2. The objective of this survey was to provide information to further determine the lateral extent of metal debris at the DRMO Site and in the vicinity. The lateral extent of subsurface metallic debris is relevant to this TM because contiguous layers may act as a preferential pathway for the migration of free-phase petroleum hydrocarbons.

Three geophysical methods were used in conducting the survey. The effective measurement depth of EM terrain conductivity methods is typically 2.5 to 200 feet bgs. The effective measurement depth of magnetometer surveys also depends on the mass of the subsurface bodies and their depth. GPR measurements are effective at less than 30 feet bgs in most soils.

The full results of the 2008 Geophysical Survey are provided as a report and a series of maps presented in *Geophysical Investigation at the Former Mare Island Naval Shipyard, Mare Island, Vallejo, California* (Norcal Geophysical Consultants, 2008). This report is provided in Appendix G and is referred to as the Geophysical Report in the remainder of this TM. Detailed descriptions of the methodology and other information are included in Appendix G.

The Geophysical Report provided summary findings of Interpreted Buried Debris Zones. These areas are described below and are shown on Figures 9 and 13.

- An area along the south side of Dump Road beginning about 480 feet from Azuar Drive and continuing for about 350 feet. This area is 40 to 80 feet wide and extends beyond the survey area to the southwest.
- An area on the north side of Dump Road beginning about 680 feet from Azuar Drive and continuing for about 150 feet. This area is set off from Dump Road by about 40 feet, is about 40 feet wide, and may extend beyond the survey area to the northwest.
- An area about 80 feet in irregular dimensions located at the intersection of Dump Road and Azuar Drive.
- An area along the central portion of Azuar Drive beginning just north of Building 661 and continuing to the north for approximately 250 feet. This area is about 40 feet wide.

During the NTCRA for the FSA, another geophysical survey was performed in January 2006 in accordance with the Removal Action Plan for the NTCRA (CH2M HILL, 2005a). This survey was performed to document as-completed site conditions following the NTCRA work completed in 2005, and was conducted using a Geonics EMG MK2 EM metal detector after the removal and screening of surface soil throughout the FSA. A combined overlay of the results of this survey and the EM map produced by the 2008 Geophysical Survey was developed for comparison and evaluation purposes. This overlay map is provided in this TM as Figure 9.

The general findings of the 2005 Geophysical Survey were that the majority of the FSA has some degree of magnetic signature. Figure 9 shows few correlations with the 2008 Geophysical Survey in overlaid and adjacent survey areas, but does appear to indicate a lack

of contiguous bodies of subsurface metallic debris in the FSA. Aside from numerous scattered anomalies, the dominant features of the 2005 survey coincide with the courses of underground electrical utilities, the industrial wastewater pipeline, sewer service lines, existing freshwater pipelines, and saltwater pipelines shown on Figure 4. An eight-band criss-cross square structure near the north extent of the FSA appears to coincide with the expected location of a foundation slab for a former structure.

5.3 2008 Field Investigation

The objectives of and work completed for the 2008 Field Investigation are described in Section 4.3. The work was completed as planned. The information obtained during the field investigation is grouped in the sections below according to the five DCCs established for the 2008 Field Investigation, which are listed in Section 4.3.2.

5.3.1 Forensic Chemistry Analysis

Nineteen free product samples were collected for forensic chemistry analysis (DCC 1) from direct-push borings. One soil sample was also collected for forensic chemistry analysis. The sampling locations are shown in Figure 8, and Table 3 includes details of the samples and associated analyses. Samples were grouped by location as described below.

- Five samples were collected from the DRMO Site along the south side of Dump Road (samples FTPH-FP-SB-G, -K, -L, -O, and -R).
- Three samples were collected from the north side of Dump Road across from the DRMO Site (samples FTPH-FP-SB-D, -C, and -WWW). Sampling location FTPH-SB-WWW is located in the EETP.
- Three samples were collected from the DRMO Site side of Azuar Drive (samples FTPH-FP-SB-GG, -MM, and -NN). Sample FTPH-SB-MM was collected from near the location of the former OSB.
- Four samples were collected from the EETP side of Azuar Drive (samples FTPH-FP-SB-PP, -SB-RR, -SB-VV, and -TR-DDD2). Sample FTPH-FP-SB-PP was collected approximately 175 feet southwest of the location of the former OSB, and was the nearest EETP sample.
- Sample FTPH-TR-DDD2 was collected from a location to the extreme southeast of all chemical forensic samples.
- Five free product samples were collected directly from within utility vault access covers (samples FTPH-FP-UT-Y1, -W1, -BB1, -QT1, and -QE1). Sample FTPH-FP-UT-BB1 was collected from a sanitary sewer manhole vault. Sample FTPH-FP-UT-W was collected from an electrical access vault, and samples FTPH-FP-SB-Y1 FTPH-FP-UT-QE were collected from electrical service vaults. Sample FTPH-FP-UT-QT was collected from a telephone service vault.
- Although forensic chemistry sampling was proposed at locations FTPH-FP-SB-J, N, OO, and ZZ, sufficient free product was not present in soil to collect samples when these locations were drilled.

Analytical results were produced by the project laboratory and were transmitted to the project chemist and a certified professional geologist experienced in applied forensic chemistry, who then conducted evaluations under several established methods of review. The forensic chemistry evaluation results are presented in the *Forensic Chemistry Evaluation of Bunker Fuel at DRMO Area, Former Mare Island Naval Shipyard, Vallejo, California* (Zemo & Associates, 2008). This report is provided as Appendix J and is referred to as "the report" later in this subsection, and as the Forensic Chemistry Evaluation in the remainder of this TM.

The report documents a series of findings of fuel type, weathering, petroleum source similarity or dissimilarity based on a series of comparisons of the relative abundance of selected organic molecules, and petroleum source similarity or dissimilarity based on the relative abundance of isotopes of hydrogen and carbon. Based on the underlying principles of the petroleum source evaluation methods and the literature, there are two important distinctions to make about findings from this type of evaluation. As stated in the report, "…similarities between samples indicates that they may be the same product, but it is not conclusive unless all of the forensic parameters "match"; if samples are different for any one parameter, then it is probable that they are not the same product…. In other words, a "match" may not be a unique solution, but a "no match" is conclusive." A summary of the conclusive findings of dissimilarity is provided in Table 5.

The findings documented in the report are presented as text findings of direct comparisons and examinations of GC/MS peaks and peak patterns, and numerically as a table of Biomarker Ratios, PAH Source Ratios, and Isotope ratios. These ratios are presented as a series of seven plots that visually show groups of similar samples. One bar chart of carbon isotope values grouped by sample area is also provided. Biomarker Ratios are generated by computing the relative measured peak heights of paired categories of groups of hydrocarbons that are resistant to weathering. PAH Source Ratios are produced by computing the ratios of quantitative analytical data for selected pairs of PAH compounds. Carbon and hydrogen Isotope Ratios are the quantitative results of analysis reported by the laboratory as of difference in the ratio of the element to its heavier isotope compared to a laboratory standard in units of per mil.

Nine principal conclusions presented in the report are summarized below.

1. The product type present at all locations except for one is a heavy fuel oil such as No. 6 (Bunker C) fuel oil.

2. The product at one location (FTPH-FP-TR-DDD2) appears to be a lighter fuel oil. Sample FTPH-FP-TR-DDD2 was collected from what was expected to be a "clean" lateral extent confirmation trench.

3. The chemical signatures of product found in the Dump Road area are different from those found in the Azuar Drive area, based on isoprenoid biomarker crossplot results.

4. Within the Dump Road and Azuar Drive areas, there is variability in the chemical signatures of product found on the DRMO Site sides of the roads and in the chemical signatures of product found on the non-DRMO-Site sides.

5. The forensic chemistry parameters of the product on the non-DRMO-Site side of the road in each area fall within the range of variability exhibited on the respective DRMO Site side, except in samples FTPH-FP-SB-D and FTPH-FP-SB-WWW (from the Dump Road area), and FTPH-FP-SB-PP, FTPH-FP-TR-DDD2, and possibly FTPH-FP-SB-RR (from the Azuar Drive area).
6. The chemical signatures of product in samples FTPH-FP-SB-D, FTPH-FP-SB-WWW (from the Dump Road area), and FTPH-FP-SB-PP (from the Azuar Drive area) are not related to the chemical signatures of product found on the DRMO Site sides of both areas.
7. The chemical signatures of product in sample FTPH-FP-SB-RR from the EETP suggest that it may be different from the product on the DRMO Site side of Azuar Drive, but this is inconclusive because the apparent difference is relatively small.
8. The product in sample FTPH-FP-TR-DDD2 is unrelated to the product found in samples from all other areas.
9. Product found in sample FTPH-FP-SB-C from the Dump Road area and sample FTPH-FP-SB-VV from the Azuar Drive area is not distinguishable from the product found on the Navy side based on the forensic chemistry results of this study.

5.3.2 Vertical Extent of Free-Phase Petroleum Hydrocarbons

Thirty direct-push borings were advanced to provide additional information regarding the vertical extent of free-phase petroleum hydrocarbons (DCC 2). The vertical extent DCC was assessed entirely from visual observations of the continuous soil cores collected from these borings. No samples for laboratory analysis were collected for this DCC. The locations for the vertical extent borings are shown on Figure 6, and observations of free product and metal debris in the vertical extent borings are listed in Table 4. The maximum observed depth of the vertical extent of free-phase petroleum hydrocarbons ranged from 10 feet bgs at location R to 13.9 feet bgs at location E. The boring logs for these locations are presented in Appendix H1.

Of the 30 direct-push boring locations, the vertical extent of free-phase petroleum hydrocarbons was reached at 14 (see Table 9). Free product was not found at the other 16 locations.

5.3.3 Lateral Extent of Free-Phase Petroleum Hydrocarbons

Thirty-one direct-push borings were advanced to provide additional information regarding the lateral extent of free-phase petroleum hydrocarbons (DCC 3). The locations of the lateral extent borings are shown on Figures 6 and 12. Observations from borings that were used to determine the confirmed lateral extent of free-phase petroleum hydrocarbons are listed in Table 10. Figure 12 shows the approximate lateral extent of free-phase petroleum hydrocarbons based on visual observations of all modes of occurrence.. The future designation of removal areas may be different when occurrences in fine-grained soil fractures, vegetative structures, and incidental occurrences are evaluated.

Of the 31 locations, free product was present at 12 (see Table 10). Free product was not found at the other 19 locations. A series of trenches were then excavated to confirm the

absence of free product in nine areas in the general vicinity of these 19 locations. No samples for laboratory analysis were collected from the lateral extent borings.

Following the installation of the lateral extent borings, the lateral extent was confirmed by the installation of nine trenches, designated as trenches A, DDD-1, DDD-2, EE, GGG, H, JJJ, RRR and UU. Free product was observed in trenches DDD-1 and DDD-2 (see Table 10). No free product was observed in the other seven trenches (see Table 10).

One soil sample (FTPH-FP-TR-DDD2-S2.5) was collected from trench DDD-2 for forensic chemistry analysis and conventional laboratory analysis. This sample was collected because free product was encountered at this location, which was excavated to confirm the absence of contamination established by nearby direct-push samples. The forensic chemistry results for this sample are discussed in Section 5.3.1. The conventional analytical results are presented in Table 8 and discussed below.

5.3.4 Confirmation of 2008 Geophysical Survey Results

This DCC (DCC 4) was assessed entirely from visual observations of the continuous soil cores collected from five direct-push borings. These borings, at locations AAA4, VVV4, SSS4, U4, and NNN4, were advanced to confirm the absence of bulk metal debris as suggested by the results of the 2008 Geophysical Survey. The locations of these borings are shown on Figure 6, and observations are reported in Table 4. Logs for these borings are presented in Appendix H1. No samples for laboratory analysis were collected for this DCC.

A boring at one planned location (HHH4) was not completed because this location had previously been excavated by Weston Solutions to a depth of 8 to 10 feet bgs, and it was no longer necessary to confirm geophysical anomalies at this location.

In the five completed borings, the absence of bulk metal debris suggested by the 2008 Geophysical Survey was confirmed.

5.3.5 Potential Migration Pathways

Seventeen locations (shown on Figure 6) were investigated using a trailer-mounted portable vacuum excavator to allow for visual inspection of utilities and the utility corridor backfill thought to be potential migration pathways for free-phase petroleum hydrocarbons (DCC 5). Three planned locations (HH5, WW5, and XX5) were not investigated because the target utility was not located by utility clearance equipment prior to the field investigation. The visually inspected portion of each utility at the 17 locations appeared to be in good condition (see Table 11).

Of the 17 locations, free product was encountered at four (P5, KK5, SS5 West, and UUU5) during visual inspection of the utility corridor backfill. In vacuum boring P5, thick, viscous, free product was observed from 7 to 7.5 feet bgs in gravelly backfill below the electrical and communication duct banks. The free product appeared to be seeping out of the electrical duct back to the north. In vacuum boring KK5, free product was encountered below a layer of metal debris at 4 feet bgs. The utility at this location was surrounded by a lean clay backfill. In vacuum boring SS5 West, only a sheen was encountered during the visual inspection. In vacuum boring UUU5, next to the saltwater pipeline, only a trace of free

product was encountered at a depth of 6 feet bgs, approximately two feet below the saltwater pipeline.

5.4 Chemical Data Quality Assurance Review Findings

Environmental samples were collected and analyzed in compliance with approved SAPs that addressed regulatory, Navy, and CH2M HILL analytical data QA program requirements. As noted in Section 4.0, the SAPs referenced below for the 2007 and 2008 Field Investigations were included as appendices to the associated project work plans.

The 2007 Field Investigation was addressed by SAP Addendum No. 2, which was provided as Appendix D in the Final Work Plan and Revision No. 1 (CH2M HILL, 2007b, 2007c). The addendum supplemented the SAP included in the Removal Action Plan for the NTCRA at the DRMO Site FSA (CH2M HILL, 2005a).

The 2008 Field Investigation was addressed by SAP Addendum No. 3, which was provided as Appendix D in the Final Work Plan Revision No. 2 (CH2M HILL, 2008c). This addendum further supplemented the SAP Addendum No. 2 referenced above. The two SAPs are collectively referred to as "the SAP" in the remainder of this section.

The objective of the data collection and analysis was to generate data of known quality appropriate to project needs in terms of end decisions. This objective was accomplished by completing the following data QA activities:

- Identification of data quality objectives (DQOs), project data needs, and decision rules. The DQOs were included in the SAP.
- Definition of the organization, functional activities, procedures, and policies implemented to obtain project-specific data of known and appropriate quality.
- Development of a sampling plan to describe the sample collection and handling procedures required to obtain samples that would meet the DQOs.
- Laboratory analytical and QA/QC method review, documentation, and procedures were addressed in the SAP. A summary of these provisions is provided in Section 5.4.1.
- Field and laboratory QC checks for compliance to SAP specifications. These were conducted through internal and external audits.
- Data quality and usability review. These were conducted outside the laboratory as documented in the data validation reports presented in Appendix I. A summary of the methodology used in these reviews is provided in Section 5.4.2.
- Qualification of the individual data points. This was completed by applying data validation report flags to the data in the project database.
- An overall data quality assessment. This was conducted within the context of project objectives as described in Section 5.4.3.
- Delivery of electronic data to the Navy as part of project closeout activities. Naval Installation Restoration Information Solution (NIRIS) data base protocols define formats

for electronic data deliverables (EDDs). EDD protocols address parameters such as sample IDs, sampling and analysis information, dates, chemical concentrations, and units.

The sections below provide descriptions of the analytical methodology, data validation methodology and findings, and overall data quality assessment. Sample- and analyte-specific data validation reports are presented in Appendix I.

5.4.1 Analytical Methodology

Analytes, associated methods, and laboratory QC are discussed in the SAP. This information has been summarized in Table 6.

For each analytical parameter and method, the standard U.S. EPA analytical method or the associated EPA Contract Laboratory Program (CLP) Statements of Work (SOWs) were followed. The SAP identifies the following method-specific QC requirements:

- Method-specific QC procedures
- Level of effort (frequency of QC checks) for each QC procedure
- Quantitative acceptance limits for QC data
- Corrective action requirements for the laboratories for QC data that are outside the acceptance limits
- Documentation

These requirements, as detailed for each analytical method in the SAP and the CLP SOWs, were followed as the project analytical requirements by the assigned laboratory.

The detection limit requirements per project needs and regulatory criteria as they apply are identified in the SAP. The analytical laboratories established method detection limits (MDLs) in accordance with Title 40, Part 136, Appendix B, of the *Code of Federal Regulations* (CFR) before the start of the work to ensure that laboratory-specific limits complied with the specifications listed in the SAP.

5.4.2 Data Validation and Findings

All data, numerically 100 percent, have been evaluated independent of the laboratory by project chemists. Sample data have been reviewed for the QC specifications identified in the SAP and the U.S. EPA CLP SOW for each specific parameter, and are flagged in accordance with the SAP and U.S. EPA functional validation guidelines as referenced in the data validation reports in Appendix I.

The sample- and parameter-specific data validation reports presented in Appendix I are based on review of the individual laboratory sample delivery groups (SDG). The SDG-based reports are ordered by analytical groups. The cover of each report identifies individual samples included in the SDG.

Each report has subsections that correspond to the internal QC check requirements for that specific method as identified in the SAP. If laboratory data are found to deviate from the specifications, the subsection provides quantitative details for the QC data deviation and the

associated affected samples and provides flags according to defined conventions. Field blank, matrix spike, and duplicate sample results have been listed in laboratory result data sheets.

The individual SDG reports provide a summary table at the end of each section where flags are applied and the report is followed by flagged data sheets. The reports list all flags and their appropriate classifications as well as the reason for the flags. U.S. EPA data validation functional guidelines and SAP criteria were used to determine flagging conventions.

Sample- and analyte-specific data validation findings and associated qualifying flags per laboratory internal QC data are provided at the end of each data validation report. Data validation flags have been entered in the individual report data tables. In addition, the field QC data (field blanks, field duplicates, matrix spike/matrix spike duplicates) are provided to users for site-wide application, as the distribution of the field QC data correlates to site information at-large rather than the individual samples in the associated SDG.

The data have met and exceeded project quality goals. Documentation for the data evaluation and validation findings includes the following:

- Laboratory hardcopy packages, assembled by SDG, which include all QC data. These packages are stored at CH2M HILL offices as well as at the laboratories.
- An electronic database, which includes all sample concentration data with validation flags and a subset of laboratory QC data. These data are provided to the Navy for long-term and Navy-wide access to environmental data.
- Chain-of-custody (COC) forms and tracking records.
- Laboratory bench records and sample custody logs maintained by the laboratory.

5.4.3 Data Quality Assessment

DQOs are prescribed in the SAP in terms of precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters and the project objectives for these parameters. The following is a description of the assessment for each parameter. Associated data for the PARCC parameters are shown in the laboratory data package.

Accuracy measurement data include laboratory control sample and matrix spike recovery data for both organic and inorganic analytical parameters, as well as surrogate recovery data for organic parameters. The accuracy data have been provided to the project team (data users) for consideration during decisionmaking because these data need to be applied to the whole site. Over 90 percent of data are within criteria, thus meeting project goals.

Precision measurement data include laboratory and field duplicate data expressed as relative percent deviation (RPD). The data validation reports were also used to detail any duplicates outside control limits, if there were any such samples. The duplicate data have been provided to the project team (data users) for consideration during decisionmaking because these data need to be applied to the whole site. Over 90 percent of the data are within these criteria, thus meeting project goals.

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemical compounds in the sampled media.

Representativeness is assessed in both qualitative and quantitative terms. The project documentation discusses the qualitative aspects of representativeness in terms of design of the field sampling plan, sampling techniques, sample handling protocols, and associated documentation. Quantitative measures of representativeness include field and laboratory blank measurements to identify whether contamination was introduced through field or laboratory operations. Field duplicate measurements are used to establish variability.

Laboratory and trip blank measurements have been detailed on a sample- and parameter-specific basis in the data validation reports. All qualifications as a result of laboratory and trip blank effects have been incorporated into the project sample/analyte specific data. Field blank results are summarized in the project database and provided to data users on a site-wide basis.

Field duplicate results and associated RPD data are also presented in the database and taken into account in project decisionmaking.

Comparability expresses the confidence with which one data set can be compared to another. Comparability of data has been established through use of following:

- Standard U.S. EPA analytical methods and QC procedures established in the SAP
- Consistent reporting units for a specified procedure
- MDLs for all analytical parameters that were established in accordance with 40 CFR Part 136, Appendix B, before the start of the analyses to meet the project requirements

Based on these comparability standards, the data meet the project objectives.

Completeness is evaluated in this assessment as a measure of the amount of valid data obtained from the analytical measurements. Field activity completeness is assessed within the context of the overall sampling design. Data completeness was found to be above 90 percent at large, and meets project objectives.

5.4.4 Usability of Data for Future Risk Assessment Calculations

Laboratory data generated by this investigation is intended for use in comparison of free-phase petroleum hydrocarbon properties for the Forensic Chemistry Evaluation. A supplementary task included in SAP Addendum No. 3, for the 2008 Field Investigation, was to define the usability of PAH data use in any future risk assessment calculations that the Navy might decide to conduct in the future. These PAH data were generated for use in the Forensic Chemistry Evaluation.

These data were reviewed by the project chemist after validation. The evaluation included review of the data validation findings, as well as PARCC and detection limits. The PAH data were processed through the full QA/QC cycle described in Section 5.4.1 and have been assessed for usability in future risk assessments as described below.

The PAH data were obtained on free product samples rather than soil, water, or air samples; therefore, use by risk assessors would not be in the context of regulated soil, water, or air media but in a more limited context. The data use is expected to be in qualitative terms.

The analyses were for an extended list of PAH parameters that includes the specific PAH analytes used for risk assessments. This list is provided in Table E-3 of SAP Addendum No.3. Detection levels are dictated by the nature of the product matrix and can not be controlled as for water, soil, or air.

The data meet the QC criteria for calibrations and internal standards. The quantitation and identification of the individual analytes are therefore expected to be reliable.

6.0 Conclusions

The 2008 Follow-on Investigation completed the study of the nature, extent, and mobility of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity. Needed information and data were identified by review of the historical documents discussed in Sections 2.0 and 3.0, and were obtained during the Follow-on Investigation. The activities and findings of the Follow-on Investigation are described in Sections 4.0 and 5.0, respectively.

Conclusions about the nature, extent, and mobility of free-phase petroleum hydrocarbons are presented in the following sections:

- Section 6.1, Nature of Free-Phase Petroleum Hydrocarbons
- Section 6.2, Extent of Free-Phase Petroleum Hydrocarbons
- Section 6.3, Conceptual Site Model
- Section 6.4, Summary

6.1 Nature of Free-Phase Petroleum Hydrocarbons

The physical characteristics of the free-phase petroleum hydrocarbons found beneath the DRMO Site and vicinity have been generally consistent. The material is visually apparent as a black, viscous liquid. It is typically observed in surrounding pieces of buried metal debris and coarse-grained geologic material, and is also found within fractures and root structures of fine-grained geologic material. In general, heavy fuel oil (HFO) has been observed in fractures and root structures of fine-grained material located below bulk metal debris along Azuar Drive and Dump Road.

The first occurrence of free-phase hydrocarbons at depth generally coincides with the average elevation of the water table in the shallow subsurface. Information obtained during the 2007 and 2008 Field Investigations consistently indicates that the chemical signature of the free-phase hydrocarbons is similar to that of an HFO such as No. 6 (Bunker C) fuel oil. The dynamic viscosity of HFO is approximately 5 orders of magnitude greater than that of water. High viscosity, lack of driving pressure, and the fine-grained nature of silts and clays at depths where HFO is found indicate that HFO found at the DRMO Site and in the vicinity present low potential for mobility in soil. This supports the predominant occurrence of HFO in layers of subsurface scrap metal debris, where pore spaces are significantly more extensive than in fine-grained soil.

One exception to this finding of fuel types arose during the 2008 Field Investigation. The chemical signature for petroleum found in a soil sample collected at location DDD (see Figures 6, 8, and 12) was found to be similar to lighter petroleum products such as fuel oil No. 4 or No. 5, or a lighter Bunker fuel oil. This sampling location was originally chosen to confirm clean soil. The sample collected at this location contained significantly more diesel-range material than the other samples. The location where the lighter fuel type was found is in the EETP across Azuar Drive from the DRMO Site (approximately 500 feet beyond the

southeastern boundary), and is offset approximately 30 feet from Azuar Drive. It is apparent that free-phase petroleum hydrocarbons at this location are not related to contamination at or attributed to the DRMO Site. References to free-product petroleum hydrocarbons below and later in this section do not include the fuel oil identified at location DDD.

The Forensic Chemistry Evaluation discussed in Section 5.3 found that the occurrence and relative distributions of selected organic compounds and stable isotopes in free product samples obtained throughout the area varies significantly, indicating the presence of multiple petroleum product sources. The Forensic Chemistry Evaluation also identified HFO to be the petroleum product present, and that HFO samples from soil along and beneath Azuar Drive appear to contain an HFO different from than that found along and beneath Dump Road.

6.2 Extent of Free-Phase Petroleum Hydrocarbons

Free-phase HFO is found in subsurface soil at the site in two principal areas beneath Dump Road and Azuar Drive and adjacent properties. The approximate extent of free-phase HFO in these two areas, as determined by visual examination of trench excavations and direct-push soil cores, is shown on Figure 12.

The presence of free-phase HFO is strongly correlated with the presence of metal debris, particularly in a defined body of metal debris that underlies Azuar Drive, Dump Road, and portions of the DRMO Site at depths between 5 and 8 feet bgs. Although buried debris can also be found at shallower depths, these shallow debris layers do not commonly contain HFO. The HFO-saturated metal debris layer terminates abruptly along the eastern side of Azuar Drive where utility corridors and railroad tracks are currently located, as indicated by the logs for trenches AD-8 and AD-9 in Appendix H1. The abrupt termination at the utility corridor suggests that metal debris and, possibly free-phase HFO, may have been present, but were removed during the construction of utilities or railroads. Farther east, smaller amounts of metal debris were found in EETP trenches T-2 (small amounts at 5 to 6 feet bgs), T-5 (one twisted thin metal strip at 12 feet bgs), and T-7 (trace metal debris from 5 to 8 feet bgs with three larger pieces).

The HFO at Dump Road includes two areas: a northern area beneath and along Dump Road and the adjacent former CTA, and a southern area extending within the DRMO Site. The two areas are separated by a parcel that was excavated and backfilled by the Navy between 2005 and 2007 to address other contaminants associated with the DRMO Site. This excavation included the removal of co-located petroleum-contaminated soil, as shown on Figure 2-5, “2007 Excavation Map”, provided by Weston Solutions, Inc. and included in Appendix F4 to this TM. The western extent of this shape is formed by an excavation referred to as the “Weston V-Trench” and by the westernmost of a series of test pits that were excavated by Weston at the locations shown in the “Dump Road Test Pit Locations” figure provided in Appendix F4, and which are documented by photographs also included in that appendix.

Free-phase hydrocarbons within the Dump Road HFO were encountered at depths ranging from 1 foot bgs (in trench DR-3) to 13.9 feet bgs (in boring E). The thickness of free product varied from 0.2 feet (in boring R) to 3.9 feet (in boring L). Within the Dump Road HFO, bulk

metal debris was encountered at depths ranging from 1 foot bgs (in trenches DR-1 and DR-3) to 10 feet bgs (in boring O). Trace metal debris was encountered at a maximum depth of 12.7 feet bgs (in boring E). The maximum thickness of the bulk metal debris was 6.5 feet (in trench DR-1).

The Azuar Drive HFO extends approximately 990 feet along the eastern boundary of the DRMO Site and roughly parallels Azuar Drive. The width of the HFO was 375 feet at its widest just northwest of the former OSB location, and approximately 50 feet at the southeastern end.

Free-phase hydrocarbons within the Azuar Drive HFO were encountered at depths ranging from 3.5 feet bgs (in trench AD-1 station 0 to 42.5) to 15 feet bgs (in boring QQ). The thickness of the free-phase hydrocarbons varied from 2.5 feet (in boring EEE) to 8 feet (in AD-2 stations 50 to 70, 97.5 to 117.5, and 140-162.5). Within the Azuar Drive HFO, bulk metal debris was encountered at depths ranging from 0.5 feet bgs (at location Z) to 12 feet bgs (in trench T-5). The maximum thickness of the observed bulk metal debris was 8 feet (in the OSB excavation).

Metal debris at some locations was encountered at a shallower depth than the groundwater table and free-phase hydrocarbons. In coarse-grained geologic material and debris, HFO surrounded the grains of the materials and pieces of debris. In fine-grained geologic material, free-phase hydrocarbons were found along fractures, as well as in roots and plant structures. Some clays had "blocky" fractures, and the HFO was also observed along these fractures.

6.3 Conceptual Site Model

A CSM is provided as Figure 11 and depicts a series of items that are relevant to the distribution and movement of HFO at the DRMO Site and in the vicinity. These items include site history, physical setting, known and potential sources of contamination, and potential migration pathways. The overall physical setting discussed in Section 1.4 is unchanged and not discussed further in this section. Given the lack of exposure pathway migration and receptor exposure indications, as well as the relatively insoluble and viscous nature of the product, potential exposure pathways and receptors are not included in the CSM. Conclusions relevant to the CSM are discussed in the sections below.

6.3.1 History

The DRMO Site is located in the north-central portion of Mare Island and is a trapezoid of approximately 8 acres located in the southwest corner of the intersection of Azuar Drive and Dump Road. The boundaries of the FSA echo the site boundaries. The FSA is 4.6 acres in size and is currently an earthen field covered to varying degrees with grasses and small shrubs. The rest of the DRMO Site consists of approximately 3.5 acres of land around the perimeter of the FSA.

The DRMO Site and the vicinity were formerly submerged land offshore of the original outline of Mare Island. Filling of these areas began in the early 1900s with the construction of dikes, and later filled with dredge spoils. Dredge spoils and possibly other fill were placed at the DRMO Site between 1925 and 1930.

The current ground surface is generally flat with elevations ranging from approximately 12 to 14 feet above MSL. Some areas are prone to flooding during periods of heavy precipitation. Surface water runoff discharges to storm sewers in the northern corner of the site. Remaining structures include Buildings 661 and 679. Figure 11 shows historical buildings and utilities. Various railroad tracks, buildings, and other surface features have been removed from the site.

Underground utilities of various types are present, although only storm sewer pipelines are shown in the CSM. A series of buried pipelines within the DRMO Site and in the vicinity were installed and removed over time.

Use of the FSA as a scrapyard began in the 1940s. The vicinity was fully developed by the late 1940s and early 1950s. Transformers, batteries, metal scrap, pesticides, and other materials were stored and managed. Petroleum was managed at the site and paper bailing was also was known to occur. Surplus material and scrap from MINS and other military facilities was stored and managed at the FSA until mid-1995.

A series of removal actions have been conducted, including the 2005-2007 CERCLA NTCRA for the removal of MEC and soil contaminated by lead, PAHs, and pesticides/PCBs. This work involved the removal of buildings, railroad tracks, pavement, other surface features, some utilities, and approximately 18,000 cubic yards of surface soil. A contiguous layer approximately 18 inches thick was removed and screened for MEC. Excavation depths reached 48 inches in some 100-foot-square grids, and continued to 6 feet deep in several localized areas. Approximately 15,800 cubic yards of soil were also removed during a concurrent NTCRA between 2005 and 2007. Removal was principally conducted in the western corner of the DRMO Site and addressed lead-, PCB-, PAH-, and pesticide-contaminated soil, although some co-located petroleum-contaminated soil was also removed. Two smaller removal actions involving the former OSB and Wooden Sump Box are discussed in Section 6.3.2.

6.3.2 Sources

Historical documents proposed that the perforated piping connected to the OSB (also referred to as the oil discharge line) was the probable source of HFO contamination at the DRMO Site and in the vicinity on both Navy and LMI properties. This premise was based on information available at various stages of previous investigations. The Follow-on Investigation provided a significant body of additional information with which to test this hypothesis.

Evaluation of visual observations, geophysical data, and forensic chemistry data indicates that the existing OSB source hypothesis is incorrect. Findings indicate that the former OSB was a source of HFO contamination on the Navy side of Azuar Drive. Findings also show that the OSB was not a source of the HFO found along Dump Road. The OSB was found not to be the origin of HFO found at one location (PP) on the LMI side of Azuar Drive, about 240 feet southwest of the OSB. Findings were inconclusive as to the former OSB being the origin of HFO found at a point (RR) about 70 feet more distant to the southwest. HFO product types found at a still more distant location (VV) to the southwest were similar to those found near the OSB; however, observations of record do not show a clear preferential pathway to this point.

Lines of evaluation leading to the above conclusions are discussed in the paragraphs below with updated source hypotheses. Lateral extent findings, forensic chemistry findings, and evaluations of possible preferential migration pathways in the form of layers of scrap metal debris are relevant to the discussion of HFO migration. The lateral extent of HFO is shown on Figure 12. It should be noted that the future designation of removal areas may be different when factors such as fine-grained soil fractures, vegetative structures, and incidental occurrences are considered.

Figure 13 shows summary forensic chemistry findings, geophysical survey information, and investigation trench locations. Forensic chemistry findings speak to the similarity or dissimilarity of HFO products found at individual points. Geophysical survey information is used to determine possible locations of contiguous layers of scrap metal debris. Observations in trenches are used to determine the confirmed presence or absence of scrap metal debris. Table 12 lists observations of scrap metal relevant to the evaluation of preferential migration pathways along specific directions to points of interest. These directions are from the former OSB to the FSA, and from the former OSB to sampling locations PP, RR, and VV along the LMI side of Azuar Drive.

The former OSB was not the source of HFO found along Dump Road according to the information obtained during the Follow-on Investigation. The two areas are separate, as established in Section 6.2. Preferential migration pathways between the Azuar Drive and Dump Road HFO are not present, as discussed below and in Section 6.3.5. Finally, the forensic chemistry conclusions presented in Section 6.2 show that the HFO product found in each area is unrelated. Given that HFO along Dump Road and Azuar Drive is physically separate, unconnected, and chemically distinct, it follows that sources for contamination in these areas must be separate.

Although the Dump Road HFO coincides to some extent with the footprint of the former railroad tracks along the south side of Dump Road, this configuration is likely an artifact of previous remedial actions in the northwestern part of the DRMO Site which removed HFO contaminants along with other COPCs. Without source and pathway information to evaluate, the forensic chemistry findings discussed in Section 5.3.1 do not lead to a conclusive source hypothesis. The forensic chemistry findings show that multiple groups of HFO source products are present and some are more weathered than others. These findings are consistent with intermittent and discrete releases of various products. There is no evidence to suggest that HFO from a Navy source has migrated to the LMI locations on the north side of Dump Road or vice-versa. Given this, the most probable remaining hypotheses for the source of contamination in the Dump Road area are intermittent and isolated disposal and releases, or backfill with undocumented contaminated materials such as mixed HFO and scrap metal that were placed within localized areas. Observations of HFO in subsurface vegetative structures along Dump Road support the hypothesis that HFO may have been land-disposed of in vegetated areas and then covered with soil. In trench FSA-3, for example, HFO was observed only in reed-type vegetative material at a depth of 4.5 to 5 feet bgs.

The former OSB appears to be the source of contamination in the FSA. Preferential migration pathways in the form of scrap metal debris are present in locations near the former OSB at depths coincident with HFO. The presence of scrap metal decreases in more distant westerly trenches. Scrap metal and HFO were not found at a still more distant trench

outside the western lateral extent of the Azuar Drive HFO. Follow-on Investigation findings leading to the conclusion that the former OSB was the principal source for HFO contamination in the FSA are listed below.

- Trench AD-1 sections showed coincident scrap metal and HFO at intervals within the depths of 3.5 to 7 feet bgs. Trench AD-1 is located immediately northwest of the former OSB.
- Trench FSA-1 sections showed decreased amounts of scrap metal at 4.5 feet bgs coincident with HFO observed at depths of 2 to 9 feet bgs. Trench FSA-1 is located approximately 100 feet northwest of the former OSB.
- Trench FSA-2 showed neither HFO nor scrap metal. Trench FSA-2 is located to the west of trench FSA 1, outside the lateral extent of HFO.

Forensic chemistry and preferential migration pathway findings indicate that the OSB formerly located on Navy property was not the source of contamination at forensic chemistry sample location PP. Location PP is approximately 240 feet southeast of the former OSB and is offset about 90 feet northeast of Azuar Drive. The findings leading to this conclusion are listed below.

- The product at location PP is not related to the product found on the DRMO Site side of Azuar Drive. Stable Isotope Ratio crossplots show the dissimilarity of this sample compared to the DRMO Site Azuar Drive samples.
- Scrap metal was not found at trench T-4 excavated near this point by LMI. Scrap metal was found to be commonly associated with both the presence and the migration of HFO along both Azuar Drive and Dump Road.
- Scrap metal was found coincident with HFO at trench AD-5 crossing Azuar Drive, but it was not found in trenches AD-9 and T-3. These trenches are located between the former OSB and sample location PP. Trenches T-8, T-9, and UU are located to the east of sample location PP, are outside the lateral extent of HFO, and did not contain scrap metal. There does not appear to be a contiguous or dispersed preferential migration pathway linking the former OSB to soil at sample location PP.

Forensic chemistry and preferential migration pathway findings are inconclusive that the OSB formerly located on Navy property was the source of contamination at forensic chemistry sample location RR. Location RR is approximately 310 feet southeast of the former OSB and is offset about 70 feet northeast of Azuar Drive. No confirmed contiguous migration pathway was apparent leading from the former OSB to this point. Isolated pieces of scrap metal were observed near the sample location and were coincident with HFO. The findings related to the origin of HFO at this location are listed below.

- The chemical signatures of product at location RR suggest it may be different from the product on the Navy side of Azuar Drive, but this finding is inconclusive as the magnitude of the apparent difference is relatively low.
- The occurrence of scrap metal decreases to the southeast of the former OSB to forensic chemistry sample location RR along the 160 feet of stationing in trench AD-2 sections. Scrap metal was found coincident with HFO at trench AD-5 crossing Azuar Drive.

Trench AD-5 is perpendicular to trench AD-2, and one end is located near the midpoint of the trench AD-2 sections. Neither HFO nor scrap metal were observed at trench OSBG03, which is located immediately across Azuar Drive from forensic chemistry sample location RR.

- Scrap metal (one piece of thin twisted metal at the base of the excavation) was found at trench T-5 excavated near this point by LMI. Scrap metal was found to be commonly associated with both the presence and the presumed migration of HFO along both Azuar Drive and Dump Road, and was partially coincident with HFO. The appearance of a single piece of scrap metal is not consistent with the contiguous layers and intervals observed to be coincident with HFO in the Dump Road and Azuar Drive areas.

Findings indicate contrasting conclusions as to the origin of HFO at forensic chemistry sample location VV, but the lack of a migration pathway supports the hypothesis that the OSB was not the source of HFO at location VV. This point is located about 410 feet southeast of the OSB and is offset about 55 feet from Azuar Drive. Forensic chemistry findings indicate that the HFO product types at location VV are similar to those found on the Navy side of Azuar Drive nearer the former OSB. No confirmed indications of a contiguous scrap metal or other preferential pathway along the Navy side of Azuar Drive were found. These findings are consistent with the hypothesis that the same type of HFO product was released at the two locations separately because the petroleum product is similar, but no preferential migration pathway was found. The findings leading to this conclusion are listed below.

- The chemical signatures of product at sample location VV suggest that it is from petroleum products similar to those found on the Navy side of Azuar Drive.
- Scrap metal pathway evaluations from the former OSB in the direction of sample location VV are noted in the discussions of sample locations VV and RR above. No indications of a preferential migration pathway beyond location RR and location VV were found.
- Scrap metal (trace amounts with isolated pieces) was found at trench T-7 excavated near this point by LMI. Scrap metal was found to be commonly associated with both the presence and the presumed migration of HFO along both Azuar Drive and Dump Road, and was partially coincident with HFO.

Information from the Follow-on Investigation discussed in this TM changes the source hypothesis for HFO contamination at the DRMO Site and in the vicinity. This updated hypothesis consists of the items listed below.

- HFO was placed in the OSB-contaminated subsurface soil in the FSA, but there is no link between the HFO from the former OSB to contaminated subsurface soil in areas along Dump Road and to the southeast along the LMI side of Azuar Drive. Given this, the most probable remaining hypothesis for the source of contamination in the Dump Road area is intermittent and isolated disposal and releases, or undocumented HFO-contaminated backfill that was placed within the EETP itself.
- Disposal, backfill, and releases involving HFO and many types of debris have occurred at various locations throughout the DRMO Site and vicinity over time. The presumption that the former OSB or other contamination on the Navy side of Azuar Drive and Dump

Road was the source of contamination in the EETP was contradicted by forensic chemistry findings and preferential migration pathway observations.

- The hypothesis that HFO from localized disposal, releases, or backfill with contaminated materials in the IR16-B4/Building 455 Area east of Azuar Drive and in other EETP areas is not contradicted by the findings and conclusions of the Follow-on Investigation. Releases may have been related to the railroad tracks formerly located in the area; to possible above-ground tanks shown on Cedar Avenue/Azuar Drive in Figure A-4A in Appendix A; to activities in the Building 489 area shown in historical aerial photographs (Figures A-4B and A-4C); or to incidental disposal in the area as Mare Island was expanded from the 1852 limits shown in Figures A-5, A-6, and A-11 to its current configuration. Given this, the most probable remaining hypothesis for the source of contamination on the LMI side of Azuar Drive is disposal, releases, or undocumented HFO-contaminated backfill that was placed within the EETP itself.

6.3.3 Affected Media

For the most part, only subsurface soil is contaminated with free-phase hydrocarbons and petroleum-related chemicals. A floating layer of HFO is found on top of groundwater in some areas.

6.3.4 Potential Migration Pathways

Two possible HFO migration pathways were identified for study during the Follow-on Investigation. These were contiguous layers of scrap metal debris in subsurface soil, and utility corridor backfill. Two additional potential HFO migration pathways were initially considered: migration through fractures in clayey/silty soil, and migration through vegetative structures (i.e., roots and mats). However, neither of these additional pathways was considered significant, and the pathways were removed from further consideration because of the limited occurrence of HFO in these features in the absence of an overlying HFO-saturated debris or fill layer; the lack of lateral continuity between fractured or vegetation horizons; and the relatively small volume of potentially mobile HFO observed in these features.

Void spaces in bulk metal debris appear to have acted as preferential pathways for migration of free-phase petroleum hydrocarbons. The dynamic viscosity, or internal resistance to flow, of HFO is approximately 5 orders of magnitude greater than that of water. High viscosity, lack of driving pressure, and the fine-grained nature of silts and clays at depths where HFO has been found indicate low mobility in soil. This supports the predominant occurrence of HFO in layers of subsurface scrap metal debris, where pore spaces are more abundant.

The highly viscous nature of the HFO currently present in these layers suggests that limited migration through soil would have been a result of the factors listed below:

- Lower viscosity of HFO before cooling to ambient ground temperatures
- Lower viscosity of HFO before loss or degradation of lighter-fraction hydrocarbons that would have made the released product more mobile
- Hydraulic pressure (e.g., hydraulic head) applied to the material as it was discharged.

HFO is unlikely to migrate laterally or vertically given its viscosity, its current state, the lack of a continuing source, and the absence of contiguous metal layers beyond those already delineated.

Probable findings of the extent of contiguous, significant layers of scrap metal debris were generated for both Dump Road and Azuar Drive and are shown on Figure 13. The Dump Road scrap metal layer was identified during the 2008 Geophysical Survey as Anomalies 1 and 2. The Azuar Drive anomaly is shown in purple as Anomaly 14. A third body has been identified at the northwest corner of Azuar Drive and Dump Road as Anomaly 10. Information obtained from borings advanced during the 2008 Field Investigation, described in Section 5.3.3 and 5.3.4, shows that this body is not contiguous with the Dump Road and Azuar Drive scrap metal zones. These same findings show the Dump Road and Azuar Drive contiguous scrap metal layers to be separate.

A candidate metal debris preferential migration pathway across Azuar Drive toward forensic chemistry sample locations PP, RR, and VV conflicts with visual observations in the area where it is located. A subsurface interpreted vertical magnetic gradient anomaly (Anomaly L on Plate 4 in Appendix G, and shown on Figure 13) does cross Azuar Drive at Building 679. Subsurface explorations around and within the boundaries of the anomaly (trench AD-2 station 140 to 162.5, and trench AD-9) found only woody debris rather than metal. The probable source of this anomaly was identified as "railroad tracks, utilities, and possible buried debris." The presence of wood debris in this trench is inconclusive in evaluating its role as a preferential migration pathway.

Utility corridor backfill does not appear to be a conduit for HFO migration based on direct visual observation. The majority of the utility corridor backfill is fine-grained material. Although small amounts of free product were observed in localized areas along utility backfill as described in Section 5.3.5, the areas were not laterally contiguous and were typically above the intervals in which the HFO occurred. Based on these observations, the utility corridor backfill did not act as a significant migration pathway for free-phase petroleum hydrocarbons and is not expected to act as a pathway for future migration of HFO.

HFO has been observed in utility vaults along the northern portion of Azuar Drive and within the former CTA. With the exception of sample BB, these appear to be the result of localized seeps into vaults from surrounding soil, and are not the result of migration along preferential pathways. Sample BB was collected from a sanitary sewer manhole. No evidence was found of significant mobility of HFO through utilities themselves other than the sanitary sewer.

Finally, based on the historical information and current conditions at the site observed during the Follow-on Investigation, it is highly unlikely that the HFO found at the DRMO Site and in the vicinity is moving through known migration pathways to exposure pathways leading to human and ecological receptors.

6.4 Summary

The nature, extent, and mobility of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity have been determined in this TM. Findings indicate that the former OSB

was a source of HFO contamination on the Navy side of Azuar Drive. The former OSB was not found to be the origin of HFO at two locations on the LMI side of Azuar Drive southeast of the OSB. Findings were inconclusive as to the former OSB being the origin of HFO found at third point to the southeast. HFO was not found to be mobilizing through exposure pathways to known human or ecological receptors. HFO is unlikely to migrate laterally or vertically given its viscosity, its current state, the lack of a continuing source, and the absence of contiguous metal layers beyond those already delineated.

The results of an historical human health risk assessment conducted for the DRMO Site showed that TPH-motor oil and TPH-diesel do not contribute significantly to the total estimated cancer risk or hazard index for the site. The findings of an historical ecological risk assessment were that the DRMO Site is paved, covered with gravel, and contains buildings, and therefore does not provide habitat for ecological receptors. As this area is designated for future commercial use per the Mare Island Final Reuse Plan, the DRMO Site will not provide such habitat in the future.

As part of the preparation of this Final TM, a Draft Final version of the document was submitted to stakeholders for review in March 2009. The stakeholders' review comments and the Navy's responses to those comments are included in this Final TM as Appendix K. Where applicable, changes resulting from the comments and responses have been incorporated into this Final TM.

The information presented in this TM will be used to develop a Petroleum Corrective Action Program for a removal action. The Navy will continue to work cooperatively and concurrently with LMI as the corrective action process moves forward. Current plans call for a petroleum removal action on the Navy DRMO Site later in 2009.

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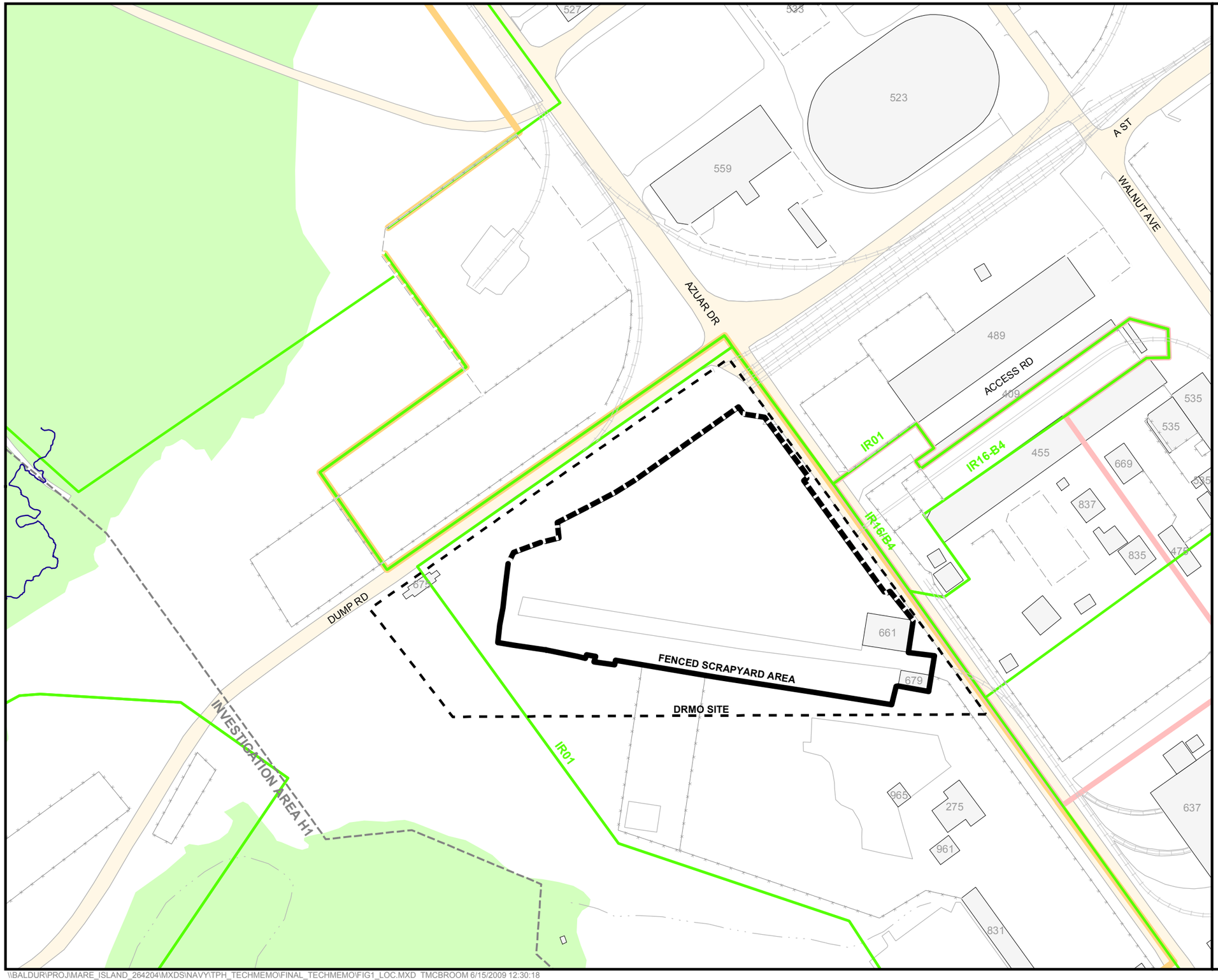
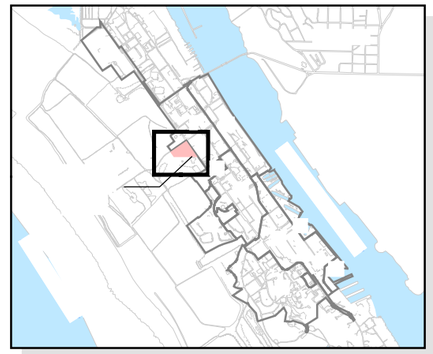




LEGEND

- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- RAILROAD
- FENCE
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- STRUCTURE
- ROAD
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)

0 160
Feet

FIGURE 1
SITE MAP
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG1_LOC.MXD TMCBROOM 6/15/2009 12:30:18

INVESTIGATION AREA B

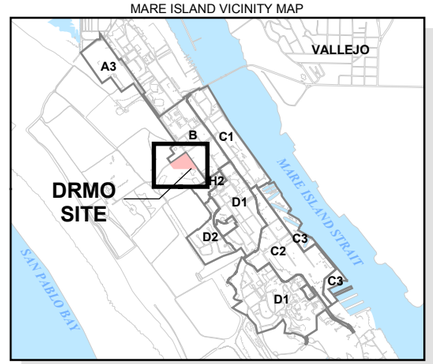
INVESTIGATION AREA B.1 - IR01 STORAGE YARD AND FORMER CRANE TEST AREA

IR01 (UNDEVELOPED AREA)

IR01 RCRA Landfill

FILL SOIL
ORIGINAL SOIL

MARE ISLAND VICINITY MAP



LEGEND

- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- FENCE
- RAILROAD
- ORIGINAL MARE ISLAND BOUNDARY - 1859
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- IR01 WITHIN INVESTIGATION AREA B
- IR01 BOUNDARY
- 1910-1920
- 1920-1930
- 1925-1930 Non Waste Fill Area
- 1925-1942
- 1942-1966
- 1942-1966 (Facility Landfill to 1978)
- 1942-1966 (RCRA Landfill to 1989)
- 1959-1983
- 1960-1983
- 1965-1978 Facility Landfill
- 1979-1989 RCRA Landfill
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- INVESTIGATION AREA
- STRUCTURE
- ROAD
- INVESTIGATION AREA B
- WATER
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)

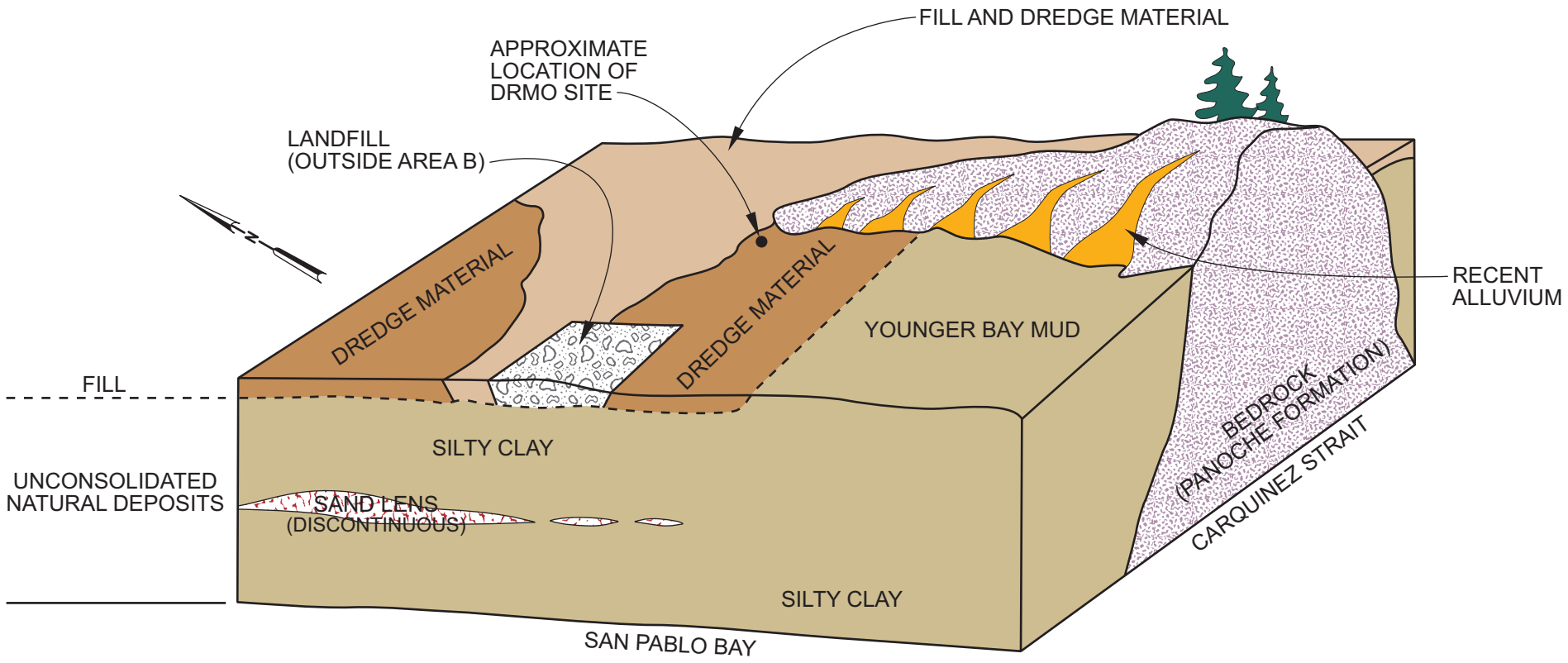
0 700 Feet

N

FIGURE 2
FILL SEQUENCE IN IR01
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINTIY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG2_FILL-CHRON.MXD TMCBROOM 6/15/2009 12:34:27



LEGEND

- FILL AND DREDGE MATERIAL - CLAY, SILT, SAND, GRAVEL NOT READILY DISTINGUISHED FROM NATURAL DEPOSITS, AND SOME DEBRIS (BRICKS, METAL)
- YOUNGER BAY MUD - UNCONSOLIDATED NATURAL DEPOSITS, SILTY CLAY AND CLAY, WITH OCCASIONAL LENSES OF SILTY SAND AND SANDY CLAY
- BEDROCK - SANDSTONE, SILTSTONES, AND SHALES OF CRETACEOUS PANOCHE FORMATION, GREAT VALLEY SEQUENCE
- RECENT ALLUVIUM - BOULDERS, COBBLES, GRAVEL, SAND, AND FINES FROM EXPOSED ERODING BEDROCK
- SAND LENS

FIGURE 3
SCHEMATIC GEOLOGIC DIAGRAM
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

ES012009001RDD_10 (2/3/09)

CH2MHILL

IR02, FORMER WASTE OIL DISPOSAL SUMPS AREA

SUMP 4
SUMP 2
SUMP 1
SUMP 3
FENCED SCRAPYARD AREA
DRMO SITE
DUMP RD
AZUAR DR
ACCESS RD
INVESTIGATION AREA H1
0 520 Feet

MARE ISLAND VICINITY MAP

VALLEJO
A3
B
C1
H2
D1
D2
C2
C3
C3
D1
DRMO SITE
MARE ISLAND STRAIT
SAN PABLO BAY

CTAMW0100
CTAMW0101
TRENCH CTAMW0100/101
CTAMW0107
TRENCH CTAMW0106/107
CTAMW0106
INVESTIGATION AREA B:1
IR01 STORAGE YARD
AND FORMER CRANE TEST AREA
CTAMW0102
CTAMW0103
TRENCH CTAMW0102/103
CTAMW0108
CTAMW0109
TRENCH CTAMW0108/109
IR01GB077
IR01GB107
CTAMW0104
TRENCH CTAMW0104/105
CTAMW0105
IR01 (UNDEVELOPED AREA)
IA B.1
IR01
IA B.2-1
IA B.1
AZUAR DR
PINTADO ST
527
559
FORMER RAILROAD TRACK CORRIDOR
DUMP RD
675
WESTON_VJ_TRENCH
IR16-715
FENCED SCRAPYARD AREA
DRMO SITE
IR16-B3/B5
INVESTIGATION AREA H1
IR01
IA B.2-2
IR16-B4
B455 AREA
FORMER OIL SUMP BOX
UTILITY VAULT UV-1
ACCESS RD
409
455
669
837
835
475
535
535
661
679
965
275
961
637
FS-1 FS-2 FS-3 FS-4 FS-5 FS-6 FS-7 FS-8 FS-9 FS-10 FS-11 FS-12 FS-13 FS-14 FS-15 FS-16 FS-17 FS-18 FS-19 FS-20 FS-21 FS-22 FS-23 FS-24 FS-25 FS-26 FS-27 FS-28 FS-29 FS-30 FS-31 FS-32 FS-33 FS-34 FS-35 FS-36 FS-37 FS-38 FS-39 FS-40 FS-41 FS-42 FS-43 FS-44 FS-45 FS-46 FS-47 FS-49 FS-50 FS-51 FS-52 FS-53 FS-54 FS-55 FS-56 FS-57 FS-58 FS-59 FS-60 FS-61 FS-62 FS-63 FS-64 FS-65 FS-66 FS-67 FS-68 FS-69 FS-70 FS-71 FS-72 FS-73 FS-74 FS-75 FS-76 FS-77 FS-78 FS-79 FS-80 FS-81 FS-82 FS-83 FS-84 FS-85 FS-86 FS-87 FS-88 FS-89 FS-90 FS-91 FS-92 FS-93 FS-94 FS-95 FS-96 FS-97 FS-98 FS-99 FS-100

LEGEND

- MONITORING WELL
- PREVIOUS INVESTIGATION BORING
- 2002 WATER LINE REPAIR EXCAVATION
- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- OIL DISCHARGE PIPELINE
- FORMER PERFORATED PIPE
- RAILROAD
- FENCE
- INVESTIGATION AREA
- 2006-2008 TRENCH LOCATION
- NTCRA SAMPLING GRID
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- 2005-2007 WESTON DRMO NON-TIME-CRITICAL REMOVAL ACTION BOUNDARY
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- IR02, FORMER WASTE OIL DISPOSAL SUMPS AREA
- STRUCTURE
- ROAD
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)

0 160 Feet

N

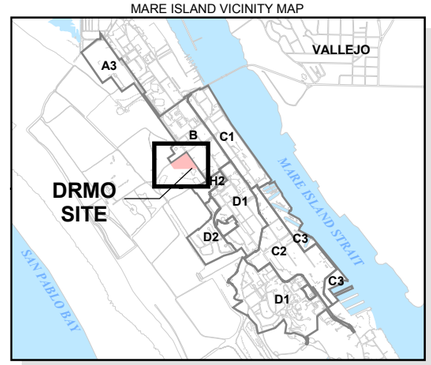
FIGURE 4
LOCATIONS OF HISTORICAL INVESTIGATIONS AND CLEANUP ACTIONS

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG4_DRMO-SITE.MXD TMCBROOM 6/15/2009 12:40:29

MARE ISLAND VICINITY MAP



LEGEND

- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- RAILROAD
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE
- BACKBONE SEWER PIPELINES
- SEWER SERVICE LINES
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER PIPELINE
- INVESTIGATION AREA
- FENCE
- NTCRA SAMPLING GRID
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- STRUCTURE
- ROAD
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)

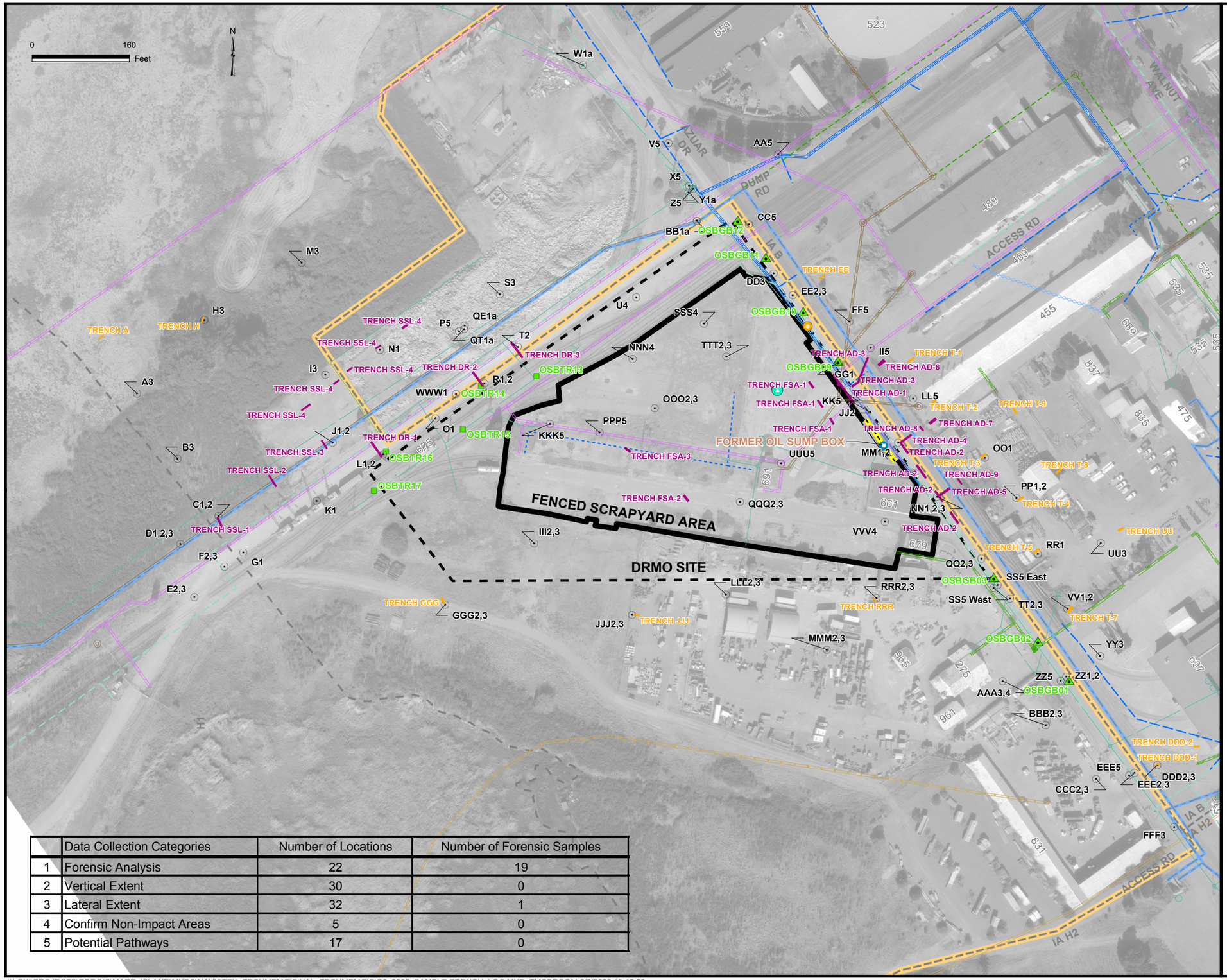
0 120 Feet

N

FIGURE 5
SITE UTILITIES
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

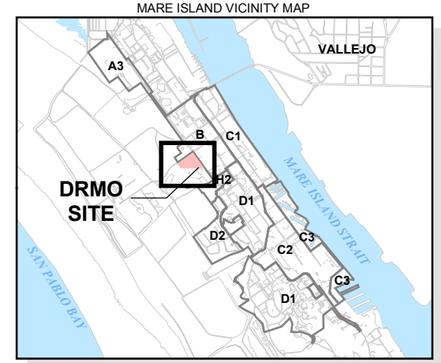
CH2MHILL

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG5_UTILITIES.MXD TMCBROOM 6/15/2009 12:47:38



	Data Collection Categories	Number of Locations	Number of Forensic Samples
1	Forensic Analysis	22	19
2	Vertical Extent	30	0
3	Lateral Extent	32	1
4	Confirm Non-Impact Areas	5	0
5	Potential Pathways	17	0

MARE ISLAND VICINITY MAP



LEGEND

- 2008 INVESTIGATION BORING
- 2005-2006 OSB INVESTIGATION BORING
- 2005-2006 OSB INVESTIGATION TRENCH
- FORMER OIL SUMP BOX
- FORMER WOODEN SUMP BOX
- 2002 WATER LINE REPAIR EXCAVATION
- SEWER CLEANOUT
- SEWER MANHOLE
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- BACKBONE SEWER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER BACKBONE
- STORMWATER SERVICE LINE
- FORMER PERFORATED PIPE
- INVESTIGATION AREA
- 2008 INVESTIGATION TRENCH
- 2007 INVESTIGATION TRENCH
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE

NOTE:
a = FREE PRODUCT SAMPLE COLLECTED FROM MANHOLE

FIGURE 6
LOCATIONS OF SOIL BORINGS AND TRENCHES INSTALLED DURING OSB INVESTIGATION AND FOLLOW-ON INVESTIGATION

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

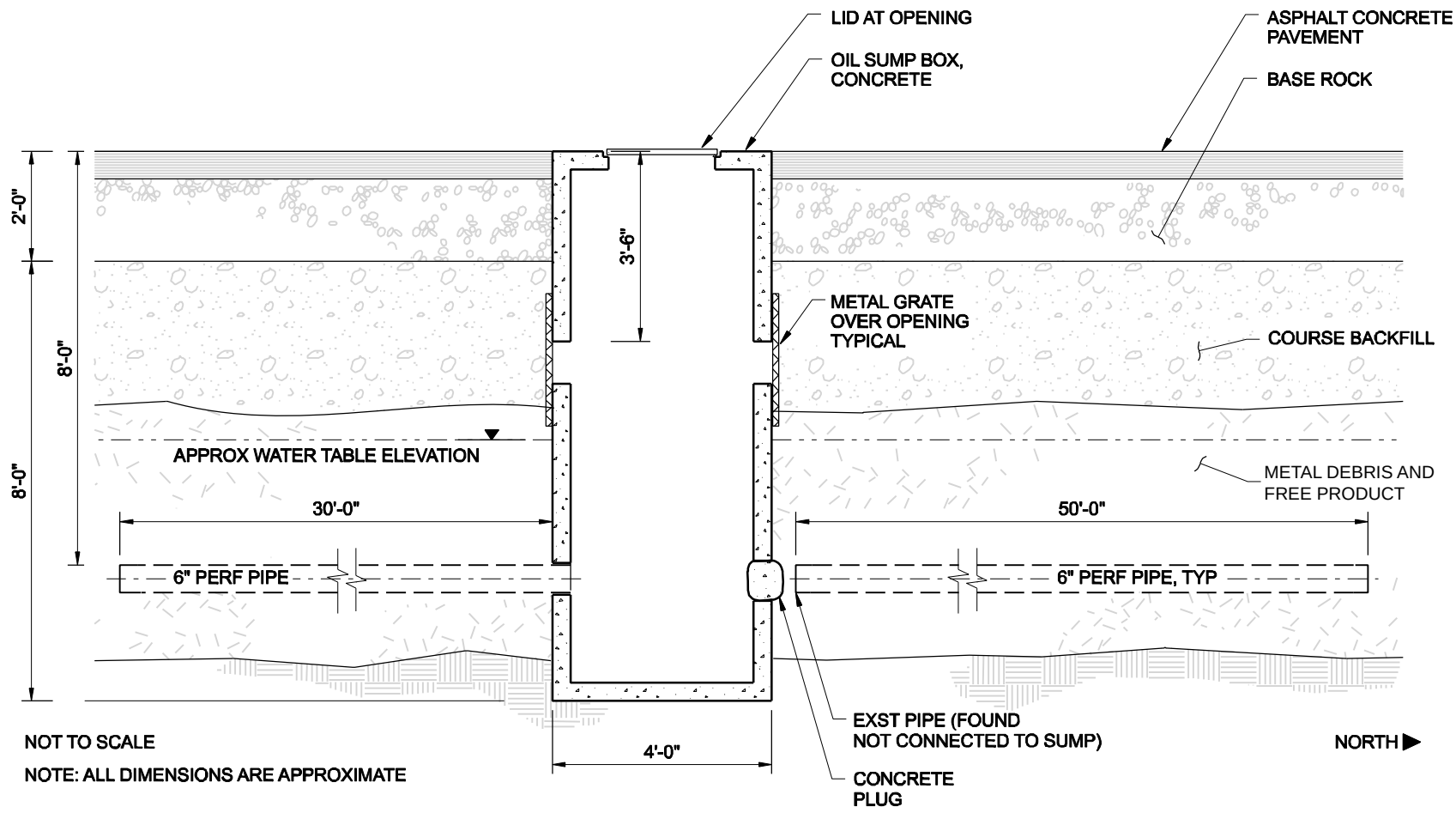
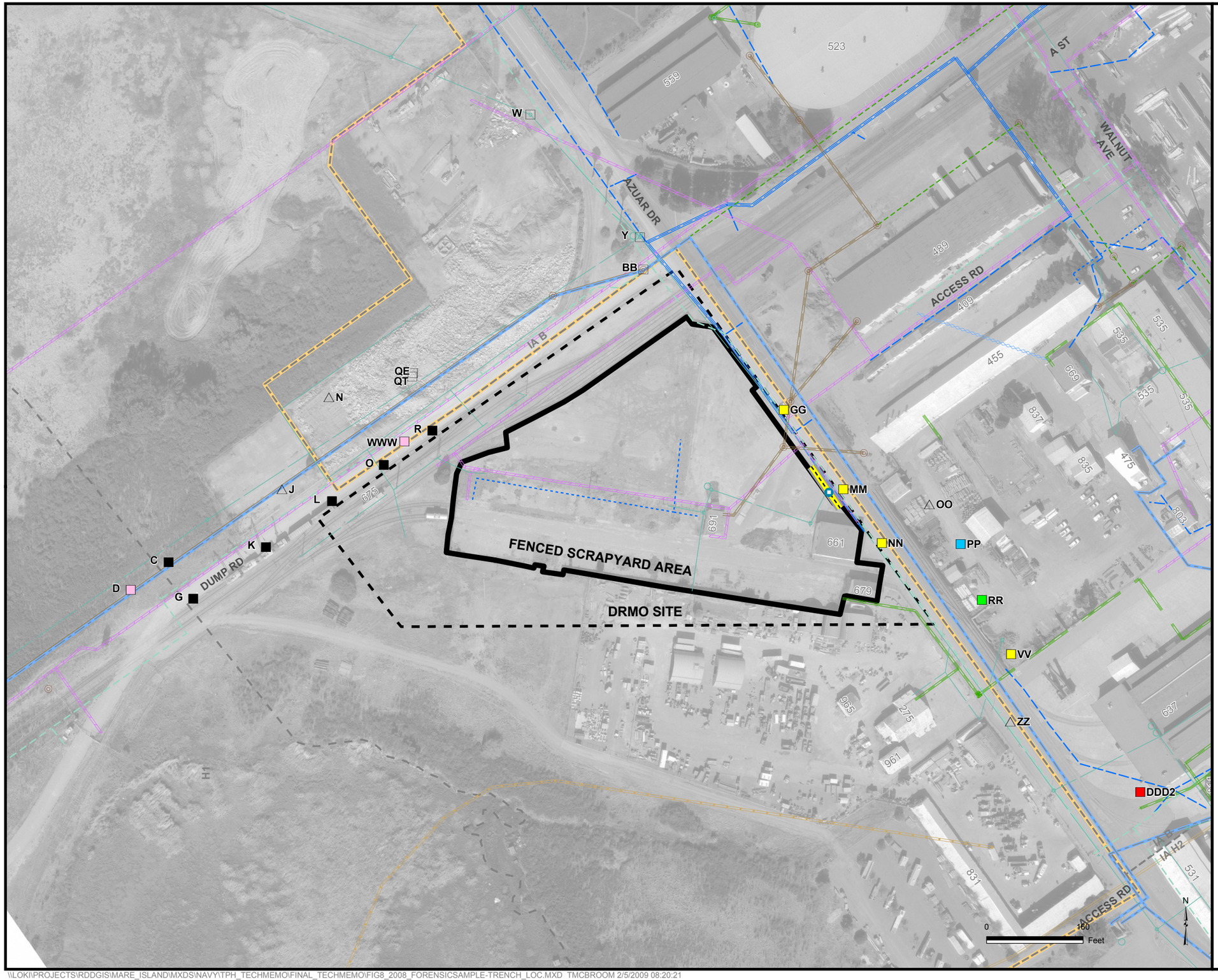


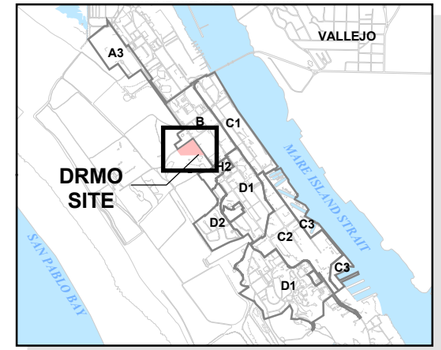
FIGURE 7
SECTION AT FORMER OIL SUMP BOX PARALLEL TO AZUAR DRIVE
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

ES012009001RDD_11 (2/3/09)

CH2MHILL



MARE ISLAND VICINITY MAP



LEGEND

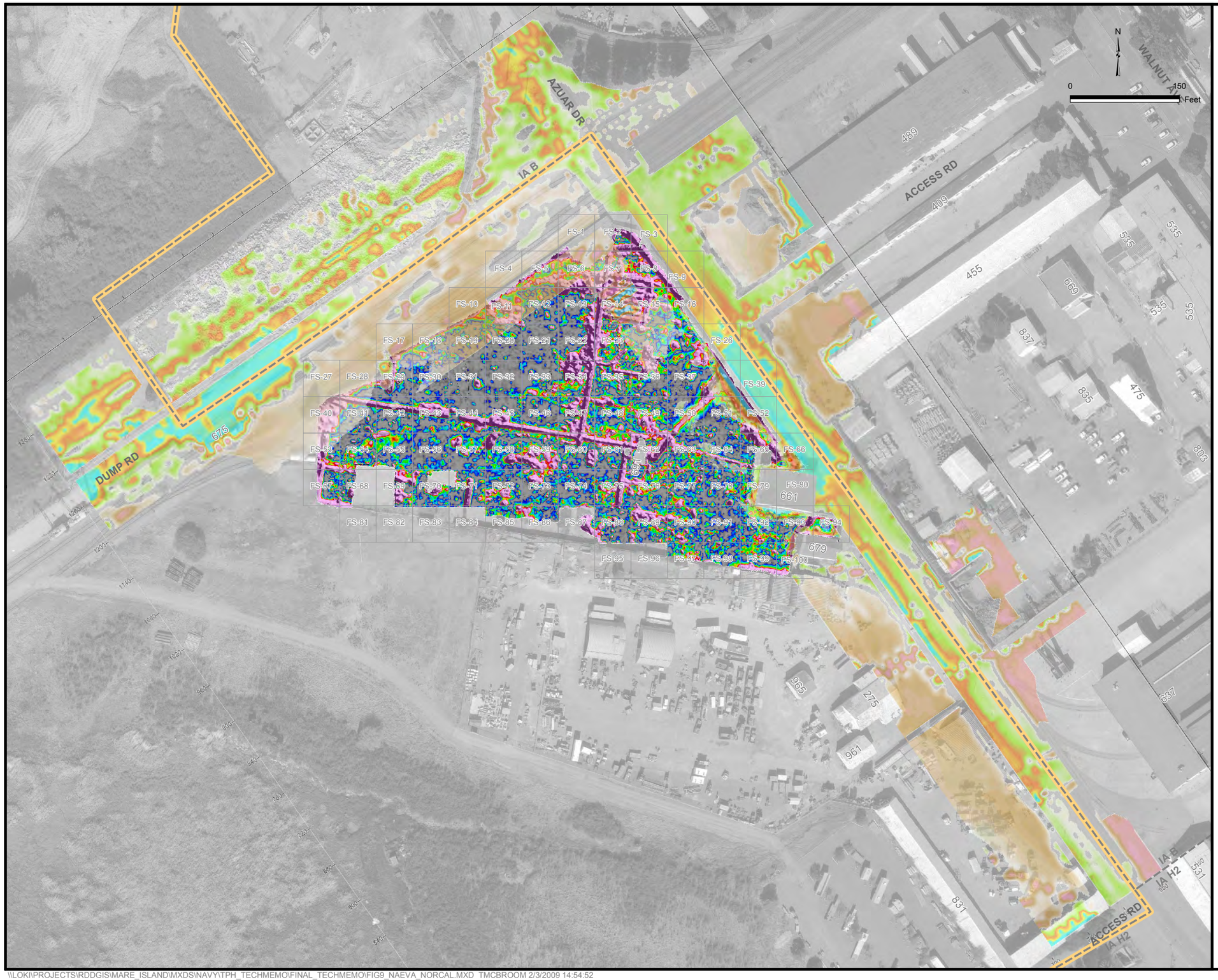
- △ INSUFFICIENT SAMPLE VOLUME AVAILABLE
- UTILITY VAULT FORENSIC SAMPLE
- FORENSIC TRENCH SAMPLE - DIFFERENT PRODUCT CHEMISTRY FROM ALL OTHER SAMPLES
- NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- INCONCLUSIVE NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- NOT NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NOT NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- FORMER OIL SUMP BOX
- SEWER CLEANOUT
- SEWER MANHOLE
- FORMER PERFORATED PIPE
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- BACKBONE SEWER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER BACKBONE
- STORMWATER SERVICE LINE
- INVESTIGATION AREA
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE

FIGURE 8
2008 CHEMICAL FORENSIC SAMPLE LOCATIONS AND SUMMARY FINDINGS

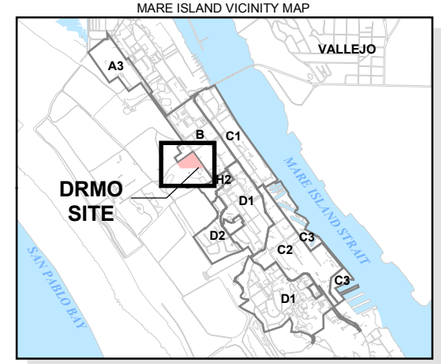
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\LOKI\PROJECTS\RDDGIS\MARE_ISLAND\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG8_2008_FORENSICSAMPLE-TRENCH_LOC.MXD TMCBROOM 2/5/2009 08:20:21



MARE ISLAND VICINITY MAP



LEGEND

- INVESTIGATION AREA
- NTCRA SAMPLING GRID
- EASTERN EARLY TRANSFER PARCEL BOUNDARY

NAEVA (JANUARY 2006) FSA MOSAIC

50
40
30
20
10
0
mV

NORCAL (MARCH 2008) IN-PHASE ELECTROMAGNETIC RESPONSE

60
50
40
30
20
10
0
-10
-20
-30
-40

(PARTS PER THOUSAND)

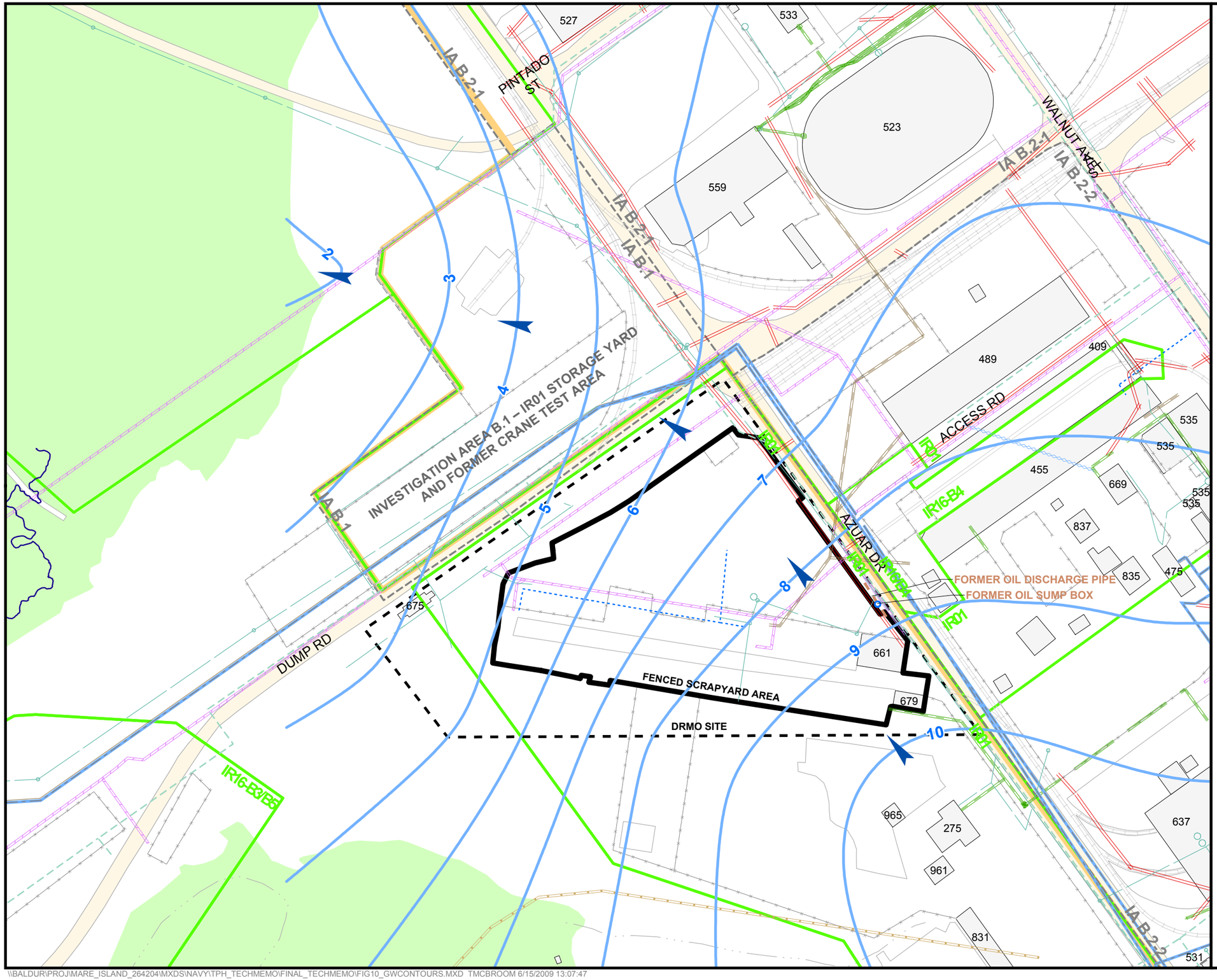
NOTE:
EM-31 DL CONDUCTIVITY METER FOR THE NORCAL SURVEY, AND EM-61 MK2 METAL DETECTOR FOR THE NAEVA SURVEY

FIGURE 9
COMBINED EM RESULTS, NAEVA AND NORCAL OVERLAY

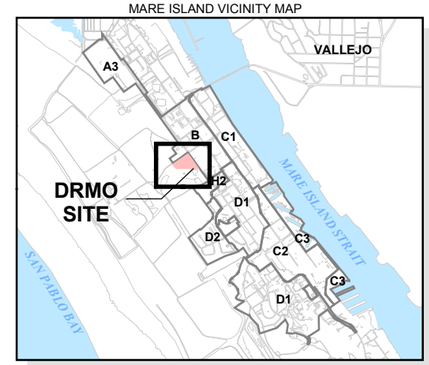
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\LOKI\PROJECTS\RDDGIS\MARE_ISLAND\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG9_NAEVA_NORCAL.MXD TMCBROOM 2/3/2009 14:54:52



MARE ISLAND VICINITY MAP



LEGEND

- GROUNDWATER FLOW DIRECTION
- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- GROUNDWATER CONTOURS (ft MSL)
- RAILROAD
- STORMWATER PIPELINE
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER PIPELINE
- FENCE
- INVESTIGATION AREA
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- STRUCTURE
- ROAD
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)

0 160 Feet

N

FIGURE 10
AREA GROUNDWATER CONTOURS

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG10_GWCONTOURS.MXD TMCBROOM 6/15/2009 13:07:47

DRMO Site and Vicinity Circa 1949

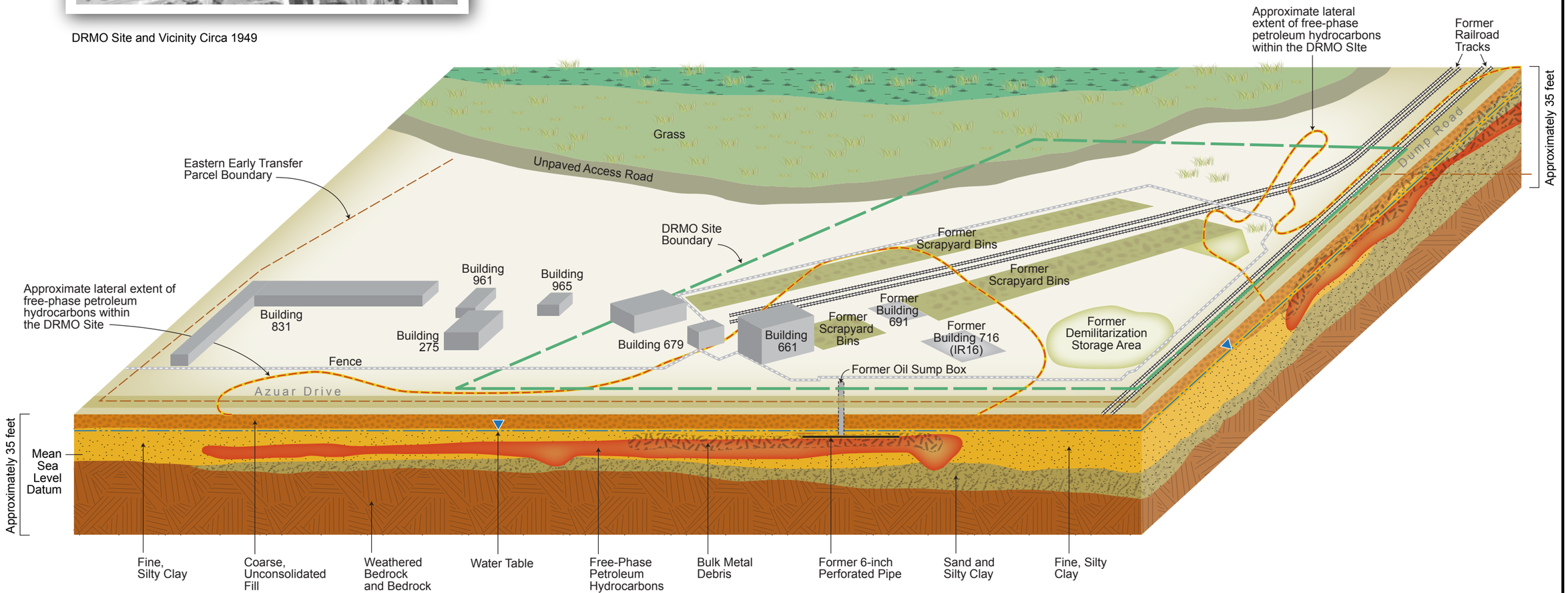
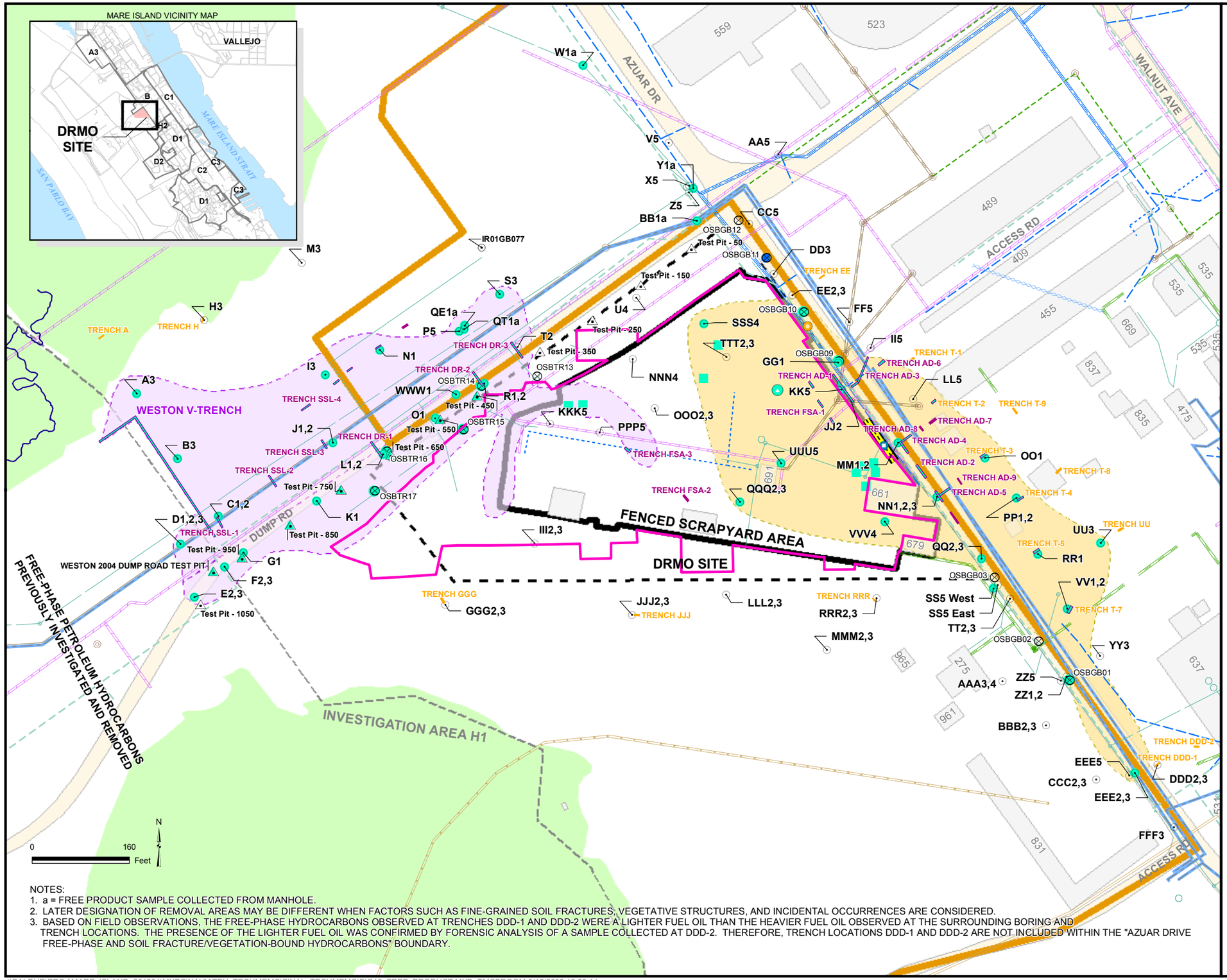


FIGURE 11
CONCEPTUAL SITE MODEL OF THE DRMO SITE AND THE VICINITY
TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

ES012009003SEA_2feb09

CH2MHILL



NOTES:
1. a = FREE PRODUCT SAMPLE COLLECTED FROM MANHOLE.
2. LATER DESIGNATION OF REMOVAL AREAS MAY BE DIFFERENT WHEN FACTORS SUCH AS FINE-GRAINED SOIL FRACTURES, VEGETATIVE STRUCTURES, AND INCIDENTAL OCCURRENCES ARE CONSIDERED.
3. BASED ON FIELD OBSERVATIONS, THE FREE-PHASE HYDROCARBONS OBSERVED AT TRENCHES DDD-1 AND DDD-2 WERE A LIGHTER FUEL OIL THAN THE HEAVIER FUEL OIL OBSERVED AT THE SURROUNDING BORING AND TRENCH LOCATIONS. THE PRESENCE OF THE LIGHTER FUEL OIL WAS CONFIRMED BY FORENSIC ANALYSIS OF A SAMPLE COLLECTED AT DDD-2. THEREFORE, TRENCH LOCATIONS DDD-1 AND DDD-2 ARE NOT INCLUDED WITHIN THE "AZUAR DRIVE FREE-PHASE AND SOIL FRACTURE/VEGETATION-BOUND HYDROCARBONS" BOUNDARY.

LEGEND

- 2007 BORING LOCATION FREE PRODUCT DETECTED
- 2007 BORING LOCATION NO FREE PRODUCT DETECTED
- 2008 BORING LOCATION NO FREE PRODUCT DETECTED
- 2005-2006 OSB INVESTIGATION LOCATION
- PETROLEUM STAINING OR ODOR NOTED IN BORING
- OBSERVATIONS OF SEPARATE-PHASE HYDROCARBONS
- OBSERVATIONS OF SEPARATE PHASE HYDROCARBONS (SAMPLE DATA UNKNOWN/SAMPLE DEPTH UNKNOWN)
- 2002 WATER LINE REPAIR EXCAVATION
- FORMER OIL SUMP BOX
- FORMER WOODEN SUMP BOX
- SEWER CLEANOUT
- SEWER MANHOLE
- PICKLEWEED (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- BACKBONE SEWER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER BACKBONE
- STORMWATER SERVICE LINE
- FORMER PERFORATED PIPE
- 2008 INVESTIGATION TRENCH (NO FREE PRODUCT OBSERVED)
- 2007 INVESTIGATION TRENCH (NO FREE PRODUCT OBSERVED)
- 2006-2007 TRENCH LOCATION (NO FREE PRODUCT OBSERVED)
- 2006-2008 FREE PRODUCT OBSERVED IN TRENCH
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- STRUCTURE
- ROAD
- NON-TIDAL WETLAND (BASED ON JUNE 2009 INFORMATION PROVIDED BY WESTON SOLUTIONS)
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- AZUAR DRIVE FREE-PHASE AND SOIL FRACTURE/VEGETATION-BOUND HYDROCARBONS
- DUMP ROAD FREE-PHASE AND SOIL FRACTURE/VEGETATION-BOUND HYDROCARBONS
- 2005-2007 WESTON DRMO NON-TIME-CRITICAL REMOVAL ACTION BOUNDARY

FIGURE 12
APPROXIMATE LATERAL EXTENT OF NAVY/LMI FREE-PHASE PETROLEUM HYDROCARBONS

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

\\BALDUR\PROJ\MARE_ISLAND_264204\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG12_FREE_PRODUCT.MXD TMCBROOM 6/15/2009 12:29:14

CH2MHILL

NORCAL (MARCH 2008) IN-PHASE ELECTROMAGNETIC RESPONSE

60
50
40
30
20
10
0
-10
-20
-30
-40

(PARTS PER THOUSAND)

NOTE:
EM-31 DL CONDUCTIVITY METER

INTERPRETED IN-PHASE ELECTROMAGNETIC ANOMALIES

1: BURIED DEBRIS, UTILITIES
2: BURIED DEBRIS, UTILITIES
10: BURIED DEBRIS, UTILITIES
14: BURIED DEBRIS, UTILITIES, RAILROAD TRACKS, BUILDING, FENCE

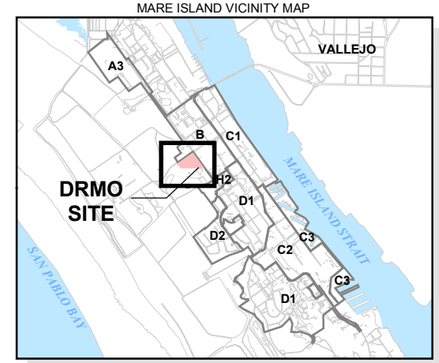
INTERPRETED VERTICAL MAGNETIC GRADIENT ANOMALIES

L: RAILROAD TRACKS, UTILITIES, POSSIBLE BURIED DEBRIS

0 140 Feet

N

MARE ISLAND VICINITY MAP



LEGEND

- FORMER OIL SUMP BOX
- 2005-2006 OSB INVESTIGATION TRENCH
- UTILITY VAULT FORENSIC SAMPLE
- NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- INCONCLUSIVE NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- NOT NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NOT NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- FORMER PERFORATED PIPE
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- BACKBONE SEWER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER PIPELINE
- INVESTIGATION AREA
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE
- INVESTIGATION TRENCH WITH TRACE, SMALL AMOUNT, OR ISOLATED METAL DEBRIS
- 2008 INVESTIGATION TRENCH
- 2007 INVESTIGATION TRENCH
- 2006 CTA TRENCH LOCATION

FIGURE 13
SUMMARY CHEMICAL FORENSIC FINDINGS WITH SELECTED GEOPHYSICAL SURVEY RESULTS AND TRENCH LOCATIONS

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

RDD \\LOKI\PROJECTS\RDDGIS\MARE_ISLAND\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\FIG13_NAEVA_NORCAL_W-SAMPLES.MXD KMORGAN 2/3/2009 15:37:25

TABLE 1

Sampling and Analytical Matrix, 2007 Field Investigation

Sample ID	Sampling Date	Sampling Depth (feet bgs)	*TPH-Diesel CA DHS DRO (8015M)	TPH-Gasoline CA DHS GRO (8015M)	CLP Volatile Organics (8260)	**CLP SVOCs (8270)	CLP Semivolatiles (PAHs Only) OLM4.3	CLP Pesticides & PCBs (8081 & 8082)	CLP Metals (ILM04.1)	CLP Cyanide (ILM04.1)
Dump Road										
FTPH-FP-DR-DR1-6.5	11/8/2007	6.5	x	x	x	x	--	x	--	--
DRMO Site, Fenced Scrapyard Area										
FTPH-FP-FSA-1-3	11/14/2007	3	x	x	x	x	--	x	--	--
Azuar Drive										
FTPH-FP-AD-4	11/26/2007	5.5	x	x	x	x	--	x	--	--
FTPH-TS-AD2-S13.5	12/3/2007	13.5	x	x	x	--	x	--	x	x
FTPH-TS-AD6-S6.5	12/10/2007	6.5	x	x	x	--	x	--	x	x
FTPH-TS-AD7-S7	12/10/2007	7	x	x	x	--	x	--	x	x

Notes:

bgs = below ground surface
CA = California
CLP = Contract Laboratory Program
DHS = Department of Health Services
DRO = diesel-range organics
GRO = gasoline-range organics
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbons

*Includes analyses for TPH-diesel and TPH-motor oil.
**PAHs were requested; however, the laboratory provided entire SVOCs.

-- = not analyzed

TABLE 2

Sampling and Analytical Matrix, 2008 Field Investigation

Sample ID	Sampling Date	Sampling Depth (feet bgs)	Forensic (ASTM D5739)	PAHs (8270-SIM)	C&H-Isotopes (IRMS)	*TPH-d (EPA 8015B)	**TPH-g (EPA 8015B)	VOCs (EPA 8260B)	SVOCs (EPA 8270C)
Sanitary Sewer Line Area West of Former Crane Test Area									
FTPH-FP-SB-D	10/23/2008	5 to 16	x	IASV	x	--	--	--	--
FTPH-FP-SB-C	11/5/2008	8 to 12	x	x	x	--	--	--	--
Former Crane Test Area									
FTPH-FP-SB-N	10/21/2008	3 to 10	IASV	x	IASV	--	--	--	--
FTPH-FP-UT-BB	10/22/2008	NA	x	x	x	--	--	--	--
FTPH-FP-UT-Y	10/23/2008	NA	x	IASV	x	--	--	--	--
FTPH-FP-UT-W	10/23/2008	NA	x	IASV	x	--	--	--	--
FTPH-FP-UT-QE	10/24/2008	NA	x	IASV	x	--	--	--	--
FTPH-FP-UT-QT	10/24/2008	NA	x	IASV	x	--	--	--	--
Dump Road									
FTPH-FP-SB-G	10/21/2008	8 to 9	x	IASV	x	--	--	--	--
FTPH-FP-SB-K	10/22/2008	9 to 10	x	IASV	x	--	--	--	--
FTPH-FP-SB-L	10/22/2008	9 to 13	x	x	x	--	--	--	--
FTPH-FP-SB-WWW	10/22/2008	Unknown	x	x	x	--	--	--	--
FTPH-FP-SB-R	10/22/2008	10	x	IASV	x	--	--	--	--
FTPH-FP-SB-O	10/23/2008	10	x	x	x	--	--	--	--
Azuar Drive									
FTPH-FP-SB-GG	10/24/2008	9 to 10	x	x	x	--	--	--	--
FTPH-FP-SB-MM	10/24/2008	7 to 13	x	IASV	x	--	--	--	--
FTPH-FP-SB-NN	10/24/2008	9 to 14	x	x	x	--	--	--	--
FP-TR-DDD2	11/13/2008	2.5	x	x	x	--	--	--	--
FTPH-FP-TR-DDD2-S2.5	11/13/2008	2.5				x	x	x	x
East of Azuar Drive									
FTPH-FP-SB-PP	10/24/2008	9 to 13	x	x	x	--	--	--	--
FTPH-FP-SB-VV	11/5/2008	8 to 14	x	x	x	--	--	--	--
FTPH-FP-SB-RR	11/12/2008	9 to 15	x	x	x	--	--	--	--

Notes:

ASTM = American Society for Testing and Materials
bgs = below ground surface
C&H = carbon and hydrogen
CLP = Contract Laboratory Program
EPA = U.S. Environmental Protection Agency
IRMS = Isotope Radio Mass Spectrometry
IASV = insufficient available sample volume
ME = modified, extractable
NA = not applicable; collected from utility trench
PAH = polynuclear aromatic hydrocarbon
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbons
TPH-d = TPH-diesel
TPH-g = TPH-gasoline
VOC = volatile organic compound

* Extractable
**Purgeable

-- = not analyzed

TABLE 3

Summary of 2005-2006 Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
Former Crane Test Area									
11/20/2006	Trench	CTAMW0100-101	0	12	No	NA	No	NA	6.5
11/22/2006	Boring	CTAMW0101	NA	NA	No	NA	No	NA	28.0
11/20/2006	Trench	CTAMW0102-103	0	7.5	No	NA	Yes	3.5 to 6.0	6.0
11/22/2006	Boring	CTAMW0103	NA	NA	No	NA	No	NA	32.0
11/20/2006	Trench	CTAMW0104-105	0	12.5	Yes	7.0 to 8.0	Yes	3.0 to 8.0	10.0
11/28/2006	Boring	CTAMW0105	NA	NA	No	NA	No	NA	25.0
11/20/2006	Trench	CTAMW0106-107	0	8	No	NA	No	NA	5.0
11/22/2006	Boring	CTAMW0107	NA	NA	No	NA	No	NA	24.0
11/20/2006	Trench	CTAMW0108-109	0	8	No	NA	Yes	2.0 to 6.0	6.5
11/22/2006	Boring	CTAMW0109	NA	NA	No	NA	No	NA	40.0
Dump Road									
6/19/2006	Trench	OSBTR13	0	9	No	NA	Yes	2.0 to 5.0	7.5
6/19/2006	Trench	OSBTR14	0	9	Yes	6.0 to 7.5	Yes	2.0 to 3.0 and 6.0 to 7.5	8.5
6/19/2006	Trench	OSBTR15	0	9	Yes	7.5 to 8.0	Yes	1.0 to 2.0 and 4.75 to 5.0	7.5
6/19/2006	Trench	OSBTR16	0	9	Yes	4.0 to 6.0	Yes	4.0 to 6.0	7.0
6/19/2006	Trench	OSBTR17	0	9	Yes	6.5 to 9.0	Yes	1.5 to 1.75 and 5.5 to 6.0	9.0
Azuar Drive									
12/19/2005	Boring	OSBGB01	NA	NA	Yes	10.0 to 13.0	No	NA	16.0
12/19/2005	Boring	OSBGB02	NA	NA	No	NA	No	NA	16.0
12/20/2005	Boring	OSBGB03	NA	NA	No	NA	No	NA	9.0
12/20/2005	Boring	OSBGB09	NA	NA	Yes	(1)	No	NA	16.0
12/21/2005	Boring	OSBGB10	NA	NA	Yes	(2)	No	NA	16.0
12/21/2005	Boring	OSBGB11	NA	NA	No	NA	No	NA	16.0
12/21/2005	Boring	OSBGB12	NA	NA	No	NA	Yes	5.0 to 12.0	16.0
1/20/2006	Trench	OSB and Pipe	0	80	Yes	4.0 to 12.0	Yes	4.0 to 12.0	12.0

Notes:

(1) Floating product of undetermined thickness; (2) 5 to 8 and 13 to 16 feet bgs. bgs = below ground surface; NA = not applicable.

TABLE 4

Summary of 2007-2008 Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
Sanitary Sewer Line Area West of Former Crane Test Area									
11/5/2007	Trench	SSL-1	0	19	Yes	4.0 to 9.0[a]	No	NA	10.0
11/6/2007	Trench	SSL-2	0	21	Yes	3.0 to 8.5[a]	Yes	3.0 to 8.5[b]	8.5
11/6/2007	Trench	SSL-3	0	17	Yes	3.0 to 8.0[a]	Yes	3.0 to 6.0[b]	8.0
12/11/2007	Trench	SSL-4	0	20	Yes	3.5 to 6.75[a]	Yes	3.0 to 6.75[b]	6.75
12/11/2007	Trench	SSL-4	68	80	Yes	6.0 to 7.5	Yes	4.0 to 7.5	8.0
10/22/2008	Boring	I3	NA	NA	Yes	8.6 to 15.0	No	NA	20.0
10/20/2008	Boring	J1,2	NA	NA	Yes	9.5 to 13.0	No	NA	20.0
11/4/2008	Boring	C1,2	NA	NA	Yes	8.0 to 12.3	No	NA	20.0
10/22/2008	Boring	D1,2,3	NA	NA	Yes	5.0 to 13.5	No	NA	20.0
11/4/2008	Boring	B3	NA	NA	Yes	10.0 to 15.0[a]	No	NA	15.0
11/4/2008	Boring	A3	NA	NA	Yes	2.0 to 8.5	No	NA	10.0
11/4/2008	Boring	H3	NA	NA	No	NA	No	NA	10.0
11/4/2008	Boring	M3	NA	NA	No	NA	Yes	Trace at 0 to 4.5	10.0
11/10/2008	Trench	Trench A	0	10	No	NA	Yes	Trace at 3.5	10.0
11/10/2008	Trench	Trench H	0	11	No	NA	No	NA	10.0
Former Crane Test Area									
12/11/2007	Trench	SSL-4	99	110	Yes	6.0 to 9.0[a]	Yes	4.0 to 8.0	9.0
12/12/2007	Trench	SSL-4	150	158	Yes	6.5 to 8.5	Yes	4.0 to 8.5	9.0
12/12/2007	Trench	SSL-4	205	217.5	No	NA	Yes	2.0 to 3.5 and 5.5 to 7.5	8.0
10/20/2008	Boring	S3	NA	NA	Yes	Trace at 6.9	Yes	4.0 to 6.3	10.0
11/4/2008	Boring	P5	NA	NA	Yes	7.0 to 7.5	No	NA	8.0
10/20/2008	Boring	N1	NA	NA	Yes	Sheen	Yes	2.7 to 9.8	10.0
Dump Road									
11/7/2007	Trench	DR-1 (Southern)	5	20	Yes	6.0 to 7.5[a]	Yes	1.5 to 7.5[b]	7.5
11/7/2007	Trench	DR-2 (Southern)	0	13	Yes	1.75 to 3.0[a]	Yes	1.75 to 3.0[b]	7.5
11/8/2007	Trench	DR-3 (Southern)	0	15	Yes	1.0 to 7.0[a]	Yes	1.0 to 7.0[b]	7.0
11/12/2007	Trench	DR-1 (Northern)	23	32	Yes	5.0[a]	Yes	1.0 to 5.0[b]	5.0
11/12/2007	Trench	DR-2 (Northern)	18	27.5	Yes	4.5 to 5.5[a]	Yes	1.75 to 5.5[b]	5.5
11/12/2007	Trench	DR-3 (Northern)	17	27	Yes	4.5 to 5.5[a]	Yes	1 to 5.5[b]	5.5
10/21/2008	Boring	E2,3	NA	NA	Yes	Trace at 9.0 and 12.5 to 13.9	Yes	Trace at 12.5 to 12.7	20.0
10/21/2008	Boring	F2,3	NA	NA	Yes	3.5 to 6.5[a]	Yes	3.5 to 6.3	6.5
10/21/2008	Boring	G1	NA	NA	Yes	8.0 to 9.3	Yes	Trace at 3.0 to 8.0 and 8.0 to 9.3	10.0
10/21/2008	Boring	K1	NA	NA	Yes	9.8 to 10[a]	Yes	Trace at 2.0 to 9.0 and 9.0 to 9.4	10.0

TABLE 4

Summary of 2007-2008 Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
10/21/2008	Boring	L1,2	NA	NA	Yes	8.6 to 12.5	Yes	8.6 to 8.8	20.0
10/22/2008	Boring	O1	NA	NA	Yes	9.5 to 10.0[a]	Yes	9.5 to 10.0	10.0
10/22/2008	Boring	R1,2	NA	NA	Yes	9.8 to 10.0	No	NA	20.0
10/22/2008	Boring	T2	NA	NA	No	NA	Yes	3.0 to 7.0	20.0
10/22/2008	Boring	WWW1	NA	NA	Yes	Unknown	Unknown	NA	30.0
DRMO Site, Fenced Scrapyard Area									
11/15/2007	Excavation	Wooden Sump Box	0	10	Yes	5.0 to 6.0[a]	No	NA	6.0
11/19/2007	Over-excavation	Wooden Sump Box	0	16	Yes	1.0 to 7.0[a]	No	NA	7.5
12/6/2007	Trench	FSA-1	0	10	Yes	4.5 to 9.0[a]	Yes	Trace at 4.5	9.0
12/6/2007	Trench	FSA-1	32.5	43.5	Yes	4.0 to 9.5[a]	No	NA	9.5
12/6/2007	Trench	FSA-1	69.5	80	Yes	2.5 to 9.0[a]	Yes	Trace at 4.5	9.0
12/6/2007	Trench	FSA-2	0	12.5	No	NA	No	NA	9.0
12/6/2007	Trench	FSA-3	0	10	Yes	4.5 to 5.0	No	NA	7.5
11/13/2008	Trench	Trench JJJ	0	10	No	NA	No	NA	10.0
11/13/2008	Trench	Trench GGG	0	10	No	NA	Yes	Isolated at 4.0 to 5.0	10.0
11/13/2008	Trench	Trench RRR	0	10	No	NA	No	NA	10.0
11/6/2008	Boring	KKK5	NA	NA	No	NA	No	NA	6.0
11/6/2008	Boring	PPP5	NA	NA	No	NA	No	NA	3.0
11/12/2008	Boring	VVV4	NA	NA	Yes	7.0 to 10.0[a]	No	NA	10.0
11/12/2008	Boring	SSS4	NA	NA	Yes	4.6 to 5.0	No	NA	10.0
11/12/2008	Boring	U4	NA	NA	No	NA	No	NA	10.0
11/12/2008	Boring	NNN4	NA	NA	No	NA	No	NA	10.0
11/12/2008	Boring	LLL2,3	NA	NA	No	NA	No	NA	20.0
11/12/2008	Boring	MMM2,3	NA	NA	No	NA	No	NA	20.0
11/12/2008	Boring	III2,3	NA	NA	No	NA	No	NA	20.0
11/12/2008	Boring	GGG2,3	NA	NA	No	NA	No	NA	20.0
11/5/2008	Boring	RRR2,3	NA	NA	No	NA	No	NA	20.0
11/5/2008	Boring	TTT2,3	NA	NA	No	NA	No	NA	20.0
11/5/2008	Boring	OOO2,3	NA	NA	No	NA	No	NA	20.0
11/5/2008	Boring	QQQ2,3	NA	NA	Yes	Trace at 7.3	No	NA	20.0
11/5/2008	Boring	JJJ2,3	NA	NA	No	NA	No	NA	20.0
Azuar Drive									
11/15/2007	Trench	AD-1	40	55	Yes	4.0 to 5.5[a]	Yes	Isolated at 4.0 and 5.5	6.0
11/20/2007	Trench	AD-1	0	42.5	Yes	3.5 to 4.0[a]	Yes	3.5 to 4.0[b]	4.0
11/21/2007	Trench	AD-1 (Deeper)	0	15	Yes	5.0 to 8.0[a]	Yes	5.0 to 7.0	8.0
11/28/2007	Trench	AD-2	0	22.5	Yes	5.5 to 11.5[a]	Yes	5.5 to 8.0	11.5
11/29/2007	Trench	AD-2	50	70	Yes	5.0 to 13.0	Yes	5.0 to 8.0	13.5
12/3/2007	Trench	AD-2	97.5	117.5	Yes	5.5 to 13.5	Yes	Isolated at 5.5	14.5
12/3/2007	Trench	AD-2	140	162.5	Yes	5.0 to 13.0	No	NA	13.5

TABLE 4

Summary of 2007-2008 Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
11/28/2007	Trench	AD-3	0	25	Yes	5.0 to 10.5[a]	Yes	3.0 to 8.5	10.5
12/4/2007	Trench	AD-3	-12.5	0	Yes	5.5 to 9.5[a]	Yes	5.5 to 8.0	9.5
12/4/2007	Trench	AD-3	30	45	No	NA	No	NA	10.0
11/26/2007	Trench	AD-4	0	20	Yes	5.5 to 11.0[a]	Yes	6.0 to 9.5	11.0
11/26/2007	Trench	AD-5	0	22	Yes	4.5 to 9.0[a]	Yes	4.5 to 8.0	9.5
12/10/2007	Trench	AD-6	0	12	Yes, trace	Trace sheen	Yes	Trace at 4.0	7.5
12/10/2007	Trench	AD-7	0	11	No	NA	Yes	Trace at 6.0	8.5
12/10/2007	Trench	AD-8	0	8	Yes, trace	Trace sheen	No	NA	8.0
12/10/2007	Trench	AD-9	0	8.5	No	NA	No	NA	7.0
2/29/2008	Trench	T-1	0	11.5	No	NA	No	NA	12.0
3/3/2008	Trench	T-2	0	9.5	Yes	5.0 to 6.0 sheen on water and 10.0 to 11.5	Yes	Small amounts at 5.0 to 6.0	12.0
3/3/2008	Trench	T-3	0	11	Yes	8.0 to 11.5	No	NA	12.0
3/4/2008	Trench	T-4	0	11	Yes	4.0 to 5.5 and 8.0 to 12.5[a]	No	NA	12.5
3/7/2008	Trench	T-5	0	10	Yes	7.5 to 12.0[a]	Yes	Several pieces of metal scrap at 11.5 to 12.0	12.0
3/7/2008	Trench	T-7	0	10	Yes	3.0 to 12.0[a]	Yes	Trace at 2.5 and 5.5 to 8.0	12.0[c]
3/11/2008	Trench	T-8	0	11	No	NA	No	NA	12.5[c]
3/12/2008	Trench	T-9	0	11	No	NA	No	NA	12.5
10/30/2008	Boring	V5	NA	NA	No	NA	No	NA	3.5
10/30/2008	Boring	X5	NA	NA	No	NA	Yes	1.0 to 3.8	3.8
10/27/2008	Boring	Z5	NA	NA	No	NA	Yes	0 to 4.25	4.25
11/4/2008	Boring	CC5	NA	NA	No	NA	No	NA	3.5
10/24/2008	Boring	DD3	NA	NA	No	NA	No	NA	10.0
10/24/2008	Boring	EE2,3	NA	NA	No	NA	No	NA	20.0
10/24/2008	Boring	GG1	NA	NA	Yes	8.5 to 10.0[a]	No	NA	10.0
10/24/2008	Boring	JJ2	NA	NA	No	NA	Yes	Trace at 15.0 and 20.0	22.0
10/28/2008	Boring	CCC2,3	NA	NA	No	NA	No	NA	20.0[c]
10/28/2008	Boring	BBB2,3	NA	NA	No	NA	No	NA	20.0[c]
10/28/2008	Boring	AAA3,4	NA	NA	No	NA	No	NA	10.0
11/6/2008	Boring	KK5	NA	NA	Yes	4.0[a]	Yes	4.0[b]	4.0
10/24/2008	Boring	MM1,2	NA	NA	Yes	7.0 to 13.0	No	NA	20.0[c]
10/27/2008	Boring	NN1,2,3	NA	NA	Yes	9.0 to 13.5	No	NA	20.0[c]
10/24/2008	Boring	QQ2,3	NA	NA	Yes	8.0 to 15.0	No	NA	20.0[c]
10/28/2008	Boring	SS5 East	NA	NA	Yes	Trace sheen	No	NA	4.0

TABLE 4

Summary of 2007-2008 Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
10/28/2008	Boring	SS5 West	NA	NA	Yes	Sheen at 1.5	No	NA	4.25[c]
10/27/2008	Boring	TT2,3	NA	NA	No	NA	No	NA	20.0[c]
10/27/2008	Boring	ZZ1,2	NA	NA	No	NA	No	NA	20.0[c]
10/29/2008	Boring	ZZ5	0	4	Yes, trace	Sheen	No	NA	4.4
10/29/2008	Boring	EEE5	NA	NA	No	NA	No	NA	4.25[c]
11/13/2008	Trench	Trench DDD-2	0	10	Yes[d]	2.3 to 2.5	No	NA	10.0[c]
10/28/2008	Boring	DDD2,3	NA	NA	No	NA	No	NA	20.0[c]
11/12/2008	Trench	Trench DDD-1	0	10	Yes[d]	4.25 to 5.0	No	NA	9.5[c]
10/28/2008	Boring	FFF3	NA	NA	No	NA	No	NA	10.0
10/27/2008	Boring	EEE2,3	NA	NA	Yes	11.0 to 13.5	No	NA	20.0[c]
East of Azuar Drive									
11/11/2008	Trench	Trench EE	0	10	No	NA	Yes	1.5 to 5.0	10.0
11/11/2008	Trench	Trench UU	0	10	Yes, trace	Sheen	No	NA	10.0
11/4/2008	Boring	LL5	NA	NA	Yes	Trace sheen on water	No	NA	4.0
11/3/2008	Boring	FF5	NA	NA	No	NA	Yes	1.25 to 1.75	4.0
11/3/2008	Boring	II5	NA	NA	Yes	Sheen at 1.0 to 4.9	Yes	1.0 to 5.0	5.0[c]
10/30/2008	Boring	UUU5	NA	NA	Yes, trace	6.0	No	NA	5.9
10/27/2008	Boring	AA5	NA	NA	No	NA	No	NA	4.5
11/4/2008	Boring	VV1,2	NA	NA	Yes	8.0 to 13.9	No	NA	20.0
10/28/2008	Boring	YY3	NA	NA	No	NA	Yes	Trace at 8.1 to 8.7	10.0
10/23/2008	Boring	OO1	NA	NA	Yes	8.0 to 9.7	No	NA	17.0
10/23/2008	Boring	PP1,2	NA	NA	Yes	9.4 to 12.5	No	NA	20.0
10/23/2008	Boring	RR 1	NA	NA	Yes	9.3 to 14.5	No	NA	20.0
10/23/2008	Boring	UU3	NA	NA	Yes	9.3 to 10.0[a]	No	NA	10.0

Notes:

bgs = below ground surface
NA = not applicable

[a] Bottom of free product interval not reached.

[b] Bottom of metal debris interval not reached.

[c] Encountered bedrock.

[d] Based on field observations, the free-phase hydrocarbons observed at trenches DDD-1 and DDD-2 were a lighter fuel oil than the heavier fuel oil observed at the surrounding boring and trench locations. The presence of the lighter fuel oil was confirmed by forensic analysis of a sample collected at DDD-2.

TABLE 5

Summary of Forensic Findings Chemistry Findings During the Follow-on Investigation

Sample ID	Difference Finding (those noted as "possible", "typical", or "similar" omitted)	Evaluation Method
FP-TR-DDD2	Product at this location appears to be a lighter fuel oil (or a different Bunker fuel formulation) with significantly more diesel-range material present.	Total Ion Chromatogram Pattern
FP-TR-DDD2	Product at this location does not fall within variability of Azuar Drive DRMO Site samples (SB-G, GG, MM, NN)	Total Ion Chromatogram Pattern
FP-TR-DDD2	Product at this location and SB-D, SB-WWW, and UT-BB is clearly dissimilar from the other samples.	Carbon Isotope Ratios
FP-TR-DDD2	Product at this location and at SB-PP, also in the Azuar Drive EETP, is not related to DRMO Site product.	Stable Istotope Ratio Crossplot
FTPH-FP-UT-BB	Product at this location is dissimilar from other samples.	Extended PAH Source Ratio Crossplot
FTPH-FP-UT-BB	Product at this location and SB-D, SB-WWW, and TR-DDD2 is clearly dissimilar from the other samples.	Carbon Isotope Ratios
FTPH-FP-SB-D	Product at this location does not fall within variability of Dump Road DRMO Site samples (SB-G, K, L, O, R).	GC/MS Ion Chromatogram Biomarker Crossplot
FTPH-FP-SB-D	Product at this location and SB-WWW, TR-DDD2, and UT-BB is clearly dissimilar from the other samples.	Carbon Isotope Ratios
FTPH-FP-SB-D	Product at this Dump Road North location near the Weston Trench and SB-WWW on the EETP side of Dump Road is clearly dissimilar from DRMO Site product.	Stable Isotope Ratio Crossplot
FTPH-FP-SB-G	Product at this location and SB-R is less weathered than the product at all locations.	Total Ion Chromatogram Pattern
FTPH-FP-SB-G	Product at this location and at SB-L appears to be dissimilar from the rest of the Dump Road samples (SB-K, O, R, D, C, WWW).	GC/MS Ion Chromatogram Biomarker Crossplot
FTPH-FP-SB-L	Product at this location and at SB-G appears to be dissimilar from the rest of the Dump Road samples (SB-K, O, R, D, C, WWW).	GC/MS Ion Chromatogram Biomarker Crossplot
FTPH-FP-SB-L	Product at this location is different from all other samples.	GC/MS Ion Chromatogram Biomarker Crossplot, Peaks 1-5 of Sterane Biomarkers
FTPH-FP-SB-PP	Product at this location and TR-DDD2 also in the Azuar Drive EETP is not related to DRMO Site product.	Stable Istotope Ratio Crossplot
FTPH-FP-SB-R	Product at this location and SB-G is less weathered than the product at all locations.	Total Ion Chromatogram Pattern
FTPH-FP-SB-WWW	Product at this location and SB-D, TR-DDD2, and UT-BB is clearly dissimilar from the other samples.	Carbon Isotope Ratios
FTPH-FP-SB-WWW	Product at this location and SB-D North of Dump Road near the Weston Trench is clearly dissimilar from DRMO Site product.	Stable Istotope Ratio Crossplot

Notes:

EETP = Eastern Early Transfer Parcel
GC/MS = gas chromatography/mass spectometry
PAH = polynuclear aromatic hydrocarbon

TABLE 6

Analytical Methods and Laboratories that Performed Analyses During the Follow-on Investigation

Analyte	Analytical Method	Laboratory
Pesticides/PCBs, free product samples (2007)	EPA SW 8081/8082	Laucks Testing Laboratories/ PACE, Seattle, WA
Pesticides/PCBs, soil samples (2007)	CLP SOW OLM04.3	Laucks Testing Laboratories/ PACE, Seattle, WA
Extended alkylated PNAs, free product samples (2008)	EPA SW 8270 Modified, lab-specific	Zymax, San Luis Obispo, CA
Full carbon range, free product samples (2008)	EPA SW 8270 Modified, lab-specific	Zymax, San Luis Obispo, CA
Carbon and hydrogen isotopes, free product samples (2008)	Lab-specific	Zymax, San Luis Obispo, CA
TPH-Purgeable by GC	EPA 8015B	Curtis & Tompkins, Ltd. / Berkeley, CA
TPH-Extractable by GC	EPA 8015B	
Volatile Organics by GC/MS	EPA 8260B	
Semivolatile Organics by GC/MS	EPA 8270C	

Notes:

SW = EPA SW-846 Methods (*Test Methods for Evaluating Solid Waste, Physical/.Chemical Methods, U.S. Environmental Protection Agency* [EPA] *SW-846, Third Edition and Updates*).
CLP = SOW OLM04.3- EPA Contract Laboratory Program (CLP) statement of work
EPA = U.S. Environmental Protection Agency
GC = gas chromatography
GC/MS = gas chromatography/mass spectometry
PCB = polychlorinated biphenyl
PNA = polynuclear aromatic hydrocarbon
TPH = total petroleum hydrocarbons

TABLE 7

Analytical Results from the 2007 Field Investigation

Sample ID	**FTPH-FP-DR-DRI-6.5**		**FTPH-FP-FSA-1-3**		**FTPH-FP-AD-4**	**FTPH-TS-AD2-S13.5**	**FTPH-TS-AD6-S6.5**	**FTPH-TS-AD7-S7**
Sample Type	Free Product		Free Product		Free Product	Soil	Soil	Soil
Sampling Depth (feet bgs)	6.5		3		5.5	13.5	6.5	7
Sampling Date	11/8/2007		11/14/2007		11/26/2007	12/3/2007	12/10/2007	12/10/2007
Pesticides (µg/kg)								
alpha-BHC	4.3 U		3.1 U		110 U	--	--	--
beta-BHC	4.3 U		3.1 U		110 U	--	--	--
delta-BHC	4.3 U		3.1 U		110 U	--	--	--
gamma-BHC	4.3 U		3.1 U		110 U	--	--	--
Heptachlor	4.3 U		3.1 U		110 U	--	--	--
Aldrin	4.3 U		3.1 U		110 U	--	--	--
Heptachlor epoxide	4.3 U		3.1 U		110 U	--	--	--
Endosulfan I	4.3 U		3.1 U		110 U	--	--	--
Dieldrin	9.0 U		6.4 U		230 U	--	--	--
4,4' - DDE	9.0 U		6.4 U		230 U	--	--	--
Endrin	9.0 U		6.4 U		230 U	--	--	--
Endosulfan II	9.0 U		6.4 U		230 U	--	--	--
4,4' - DDD	9.0 U		6.4 U		230 U	--	--	--
Endosulfan sulfate	9.0 U		6.4 U		230 U	--	--	--
4,4' -DDT	9.0 U	UJ	6.4 U	UJ	230 U	--	--	--
Endrin ketone	9.0 U		6.4 U		230 U	--	--	--
Endrin aldehyde	9.0 U		6.4 U		230 U	--	--	--
alpha-Chlordane	4.3 U		3.1 U		110 U	--	--	--
gamma-Chlordane	4.3 U		3.1 U		110 U	--	--	--
Methoxychlor	43 U		31 U		1100 U	--	--	--
Toxaphene	570 U		400 U		14,000 U	--	--	--
Polychlorinated Biphenyls (PCBs) (µg/kg)								
Aroclor-1016	57 U		40 U		1,400 U	--	--	--
Aroclor-1221	57 U		40 U		1,400 U	--	--	--
Arclor-1232	57 U		40 U		1,400 U	--	--	--
Arclor-1242	57 U		40 U		1,400 U	--	--	--
Aroclor-1248	57 U		40 U		1,400 U	--	--	--
Aroclor-1254	57 U		40 U		1,400 U	--	--	--
Aroclor 1260	57 U		40 U		1,400 U	--	--	--
Aroclor 1262	57 U		40 U		1,400 U	--	--	--
Aroclor 1268	57 U		40 U		1,400 U	--	--	--
Metals (mg/kg)								
Aluminum	--		--		--	21,900	14,800	21,800
Antimony	--		--		--	0.19 U	0.92 UJ	0.94 UJ
Arsenic	--		--		--	7.9	24.3	13.7
Barium	--		--		--	69.6	487	197
Beryllium	--		--		--	0.073 J	0.26 J	0.47 J
Cadmium	--		--		--	0.70 U	0.68 UJ	0.69 UJ
Calcium	--		--		--	4,950	5,610	19,300
Chromium	--		--		--	61.6	43.6J	56.4J
Cobalt	--		--		--	13.9	11.6	19.2
Copper	--		--		--	22.0	402	48.4
Iron	--		--		--	26,800	45,200	39,400
Lead	--		--		--	17.6	1,170	28.8
Magnesium	--		--		--	7050	5250	7680

TABLE 7

Analytical Results from the 2007 Field Investigation

Sample ID	**FTPH-FP-DR-DRI-6.5**		**FTPH-FP-FSA-1-3**		**FTPH-FP-AD-4**	**FTPH-TS-AD2-S13.5**	**FTPH-TS-AD6-S6.5**	**FTPH-TS-AD7-S7**
Sample Type	Free Product		Free Product		Free Product	Soil	Soil	Soil
Sampling Depth (feet bgs)	6.5		3		5.5	13.5	6.5	7
Sampling Date	11/8/2007		11/14/2007		11/26/2007	12/3/2007	12/10/2007	12/10/2007
Manganese	--		--		--	325	997J	896J
Mercury	--		--		--	0.21	7.5	0.037 J
Nickel	--		--		--	55.6	61.5J	68.2J
Potassium	--		--		--	1,880	1,870	1,440
Selenium	--		--		--	0.80 J	1.2 U	1.3 U
Silver	--		--		--	0.061 U	0.30 UJ	0.30 UJ
Sodium	--		--		--	2,930	422 J	333 J
Thallium	--		--		--	0.35 U	0.34 UJ	0.35 UJ
Vanadium	--		--		--	55.6	52J	71.3J
Zinc	--		--		--	52.1	867	74.4
Volatiles (µg/kg)								
Dichlorodifluoromethane	1,800 U	UJ	1,200 U		210 U	4.2 U	3.3 U	3.5 U
Chloromethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Vinyl Chloride	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Bromomethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Chloroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Trichlorofluoromethane	1,800 U		1,200 U		210 U	2.1 J	3.3 U	3.5 U
1,1-Dichloroethene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
1,1,2-Trichloro-1,2,2-trifluoroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Acetone	5,400 JB	9000 U	2,600 J	6000 U	1,100 U	19	13	3.1 J
Carbon disulfide	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Methyl acetate	8,900 U		1,900 J		1,100 U	14 U	11 U	12 U
Methylene chloride	1,800 U		1,200 U		210 U	17	3.3 U	6.0
Methyl tert-butyl ether	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
trans-1,2-Dichloroethene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
1,1-Dichloroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
cis-1,2-Dichloroethene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
2-Butanone	8,900 U		6,000 U		1,100 U	4.8 J	1.8 J	12 U
Bromochloromethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Chlorform	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
1,1,1-Trichloroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Cyclohexane	2,200		1,200 U		720	4.2 U	3.3 U	3.5 U
Carbon tetrachloride	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Benzene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
1,2-Dichloroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Trichloroethene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Methylcyclohexane	8,800		2,500		3,800	4.2 U	3.3 U	3.5 U
1,2-Dichloropropane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Bromodichloromethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
cis-1,3-Dichloropropene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
4-Methyl-2-pentanone	8,900 U		6,000 U		1,100 U	14 U	11 U	12 U
Toluene	1,800 U		1,200 U		46 J	4.2 U	3.3 U	3.5 U
trans-1,3-Dichloropropene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
1,1,2-Trichloroethane	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
Tetrachloroethene	1,800 U		1,200 U		210 U	4.2 U	3.3 U	3.5 U
2-Hexanone	8,900 U		6,000 U	UJ	1,100 U	14 U	11 U	12 U

TABLE 7

Analytical Results from the 2007 Field Investigation

Sample ID	**FTPH-FP-DR-DRI-6.5**	**FTPH-FP-FSA-1-3**	**FTPH-FP-AD-4**	**FTPH-TS-AD2-S13.5**	**FTPH-TS-AD6-S6.5**		**FTPH-TS-AD7-S7**	
Sample Type	Free Product	Free Product	Free Product	Soil	Soil		Soil	
Sampling Depth (feet bgs)	6.5	3	5.5	13.5	6.5		7	
Sampling Date	11/8/2007	11/14/2007	11/26/2007	12/3/2007	12/10/2007		12/10/2007	
Dibromochloromethane	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,2-Dibromoethane	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
Chlorobenzene	1,800 U	270 J	210 U	4.2 U	3.3 U		3.5 U	
Ethylbenzene	450 J	1,200 U	240	4.2 U	3.3 U		3.5 U	
1,1,1,2-Tetrachloroethane	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
m,p-Xylene	390 J	2,400 U	650	8.4 U	6.5 U		6.9 U	
o-Xylene	520 J	290 J	650	4.2 U	3.3 U		3.5 U	
Styrene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
Bromoform	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
Isopropylbenzene	4,600	420 J	710	4.2 U	3.3 U		3.5 U	
1,1,2,2-Tetrachloroethane	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,3-Dichlorobenzene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,4-Dichlorobenzene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,2-Dichlorobenzene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,2-Dibromo-3-chloropropane	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,2,4-Trichlorobenzene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
1,2,3-Trichlorobenzene	1,800 U	1,200 U	210 U	4.2 U	3.3 U		3.5 U	
Polynuclear Aromatic Hydrocarbons (PAHs) (µg/kg)						**(Re-analysis) 12/20/07**		**(Re-analysis) 12/20/07**
Napthalene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
2-Methylnapthalene	--	--	--	9.6 U	8.6 U	3.8 J	3.8 JB	7.4 J
Acenapthylene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Acenaphthene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Fluorene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Phenanthrene	--	--	--	9.6 U	5.8 J	13	7.4 J	8.6 U
Anthracene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Fluoranthene	--	--	--	4.3 J	4.2 J	13	3.8 J	8.6 U
Pyrene	--	--	--	5.4 J	7.4 J	13	4.2 J	8.6 U
Benzo(a) anthracene	--	--	--	9.6 U	3.5 J	5.1 J	8.6 U	8.6 U
Chrysene	--	--	--	9.6 U	3.8 J	10	8.6 U	8.6 U
Benzo (b) fluoranthene	--	--	--	9.6 U	3.5 J	8.0 J	8.6 U	8.6 U
Benzo (k) fluoranthene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Benzo (a) pyrene	--	--	--	5.4 J	8.6 U	8.6 U	8.6 U	8.6 U
Indeno (1,2,3-cd) pyrene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Dibenzo (a,h) anthracene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Benzo (g, h, i) perylene	--	--	--	9.6 U	8.6 U	8.6 U	8.6 U	8.6 U
Semivolatile Organics (µg/kg)								
Benzaldehyde	66,000 U	66,000 U	33,000 U	--	--		--	
Phenol	66,000 U	66,000 U	33,000 U	--	--		--	
bis (2-Chloroethyl) ether	66,000 U	66,000 U	33,000 U	--	--		--	
2-Chlorophenol	66,000 U	66,000 U	33,000 U	--	--		--	
2-Methylphenol	66,000 U	66,000 U	33,000 U	--	--		--	
bis (2-Chloroisopropyl) ether	66,000 U	66,000 U	33,000 U	--	--		--	
Bis (2-chloroethoxy) methane	66,000 U	66,000 U	33,000 U	--	--		--	
Acetophenone	66,000 U	66,000 U	33,000 U	--	--		--	

TABLE 7

Analytical Results from the 2007 Field Investigation

Sample ID	**FTPH-FP-DR-DRI-6.5**		**FTPH-FP-FSA-1-3**	**FTPH-FP-AD-4**	**FTPH-TS-AD2-S13.5**	**FTPH-TS-AD6-S6.5**	**FTPH-TS-AD7-S7**
Sample Type	Free Product		Free Product	Free Product	Soil	Soil	Soil
Sampling Depth (feet bgs)	6.5		3	5.5	13.5	6.5	7
Sampling Date	11/8/2007		11/14/2007	11/26/2007	12/3/2007	12/10/2007	12/10/2007
3 & 4-Methylphenol	66,000 U		66,000 U	33,000 U	--	--	--
4-Methylphenol	--		--	--	--	--	--
N-Nitroso-di-n-propylamine	66,000 U		66,000 U	33,000 U	--	--	--
Hexachloroethane	66,000 U		66,000 U	33,000 U	--	--	--
Nitrobenzene	66,000 U		66,000 U	33,000 U	--	--	--
Isophorone	66,000 U		66,000 U	33,000 U	--	--	--
2-Nitrophenol	66,000 U		66,000 U	33,000 U	--	--	--
Benzoic acid	--		--	--	--	--	--
2,4-Dimethylphenol	66,000 U		66,000 U	33,000 U	--	--	--
2-4-Dichlorophenol	66,000 U		66,000 U	33,000 U	--	--	--
Napthalene	66,000 U		66,000 U	9,900 J	--	--	--
2,6-Dinitrotoluene	66,000 U		66,000 U	33,000 U	--	--	--
4-Chloranaline	66,000 U		66,000 U	33,000 U	--	--	--
Hexachlorobutadiene	66,000 U		66,000 U	33,000 U	--	--	--
Caprolactam	66,000 U		66,000 U	33,000 U	--	--	--
4-Chloro-3-methylphenol	66,000 U		66,000 U	33,000 U	--	--	--
2-Methylnaphthalene	220,000		49,000 J	170,000	--	--	--
Hexachlorocyclopentadiene	66,000 U	R	66,000 U	33000 U	--	--	--
2,4,6-Trichlorophenol	66,000 U		66,000 U	33000 U	--	--	--
2,4,5-Trichlorophenol	66,000 U		66,000 U	33000 U	--	--	--
1,1'-Biphenyl	66,000 U		66,000 U	33,000 U	--	--	--
2-Chloronaphthalene	66,000 U		66,000 U	33,000 U	--	--	--
2-Nitroaniline	66,000 U		66,000 U	33,000 U	--	--	--
Dimethylphthalate	66,000 U		66,000 U	33,000 U	--	--	--
Acenaphthylene	66,000 U		66,000 U	33,000 U	--	--	--
3-Nitroaniline	66,000 U		66,000 U	33,000 U	--	--	--
Acenaphthene	57,000 J		8,900 J	22,000 J	--	--	--
2,4-Dinitrophenol	130,000 U		130,000 U	67,000 U	--	--	--
4-Nitrophenol	66,000 U		66,000 U	33000 U	--	--	--
Dibenzofuran	66,000 U		66,000 U	33,000 U	--	--	--
2,4-Dinitrotoluene	66,000 U		66,000 U	33,000 U	--	--	--
Diethylphthalate	66,000 U		66,000 U	33,000 U	--	--	--
Fluorene	62,000 J		16,000 J	48,000	--	--	--
4-Chlorophenyl-phenylether	66,000 U		66,000 U	33,000 U	--	--	--
4-Nitroaniline	66,000 U		66,000 U	33,000 U	--	--	--
4,6-Dinitro-2-methylphenol	66,000 U	UJ	66,000 U	33,000 U	--	--	--
4-Bromophenyl-phenyl ether	66,000 U		66,000 U	33,000 U	--	--	--
N-Nitrosodiphenylamine	--		--	--	--	--	--
Hexachlorobenzene	66,000 U		66,000 U	33,000 U	--	--	--
Atrazine	66,000 U		66,000 U	33,000 U	--	--	--
Pentachlorophenol	66,000 U		66,000 U	33,000 U	--	--	--
Phenanthrene	280,000		42000 J	120,000	--	--	--
Anthracene	53,000 J		11,000 J	27,000 J	--	--	--
Carbazole	66,000 U		66,000 U	33,000 U	--	--	--
Di-n-butylphthalate	66,000 U		66,000 U	33,000 U	--	--	--
Fluoranthene	120,000		8,100 J	33,000 U	--	--	--

TABLE 7

Analytical Results from the 2007 Field Investigation

Sample ID	**FTPH-FP-DR-DRI-6.5**		**FTPH-FP-FSA-1-3**		**FTPH-FP-AD-4**		**FTPH-TS-AD2-S13.5**		**FTPH-TS-AD6-S6.5**		**FTPH-TS-AD7-S7**	
Sample Type	Free Product		Free Product		Free Product		Soil		Soil		Soil	
Sampling Depth (feet bgs)	6.5		3		5.5		13.5		6.5		7	
Sampling Date	11/8/2007		11/14/2007		11/26/2007		12/3/2007		12/10/2007		12/10/2007	
Pyrene	310,000	J/UJ	41,000 J	J/UJ	65,000	J/UJ	--		--		--	
Butylbenzylphthalate	66,000 U	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
3,3'-Dichlorobenzidine	66,000 U	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Benzo (a) anthracene	62,000 J	J/UJ	66,000 U	J/UJ	18,000 J	J/UJ	--		--		--	
Bis (2-Ethylhexyl)phthalate	66,000 U	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Chrysene	79,000	J/UJ	13,000 J	J/UJ	30,000 J	J/UJ	--		--		--	
Di-n-octylphthalate	66,000 U	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Benzo (b) fluoranthene	57,000 J	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Benzo (k) fluoranthene	23,000 J	J/UJ	66,000 U	J/UJ	33,000 U		--		--		--	
Benzo (a) pyrene	53,000 J	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Indeno (1,2,3-cd) pyrene	22,000 J	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Dibenzo (a,h) anthracene	66,000 U	J/UJ	66,000 U	J/UJ	33,000 U	J/UJ	--		--		--	
Benzo (g,h,I) perylene	23,000 J	J/UJ	66,000 U	J/UJ	5,500 J	J/UJ	--		--		--	
TPH-Gasoline (mg/kg)												
TPH-Gasoline	8,700		720		1,800		7.9 U		6.0 U		6.5 U	
TPH-Diesel (mg/kg)												
TPH-Diesel	150,000 B		67,000 B		90,000		7.1 U		6.4 U		6.4 U	
TPH-Oil	180,000 B		120,000 B		130000 B		29 U		26 U		26 U	
Cyanide (mg/kg)												
Cyanide	--		--		--		0.14 J	2.0 U	0.16 J	2.0 U	0.30 J	2.0 U

Notes:

Review Qualifiers:

Laboratory Flag Definitions:

B = When used in relation to organics fractions, the "B" flag indicates that the analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself.
The "B" flag is applied without regard to the relative concentrations detected in the blank and sample.
J (for organic analyses) = The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.
J (for Inorganic analyses) = The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If
U = The analyte of interest was not detected to the limit of detection indicated.

Data Validation Flag Definitions:

J = The associated numerical value is an estimate
R = The reported result is rejected and should not be used to any extent
UJ = The analyte was not detected at or above the MDL, and the MDL is an estimate.

bgs = below ground surface
mg/kg = milligrams per kilogram
µg/kg = micrograms per kiiogram
TPH = total petroleum hydrocarbons

-- = not analyzed

TABLE 8

Analytical Results from the 2008 Field Investigation

Sample ID	**FTPH-FP-TR-DDD2-S2.5**	
Sample Type	Soil	
Sample Depth (feet bgs)	2.5	Validation
Sample Date	11/13/2008	Flag
Semivolatile Organics by GC/MS (µg/kg)		
Phenol	ND	
bis (2-Chloroethyl) ether	ND	
2-Chlorophenol	ND	
2-Methylphenol	ND	
bis (2-Chloroisopropyl) ether	ND	
4-Methylphenol	ND	
N-Nitroso-di-n-propylamine	ND	
Hexachloroethane	ND	
Nitrobenzene	ND	
Isophorone	ND	
2,4-Dimethylphenol	ND	
Benzoic Acid	ND	
2,4-Dichlorophenol	ND	
4-Chloranaline	ND	
Hexachlorobutadiene	ND	
2-Methylnaphthalene	ND	
1-Methylnapththalene	1,000	
Hexachlorocyclopentadiene	ND	
2,4,6-Trichlorophenol	ND	
2,4,5-Trichlorophenol	ND	
2-Chloronaphthalene	ND	
2-Nitroaniline	ND	
Dimethylphthalate	ND	
2,4-Dinitrophenol	ND	UJ
4-Nitrophenol	ND	
Dibenzofuran	ND	
Diethylphthalate	ND	
N-Nitrosodiphenylamine	2,000	J
Hexachlorobenzene	ND	
Pentachlorophenol	ND	
Carbazole	ND	
Di-n-butylphthalate	ND	
Butylbenzylphthalate	ND	
3,3'-Dichlorobenzidine	ND	
Bis (2-Ethylhexyl)phthalate	ND	
Di-n-octylphthalate	ND	

TABLE 8

Analytical Results from the 2008 Field Investigation

Sample ID	**FTPH-FP-TR-DDD2-S2.5**	
Sample Type	Soil	
Sample Depth (feet bgs)	2.5	Validation
Sample Date	11/13/2008	Flag
TPH-Gasoline (mg/kg)		
Gasoline C7-C12	0.88	Y
TPH-Diesel (mg/kg)		
Diesel C10-C24	4,800	
Motor Oil C24-C36	1,900	
Volatile Organics by GC/MS (µg/kg)		
Freon 12	ND	
Chloromethane	ND	
Vinyl Chloride	ND	
Bromomethane	ND	
Chloroethane	ND	
Acetone	200 J	
Freon 113	ND	
1,1-Dichloroethene	ND	
Methylene Chloride	180 J	1000 U
Carbon Disulfide	ND	
MTBE	ND	
trans-1,2-Dichloroethene	ND	
1,1-Dichloroethane	ND	
2-Butanone	ND	
cis-1,2-Dichloroethene	ND	
Chloroform	ND	
1,1,1-Trichloroethane	ND	
Carbon Tetrachloride	ND	
1,2-Dichloroethane	ND	
Benzene	ND	
Trichloroethene	ND	
1,2-Dichloropropane	ND	
Bromodichloromethane	ND	
4-methyl-2-pentanone	ND	
Toluene	11 J	
1,1,2-Trichloroethane	ND	
Tetrachloroethene	ND	
Dibromochloromethane	ND	
1,2-Dibromoethane	ND	
Chlorobenzene	ND	
1,1,1,2-Tetrachloroethane	ND	
Ethylbenzene	ND	
m,p-Xylenes	14 J	
o-Xylene	ND	
Styrene	ND	
Bromoform	ND	

TABLE 8

Analytical Results from the 2008 Field Investigation

Sample ID	**FTPH-FP-TR-DDD2-S2.5**	
Sample Type	Soil	
Sample Depth (feet bgs)	2.5	Validation
Sample Date	11/13/2008	Flag
Isopropylbenzene	32 J	
1,1,2,2-Tetrachloroethane	ND	
1,2,3-Trichloropropane	ND	
Propylbenzene	25 J	
Bromobenzene	ND	
1,3,5-Trimethylbenzene	ND	
2-Chlorotoluene	ND	
tert-Butylbenzene	12 J	
1,2,4-Trimethylbenzene	19 J	
sec-Butylbenzene	230 J	
1,3-Dichlorobenzene	ND	
1,4-Dichlorobenzene	ND	
n-Butylbenzene	330 J	
1,2-Dichlorobenzene	ND	
1,2-Dibromo-3-Chloropropane	ND	
1,2,4-Trichlorobenzene	ND	

Notes:

Review Qualifiers:

Laboratory Flag Definitions:

J = Estimated Value

ND = Not Detected

Y = Sample exhibits chromatographic pattern which does not resemble standard.

Data Validation Flag Definitions:

U = The analyte was analyzed for, but was not detected above the reported quantitative unit.

UJ = The analyte was not detected at or above the MDL, and the MDL is an estimate.

bgs = below ground surface

mg/kg = milligrams per kilogram

µg/kg = micrograms per kiiogram

GC/MS = gas chromatography/mass spectometry

TPH = total petroleum hydrocarbons

TABLE 9

Locations of Vertical Extent Observations

Date Completed	Trench or Boring	Location	Area	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
10/28/2008	Boring	BBB2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/4/2008	Boring	C1,2	SSL West CTA	NA	NA	Yes	8.0 to 12.3	No	NA	20.0
10/28/2008	Boring	CCC2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/22/2008	Boring	D1,2,3	SSL West CTA	NA	NA	Yes	5.0 to 13.5	No	NA	20.0[b]
10/28/2008	Boring	DDD2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0[b]
10/21/2008	Boring	E2,3	Dump Road	NA	NA	Yes	Trace at 9.0 and 12.5 to 13.9	Yes	Trace at 12.5 to 12.7	20.0
10/24/2008	Boring	EE2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0
10/27/2008	Boring	EEE2,3	Azuar Drive	NA	NA	Yes	11.0 to 13.5	No	NA	20.0[b]
10/21/2008	Boring	F2,3	Dump Road	NA	NA	Yes	3.5 to 6.5[a]	Yes	3.5 to 6.3	6.5
11/12/2008	Boring	GGG2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/12/2008	Boring	III2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/20/2008	Boring	J1,2	SSL West CTA	NA	NA	Yes	9.5 to 13.0	No	NA	20.0
10/24/2008	Boring	JJ2	Azuar Drive	NA	NA	No	NA	Yes	Trace at 15.0 and 20.0	22.0
11/5/2008	Boring	JJJ2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/21/2008	Boring	L1,2	Dump Road	NA	NA	Yes	8.6 to 12.5	Yes	8.6 to 8.8	20.0
11/12/2008	Boring	LLL2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/24/2008	Boring	MM1,2	Azuar Drive	NA	NA	Yes	7.0 to 13.0	No	NA	20.0[b]
11/12/2008	Boring	MMM2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/27/2008	Boring	NN1,2,3	Azuar Drive	NA	NA	Yes	9.0 to 13.5	No	NA	20.0[b]
11/5/2008	Boring	OOO2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/23/2008	Boring	PP1,2	Azuar EETP	NA	NA	Yes	9.4 to 12.5	No	NA	20.0[b]
10/24/2008	Boring	QQ2,3	Azuar Drive	NA	NA	Yes	8.0 to 15.0	No	NA	20.0[b]
11/5/2008	Boring	QQQ2,3	FSA	NA	NA	Yes	Trace at 7.3	No	NA	20.0
10/22/2008	Boring	R1,2	Dump Road	NA	NA	Yes	9.8 to 10.0	No	NA	20.0
11/5/2008	Boring	RRR2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/22/2008	Boring	T2	Dump Road	NA	NA	No	NA	Yes	3.0 to 7.0	20.0
3/3/2008	Trench	T-2	Azuar Drive	0	9.5	Yes	5.0 to 6.0 sheen on water and 10.0 to 11.5	Yes	5.0 to 6.0	12.0
11/13/2008	Trench	Trench DDD-2	Azuar Drive	0	10	Yes[c]	2.3 to 2.5	No	NA	10.0[b]
10/27/2008	Boring	TT2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0[b]
11/5/2008	Boring	TTT2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/4/2008	Boring	VV1,2	Azuar EETP	NA	NA	Yes	8.0 to 13.9	No	NA	20.0
10/27/2008	Boring	ZZ1,2	Azuar Drive	NA	NA	No	NA	No	NA	20.0[b]

Notes:

bgs = below ground surface
CTA = Former Crane Test Area
EETP = Eastern Early Transfer Parcel
FSA = DRMO Site, Fenced Scrapyard Area
NA - not applicable
SSL = Sanitary Sewer Line Area

[a] Bottom of free product interval not reached.

[b] Encountered bedrock.

[c] Based on field observations, the free-phase hydrocarbons observed at trench DDD-2 were a lighter fuel oil than the heavier fuel oil observed at the surrounding boring and trench locations. The presence of the lighter fuel oil was confirmed by forensic analysis of a sample collected at DDD-2.

TABLE 10

Locations of Lateral Extent Observations

Date Completed	Trench or Boring	Location	Area	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
11/4/2008	Boring	A3	SSL West CTA	NA	NA	Yes	2.0 to 8.5	No	NA	10.0
10/28/2008	Boring	AAA3,4	FSA	NA	NA	No	NA	No	NA	10.0
11/4/2008	Boring	B3	SSL West CTA	NA	NA	Yes	10.0 to 15.0[a]	No	NA	15.0
10/28/2008	Boring	BBB2,3	FSA	NA	NA	No	NA	No	NA	20.0[b]
10/28/2008	Boring	CCC2,3	FSA	NA	NA	No	NA	No	NA	20.0[b]
10/22/2008	Boring	D1,2,3	SSL West CTA	NA	NA	Yes	5.0 to 13.5	No	NA	20.0
10/24/2008	Boring	DD3	Azuar Drive	NA	NA	No	NA	No	NA	10.0
10/28/2008	Boring	DDD2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0[b]
10/21/2008	Boring	E2,3	Dump Road	NA	NA	Yes	Trace at 9.0 and 12.5 to 13.9	Yes	Trace at 12.5 to 12.7	20.0
10/24/2008	Boring	EE2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0
10/27/2008	Boring	EEE2,3	Azuar Drive	NA	NA	Yes	11.0 to 13.5	No	NA	20.0[b]
10/21/2008	Boring	F2,3	Dump Road	NA	NA	Yes	3.5 to 6.5[a]	Yes	3.5 to 6.3	6.5
10/28/2008	Boring	FFF3	Azuar Drive	NA	NA	No	NA	No	NA	10.0
11/12/2008	Boring	GGG2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/4/2008	Boring	H3	SSL West CTA	NA	NA	No	NA	No	NA	10.0
10/22/2008	Boring	I3	SSL West CTA	NA	NA	Yes	8.6 to 15.0	No	NA	20.0
11/12/2008	Boring	III2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/5/2008	Boring	JJJ2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/12/2008	Boring	LLL2,3	FSA	NA	NA	No	NA	No	NA	20.0
11/4/2008	Boring	M3	SSL West CTA	NA	NA	No	NA	Yes	Trace at 0 to 4.5	10.0
11/12/2008	Boring	MMM2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/27/2008	Boring	NN1,2,3	Azuar Drive	NA	NA	Yes	9.0 to 13.5	No	NA	20.0[b]
11/5/2008	Boring	OOO2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/24/2008	Boring	QQ2,3	Azuar Drive	NA	NA	Yes	8.0 to 15.0	No	NA	20.0[b]
11/5/2008	Boring	QQQ2,3	FSA	NA	NA	Yes	Trace at 7.3	No	NA	20.0
11/5/2008	Boring	RRR2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/20/2008	Boring	S3	CTA	NA	NA	Yes	Trace at 6.9	Yes	4.0 to 6.3	10.0
3/3/2008	Trench	T-3	Azuar Drive	0	11	Yes	8.0 to 11.5	Yes	Trace at 3.5	12.0
11/10/2008	Trench	Trench A	SSL West CTA	0	10	No	NA	No	NA	10.0
11/12/2008	Trench	Trench DDD-1	Azuar Drive	0	10	Yes[c]	4.25 to 5.0	No	NA	9.5[b]

TABLE 10

Locations of Lateral Extent Observations

Date Completed	Trench or Boring	Location	Area	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
11/13/2008	Trench	Trench DDD-2	Azuar Drive	0	10	Yes[c]	2.3 to 2.5	No	NA	10.0[b]
11/11/2008	Trench	Trench EE	Azuar EETP	0	10	No	NA	Yes	1.5 to 5.0	10.0
11/13/2008	Trench	Trench GGG	FSA	0	10	No	NA	Yes	4.0 to 5.0	10.0
11/10/2008	Trench	Trench H	SSL West CTA	0	11	No	NA	No	NA	10.0
11/13/2008	Trench	Trench JJJ	FSA	0	10	No	NA	No	NA	10.0
11/11/2008	Trench	Trench UU	Azuar EETP	0	10	Yes, trace	Sheen	No	NA	10.0
10/27/2008	Boring	TT2,3	Azuar Drive	NA	NA	No	NA	No	NA	20.0[b]
11/5/2008	Boring	TTT2,3	FSA	NA	NA	No	NA	No	NA	20.0
10/23/2008	Boring	UU3	Azuar EETP	NA	NA	Yes	9.3 to 10.0[a]	No	NA	10.0
10/28/2008	Boring	YY3	Azuar EETP	NA	NA	No	NA	Yes	Trace at 8.1 to 8.7	10.0

Notes:

bgs = below ground surface
CTA = Former Crane Test Area
EETP = Eastern Early Transfer Parcel
FSA = DRMO Site, Fenced Scrapyard Area
NA = not applicable
SSL = Sanitary Sewer Line Area

[a] Bottom of free product interval not reached.

[b] Encountered bedrock.

[c] Based on field observations, the free-phase hydrocarbons observed at trenches DDD-1 and DDD-2 were a lighter fuel oil than the heavier fuel oil observed at the surrounding boring and trench locations. The presence of the lighter fuel oil was confirmed by forensic analysis of a sample collected at DDD-2. Therefore, trench locations DDD-1 and DDD-2 are not included within the "Azuar Drive Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbons" boundary shown on Figure 12.

TABLE 11

Locations of Potential Migration Pathway Observations

Date Completed	Trench or Boring	Location	Area	Station from (feet)	Station to (feet)	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
10/27/2008	Boring	AA5	Azuar EETP	NA	NA	No	NA	No	NA	4.5
11/4/2008	Boring	CC5	Azuar Drive	NA	NA	No	NA	No	NA	3.5
10/29/2008	Boring	EEE5	Azuar Drive	NA	NA	No	NA	No	NA	4.25[c]
11/3/2008	Boring	FF5	Azuar EETP	NA	NA	No	NA	Yes	1.25 to 1.75	4.0
11/3/2008	Boring	II5	Azuar EETP	NA	NA	Yes	Sheen at 1.0 to 4.9	Yes	1.0 to 4.9	5.0
11/6/2008	Boring	KK5	Azuar Drive	NA	NA	Yes	4.0[a]	Yes	4.0[b]	4.0
11/6/2008	Boring	KKK5	FSA	NA	NA	No	NA	No	NA	6.0
11/4/2008	Boring	LL5	Azuar EETP	NA	NA	Yes	Trace sheen on water	No	NA	4.0
11/4/2008	Boring	P5	CTA	NA	NA	Yes	7.0 to 7.5	No	NA	8.0
11/6/2008	Boring	PPP5	FSA	NA	NA	No	NA	No	NA	3.0
10/28/2008	Boring	SS5 East	Azuar Drive	NA	NA	Yes	Trace sheen	No	NA	4.0
10/28/2008	Boring	SS5 West	Azuar Drive	NA	NA	Yes	Sheen at 1.5	No	NA	4.25
3/7/2008	Trench	T-5	Azuar Drive	0	10	Yes	7.5 to 12.0	Yes	11.5 to 12.0	12.0
10/30/2008	Boring	UUU5	Azuar EETP	NA	NA	Yes, trace	5.9	No	NA	5.9
10/30/2008	Boring	V5	Azuar Drive	NA	NA	No	NA	No	NA	3.5
10/30/2008	Boring	X5	Azuar Drive	NA	NA	No	NA	Yes	0.5 to 3.8[b]	3.8
10/27/2008	Boring	Z5	Azuar Drive	NA	NA	No	NA	Yes	0.5 to 4.25[b]	4.25
10/29/2008	Boring	ZZ5	Azuar Drive	0	4	Yes, trace	Sheen	No	NA	4.4

Notes:

bgs = below ground surface
CTA = Former Crane Test Area
EETP = Eastern Early Transfer Parcel
FSA = DRMO Site, Fenced Scrapyard Area
NA = not applicable

[a] Bottom of free product interval not reached.

[b] Bottom of metal debris Interval not reached.

[c] Encountered bedrock.

TABLE 12

Summary of Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences at the Fenced Scrapyard Area of the DRMO Site and Azuar Drive, Grouped by Possible Direct Preferential Migration Pathway and in Order of Increasing Distance from the Former Oil Sump Box

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Figure 12 Azuar Drive Lateral Extent Position	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
DRMO Site, Fenced Scrapyard Area Observations from OSB and Perforated Pipe and Outwards										
1/20/2006	Trench	OSB and Pipe	0	80	Inside	Yes	4.0 to 12.0	Yes	4.0 to 12.0	12.0
Westerly Observations within 160 feet of OSB and Perforated Pipe										
11/15/2007	Trench	AD-1	40	55	Inside	Yes	4.0 to 5.5[a]	Yes	Isolated at 4.0 and 5.5	6.0
11/20/2007	Trench	AD-1	0	42.5	Inside	Yes	3.5 to 4.0[a]	Yes	3.5 to 4.0[b]	4.0
11/21/2007	Trench	AD-1 (Deeper)	0	15	Inside	Yes	5.0 to 8.0[a]	Yes	5.0 to 7.0	8.0
10/24/2008	Boring	MM1,2	NA	NA	Inside	Yes	7.0 to 13.0	No	NA	20.0[c]
11/6/2008	Boring	KK5	NA	NA	Inside	Yes	4.0[a]	Yes	4.0[b]	4.0
10/24/2008	Boring	JJ2	NA	NA	Inside	No	NA	Yes	Trace at 15.0 and 20.0	22.0
10/30/2008	Boring	UUU5	NA	NA	Inside	Yes, trace	5.9	No	NA	5.9
10/24/2008	Boring	GG1	NA	NA	Inside	Yes	8.5 to 10[a]	No	NA	10.0
12/6/2007	Trench	FSA-1	0	10	Inside	Yes	4.5 to 9.0[a]	Yes	Trace at 4.5	9.0
12/6/2007	Trench	FSA-1	32.5	43.5	Inside	Yes	4.0 to 9.5[a]	No	NA	9.5
12/6/2007	Trench	FSA-1	69.5	80	Inside	Yes	2.5 to 9.0[a]	Yes	Trace at 4.5	9.0
Westerly Observations within 160 to 320 feet of OSB and Perforated Pipe										
11/15/2007	Excavation	Wooden Sump Box	0	10	Inside	Yes	5.0 to 6.0[a]	No	NA	6.0
11/19/2007	Over Excavation	Wooden Sump Box	0	16	Inside	Yes	1.0 to 7.0[a]	No	NA	7.5
11/5/2008	Boring	TTT2,3	NA	NA	Inside	No	NA	No	NA	20.0
11/5/2008	Boring	QQQ2,3	NA	NA	Inside	Yes	Trace at 7.3	No	NA	20.0
12/21/2005	Boring	OSBGB10	NA	NA	Inside	Yes	Floating product of undetermined thickness	No	NA	16.0
11/11/2008	Trench	Trench EE	0	10	Outside	No	NA	Yes	1.5 to 5.0	10.0
10/24/2008	Boring	DD3	NA	NA	Outside	No	NA	No	NA	10.0
12/21/2005	Boring	OSBGB11	NA	NA	Outside	No	NA	No	NA	16.0
11/12/2008	Boring	SSS4	NA	NA	Inside	Yes	4.6 to 5.0	No	NA	10.0
11/5/2008	Boring	OOO2,3	NA	NA	Outside	No	NA	No	NA	20.0
12/6/2007	Trench	FSA-2	0	12.5	Outside	No	NA	No	NA	9.0
11/12/2008	Boring	LLL2,3	NA	NA	Outside	No	NA	No	NA	20.0
11/12/2008	Boring	MMM2,3	NA	NA	Outside	No	NA	No	NA	20.0
11/5/2008	Boring	RRR2,3	NA	NA	Outside	No	NA	No	NA	20.0
11/13/2008	Trench	Trench RRR	0	10	Outside	No	NA	No	NA	10.0
Pathway Observations from OSB and Perforated Pipe to LMI Side Forensic Sampling Location PP										
1/20/2006	Trench	OSB and Pipe	0	80	Inside	Yes	4.0 to 12.0	Yes	4.0 to 12.0	12.0

TABLE 12

Summary of Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences at the Fenced Scrapyard Area of the DRMO Site and Azuar Drive, Grouped by Possible Direct Preferential Migration Pathway and in Order of Increasing Distance from the Former Oil Sump Box

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Figure 12 Azuar Drive Lateral Extent Position	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
Southeasterly Observations along Navy Side of Azuar Drive										
11/28/2007	Trench	AD-2	0	22.5	Inside	Yes	5.5 to 11.5[a]	Yes	5.5 to 8.0	11.5
11/29/2007	Trench	AD-2	50	70	Inside	Yes	5.0 to 13.0	Yes	5.0 to 8.0	13.5
12/3/2007	Trench	AD-2	97.5	117.5	Inside	Yes	5.5 to 13.5	Yes	Isolated at 5.5	14.5
12/3/2007	Trench	AD-2	140	162.5	Inside	Yes	5.0 to 13.0	No	NA	13.5
Trenches Crossing Azuar Drive										
11/26/2007	Trench	AD-4	0	20	Inside	Yes	5.5 to 11[a]	Yes	6.0 to 9.5	11.0
11/26/2007	Trench	AD-5	0	22	Inside	Yes	4.5 to 9.0[a]	Yes	4.5 to 8.0	9.5
Trenches and Borings along LMI Side of Azuar Drive										
12/10/2007	Trench	AD-7	0	11	Inside	Yes	Trace at 6.0	No	NA	8.5
12/10/2007	Trench	AD-8	0	8	Inside	Yes, trace	Trace sheen	No	NA	8.0
12/10/2007	Trench	AD-9	0	8.5	Inside	No	NA	No	NA	7.0
10/23/2008	Boring	OO1	NA	NA	Inside	Yes	8.0 to 9.7	No	NA	17.0[c]
3/3/2008	Trench	T-3	0	11	Inside	Yes	8.0 to 11.5	No	NA	12.0
3/4/2008	Trench	T-4	0	11	Inside	Yes	4.0 to 5.5 and 8.0 to 12.5	No	NA	12.5
10/23/2008	Boring	PP1,2	NA	NA	Inside	Yes	9.4 to 12.5	No	NA	20.0[c]
3/11/2008	Trench	T-8	0	11	Outside	No	NA	No	NA	12.5[c]
Pathway Observations from OSB and Perforated Pipe to LMI Side Forensic Sampling Location RR										
1/20/2006	Trench	OSB and Pipe	0	80	Inside	Yes	4.0 to 12.0	Yes	4.0 to 12.0	12.0
Southeasterly Observations along Navy Side of Azuar Drive										
11/28/2007	Trench	AD-2	0	22.5	Inside	Yes	5.5 to 11.5[a]	Yes	5.5 to 8.0	11.5
11/29/2007	Trench	AD-2	50	70	Inside	Yes	5.0 to 13.0	Yes	5.0 to 8.0	13.5
12/3/2007	Trench	AD-2	97.5	117.5	Inside	Yes	5.5 to 13.5	Yes	Isolated at 5.5	14.5
12/3/2007	Trench	AD-2	140	162.5	Inside	Yes	5.0 to 13.0	No	NA	13.5
10/27/2008	Boring	NN1,2,3	NA	NA	Inside	Yes	9.0 to 13.5	No	NA	20.0[c]
11/12/2008	Boring	VVV4	NA	NA	Inside	Yes	7.0 to 10.0[a]	No	NA	10.0
10/24/2008	Boring	QQ2,3	NA	NA	Inside	Yes	8.0 to 15.0	No	NA	20.0[c]
12/20/2005	Boring	OSBGB03	NA	NA	Inside	No	NA	No	NA	9.0
Trenches Crossing Azuar Drive										
11/26/2007	Trench	AD-4	0	20	Inside	Yes	5.5 to 11.0[a]	Yes	6.0 to 9.5	11.0
11/26/2007	Trench	AD-5	0	22	Inside	Yes	4.5 to 9.0[a]	Yes	4.5 to 8.0	9.5
Trenches and Borings along LMI Side of Azuar Drive										
12/10/2007	Trench	AD-7	0	11	Inside	Yes	Trace at 6.0	No	NA	8.5
12/10/2007	Trench	AD-8	0	8	Inside	Yes, trace	Trace sheen	No	NA	8.0
12/10/2007	Trench	AD-9	0	8.5	Inside	No	NA	No	NA	7.0

TABLE 12

Summary of Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences at the Fenced Scrapyard Area of the DRMO Site and Azuar Drive, Grouped by Possible Direct Preferential Migration Pathway and in Order of Increasing Distance from the Former Oil Sump Box

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Figure 12 Azuar Drive Lateral Extent Position	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
10/23/2008	Boring	OO1	NA	NA	Inside	Yes	8.0 to 9.7	No	NA	17.0[c]
3/3/2008	Trench	T-3	0	11	Inside	Yes	8.0 to 11.5	No	NA	12.0
3/4/2008	Trench	T-4	0	11	Inside	Yes	4.0 to 5.5 and 8.0 to 12.5	No	NA	12.5
10/23/2008	Boring	PP1,2	NA	NA	Inside	Yes	9.4 to 12.5	No	NA	20.0[c]
3/11/2008	Trench	T-8	0	11	Inside	No	NA	No	NA	12.5[c]
3/7/2008	Trench	T-5	0	10	Inside	Yes	7.5 to 12.0[a]	Yes	Several pieces of metal scrap at 11.5 to 12.0	12.0
10/23/2008	Boring	RR 1	NA	NA	Inside	Yes	9.3 to 14.5	No	NA	20.0[c]
11/11/2008	Trench	Trench UU	0	10	Outside	Yes, trace	Sheen	No	NA	10.0
10/23/2008	Boring	UU3	NA	NA	Inside	Yes	9.3 to 10[a]	No	NA	10.0
Pathway Observations from OSB and Perforated Pipe to LMI Side Forensic Sampling Location VV										
1/20/2006	Trench	OSB and Pipe	0	80	Inside	Yes	4.0 to 12.0	Yes	4.0 to 12.0	12.0
Southeasterly Observations along Navy Side of Azuar Drive										
11/28/2007	Trench	AD-2	0	22.5	Inside	Yes	5.5 to 11.5[a]	Yes	5.5 to 8.0	11.5
11/29/2007	Trench	AD-2	50	70	Inside	Yes	5.0 to 13.0	Yes	5.0 to 8.0	13.5
12/3/2007	Trench	AD-2	97.5	117.5	Inside	Yes	5.5 to 13.5	Yes	Isolated at 5.5	14.5
12/3/2007	Trench	AD-2	140	162.5	Inside	Yes	5.0 to 13.0	No	NA	13.5
10/27/2008	Boring	NN1,2,3	NA	NA	Inside	Yes	9.0 to 13.5	No	NA	20.0[c]
11/12/2008	Boring	VVV4	NA	NA	Inside	Yes	7.0 to 10.0[a]	No	NA	10.0
10/24/2008	Boring	QQ2,3	NA	NA	Inside	Yes	8.0 to 15.0	No	NA	20.0
12/20/2005	Boring	OSBGB03	NA	NA	Inside	No	NA	No	NA	9.0
10/28/2008	Boring	SS5 East	NA	NA	Inside	Yes, trace	Sheen	No	NA	4.0
10/28/2008	Boring	SS5 West	NA	NA	Outside	Yes	Sheen at 1.5	No	NA	4.25
10/27/2008	Boring	TT2,3	NA	NA	Inside	No	NA	No	NA	20.0[c]
12/19/2005	Boring	OSBGB02	NA	NA	Outside	No	NA	No	NA	16.0
Trenches Crossing Azuar Drive										
11/26/2007	Trench	AD-4	0	20	Inside	Yes	5.5 to 11.0[a]	Yes	6.0 to 9.5	11.0
11/26/2007	Trench	AD-5	0	22	Inside	Yes	4.5 to 9.0[a]	Yes	4.5 to 8.0	9.5
Trenches and Borings along LMI Side of Azuar Drive										
12/10/2007	Trench	AD-7	0	11	Inside	Yes	Trace at 6.0	No	NA	8.5
12/10/2007	Trench	AD-8	0	8	Inside	Yes, trace	Trace sheen	No	NA	8.0
12/10/2007	Trench	AD-9	0	8.5	Inside	No	NA	No	NA	7.0
10/23/2008	Boring	OO1	NA	NA	Inside	Yes	8.0 to 9.7	No	NA	17.0[c]
3/3/2008	Trench	T-3	0	11	Inside	Yes	8.0 to 11.5	No	NA	12.0

TABLE 12

Summary of Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbon and Metal Occurrences at the Fenced Scrapyard Area of the DRMO Site and Azuar Drive, Grouped by Possible Direct Preferential Migration Pathway and in Order of Increasing Distance from the Former Oil Sump Box

Date Completed	Trench or Boring	Location	Station from (feet)	Station to (feet)	Figure 12 Azuar Drive Lateral Extent Position	Free Product Observed	Free Product Interval (feet bgs)	Metal Debris Observed	Metal Debris Interval (feet bgs)	Maximum Depth (feet bgs)
3/4/2008	Trench	T-4	0	11	Inside	Yes	4.0 to 5.5 and 8.0 to 12.5	No	NA	12.5
10/23/2008	Boring	PP1,2	NA	NA	Inside	Yes	9.4 to 12.5	No	NA	20.0[c]
3/11/2008	Trench	T-8	0	11	Outside	No	NA	No	NA	12.5[c]
3/7/2008	Trench	T-5	0	10	Inside	Yes	7.5 to 12.0[a]	Yes	Several pieces of metal scrap at 11.5 to 12.0	12.0
10/23/2008	Boring	RR 1	NA	NA	Inside	Yes	9.3 to 14.5	No	NA	20.0[c]
11/11/2008	Trench	Trench UU	0	10	Outside	Yes, trace	Sheen	No	NA	10.0
10/23/2008	Boring	UU3	NA	NA	Inside	Yes	9.3 to 10.0[a]	No	NA	10.0
3/7/2008	Trench	T-7	0	10	Inside	Yes	3.0 to 12.0[a]	Yes	Trace at 2.5 and 5.5 to 8.0	12.0[c]
11/4/2008	Boring	VV1,2	NA	NA	Inside	Yes	8.0 to 13.9	No	NA	20.0
12/19/2005	Boring	OSBGB01	NA	NA		Yes	10.0 to 13.0	No	NA	16.0
11/12/2008	Trench	Trench DDD-1	0	10		Yes[d]	4.25 to 5.0	No	NA	9.5[c]
11/13/2008	Trench	Trench DDD-2	0	10		Yes[d]	2.3 to 2.5	No	NA	10.0[c]

Notes:

NA = not applicable
bgs = below ground surface

[a] Bottom of free product interval not reached.

[b] Bottom of metal debris interval not reached.

[c] Encountered bedrock.

[d] Based on field observations, the free-phase hydrocarbons observed at trenches DDD-1 and DDD-2 were a lighter fuel oil than the heavier fuel oil observed at the surrounding boring and trench locations. The presence of the lighter fuel oil was confirmed by forensic analysis of a sample collected at DDD-2. Therefore, trench locations DDD-1 and DDD-2 are not included within the "Azuar Drive Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbons" boundary shown on Figure 12.

Final Technical Memorandum

Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California

Volume II: Appendices

Contract No. N62467-98-D-0995
Task Order 0065

Document Control Number: HILL-0995-0065-0024

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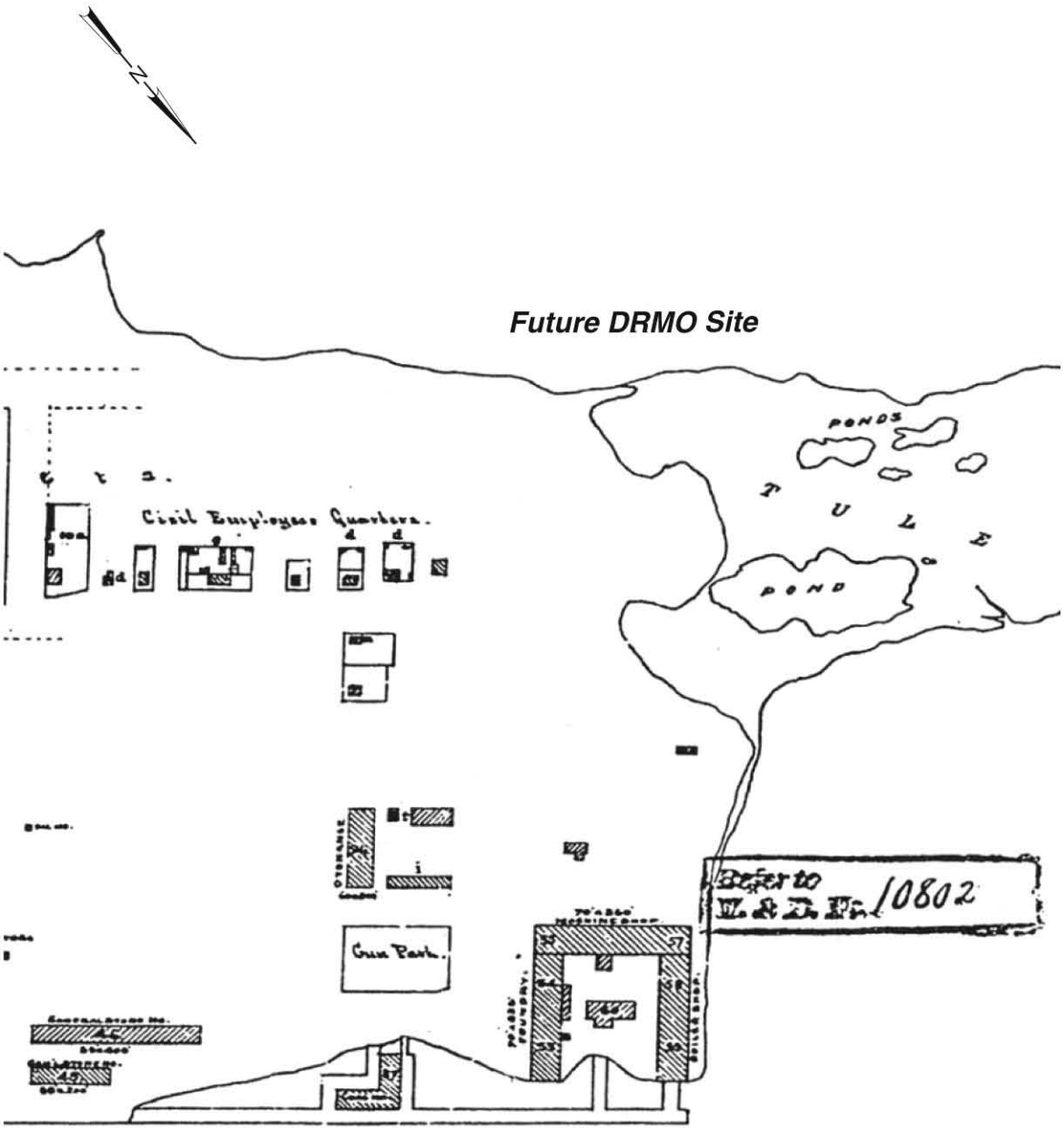
Bellevue, WA 98004

June 2009

APPENDIX A

Historical Maps and Aerial Photographs of Fill Operations at the DRMO Site and in the Vicinity



SCALE
0' 100' 200' 400'

FIGURE A-1
PLAN OF U.S. NAVY YARD
JUNE 10, 1890
MARE ISLAND, CALIFORNIA

CH2MHILL

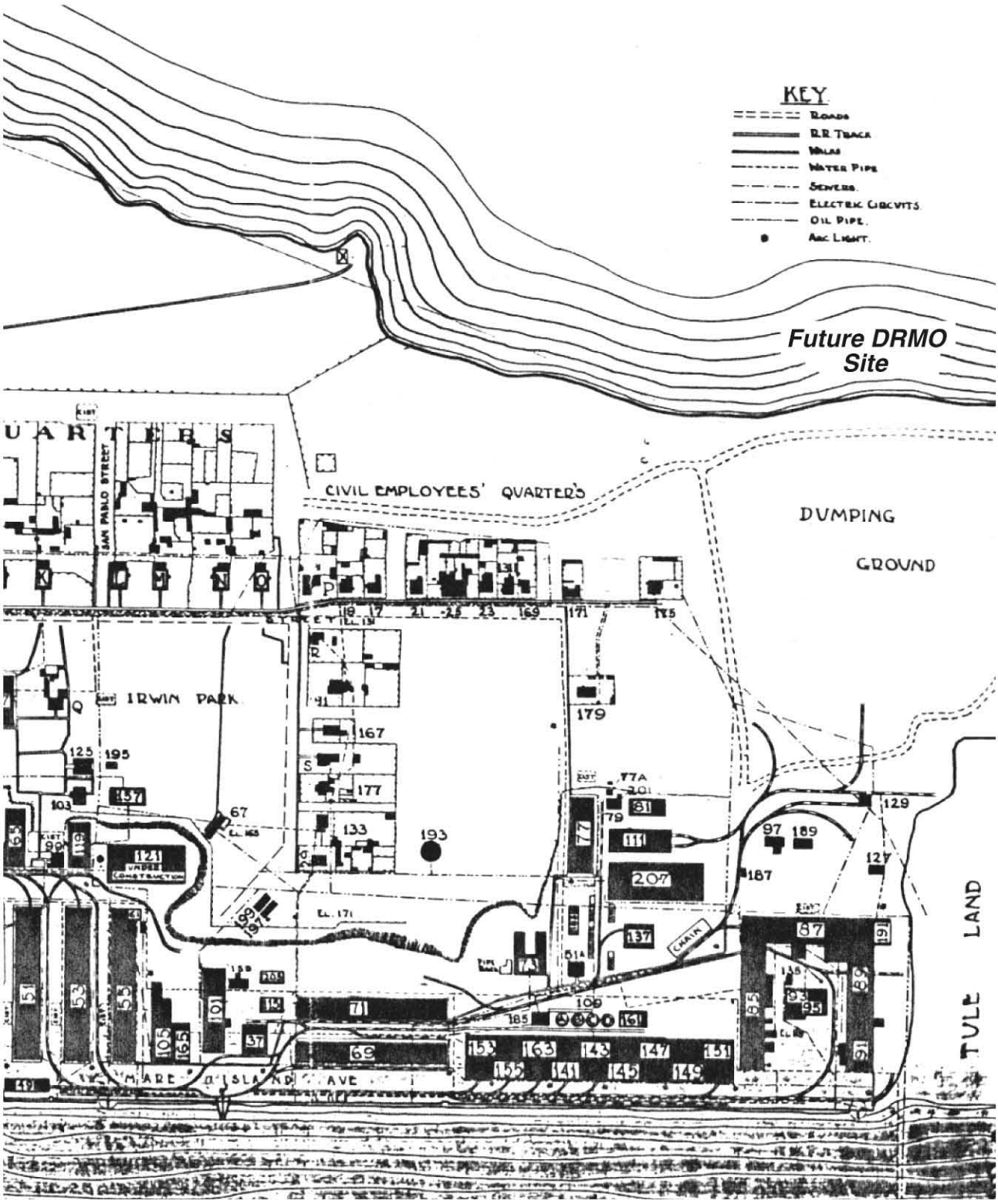


FIGURE A-2
PLAN OF U.S. NAVY YARD
JULY 1, 1911
MARE ISLAND, CALIFORNIA

CH2MHILL

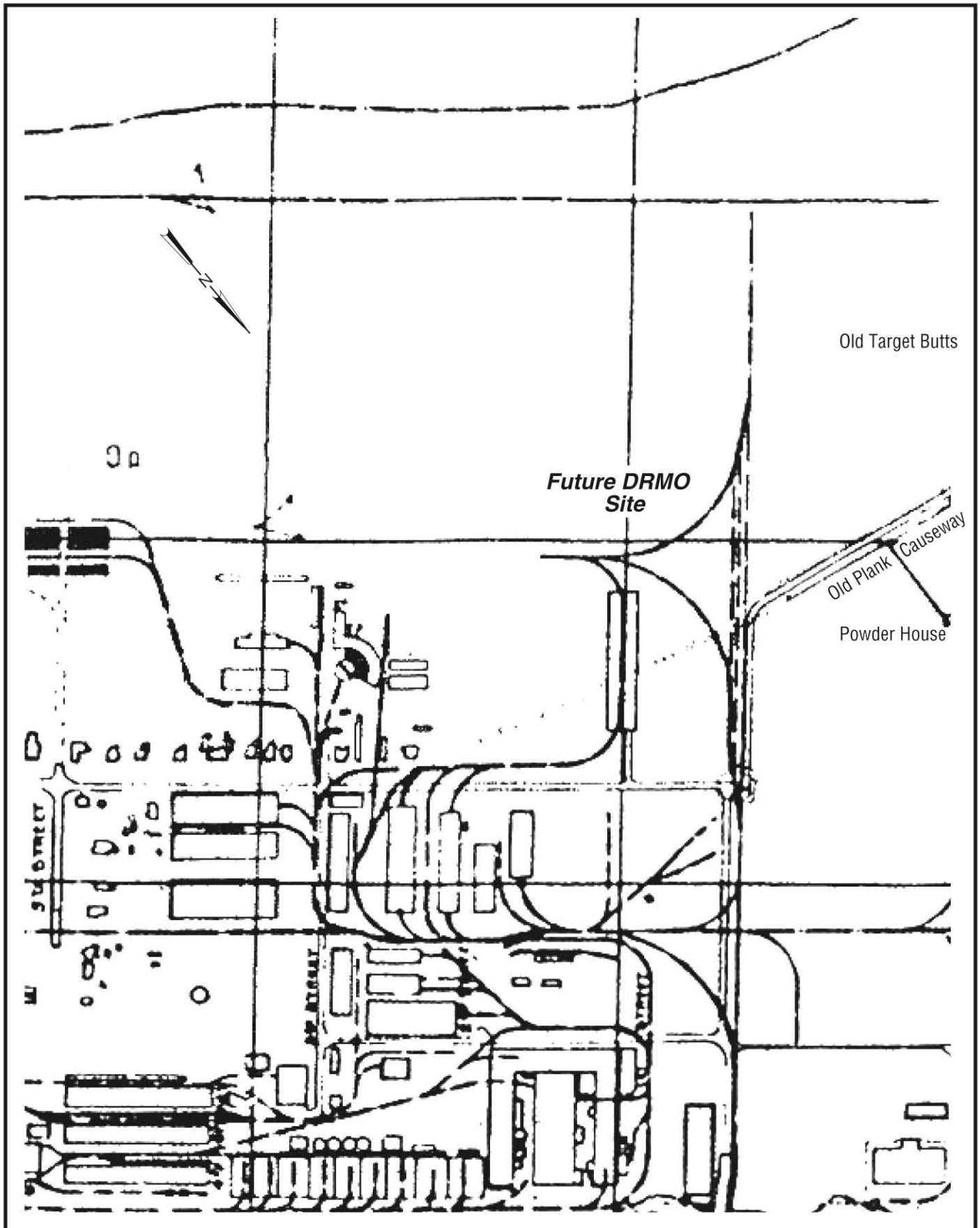


FIGURE A-3
PLAN OF U.S. NAVY YARD
JUNE 30, 1920
MARE ISLAND, CALIFORNIA

CH2MHILL

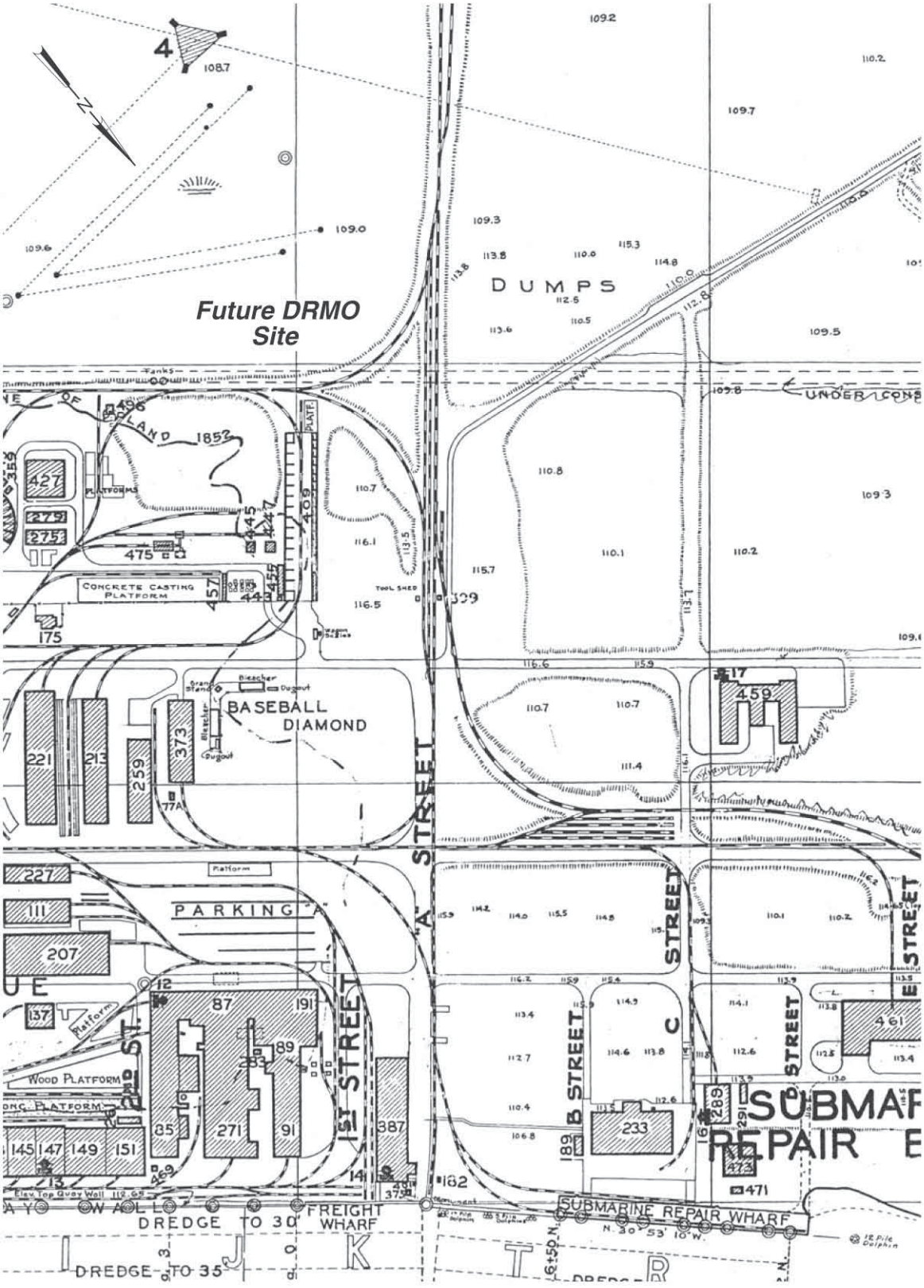


FIGURE A-4A
PLAN OF U.S. NAVY YARD
JUNE 30, 1935
MARE ISLAND, CALIFORNIA

CH2MHILL

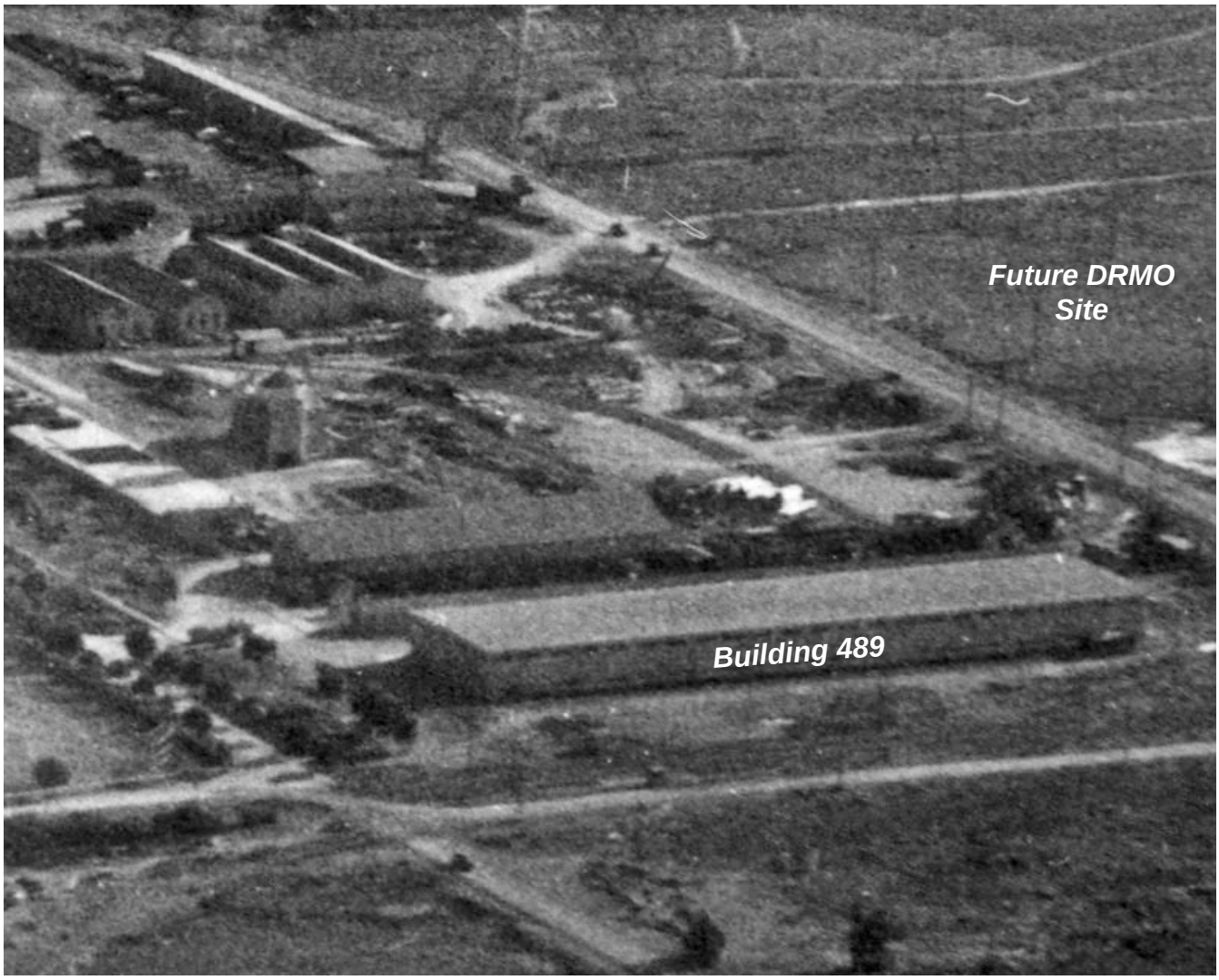


FIGURE A-4B
OBLIQUE AERIAL PHOTO FROM NORTH,
BUILDING 489 AREA, CIRCA 1936
(FROM WESTON SOLUTIONS, JUNE 2009)
MARE ISLAND, CALIFORNIA

CH2MHILL

FIGURE A-4C
OBLIQUE AERIAL PHOTO FROM NORTH,
BUILDING 489 AREA, CIRCA 1936
(FROM WESTON SOLUTIONS, JUNE 2009)
MARE ISLAND, CALIFORNIA

CH2MHILL

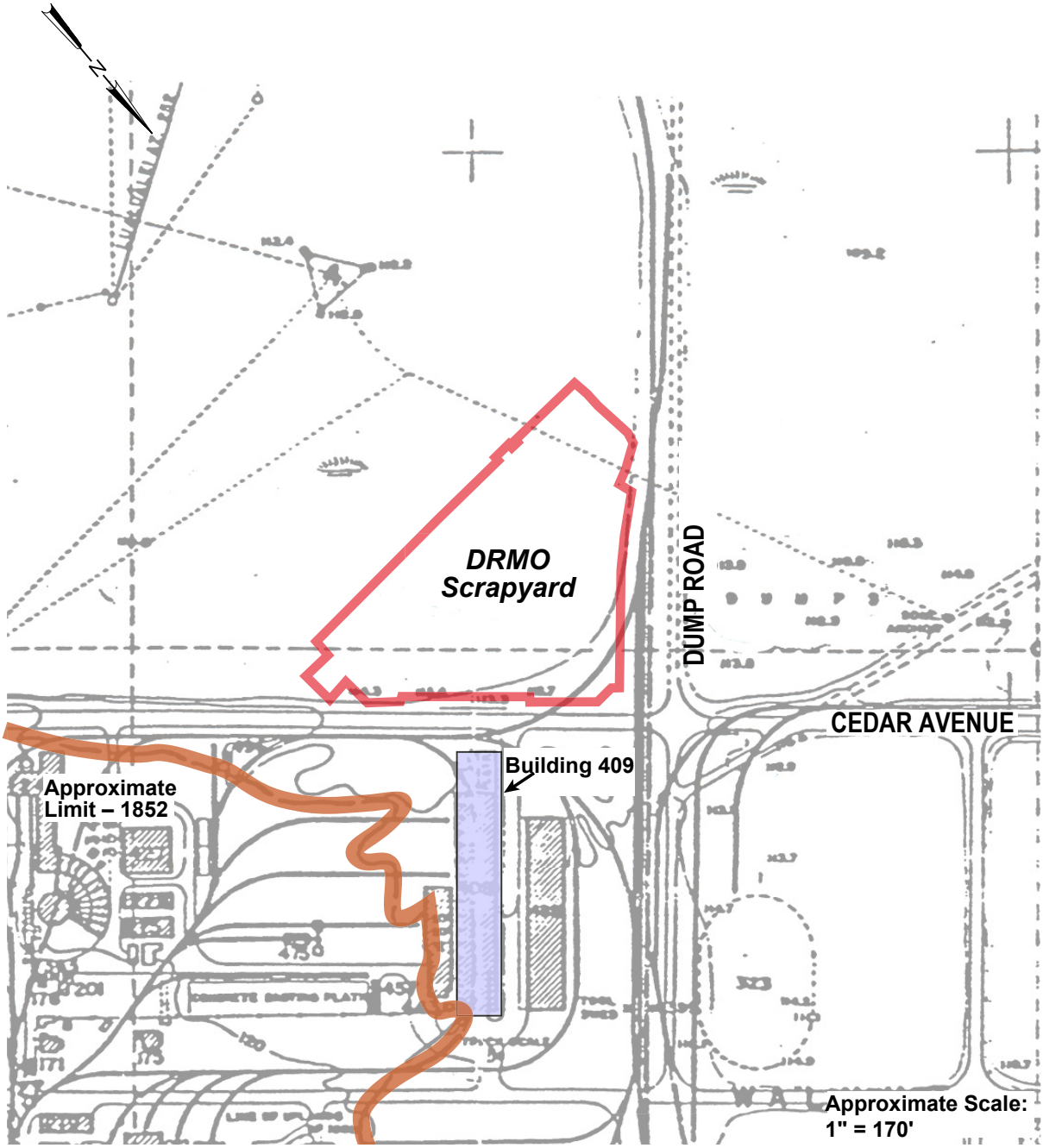


FIGURE A-5
PLAN OF U.S. NAVY YARD
1940
MARE ISLAND, CALIFORNIA

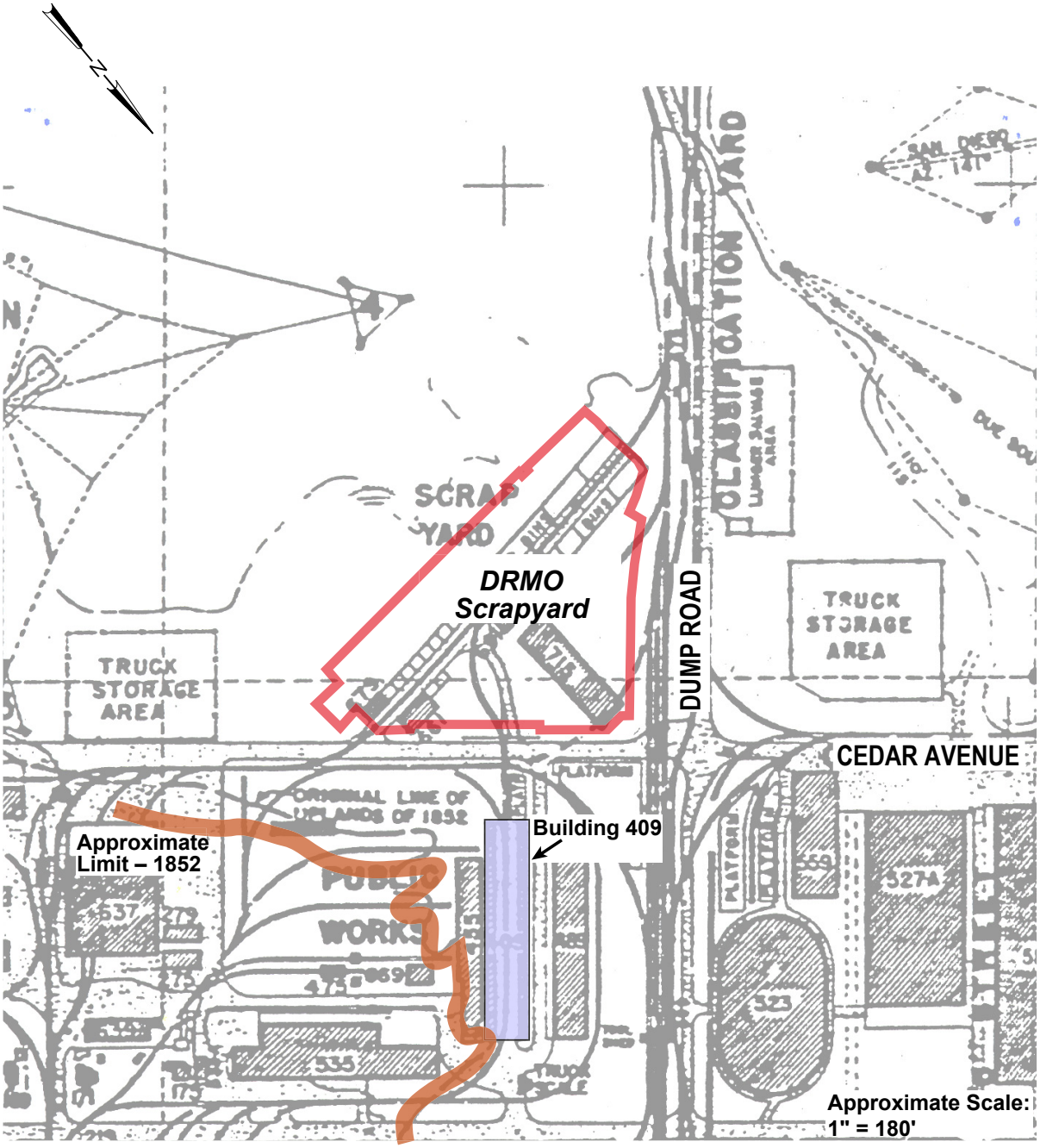


FIGURE A-6
PLAN OF U.S. NAVY YARD
1944
MARE ISLAND, CALIFORNIA

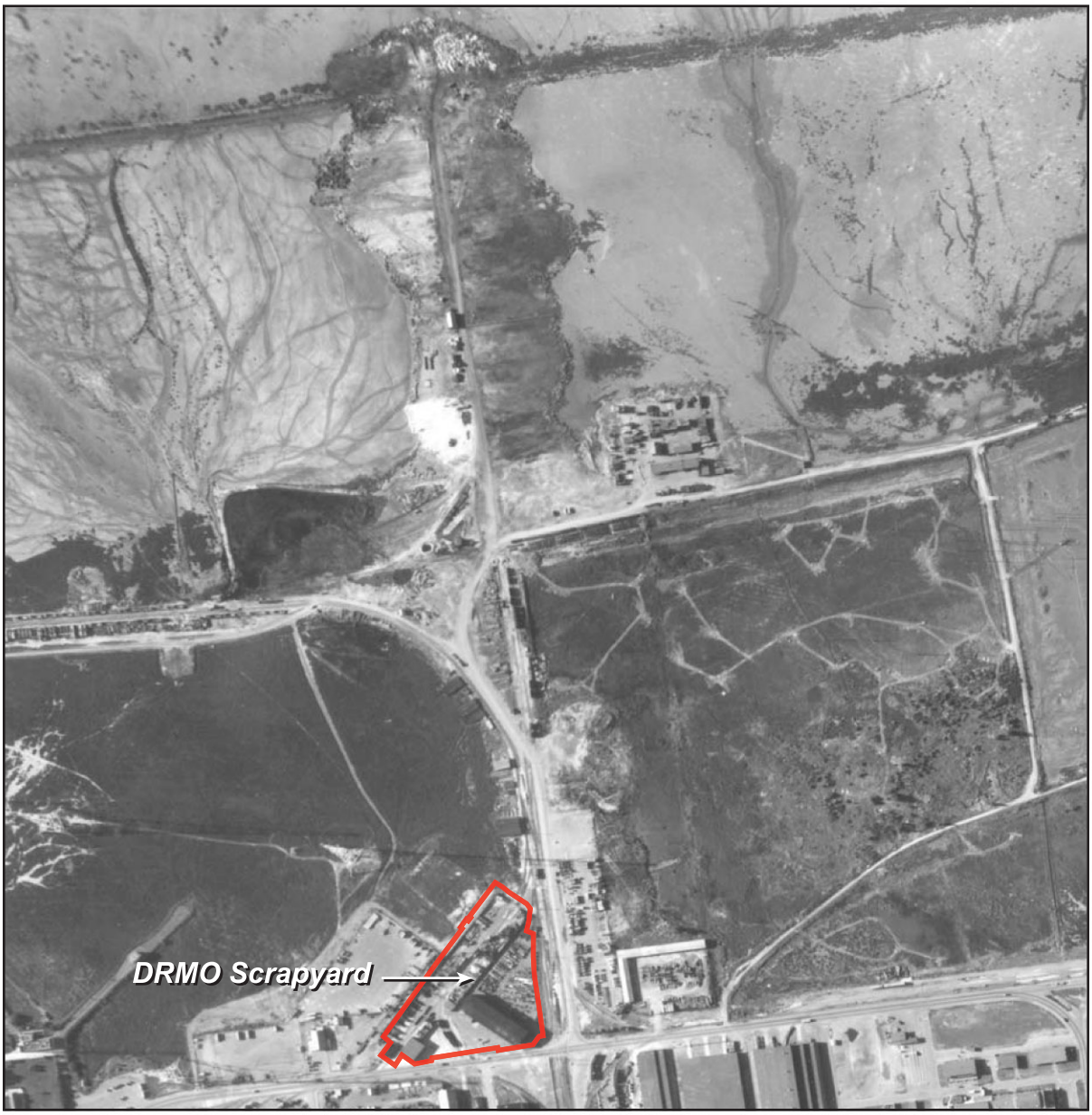


FIGURE A-7
PLAN OF U.S. NAVY YARD, 1949
MARE ISLAND, CALIFORNIA

FIGURE A-8
PLAN OF U.S. NAVY YARD, 1952
MARE ISLAND, CALIFORNIA

FIGURE A-9
PLAN OF U.S. NAVY YARD, 1958
MARE ISLAND, CALIFORNIA

CH2MHILL

FIGURE A-10
PLAN OF U.S. NAVY YARD, 1968
MARE ISLAND, CALIFORNIA

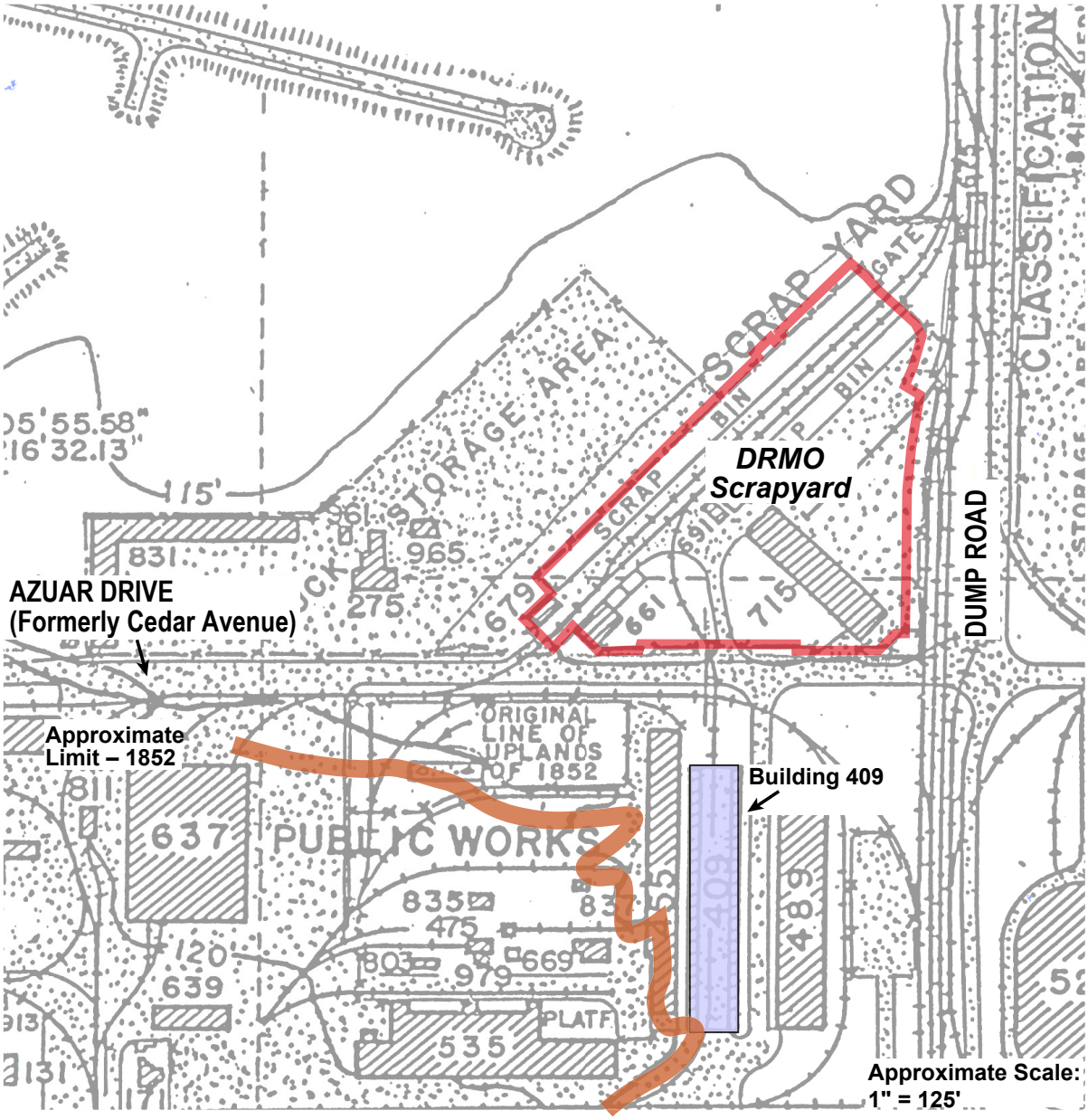


FIGURE A-11
PLAN OF U.S. NAVY YARD
1975
MARE ISLAND, CALIFORNIA

FIGURE A-12
PLAN OF U.S. NAVY YARD, 1980
MARE ISLAND, CALIFORNIA

FIGURE A-13
PLAN OF DRMO SITE,
2003
MARE ISLAND, CALIFORNIA

CH2MHILL

APPENDIX B

Historical Navy Documentation Regarding the Oil Sump Box and the Possible Extent of Free Product at the DRMO Site and in the Vicinity

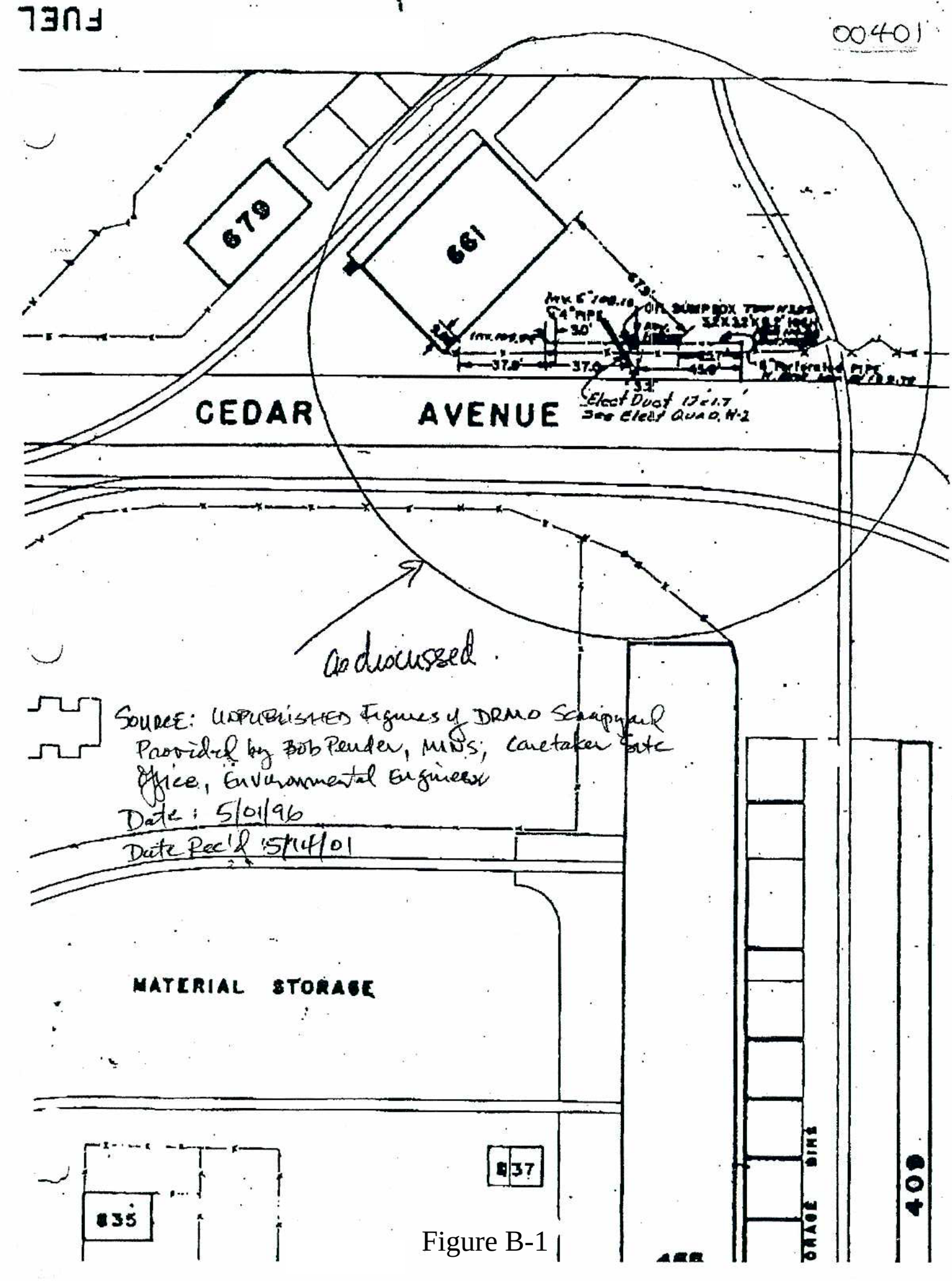

FUEL
00401
679
661
CEDAR AVENUE
MATERIAL STORAGE
835
837
409
As discussed.
SOURCE: UNPUBLISHED Figures of DRMO Scrapyard Provided by Bob Pender, MWS; Caretaker Site Office, Environmental Engineer
Date: 5/01/96
Date Rec'd 5/14/01

Figure B-1

EXPLANATION

- Coarse, Unconsolidated Fill
- Fine, Silty Clay
- Sand and Silty Clay
- Weathered Bedrock and Bedrock
- Manhole with Subsurface Utility Line
- Utility Line
- Fence
- Rail Track
- Water Table
- Potential Surface Transport (surface runoff and wind transport)
- Potential Transport via Dissolution of Soil Contamination or Free Product

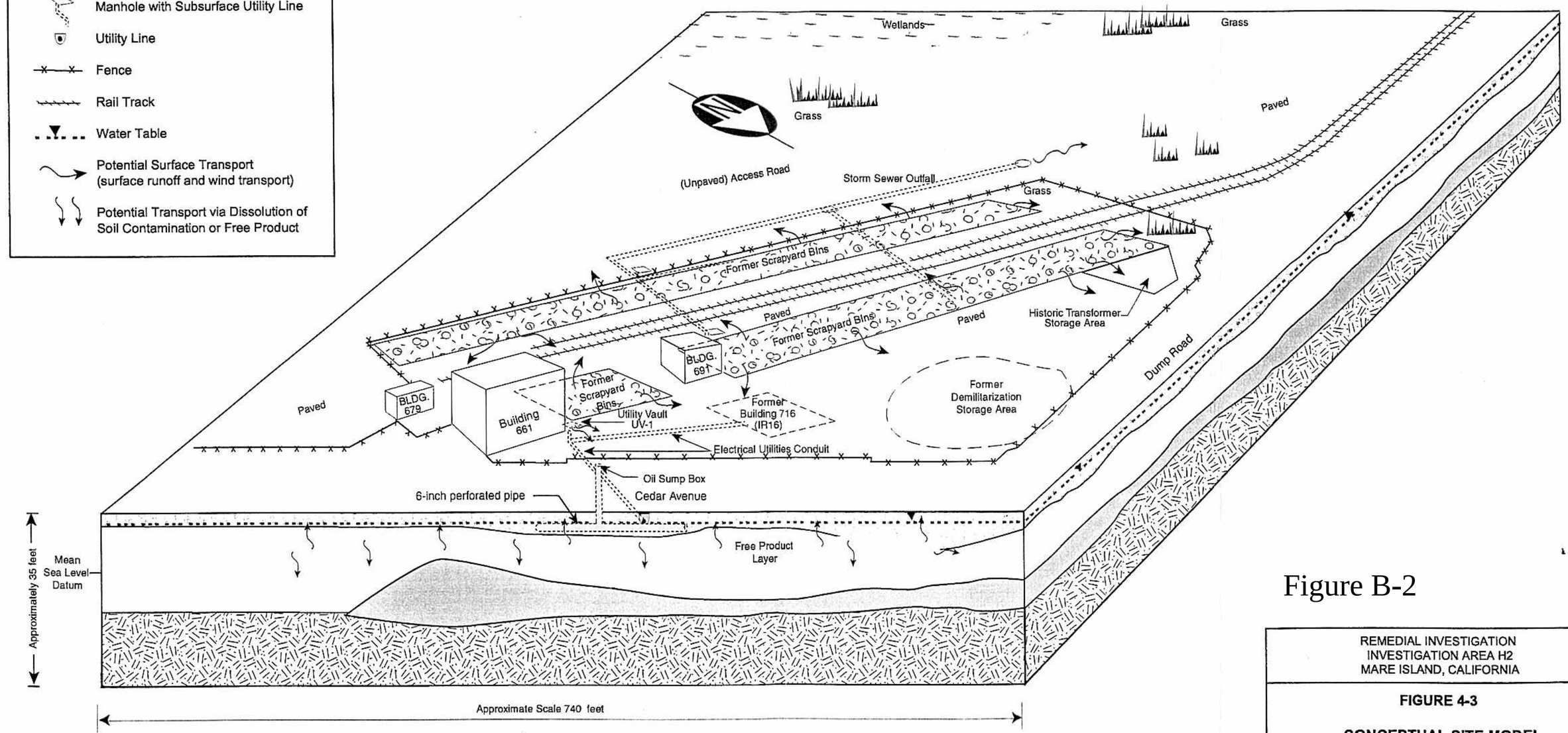


Figure B-2

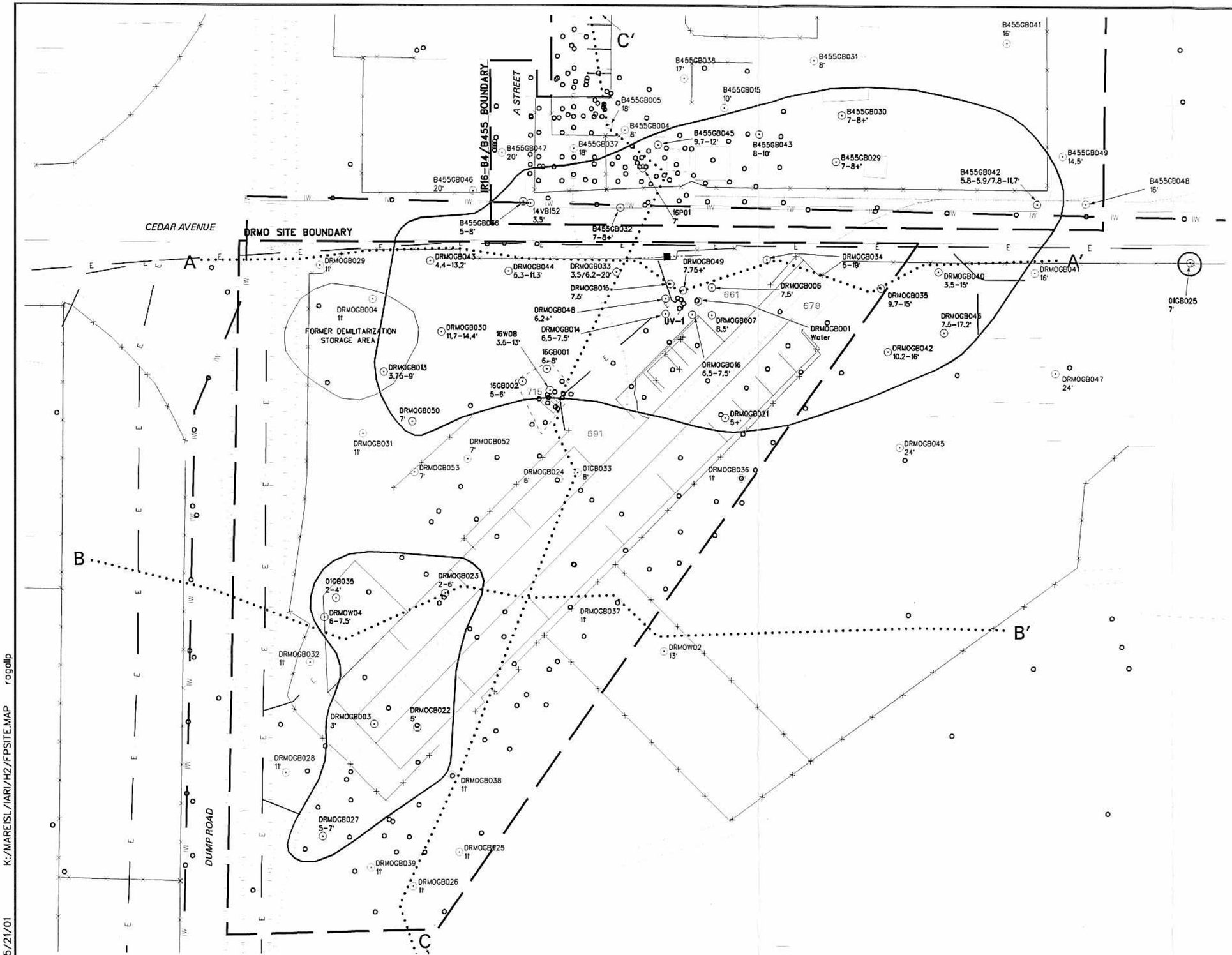
REMEDIAL INVESTIGATION
INVESTIGATION AREA H2
MARE ISLAND, CALIFORNIA

FIGURE 4-3

CONCEPTUAL SITE MODEL
DRMO AREA

DS.0132.12489

November 27,



K:/MAREISL/IARI/H2/FPSITE.MAP rogallp

05/21/01

INVESTIGATION AREA H2 ADDENDUM
MARE ISLAND, CALIFORNIA

FIGURE 1

EXTENT OF FREE PRODUCT
AT DRMO SCRAPYARD AND
IR16-B4/BUILDING 455 AREA

TC.0132.10946

APPENDIX C

Documentation from the Site Characterization and Analysis Penetrometer System Investigation at IR02, Former Waste Oil Disposal Sumps Area

SITE MAPS

FIGURE 3

DATA FROM SCAPS INVESTIGATION

MI Sump-124
32,554 @ 4.6'

Depth	5.0'
TPHg	<10
TPHjp5	<10
TPHd	<10
TPHdro	<10

SCAPS LIF PUSH LOCATION SHOWING PUSH ID, PEAK FLUORESCENCE INTENSITY AND DEPTH, AND WHERE APPLICABLE, DEPTH AND ANALYTICAL RESULTS IN mg/kg FOR SOIL SAMPLE. "<" INDICATES LESS THAN THE LIMIT OF DETECTION SHOWN.

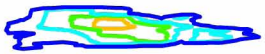
Push Location Symbols

- Non-POL fluorescence
- Potential POL fluorescence

MAXIMUM POL FLUORESCENCE

- <100,000 counts
- 100,000-150,000
- 150,000-200,000
- Clipped Signal

CONTOURS BASED ON ISOSURFACES FROM THREE-DIMENSIONAL INTERPOLATION OF LIF DATA.



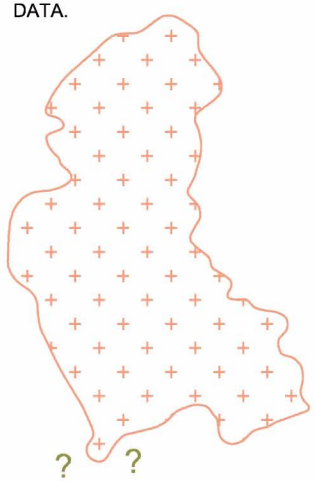
- =50,000 counts
- =100,000 counts
- =150,000 counts
- =200,000 counts

LOCATION OF CROSS SECTION

D D'

FIGURES 3 and 4

APPROXIMATE EXTENT OF PETROLEUM-IMPACTED SOIL BASED ON INTERPRETATION OF SCAPS LIF AND SAMPLING DATA.



QUERIED WHERE UNCERTAIN

FIGURE 4

DATA FROM PREVIOUS INVESTIGATIONS. DATA TAKEN FROM "Mare Island ArcView Query Station" by TtEMI.

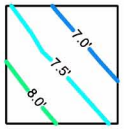
16GB039

Depth	3
TPHg	0
TPHd	0
TPHmo	810
TRPH	0

SOIL SAMPLE LOCATION FROM PREVIOUS INVESTIGATION SHOWING DEPTH IN FEET AND ANALYTICAL RESULTS IN mg/kg. DETECTION LIMITS UNKNOWN. DATA TAKEN FROM "Mare Island ArcView Query Station" by TtEMI.

16W01
9.33

MONITORING WELL LOCATION SHOWING WELL I.D., WATER TABLE ELEVATION IN FEET ABOVE MSL (assumed).

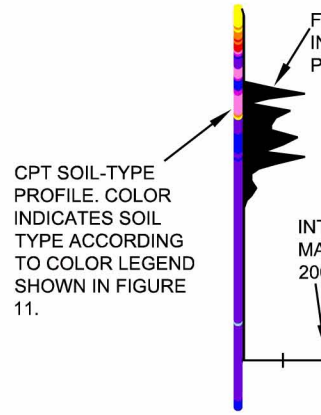


WATER TABLE ELEVATION IN FEET ABOVE MSL. CONTOUR INTERVAL IS 0.5 FEET. CONTOURS ARE LABELLED.

CROSS SECTIONS

SCAPS DATA PROFILE SHOWING PUSH I.D., MAXIMUM INTENSITY AND DEPTH.

MI Sump-113
152,641 @ 4.1'



SOIL SAMPLES

ALL SOIL SAMPLE LOCATIONS SHOW THE PUSH/BORING ID, AND ANALYTICAL RESULTS IN MG/KG.

- SOIL SAMPLE FROM SCAPS INVESTIGATION.
- SOIL SAMPLE FROM PREVIOUS INVESTIGATION.

GENERALIZED SOIL TYPES

- CLAY, SILTY CLAY
- SILT, CLAYEY SILT
- SAND, SANDY GRAVEL

NOTE: MIXED SOIL TYPES INDICATED BY COMBINED HATCH PATTERNS.

CONTOURS BASED ON ISOSURFACES FROM THREE-DIMENSIONAL INTERPOLATION OF LIF DATA.

- =50,000 counts
- =100,000 counts
- =150,000 counts
- =200,000 counts

WATER TABLE ELEVATION BASED ON INTERPOLATION OF DATA PROVIDED BY TtEMI. LEVELS MEASURED ON 05/26/99.

LEGEND FOR FIGURES E-1 AND E-2

LEGEND FOR MAPS AND CROSS SECTIONS

MARE ISLAND NAVAL SHIPYARD INSTALLATION RESTORATION SITE 02 FORMER WASTE OIL DISPOSAL SUMPS

NAVY PUBLIC WORKS CENTER
CODE 980
2730 MCKEAN ST. SUITE 1
SAN DIEGO, CALIFORNIA 92136

Date: 07-07-2000
File No. MIS fig2.dwg

FIGURE 2

SENSITIVE

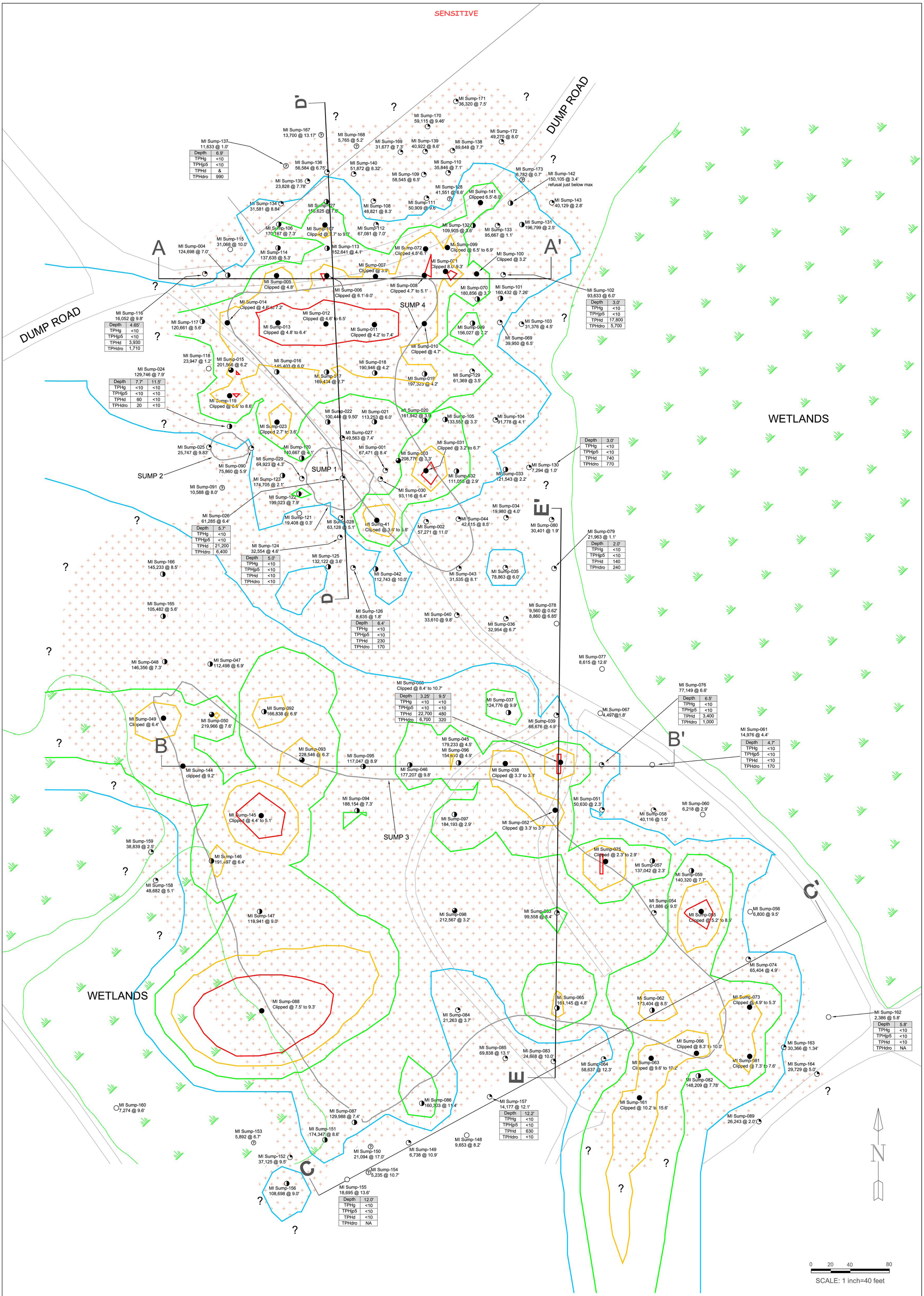


FIGURE C-1

NOTE: Legend is shown in Figure 2

SCAPS LIF DATA AND SOIL SAMPLE ANALYTICAL RESULTS

MAREI ISLAND NAVAL SHIPYARD
INSTALLATION RESTORATION SITE 02
FORMER WASTE OIL DISPOSAL SUMPS

NAVY PUBLIC WORKS CENTER
CODE 980
2730 MCKEAN ST. SUITE 1
SAN DIEGO, CALIFORNIA 92136

Date: 07-07-2000
File No. MIS fig3.dwg

FIGURE 3

SENSITIVE

SENSITIVE

Depth	3.5	7.5	9.5
TPHg	0	0	0
TPHd	0	160	0
TPHmo	0	0	47
TRPH	0	0	0

16GB056

Depth	3.5	7.5	9
TPHg	0	0	280
TPHd	0	0	6100
TPHmo	57	0	0
TRPH	0	0	0

16GB055

16GB057

Depth	3.5	7.5	9.5
TPHg	0	0	0
TPHd	0	0	0
TPHmo	0	0	54
TRPH	0	0	0

UPLASS001

Depth	0	1
TPHg	0.51	0.54
TPHd	100	11
TPHmo	170	95
TRPH	0	0

Depth	3.5	8	11.5
TPHg	0	7	0
TPHd	0	0	0
TPHmo	220	500	0
TRPH	0	0	0

16GB024

16W04
6.35

16GB027

Depth	2.5	7.5	11.5
TPHg	0	0	0
TPHd	0	0	0
TPHmo	0	0	0
TRPH	35	0	0

Depth	3.5	7.5
TPHg	940	6
TPHd	13000	0
TPHmo	0	0
TRPH	0	0

16GB028

16GB006

Depth	2	4.5
TPHg	0	0
TPHd	3700	0
TPHmo	0	0
TRPH	0	0

16GB007

Depth	2.5	4.5
TPHg	0	0
TPHd	0	0
TPHmo	410	160
TRPH	0	0

16GB068

Depth	2.5	5.5	9
TPHg	0	0	0
TPHd	0	930	0
TPHmo	0	0	0
TRPH	0	0	0

16GB008

Depth	2.75	5
TPHg	0	0
TPHd	0	0
TPHmo	44	0
TRPH	0	0

02GB012

Depth	1.5	5	7	10.5	13.5
TPHg	7	0	0	0	0
TPHd	1800	0	0	220	0
TPHmo	0	39	0	0	0
TRPH	0	0	0	0	0

16GB066

Depth	2.5	5.5
TPHg	0	0
TPHd	0	0
TPHmo	240	0
TRPH	0	0

16GB067

Depth	1.75	5.5
TPHg	0	300
TPHd	0	3100
TPHmo	48	0
TRPH	570	0

01VB007

Depth	3.42
TPHg	0
TPHd	0
TPHmo	110
TRPH	0

16GB025

Depth	3.5	8	11.5
TPHg	0	7	0
TPHd	0	0	0
TPHmo	220	500	0
TRPH	0	0	0

02GB013

Depth	1.5	3.5	7	10.5	13.5
TPHg	21	12	0	0	0
TPHd	0	0	0	0	0
TPHmo	550	250	0	52	94
TRPH	0	0	0	0	0

Depth	3	6.75	9.5
TPHg	0	0	0
TPHd	0	0	0
TPHmo	0	0	0
TRPH	0	24	0

16GB054

16GB019

Depth	4	8	11.5
TPHg	0	0	0
TPHd	0	0	0
TPHmo	0	210	0
TRPH	0	0	0

02GB008

Depth	1.5	4.5	7	9.5	13	15
TPHg	0	0	0	9	34	0
TPHd	0	0	0	0	1200	0
TPHmo	280	29	0	0	0	0
TRPH	0	0	0	0	0	0

16GB020

Depth	3.5	7.5	11.5
TPHg	0	0	0
TPHd	0	370	0
TPHmo	0	0	0
TRPH	0	0	0

02GB015

Depth	1.5	3.5	7.5
TPHg	0	21	290
TPHd	0	1500	2300
TPHmo	0	0	0
TRPH	0	0	0

01SA009

Depth	0
TPHg	0
TPHd	0
TPHmo	810
TRPH	840

16GB021

Depth	1.5	3.5	7.5
TPHg	0	0	2500
TPHd	0	0	8100
TPHmo	0	2200	0
TRPH	0	?	0

01VB006

Depth	3
TPHg	0
TPHd	0
TPHmo	150
TRPH	0

DUMP ROAD

DUMP ROAD

SUMP 4

01GB101

Depth	1.5	3.5	7.5	14
TPHg	0	0	0	0
TPHd	8000	3300	17000	11
TPHmo	24000	9500	44000	49
TRPH	0	0	0	0

01SA008

Depth	0
TPHg	0
TPHd	0
TPHmo	76
TRPH	26

01GB102

Depth	1.5	3.5	7.5
TPHg	0	0	0
TPHd	13	640	0
TPHmo	16	690	0
TRPH	10	20	0

01-SS05IT

Depth	2
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

01HA008

Depth	0	3.5
TPHg	0	0
TPHd	0	840
TPHmo	220	83
TRPH	0	0

01HA013

Depth	0	2.5
TPHg	0	0
TPHd	0	0
TPHmo	230	0
TRPH	0	0

01HA009

Depth	0	3
TPHg	0	0
TPHd	0	0
TPHmo	0	45
TRPH	0	0

01HA014

Depth	0	2.5
TPHg	0	0
TPHd	0	160
TPHmo	0	0
TRPH	0	0

WETLANDS

01-SS04IT

Depth	2
TPHg	0
TPHd	0
TPHmo	0
TRPH	540

SUMP 2

SUMP 1

02TP002

Depth	0
TPHg	49700
TPHd	5300
TPHmo	10000
TRPH	0

02TP001

Depth	0
TPHg	3440
TPHd	2300
TPHmo	2900
TRPH	0

02W02
9.22

01HA010

Depth	0	3
TPHg	0	0
TPHd	0	0
TPHmo	45	57
TRPH	0	0

6.5'

7.0'

7.5'

8.0'

8.5'

9.0'

9.5'

10.0'

10.5'

02GB045

Depth	3
TPHg	85800
TPHd	650
TPHmo	1000
TRPH	0

01HA011

Depth	0	3
TPHg	0	0
TPHd	0	0
TPHmo	200	0
TRPH	0	0

01W51
8.79

01W51

Depth	3.5	7
TPHg	0	0
TPHd	0	0
TPHmo	0	0
TRPH	15000	11000

Depth	1.5	6.5	19.5
TPHg	0	0	0
TPHd	20	50000	11
TPHmo	680	110000	21
TRPH	0	0	0

16GB072

02GB039

Depth	1.5	3.5	7	10	13	18.5
TPHg	0	0	840	0	220	0
TPHd	0	0	30000	0	15000	0
TPHmo	0	760	0	0	0	0
TRPH	0	0	0	0	0	0

Depth	3	5.5	7.5
TPHg	4700	2500	730
TPHd	14000	12000	5900
TPHmo	0	0	0
TRPH	0	0	0

16GB050

16GB045

Depth	2.5	5.5	7.5
TPHg	0	0	0
TPHd	0	78	62
TPHmo	0	0	0
TRPH	0	0	0

Depth	2.5	4.75	7.5
TPHg	0	0	0
TPHd	0	96	0
TPHmo	0	0	0
TRPH	0	34	0

16GB041

01-SB04IT

Depth	2.5	3.5
TPHg	0	0
TPHd	0	0
TPHmo	0	0
TRPH	50	50

02GB042

Depth	0
TPHg	193000
TPHd	1500
TPHmo	3100
TRPH	0

16GB044

Depth	3.25	6.5	11.5
TPHg	3000	0	23
TPHd	8800	0	670
TPHmo	0	0	0
TRPH	12000	0	0

SUMP 3

02W01
9.69

16GB043

Depth	1.5
TPHg	0
TPHd	0
TPHmo	3100
TRPH	0

02TP005

Depth	6
TPHg	24500
TPHd	3500
TPHmo	4700
TRPH	0

16GB040

Depth	2.5	5.5	7.5
TPHg	13	210	38
TPHd	4000	5100	570
TPHmo	0	0	0
TRPH	0	0	0

16GB039

Depth	3
TPHg	0
TPHd	0
TPHmo	810
TRPH	0

02GB019

Depth	1.5	3.5	7.5	10.5
TPHg	0	0	0	0
TPHd	0	0	0	0
TPHmo	0	38	91	45
TRPH	0	0	0	0

16GB035

Depth	2.5	5.5	7.5
TPHg	0	0	0
TPHd	0	0	0
TPHmo	0	0	79
TRPH	0	0	0

Depth	2.5
TPHg	19
TPHd	380
TPHmo	0
TRPH	0

16GB051

UPLASS010

Depth	0	1
TPHg	0.52	0.52
TPHd	130	130
TPHmo	1000	1500
TRPH	0	0

Depth	3.5
TPHg	46
TPHd	1200
TPHmo	0
TRPH	0

16GB036

16W03
10.3

16GB037

Depth	2.5	7	15
TPHg	0	21	290
TPHd	0	0	1300
TPHmo	1300	0	0
TRPH	0	0	0

16W01
9.33

16GB034

Depth	2.5	5.5	7.5
TPHg	0	19	12
TPHd	110	0	160
TPHmo	0	0	0
TRPH	0	0	0

02GB040

Depth	1.5	3.5	6.5	10.5	14.5
TPHg	0	970	34	1100	100
TPHd	0	20000	1500	12000	1100
TPHmo	0	0	0	0	0
TRPH	0	0	0	0	0

Depth	2.5	4.75	7.5
TPHg	7.0	48	79
TPHd	0	990	5200
TPHmo	0	72	0
TRPH	0	130	0

16GB033

Depth	5.5	2.5	7.5
TPHg	600	0	310
TPHd	26000	0	8000
TPHmo	0	0	0
TRPH	0	0	0

Depth	5
TPHg	538
TPHd	2000
TPHmo	4800
TRPH	0

02GB044

16GB032

02GB016

Depth	1.5	3.5	10	13.5
TPHg	0	0	0	0
TPHd	0	0	0	0
TPHmo	0	0	0	56
TRPH	0	0	0	0

Depth	1.5	3.5	7	10	13
TPHg	0	0	0	67	30
TPHd	0	89	210	400	220
TPHmo	0	0	0	0	0
TRPH	0	0	0	0	0

02GB038

16GB053

Depth	2.5	4.75	7.5
TPHg	0	0	260
TPHd	220	0	2800
TPHmo	0	0	0
TRPH	0	45	0

16GB052

Depth	1.75	5.5	7.5
TPHg	0	130	620
TPHd	0	3500	2500
TPHmo	240	0	0
TRPH	26	0	0

Depth	1.5	3.5	7	10	13
TPHg	10	0	19	28	19
TPHd	240	160	310	340	420
TPHmo	0	0	0	0	0
TRPH	0	0	0	0	0

02-GB036

16W02
10.74

02GB032

Depth	1.5	4.5	7.5	10.5	13.5	16.5
TPHg	0	13	10	120	96	0
TPHd	0	240	0	1700	890	0
TPHmo	71	0	0	0	0	0
TRPH	0	0	0	0	0	0

02GB018

Depth	1.5	3.5	7.5	10.5
TPHg	0	0	0	0
TPHd	0	0	0	0
TPHmo	0	0	0	0
TRPH	0	0	0	0

01-SB05IT

Depth	2.5	5.5
TPHg	0	0
TPHd	0	0
TPHmo	0	0
TRPH	50	50

01SA003

Depth	0
TPHg	0
TPHd	0
TPHmo	0
TRPH	21

02GB017

Depth	1.5	3.5	7.5	11
TPHg	0	0	0	0
TPHd	0	0	0	1100
TPHmo	0	160	0	0
TRPH	0	43	0	0

01HA021

Depth	0	2.5	5.5	7.5
TPHg	0	0	0	25
TPHd	0	0	0	590
TPHmo	86	61	0	0
TRPH	0	0	0	0

WETLANDS

01-SS12IT

Depth	4
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

01-SS13IT

Depth	3.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	38000

02TP004

Depth	7
TPHg	12900
TPHd	5000
TPHmo	14000
TRPH	0

01-SS15IT

Depth	3.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	88

01-SS14IT

Depth	5
TPHg	0
TPHd	0
TPHmo	0
TRPH	61

WETLANDS

02GB025

Depth	1.5	4.5	7.5	10.5	13.5	16.5
TPHg	0	0	11	0	9	0
TPHd	290	0	160	390	830	0
TPHmo	220	45	0	0	0	67
TRPH	0	0	0	0	0	0

01-SB07IT

Depth	2.5	5.5
TPHg	0	0
TPHd	0	0
TPHmo	0	0
TRPH	50	68

01-SS20IT

Depth	4
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

02GB043

Depth	7
TPHg	15400
TPHd	980
TPHmo	3300
TRPH	0

02GB037

Depth	1	3	7	10	13	15
TPHg	0	0	11	48	0	0
TPHd	0	0	360	3400	410	0
TPHmo	220	45	0	0	0	0
TRPH	0	0	0	0	0	0

01-SS16IT

Depth	0.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

01GB074

Depth	0	2.5	4.5	8.5	11.5	14.5	18	19.5
TPHg	0	0	0	0	0	0	0	13
TPHd	0	0	7	0	0	0	0	730
TPHmo	39	0	82	0	0	0	0	0
TRPH	0	0	14	0	0	0	0	0

01-SS19IT

Depth	0.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

01-SS18IT

Depth	0.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	50

01W36A
10.5

10.5'

Depth	1.5	3.5	7	10	13
TPHg	0	0	12	9	18
TPHd	0	170	290	150	97
TPHmo	220	0	0	0	0
TRPH	0	0	0	0	0

02GB035

Depth	0.5
TPHg	0
TPHd	0
TPHmo	0
TRPH	?

01-SS17IT

Depth	1.5	3.5	7.5	10.5	13.5	16.5
TPHg	0	0	0	0	0	0
TPHd	0	0	0	0	0	0
TPHmo	0	0	0	0	0	0
TRPH	0	0	0	0	0	0

02GB033

Depth	1.5	4.5	7	10	13.5
TPHg	0	0	11	19	24
TPHd	0	0	310	330	390
TPHmo	86	0	0	0	0
TRPH	0	0	0	0	0

0 20 40 80

SCALE: 1 inch=40 feet

FIGURE C-2

WATER TABLE AND SOIL SAMPLE ANALYTICAL RESULTS FROM PREVIOUS INVESTIGATIONS

MARE ISLAND NAVAL SHIPYARD
INSTALLATION RESTORATION SITE 02
FORMER WASTE OIL DISPOSAL SUMPS

NAVY PUBLIC WORKS CENTER
CODE 980
2730 MCKEAN ST. SUITE 1
SAN DIEGO, CALIFORNIA 92136

Date: 07-07-2000
File No. MIS fig4.dwg

FIGURE 4

NOTE: Legend is shown in Figure 2

SENSITIVE

APPENDIX D

Documentation from the Oil Sump Box Investigation

APPENDIX D1

Boring and Trench Logs

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB01	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water ____ feet	12/19/05	12/19/05	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	COMMENTS: SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		10" ashphalt core
2						WELL GRADED GRAVEL (GW) dark brown 10YR 4/3, dry, loose gravel		OVM = background hand augered to 5 feet
3						SANDY LEAN CLAY (CL) very pale brown 10YR 7/4, dry, stiff clay with clasts of weathered sandstone		appears to be weathered bedrock at 2 feet
4						SANDY LEAN CLAY (CL) Yellowish brown 10YR 5/6, moist clay with fine sand		
5								Hard material at 3-1/2 feet deflects breaker bar, move hole over auger again
6						WEATHERED SANDSTONE (SST) Yellowish brown 10YR 5/6, moist, hard, fine grained, weathered sandstone		OVM = background
7			2.0					
8								
9						WEATHERED SANDSTONE (SST) Yellowish brown 10YR 5/6, wet, hard, weakly cemented, medium grained, weathered sandstone		
10			2.0					
11						CLAYEY SAND WITH GRAVEL (SC) Black N2.5, wet, dense, oily, sand, clay and gravel.		Black material at 10 feet OVM = 1 ppm Sample OSBGB01-S12 for VOCs, SVOCs, TPH diesel & motor oil, PCB and Cam 17 metals
12								
13								
14			2.0			CLAYEY SAND (SC) Yellowish brown 10YR 6/6, moist, dense, fine sand with clay		OVM = 0 ppm
15								
16								
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface, Top soil replaced Ashphalt patched
20								
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB02	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water 4 feet	12/19/05	12/19/2005	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		10" ashphalt core
2						WELL GRADED GRAVEL WITH SAND (GW) dark brown 10YR 4/3, dry, loose, fine to coarse, angular gravel		OVM = background hand augered to 5 feet
3								
4						SANDY LEAN CLAY (CL) Grayish Green 5G 4/2, dry, stiff clay with >30% fine sand and silt		green material at 3 feet
5								water at app. 4 feet
6						SANDY LEAN CLAY (CL) Grayish Green 5G 4/2 with some yellowish brown 10YR 5/6, wet, firm clay		OVM = 2 ppm on fresh sample
7			2.0			GRAVELLY LEAN CLAY (CL) Greenish gray 5GY 5/4, wet, soft clay with gravel		piece of wood at 7 feet
8								no black material observed
9						`		
10			2.0					
11								OVM = background
12								No samples taken this boring
13						LEAN CLAY WITH SAND (CL) Greenish Gray 5GY 5/4, wet, soft clay with silt and sand.		
14			4.0					OVM = 0 ppm
15								
16						SILTY SAND (SM) Yellowish brown 10YR 5/6, moist, dense, fine sand with silt dippping app. 40 degrees		Weathered bedrock at 15 feet
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface,
20								Top soil replaced Ashphalt patched
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB03	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water ____ feet	12/20/05	12/20/05	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	COMMENTS: SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		
2						WELL GRADED GRAVEL WITH SAND (GW) dark brown 10YR 4/3, dry, loose gavel with coarse sand- road base		Dec. 19, 2005 hand augered to 5 feet
3								
4						SANDY LEAN CLAY (CL) Grayish Green 5GY 4/2, moist, firm clay		
5						SANDY LEAN CLAY (CL) Grayish Green 5GY 4/2, wet, firm clay		MiniRae = background
6						GRAVELLY LEAN CLAY (CL) Grayish green 5G 4/2, wet, soft clay with app. 40% gravel		Dec. 20, 2005 start coring Sample OSBGB03-S06 for VOCs,
7			1.5					SVOCs, TPH- diesel & motor oil PCBS & CAM 17 metals
8						Block of wood in clay		block of wood at 7 feet Minirae background level
9			0.3 0.5					very hard drilling, repeated attempts only went a few inches
10						Total Depth 9 feet		
11								Borehole grouted to surface, Top soil replaced Ashphalt patched
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB09	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive App 280 ft S of Dump Rd.

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water ____ feet	12/20/2005	12/20/2005	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		10" ashphalt core
2						WELL GRADED GRAVEL (GW) dark brown 10YR 4/3, dry, loose gravel		OVM = background hand augered to 5 feet
3						CLAYEY SAND (SC) Grayish Green 5GY 4/2, moist fine sand with clay		Raining, cold
4								
5								
6						LEAN CLAY (CL) Grayish green 5GY 4/2 and Black , soft, wet clay with oil.		very soft from 5 to 10 feet. Black viscous oil coming out of core barrel for 5 to 8 foot sample
7			0.5					only 5 inches of green clay recovered
8			5 inches					Sample OSB-GB09-S07 for VOCs, SVOCs, TPH diesel & motor oil, PCB and Cam 17 metals
9			2.0			LEAN CLAY (CL) Grayish green 5GY 4/2 and Black , soft to firm, wet clay with soft greenish black fill material		Filled 40 ml Vials with oil for "fingerprinting" analysis OVM = background
10								soft, black-green material
11			2.0					
12								
13						LEAN CLAY (CL) Grayish green 5GY, soft, wet clay with black streaks of oil or organic material.		
14			2.0					
15								
16								
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface, Top soil replaced Ashphalt patched
20								
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB10	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive app. 200 ft S of Dump Rd.

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water 2.3 feet	12/20/2005	12/21/2005	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	COMMENTS: SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		raining cold 14" ashphalt core
2						WELL GRADED SAND WITH GRAVEL (SW/GW) dark brown 10YR 4/3, dry , loose coarse sand with gravel.		OVM = 17 ppm on fresh sample, odor
3						POORLY GRADED SAND (SP) light yellowish brown 10Y 6/3, dry, fine sand with silt and gravel		OVM=22 ppm on fresh sample petroleum odor
4						CONCRETE		Breathing zone = background water level at 2.3 feet. many oil drops on the water in the borehole
5						*NEED NOTES FROM BEN*		
6						SILTY SAND (SM) yellowish brown 10YR 5/4, moist, fine sand with silt		hand augered to 5 feet OVM = 2 ppm on fresh sample
7			2.5			LEAN CLAY (CL) Grayish green 5GY 4/2, soft, wet clay with shell fragments to 2 mm.		
8								Sample OSB GB10-S07 for VOCs, SVOCs, TPH diesel & motor oil, PCB and Cam 17 metals
9			0.3			LEAN CLAY (CL) Grayish green 5GY 4/2, soft to firm, wet clay with soft greenish black fill material		
10			3 inches					very poor recovery even with sample catcher in core barrel
11								some gravel in core barrel probably gravel fill
12								
13						LEAN CLAY (CL) Grayish green 5GY, soft, wet clay		OVM = 2 ppm on fresh sample
14			2.0					
15								
16								
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface, Top soil replaced Ashphalt patched
20								
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB11	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: South Bound Lane Azuar Drive App 80 Ft S of Dump Rd.

DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water 2.5 feet	12/20/2005	12/21/2005	Rob Pexton, RG, CEG, CHG

DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	COMMENTS: SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		Raining, Cold first 2-1/2 feet is ashphalt over concrete petroleum odor OVM = 17 ppm on fresh sample
2						CONCRETE		
3						POORLY GRADED GRAVEL WITH SAND (GP) dark brown WELL GRADED GRAVEL (GW) reddish brown		no petroleum odor
4						SANDY LEAN CLAY WITH GRAVEL (CL) Grey moist clay		OVM 15.6 ppm on fresh sample hand augered to 5 feet
5								
6						SANDY LEAN CLAY (CL) Grayish green 5GY 4/2, soft, wet clay with silt		OVM = background on fresh sample
7			2.0			LEAN CLAY (CL) Grayish green 5GY 4/2, soft, wet clay with shell fragments to 2 mm. black organic matter in the clay.		Sample OSB GB11-S08 for VOCs, SVOCs, TPH diesel & motor oil, PCB and Cam 17 metals
8								
9			4.0			LEAN CLAY (CL) Grayish green 5GY 4/2, soft, wet with shell fragments to 2 mm.		Solano County Grout Inspector Bradley on site.
10								
11								
12								
13						LEAN CLAY (CL) Grayish green 5GY, soft, wet clay some spots of black organic mater in the clay.		OVM = background
14			4.0					
15								
16								
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface, Top soil replaced Ashphalt patched
20								
21								
22								
23								
24								
25								

CH2MHILL

PROJECT NUMBER:	BORING NUMBER:	SHEET 1 OF 1
273939.11.01	OSBGB12	

PROJECT NAME: Mare Island Sump Investigation, Vallejo, Ca

LOCATION: Azuar Drive at Dump Road Railroad tracks.

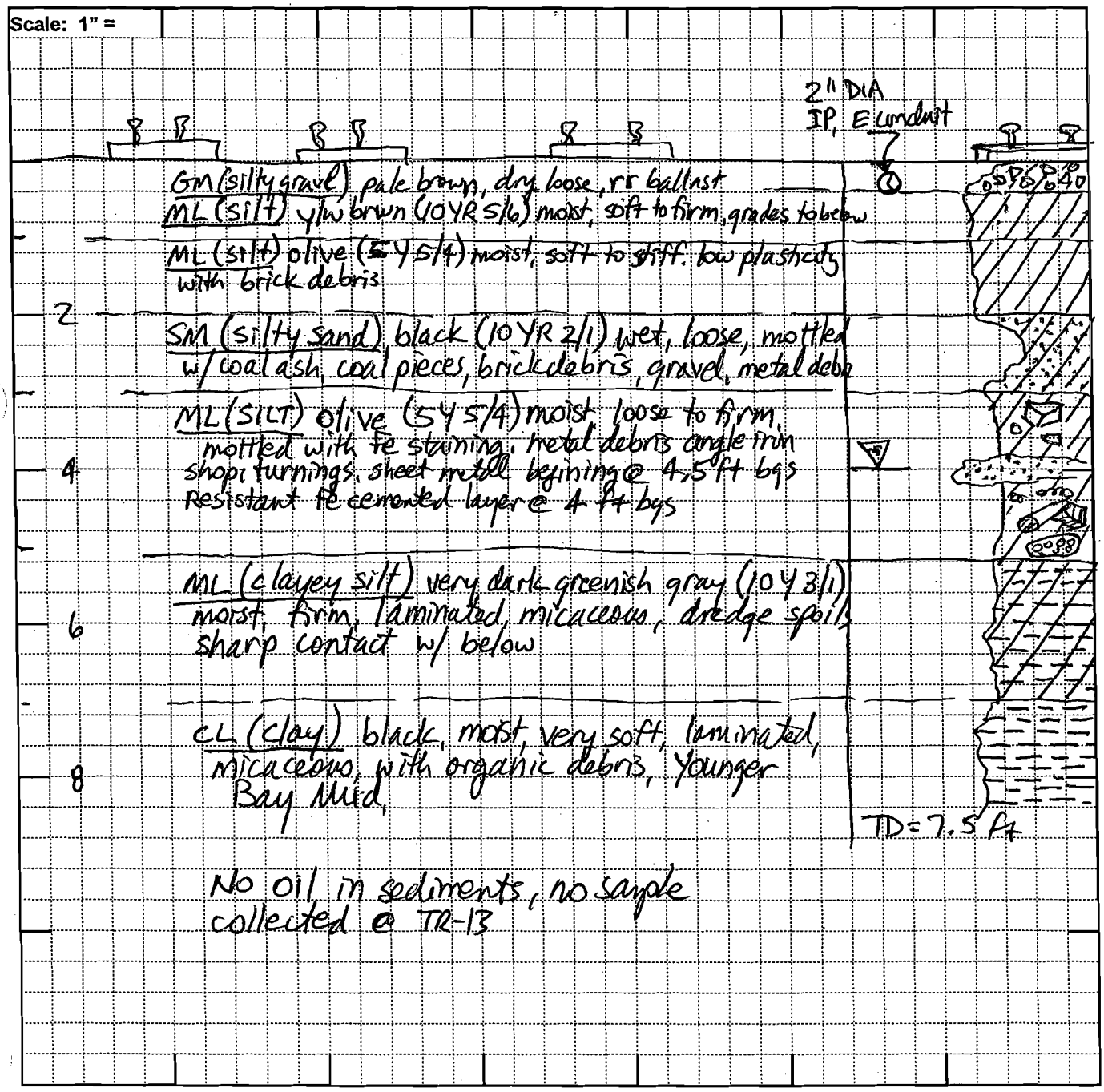
DRILLING CONTRACTOR: Precision Sampling, Richmond Ca.

DRILLING METHOD AND EQUIPMENT: Direct push Geoprobe coring unit mounted on 3500 Flatbed Truck

WATER LEVELS, DATE, AND TIME:	DRILLING START DATE:	DRILLING FINISH DATE:	LOGGER:
first water 2.5 feet	12/21/2005	12/21/2005	Rob Pexton, RG, CEG, CHG

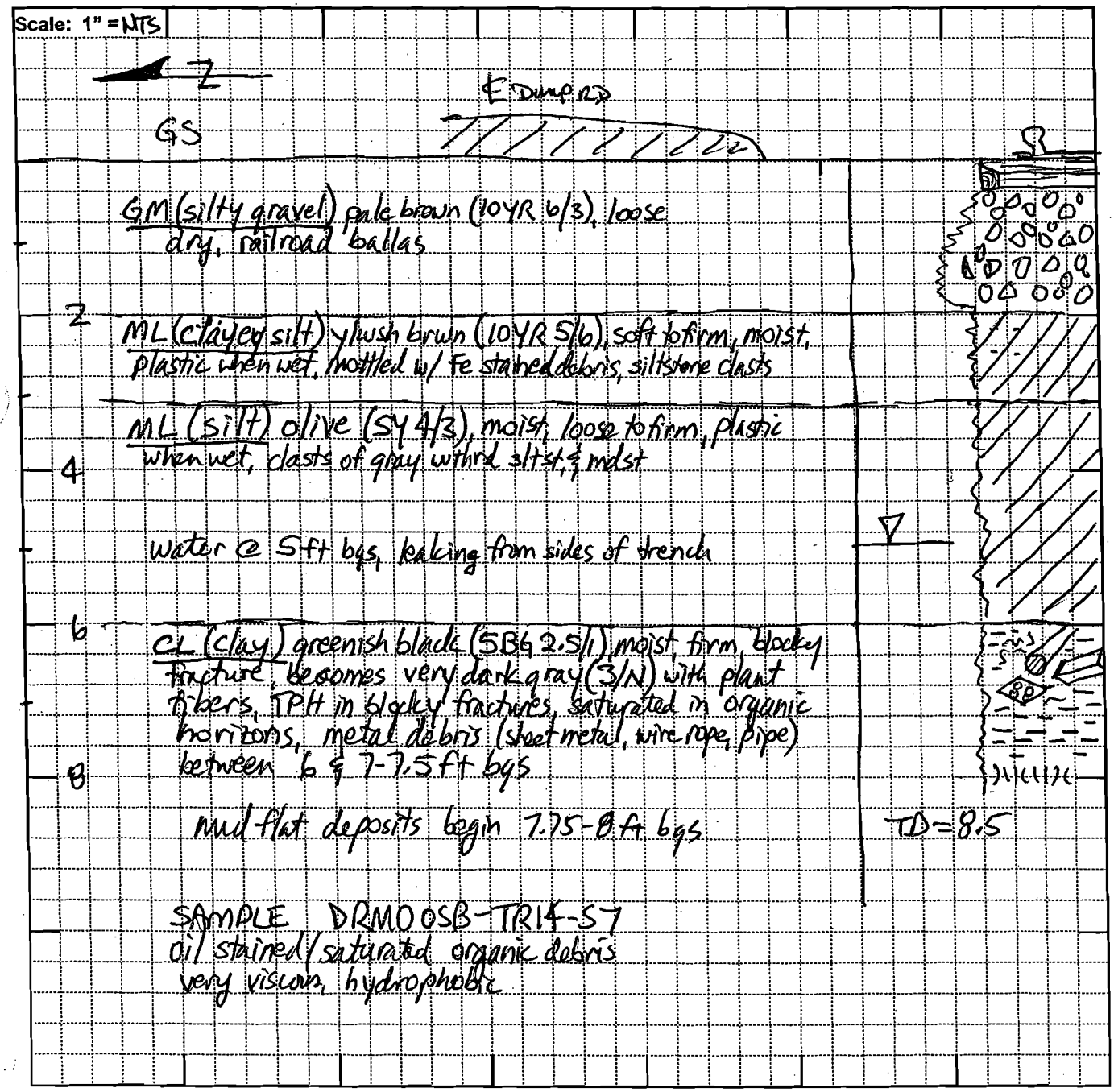
DEPTH BELOW SURFACE (FEET)	SPT BLOW COUNT 6"-6"(N)	SAMPLE INTERVAL DEPTH (FEET)	LENGTH OF RECOVERY OF CORE (FEET)	SAMPLE NAME & TYPE E.G.cuttings	SYMBOLIC LOG	CORE DESCRIPTION: SOIL NAME, (USCS SYMBOL), COLOR (STAINING), MOISTURE CONTENT, RELATIVE DENSITY, CONSISTENCY, SOIL STRUCTURE, MINERALOGY, ODOR, PRESENCE OF NON AQUEOUS PHASE LIQUID, OTHER CONTAMINANTS	COMMENTS: SYMBOLIC LOG	COMMENTS: DRILLING RATE, DRILLING FLUID LOSS CIRCULATION ZONES, TESTS CONDUCTED WATER LEVELS, WELL INSTRUMENTATION
1						Ashphalt and Road base		Gravel 0.5 to 2.2 feet auger hole caves
2						POORLY GRADED GRAVEL (GP) dark brown dry, medium to coarse gravel - road base.		OVM = background
3						WOOD AND SILTY SAND (SM) moist sand with silt and some fine gravel.		OVM = 3 to 4 ppm
4						FILL AND GRAVELLY SAND WITH SILT (SW) dark reddish brown 10YR??? with wood, porcelin, glass and rubbish.		
5								Raining, cold hand augered to 5 feet
6						POORLY GRADED SAND (SP) Dark reddish brown _____, wet, fine sand with somepieces of rusty metal up to 10 cm.		poor recovery
7			0.3			dark brown and black chert and other lithic clasts.		OVM = background on fresh sample
8								
9			0.5			POORLY GRADED SAND (SP) Dark reddish brown _____, wet, fine sand with some pieces of rusty metal as above.		OVM = background on fresh sample
10								
11								
12								
13			4.0			LEAN CLAY (CL) Grayish green 5GY, soft, wet clay some spots of black organic mater in the clay.		OVM = background Sample OSB GB12-S12 for VOCs, SVOCs, TPH diesel & motor oil, PCB and Cam 17 metals
14								
15								
16						POORLY GRADED SAND (SP) Grayish green 5GY, wet, fine sand		
17						Total Depth 16 feet		
18								
19								Borehole grouted to surface, Top soil replaced Ashphalt patched
20								
21								
22								
23								
24								
25								

TRENCH SIDEWALL RECORD	TRENCH # OSB-13
Contractor Turn-key Construction Services, Inc	Date 06/19/06
Project No. 273939.12.01	Site OS3 & RAILROAD TRACK, GEOPROBE #13
Location Between railroad track spurs and Dump Road, N of DEMO	
180 ft E of Bldg 675	
DIMENSION 9ft L x 2 ft W x 7.5 ft D	
GPS Coords N 1799202.75	
E 6480890.43 TRENCH VIEW	



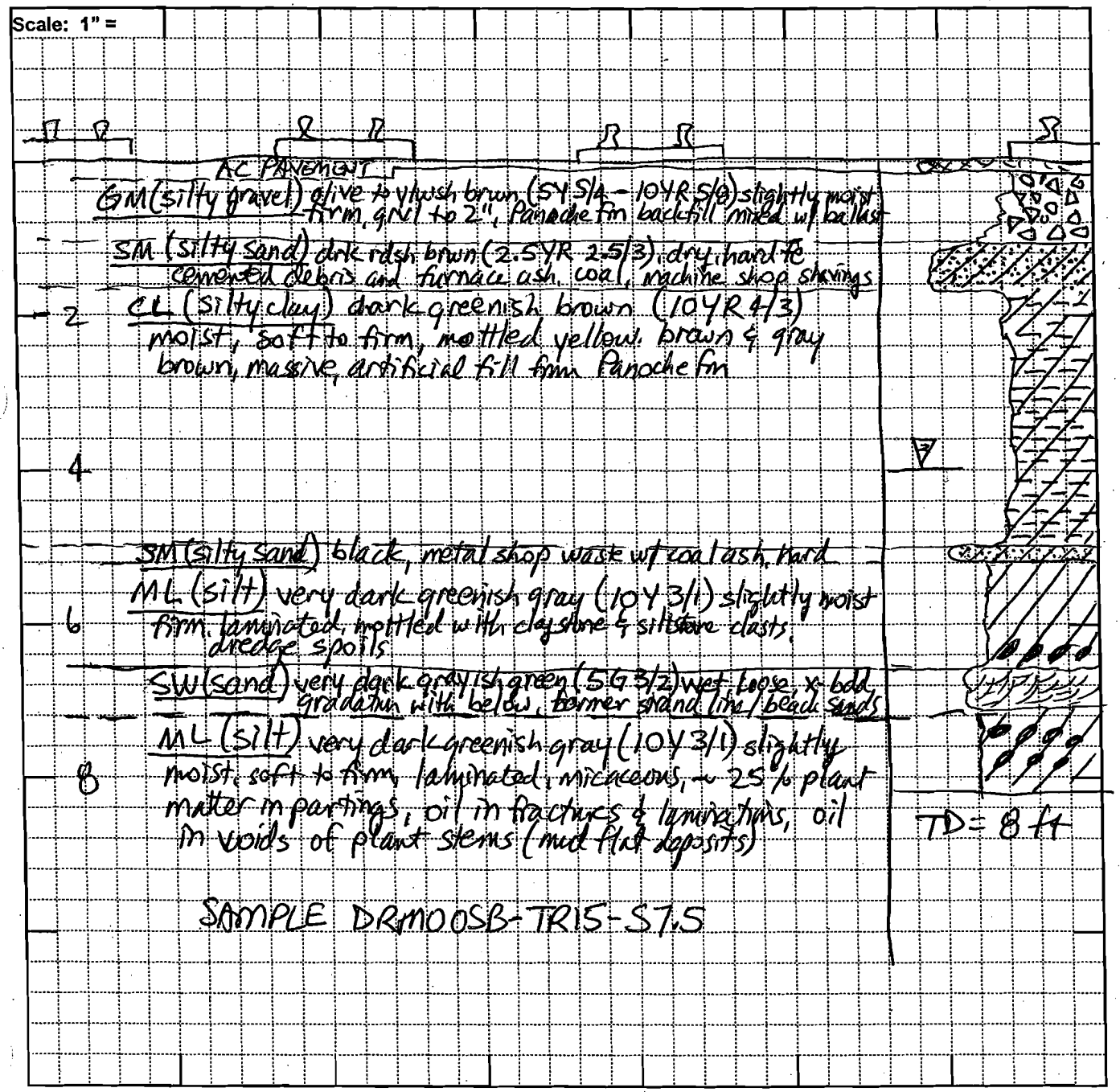
TRENCH SIDEWALL RECORD	TRENCH # OSB-14
Contractor Turn-key Construction Services, Inc	Date 06/19/06
Project No. 273939.12.01	Site OSB & RAILROAD TRACK GEOPROBE #14
Location Railroad track & Dump Road, 120 ft NE Bldg 675, between edge of pavement & railroad track spur	
DIMENSION 9 ft L x 2 ft W x 8.5 ft D	
GPS Coords N 1799186.5 E 6480799.18	TRENCH VIEW

Scale: 1" = NTS



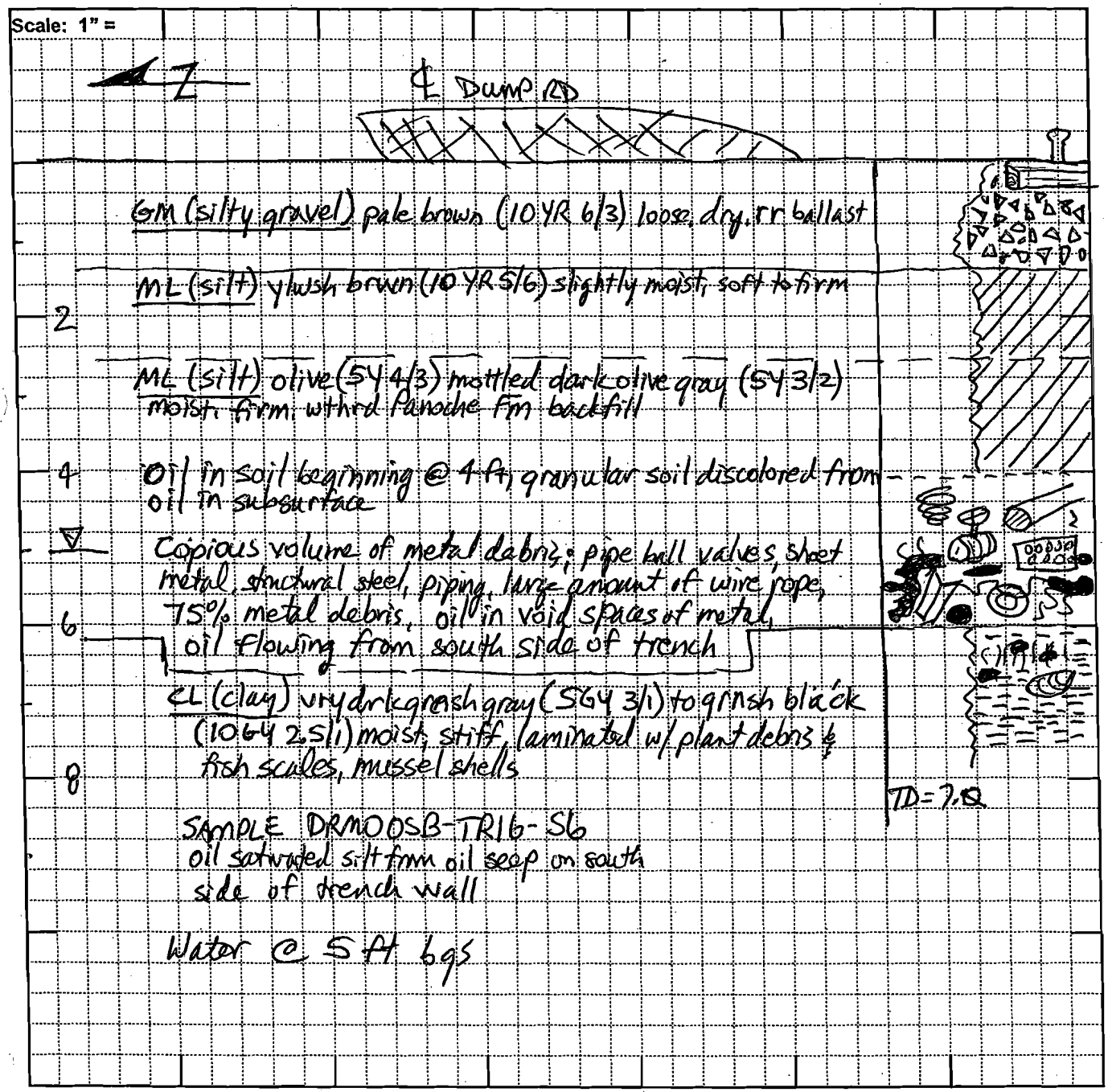
TRENCH SIDEWALL RECORD	TRENCH # OSB-15
Contractor Turn-key Construction Services, Inc	Date 06/19/06
Project No. 273939.12.01	Site OSB & RAILROAD TRACK, GEOPROBE #15
Location Railroad track spurs between Dump Road & DRMO	
40 ft E of Bldg 675	
DIMENSION 8ft L x 2 ft W x 8 ft D	
GPS Coords N 1799115.25	
E 6480769.18 TRENCH VIEW	

Scale: 1" =



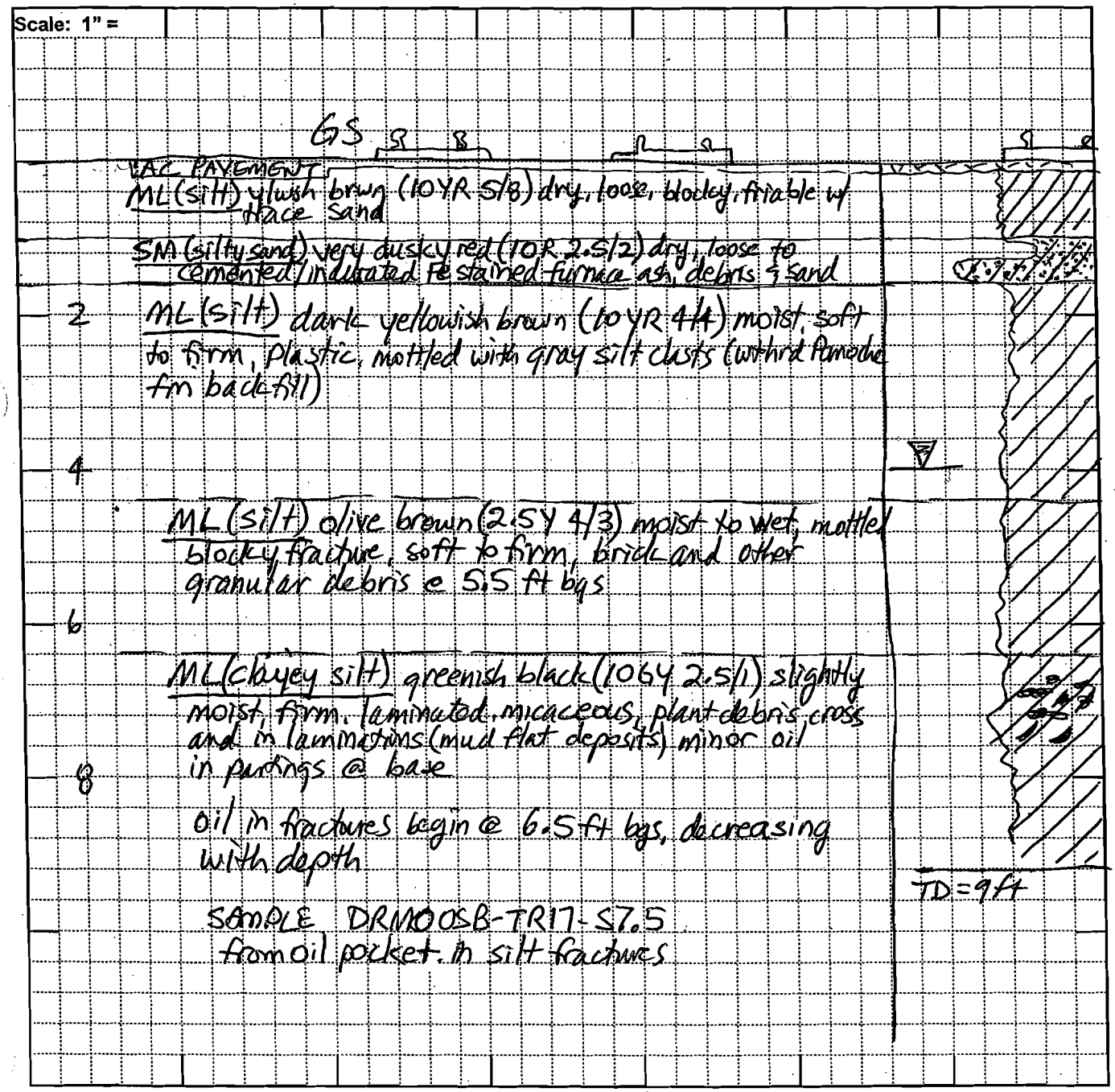
TRENCH SIDEWALL RECORD	TRENCH # OSB-16
Contractor Turn-key Construction Services, Inc	Date 6/19/06
Project No. 273939.12.01	Site OSB & RAILROAD TRACK GEOPROBE LOC #16
Location Railroad tracks & Dump Road, 40ft NW Bldg 675, between edge of pavement & railroad track spur	
DIMENSION 8ft L X 2ft W X 7ft D	
GPS Coords N 1799079 E 6480642.93	TRENCH VIEW

Scale: 1" =



TRENCH SIDEWALL RECORD	TRENCH # OSB-17
Contractor Turn-key Construction Services, Inc	Date 06/19/06
Project No. 273939.12.01	Site OSB & RAILROAD TRACK, GEOPROBE #17
Location Railroad track spurs between Dump Road & DRMO	
75 ft W Bldg 675	
DIMENSION 9ft L x 2ft W x 9ft D	
GPS Coords N 1799014	
E 6480622.93	TRENCH VIEW

Scale: 1" =



APPENDIX D2

Analytical Results and Fingerprint Chromatograms

TABLE D2-1
Sampling and Analytical Matrix, Oil Sump Box Investigation

Sample #	Sampling Date	Sampling Depth (feet bgs)	TPH-Diesel and TPH-Motor Oil (8015-E)	VOCs (OLM04.3)	SVOCs (OLM04.3)	Pesticides (OLM04.3)	Total Metals (ILM04.1)	TCLP Metals (1311/601B/ 7470A)	STLC Metals (CCR Title 22)	TTLC Metals (SW 846)	Cyanide (ILM04.1)
Soil Borings Along Azuar Drive											
OSBGB01-S12	12/19/2005	12	X	X	X	X	X				X
OSBGB09-S07	12/20/2005	7	X	X	X	X	X				X
OSBGB09-S07P	12/20/2005	7	X								
OSBGB10-S07	12/21/2005	7	X	X	X	X	X				X
OSBGB11-S08	12/21/2005	8	X	X	X	X	X				X
OSB-FP-ETN15-S6	1/19/2006	6	X	X	X	X	X				
OSB-FP-ETN47-S3	1/19/2006	3	X	X	X	X	X				
Exploratory Trenches Along Dump Road											
DRMOOSB-TR14-S7	6/19/2006	7	X								
DRMOOSB-TR15-S7.5	6/19/2006	7.5	X								
DRMOOSB-TR16-S6	6/19/2006	6	X								
DRMOOSB-TR17-S7.5	6/19/2006	7.5	X								

Notes:

bgs = below ground surface
CCR = California Code of Regulations
STLC = Soluble Threshold Limit Concentration
SVOCs = semivolatile organic compounds
TCLP = Toxicity Characteristic Leaching Procedure
TPH = total petroleum hydrocarbons
TTLC = Total Threshold Limit Concentration
VOCs = volatile organic compounds

TABLE D2-2
Volatile Organic Compounds, OLM04.3 (mg/kg)

ANALYTE	SAMPLE # (DATE)						
	OSBGB01-S12 (12/19/05)	OSBGB09-S07 (12/20/05)	OSBGB10-S07 (12/21/05)	OSBGB11-S08 (12/21/05)	OSB-FP-ETN15-S6 (1/19/06)	OSB-FP-ETN47-S3 (1/19/06)	OSB-IDW-SE-001 (1/19/06)
Dichlorodifluoromethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Chloromethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Vinyl Chloride	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Bromomethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Chloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Trichlorofluoromethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1-Dichloroethene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1,2-Trichloro-1,2,2-trifluoroetha	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Acetone	0.058 B	1.7 U	0.12 B	0.069 B	5.0 U	5.0 U	1.5 U
Carbon Disulfide	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Methyl Acetate	0.015 U	0.34 J	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Methylene Chloride	0.006 JB	0.56 JB	0.014 JB	0.009 JB	5.0 U	5.0 U	1.5 U
trans-1,2-Dichloroethene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Methyl tert-Butyl Ether	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1-Dichloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
cis-1,2-Dichloroethene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
2-Butanone	0.006 J	0.18 J	0.024	0.012 J	5.0 U	5.0 U	1.5 U
Chloroform	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1,1-Trichloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Cyclohexane	0.015 U	0.25 J	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Carbon Tetrachloride	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Benzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,2-Dichloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Trichloroethene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Methylcyclohexane	0.015 U	1.0 J	0.015 U	0.015 U	5.0 U	2.0 J	1.5 U
1,2-Dichloropropane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Bromodichloromethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
cis-1,3-Dichloropropene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
4-Methyl-2-pentanone	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
trans-1-3-Dichloropropene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1,2-Trichloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Tetrachloroethene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
2-Hexanone	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Dibromochloromethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,2-Dibromoethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Chlorobenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Ethylbenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Styrene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Bromoform	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Isopropylbenzene	0.015 U	0.21 J	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,1,2,2-Tetrachloroethane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,3-Dichlorobenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,4-Dichlorobenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,2-Dichlorobenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,2-Dibromo-3-chloropropane	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
1,2,4-Trichlorobenzene	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U
Xylene (total)	0.015 U	1.7 U	0.015 U	0.015 U	5.0 U	5.0 U	1.5 U

Notes:

Results were originally in micrograms per kilogram (ug/kg); divided by 1,000 to get milligrams per kilogram (mg/kg).

B When used in relation to organics fractions, the "B" flag indicates that the analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself. The "B" flag is applied without regard to the relative concentrations detected in the blank and sample.

J The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-3
Semvolatile Organic Compounds, OLM04.3 (mg/kg)

ANALYTE	SAMPLE # (DATE)							
	OSBGB01-S12 (12/19/05)	OSBGB09-S07 (12/20/05)	OSBGB10-S07 (12/21/05)	OSBGB11-S08 (12/21/05)	OSB-FP-ETN15-S6RE (1/19/06)	OSB-FP-ETN47-S3RE (1/19/06)	OSB-IDW-SE-001RE (1/19/06)	DRMOOSB-TRENCH-IDW (6/20/06)
Benzaldehyde	0.29	30 U	0.06 J	0.49 J	24.0 U	23.0 U	0.44 U	6.5 U
Phenol	0.068 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
bis (2-Chloroethyl)ether	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Chlorophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Methylphenol	0.074 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,2'-oxybis(1-Chloropropane)	0.23 u	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4-Methylphenol	0.19 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Acetophenone	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
N-Nitroso-di-n-propylamine	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Hexachloroethane	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Nitrobenzene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Isophorone	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Nitrophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,4-Dimethylphenol	0.079 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
bis(2-Chloroethoxy)methane	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,4-Dichlorophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Naphthalene	0.14 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.25 J	1.4 J
4-Chloroaniline	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Hexachlorobutadiene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Caprolactam	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4-Chloro-3-methylphenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Methylnaphthalene	0.29	120	0.25 U	0.24 U	81.0 J	69.0 J	4.0	7.6
Hexachlorocyclopentadiene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,4,6-Trichlorophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,4.5-Trichlorphenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
1,1'-Biphenyl	0.083 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Chloronapththalene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2-Nitroaniline	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Dimethylphthalate	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,6-Dinitrotoluene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Acenaphthylene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
3-Nitroanline	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Acenaphthene	0.23 U	11 J	0.25 U	0.24 U	24.0 U	23.0 U	0.44 J	2.9 J
2,4-Dinitrophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4-Nitrophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Dibenzofuran	0.051 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
2,4-Dinitrotoluene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Diethylphthalate	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.30 J	6.5 U
Fluorene	0.069 J	23 J	0.25 U	0.24 U	24.0 U	23.0 U	0.69	3.1 J
4-Chlorophenyl-phenylether	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4-Nitroanline	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4,6-Dinitro-2-methylphenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
n-Nitrosodiphenalylamine	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
4-Bromophenyl-phenylether	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Hexachlorobenzene	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Atrazine	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Pentachlorophenol	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Phenanthrene	0.42	58	0.25 U	0.24 U	81.0 J	72.0 J	2.4	14.0
Anthracene	0.069 J	9.5 J	0.14 J	0.24 U	24.0 U	23.0 U	0.30 J	2.9 J
Carbazole	0.055 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Di-n-butylphthalate	0.23 U	30 U	0.25 U	0.090 J	24.0 U	23.0 U	0.27 J	6.5 U
Fluoranthene	0.13 J	30 U	0.80	0.062 J	24.0 U	23.0 U	0.16 J	6.5 J
Pyrene	0.31	34	0.79	0.071	76.0 J	69.0 J	1.0	17.0
Butylbenzylphthalate	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
3,3'-Dichlorobenzidine	0.23 U	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Benzo[a]anthracene	0.19 J	30 U	0.37	0.24 U	24.0 U	23.0 U	0.21 J	3.3 J
Chrysene	0.37	11 J	0.38	0.24 U	24.0 U	23.0 U	0.48	3.8 J
bis (2-Ethylhexyl)phthalate	0.21 JB	30 U	0.49	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Di-n-octylphthalate	0.23 U	30 U	0.25 U	0.40	24.0 U	23.0 U	0.44 U	6.5 U
Benzo[b]fluoranthene	0.37	30 U	0.44	0.057 J	24.0 U	23.0 U	0.44 U	1.4 J
Benzo[k]fluoranthene	0.059 J	30 U	0.13 J	0.24 U	24.0 U	23.0 U	0.44 U	1.8 J
Benzo[a]pyrene	0.21 J	30 U	0.33	0.24 U	24.0 U	23.0 U	0.44 U	2.0 J
Indeno[1,2,3-cd]pyrene	0.11 J	30 U	0.14 J	0.24 U	24.0 U	23.0 U	0.44 U	2.3 J
Dibenz[a,h]anthracene	0.10 J	30 U	0.25 U	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U
Benzo[g,h,i]perylene	0.15 J	30 U	0.15 J	0.24 U	24.0 U	23.0 U	0.44 U	6.5 U

Notes:

Results were originally in micrograms per kilogram (ug/kg); divided by 1,000 to get milligrams per kilogram (mg/kg).

B When used in relation to organics fractions, the "B" flag indicates that the analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself. The "B" flag is applied without regard to the relative concentrations detected in the blank and sample.
J The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.
U The analyte of interest was not detected to the limit of detection indicated.

RE Re-extract: used re-extraction results.

TABLE D2-4
Pesticides and PCBs, OLM04.3 (mg/kg)

ANALYTE	SAMPLE # (DATE)							
	OSBGB01-S12 (12/19/05)	OSBGB09-S07 (12/20/05)	OSBGB10-S07 (12/21/05)	OSBGB11-S08 (12/21/05)	OSB-FP-ETN15-S6 (1/19/06)	OSB-FP-ETN47-S3 (1/19/06)	OSB-IDW-SE-001 (1/19/06)	DRMOOSB-TRENCH-IDW (6/20/06)
alpha-BHC	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
beta-BHC	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
delta-BHC	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
gamma-BHC	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Heptachlor	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Aldrin	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Heptachlor epoxide	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Endosulfan I	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Dieldrin	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
4,4'-DDE	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
Endrin	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
Endosulfan II	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
4,4'-DDD	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
Endosulfan sulfate	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
4,4' - DDT	0.0023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
Methoxychlor	0.012 U	0.380 U	0.013 U	0.012 U	25 U	25 U	0.011 U	0.33 U
Endrin ketone	0.023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
Endrin aldehyde	0.023 U	0.074 U	0.0025 U	0.0024 U	4.8 U	4.9 U	0.0022 U	0.064 U
alpha-Chlordane	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
gamma-Chlordane	0.0012 U	0.038 U	0.0013 U	0.0012 U	2.5 U	2.5 U	0.0011 U	0.033 U
Toxaphene	0.12 U	3.8 U	0.130 U	0.120 U	250 U	250 U	0.110 U	3.3 U
Aroclor-1016	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.022 U	0.64 U
Aroclor-1221	0.046 U	1.5 U	0.050 U	0.049 U	98 U	99 U	0.045 U	1.3 U
Aroclor-1232	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.022 U	0.64 U
Aroclor-1242	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.022 U	0.64 U
Aroclor-1248	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.022 U	0.64 U
Aroclor-1254	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.022 U	0.64 U
Aroclor-1260	0.023 U	0.74 U	0.025 U	0.024 U	48 U	49.0 U	0.15	0.64 U

Notes:

Results were originally in micrograms per kilogram (ug/kg); divided by 1,000 to get milligrams per kilogram (mg/kg).

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-5
Total Petroleum Hydrocarbons, Diesel-Range (8015M) and Motor Oil-Range (mg/kg)

SAMPLE # (DATE)	ANALYTE	
	Diesel-Range Organics (C10-C23)	Motor Oil-Range Organics (C24-C40)
OSBGB01-S12 (12/19/05)	110	450
OSBGB09-S07 (12/20/05)	38,000	30,000
OSBGB09-S07P (12/20/05)	180,000	320,000
OSBGB10-S07 (12/21/05)	8.0	30 U
OSBGB11-S08 (12/21/05)	7.2 U	29 U
OSB-FP-ETN15-S6 (1/19/06)	130,000	320,000
OSB-FP-ETN47-S3 (1/19/06)	120,000	300,000
OSB-IDW-SE-001 (1/19/06)	2,200	4,600
DRMOOSB-TR14-S7 (6/19/06)	100,000	220,000
DRMOOSB-TR15-S7.5 (6/19/06)	2,000	4,100
DRMOOSB-TR16-S6 (6/19/06)	93,000	140,000
DRMOOSB-TR17-S7.5 (6/19/06)	18,000	25,000
DRMOOSB-TRENCH-IDW (6/20/06)	6,300	10,000

Notes:

mg/kg = milligrams per kilogram

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-6
Total Metals, ILM04.1 (mg/kg)

ANALYTE	SAMPLE # (DATE)							
	OSBGB01-S12RE (12/19/05)	OSBGB09-S07RE (12/20/05)	OSBGB10-S07RE (12/21/05)	OSBGB11-S08 (12/21/05)	OSB-FP-ETN15-S6 (1/19/06)	OSB-FP-ETN47-S3 (1/19/06)	OSB-IDW-SE-001 (1/19/06)	DRMOOSB-TRENCH-IDW (6/20/06)
Aluminum	13,700	24,200	43,600	46,900	356	248	25,100	17,500
Antimony	0.45 U	2.9 B	1.9 B	0.95 B	1.3 B	1.0 B	2.0 B	3.4 B
Arsenic	8.5	25.0	17.2	16.7	2.1	2.5	9.0	14.5
Barium	388	115	250	108	5.7 B	3.8 B	366	338
Beryllium	0.17 B	0.42 B	0.62 B	0.64 B	0.54 B	0.47 B	0.76 B	0.50 B
Cadmium	0.06 U	0.07 U	0.34 U	0.07 U	1.4	1.1	0.06 U	0.39 B
Calcium	9,690	2,990	4,680	3,520	393 B	263 B	14,600	5,900
Chromium	29.6	57.7	74.6	106	0.88 B	0.73 B	51.3	50.3
Copper	54.7	78.6	58.3	58.1	9.3	9.1	99.2	342
Cobalt	9.8 B	15.0	16.3	21.6	0.37 B	0.26 B	19.4	12.1
Iron	31,500	40,000	53,500	48,900	643	545	40,300	34,200
Lead	2,130	157	44.4	22.7	21.7	21.1	251	602
Magnesium	5,160	6,930	8,430	8,840	103 B	71.0 B	9,090	5,970
Manganese	520	475	636	506	13.5	8.5	673	464
Nickel	24.0	61.9	67.7	86.3	7.9	8.1	59.7	59.7
Potassium	2,750	2,950	5,420	3,410	23.5 B	14.7 B	2,180	2,020
Selenium	3.5	4.9	11.9	5.1	0.76 B	1.1	3.8	3.6
Mercury	0.096 B	0.35	0.13 B	0.29	0.18	0.053 B	0.083 B	0.10 U
Silver	0.11 U	0.12 U	0.11 U	0.12 U	0.08 U	0.08 U	0.10 U	1.2
Sodium	21.8 U	810 B	23.2 U	825 B	293 B	16.3 U	32.4 B	96.7 U
Thallium	4.0 U	0.91 U	4.3 U	0.91 U	3.0 U	3.0 U	3.8 U	0.71 U
Vanadium	51.5	84.1	118	122	12.5	10.9	76.1	62.8
Zinc	769	178	261	83.4	439	324	381	1,330

Notes:

Results were originally in micrograms per kilogram (ug/kg); divided by 1,000 to get milligrams per kilogram (mg/kg).

B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.

U The analyte of interest was not detected to the limit of detection indicated.

RE Re-extract: used re-extraction results.

TABLE D2-7
TCLP Metals, 1311/601B/7470A (ug/L)

ANALYTE	SAMPLE # (DATE)	
	OSB-IDW-SE-001 (1/19/06)	DRMOOSB-TRENCH-IDW (6/20/06)
Arsenic	40.3 B	32.0 U
Barium	4,410	2,150
Cadmium	29.3 B	44.5 B
Chromium	7.7 B	3.0 U
Copper	48.0 U	491 B
Lead	7,830	3,260
Nickel	173 B	173 B
Selenium	57.3 B	43.5 B
Mercury	0.15 U	5.0 U
Silver	5.0 U	0.10 U

Notes:

TCLP = Toxicity Characteristic Leaching Procedure
ug/L = micrograms per liter

B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-8
STLC Metals, CCR Title 22 (ug/L)

ANALYTE	SAMPLE # (DATE)	
	OSB-IDW-SE-001 (1/19/06)	DRMOOSB-TRENCH-IDW (6/20/06)
Arsenic	211 B	432 B
Barium	15,900 B	16,500 B
Cadmium	25.9 B	20.1 B
Chromium	862 B	892 B
Copper	86.1 B	48.0 U
Lead	13,200	34,500
Nickel	849 B	1,490 B
Selenium	65.5 B	128 B
Mercury	1.6 U	1.0 U
Silver	5.0 U	5.0 U

Notes:

STLC = Soluble Threshold Limit Concentration
ug/L = micrograms per liter

B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-9
TTLC Metals (mg/kg)

ANALYTE	SAMPLE # (DATE) DRMOOSB-TRENCH-IDW (6/20/06)
Antimony	0.71 B
Arsenic	13.7
Barium	367
Beryllium	0.51
Cadmium	2.9
Chromium	61.1
Copper	333
Cobalt	13.6
Lead	1,450
Molybdenum	0.20 U
Nickel	55.9
Selenium	4.4 B
Silver	0.05 U
Thallium	1.7 U
Vanadium	80.3
Zinc	2,080

Notes:

TTLC = Total Threshold Limit Concentration
mg/kg = milligrams per kilogram

B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.

U The analyte of interest was not detected to the limit of detection indicated.

TABLE D2-10
Cyanide, ILM04.1 (mg/kg)

SAMPLE # (DATE)	Cyanide
OSBGB01-S12RE (12/19/05)	0.34 U
OSBGB09-S07RE (12/20/05)	280
OSBGB10-S07RE (12/21/05)	1.0 B
OSBGB11-S08RE (12/21/05)	0.36 U
OSB-IDW-SE-001 (1/19/06)	0.33 U
DRMOOSB-TRENCH-IDW (6/20/06)	0.53

Notes:

mg/kg = milligrams per kilogram

B The reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL). If the analyte was analyzed for but not detected, a "U" shall be entered.

U The analyte of interest was not detected to the limit of detection indicated.

RE Re-extract: used re-extraction results.

Pesticide/PCB Fraction:

Sample Analysis:
Samples OSB-FP-ETN15-S6 and OSB-FP-ETN47-S3 were prepared by dissolving approximately 0.20 grams of sample in 10mL of hexane. Surrogates were added and the solutions were then diluted ten-fold and analyzed by GC-ECD along with the other sample extracts.

TPH Diesel Fraction:

California DHS 8015 modified was used to quantitate the samples for diesel and motor oil. Diesel range responses were determined by summing the responses of all components, resolved and unresolved, between C_{10} and C_{23} integrated to a horizontal baseline. Motor oil range responses were determined by summing the responses of all components, resolved and unresolved, between C_{24} and C_{40} integrated to a horizontal baseline. Quantitation in both cases was based on a linear regression.

The quantitation of extractable organics within the retention time as stated does not indicate the presence of diesel or any other specific fuel type since other extractable organic material may be present in the sample. Qualitative determination of the presence of diesel or a specific fuel type based on the characteristic hydrocarbon pattern of the appropriate fuel type is tabulated below:

Sample ID	Characteristic Diesel Pattern	Characteristic Oil Pattern
OSB-FP-ETN15-S6	No	Partial
OSB-FP-ETN47-S3	No	Partial
OSB-IDW-SE-001	No	Partial

Sample Analysis:
Sample OSB-FP-ETN15-S6 was prepared by dissolving 0.25 grams of sample in 10mL of methylene chloride on 1/23/2006. Sample OSB-FP-ETN47-S3 was prepared by dissolving 0.23 grams of sample in 10mL of methylene chloride on 1/23/2006. The solutions were then diluted ten-fold and analyzed by GC-FID along with the other sample extracts. Surrogates were added at the instrument after the dilution. The hydrocarbon pattern for these samples most closely resembled a bunker c fuel. The hydrocarbon range was from approximately C12 to at least C40. Sample OSB-IDW-SE-001 demonstrated the same hydrocarbon pattern.

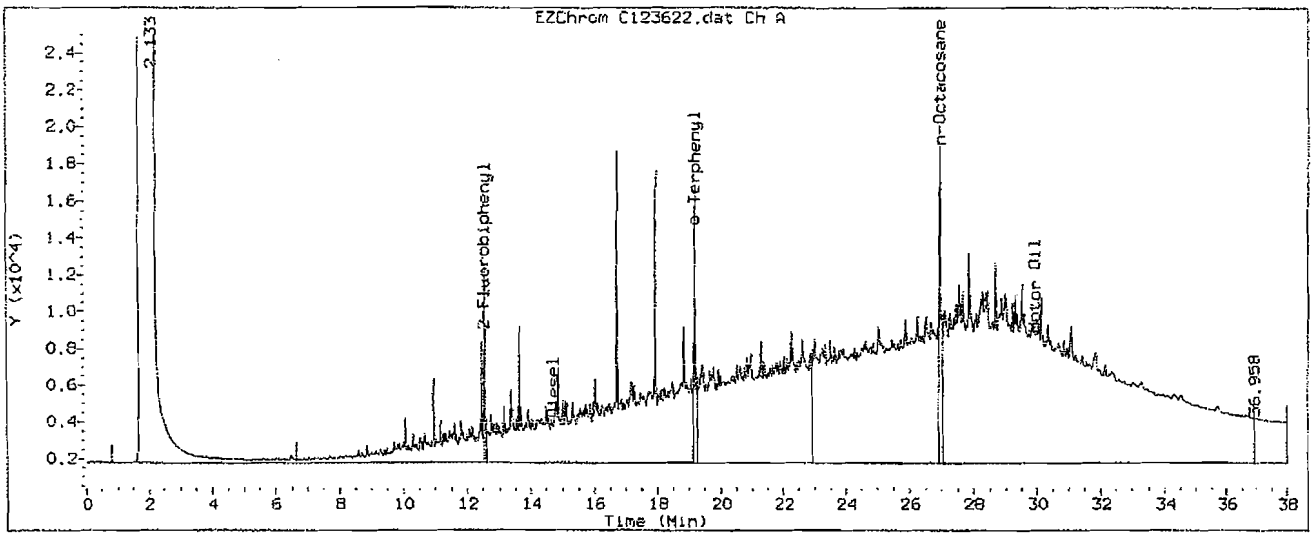
The associated reagent blank for samples OSB-FP-ETN15-S6 and OSB-FP-ETN47-S3 consisted of methylene chloride.

Quality Control Analysis:
MS/MSD analyses were performed on sample OSB-IDW-SE-001 for both diesel and motor oil. The diesel and oil recoveries were not calculable due to the dilution factor employed.

All blank spike recoveries were within the acceptance limits.

All other quality control parameters were met.

Laucks Testing Labs
Quantitation Report



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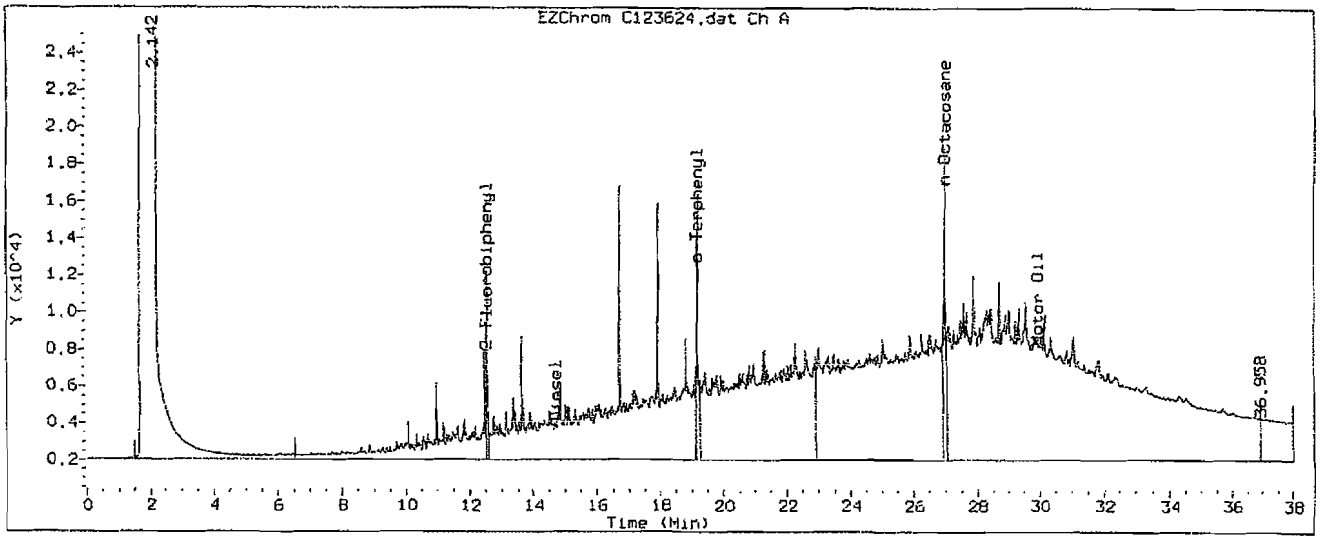
Sample Info : CMI6541-001
Misc. Info : CA DHS 8015Bmod - Diesel(C10-C23)
Laboratory ID : CMI6541-001 Client ID : OSB-FP-ETN15-S6
Instrument ID : 5890c.i Operator : JNH
Method : CCA91426.m Sublist : TPHDX+
Quantitation : ESTD Integrator : Falcon
Dilution Factor : 10.0 Sample Type: SAMPLE
Column : RTX-5 Column Size: 30.00m L- 0.00mm ID

UnitFactor : 0.001000
FinalVolume : 10000 uL
SampleWeight: 0.2500 g
Moisture : 0.0000 %
InjectionVol: 2.000 uL

Compound	RT	RT Window	Response	Concentrations Soln ug/ml	Concentrations Final mg/Kg
	2.13		30064251		
2-Fluorobiphenyl	12.55	12.52 - 12.62	15594	2.3247	930
Diesel		6.55 - 22.92	2583534	322.50	129000
o-Terphenyl	19.18	19.15 - 19.25	19122	2.0910	836
n-Octacosane	26.96	26.92 - 27.02	16700	2.4104	964
Motor Oil		22.92 - 36.94	4736369	809.24	324000
	36.96		148940		

Response is in area units.
M - The peak was manually integrated.
E - The quantitated amount exceeds the calibration range.

Laucks Testing Labs
Quantitation Report



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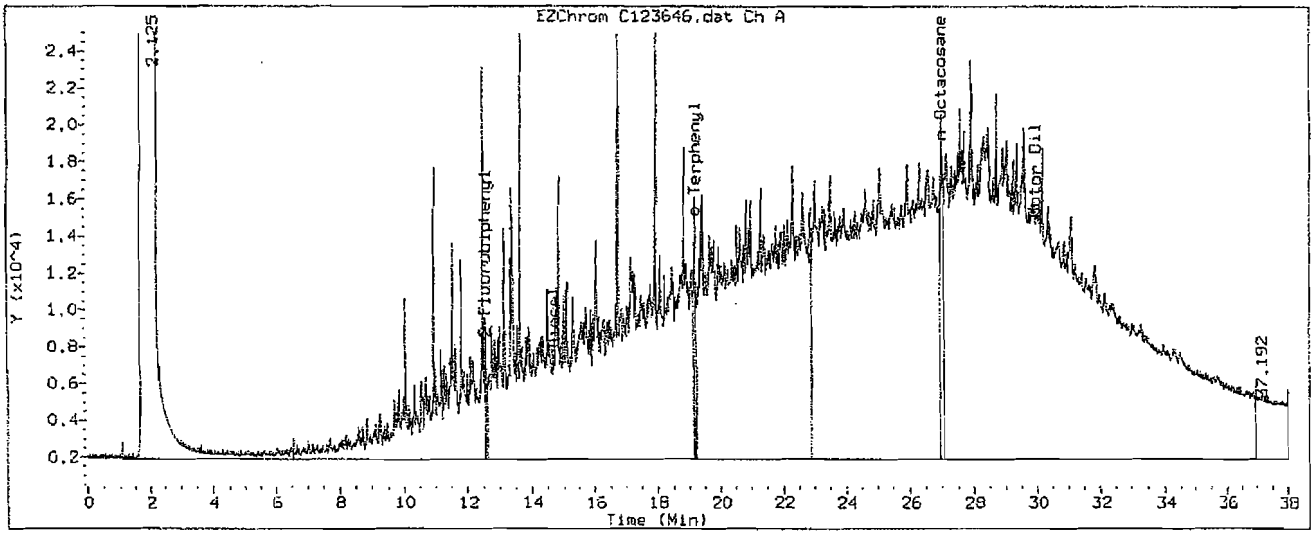
Injection Date : 24-JAN-2006 05:39
Sample Info : CMI6541-002
Misc. Info : CA DHS 8015Bmod - Diesel(C10-C23)
Laboratory ID : CMI6541-002 Client ID : OSB-FP-ETN47-S3
Instrument ID : 5890c.i Operator : JNH
Method : CCA91426.m Sublist : TPHDX+
Quantitation : ESTD Integrator : Falcon
Dilution Factor : 10.0 Sample Type: SAMPLE
Column : RTX-5 Column Size: 30.00m L- 0.00mm ID

UnitFactor : 0.001000
FinalVolume : 10000 uL
SampleWeight: 0.2300 g
Moisture : 0.0000 %
InjectionVol: 2.000 uL

Compound	RT	RT Window	Response	Concentrations Soln ug/ml	Concentrations Final mg/Kg
	2.14		30041189		
2-Fluorobiphenyl	12.55	12.52 - 12.62	15514	2.3134	1000
Diesel		6.55 - 22.92	2297848	284.02	123000
o-Terphenyl	19.18	19.15 - 19.25	19051	2.0826	906
n-Octacosane	26.96	26.92 - 27.02	17364	2.4946	1080
Motor Oil		22.92 - 36.94	4215187	696.26	303000
	36.96		139654		

Response is in area units.
M - The peak was manually integrated.
E - The quantitated amount exceeds the calibration range.

Laucks Testing Labs
Quantitation Report



Data File : //NEPTUNE/Target/Chem/5890c.i/C1236CA.b/C123646.d
Injection Date : 24-JAN-2006 22:32
Sample Info : CMI6541-003
Misc. Info : CA DHS 8015Bmod - Diesel(C10-C23)
Laboratory ID : CMI6541-003 Client ID : OSB-IDW-SE-001
Instrument ID : 5890c.i Operator : JNH
Method : CCA91426.m Sublist : TPHDX+
Quantitation : ESTD Integrator : Falcon
Dilution Factor : 20.0 Sample Type: SAMPLE
Column : RTX-5 Column Size: 30.00m L- 0.00mm ID

UnitFactor : 0.001000
FinalVolume : 2000 uL
SampleWeight: 20.00 g
Moisture : 25.00 %
InjectionVol: 2.000 uL

Compound	RT	RT Window	Response	Concentrations Soln ug/ml	Final mg/Kg
	2.12		29952659		
2-Fluorobiphenyl	12.56	12.52 - 12.62	7549	1.1767	3.14
Diesel		6.55 - 22.92	6195818	809.01	2160
o-Terphenyl	19.18	19.15 - 19.25	8805	0.86790	2.31
n-Octacosane	26.97	26.92 - 27.02	7968	1.3022	3.47
Motor Oil		22.92 - 36.94	8899022	1711.7	4560
	37.19		196862		

Response is in area units.
M - The peak was manually integrated.
E - The quantitated amount exceeds the calibration range.

APPENDIX D3

Photographs

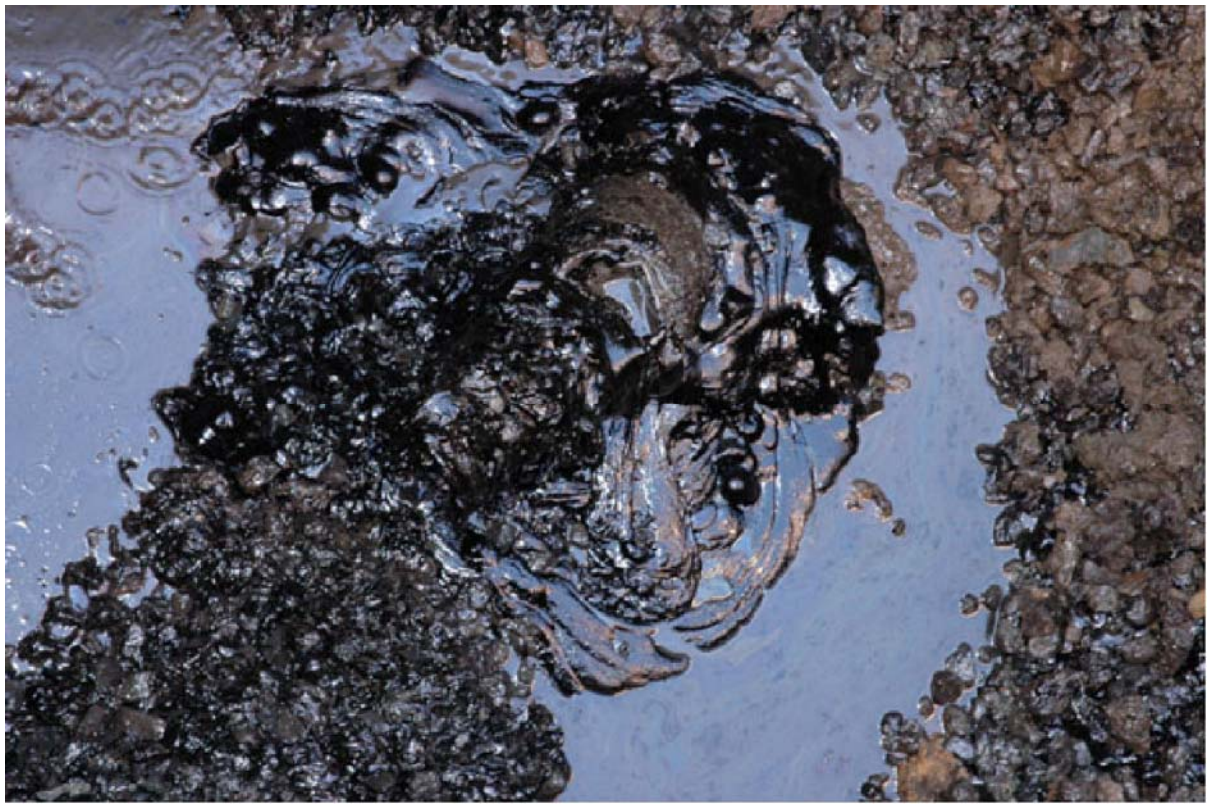
View of East Side of OSB (01/20/06)

View of South Side of OSB (01/20/06)

View of North Side of OSB

Closeup View of Concrete Plug in North Wall of OSB (01/20/06)

Removing Accumulated Free Product from Excavation (01/18/06)



Closeup View of Free Product in Excavation (01/18/06)

Example of Free Product and Metal Debris (01/18/06)

Closeup View of Free Product and Metal Debris in Excavation (01/18/06)

Closeup View of Metal Debris and Free Product in Sidewall of Excavation (01/18/06)

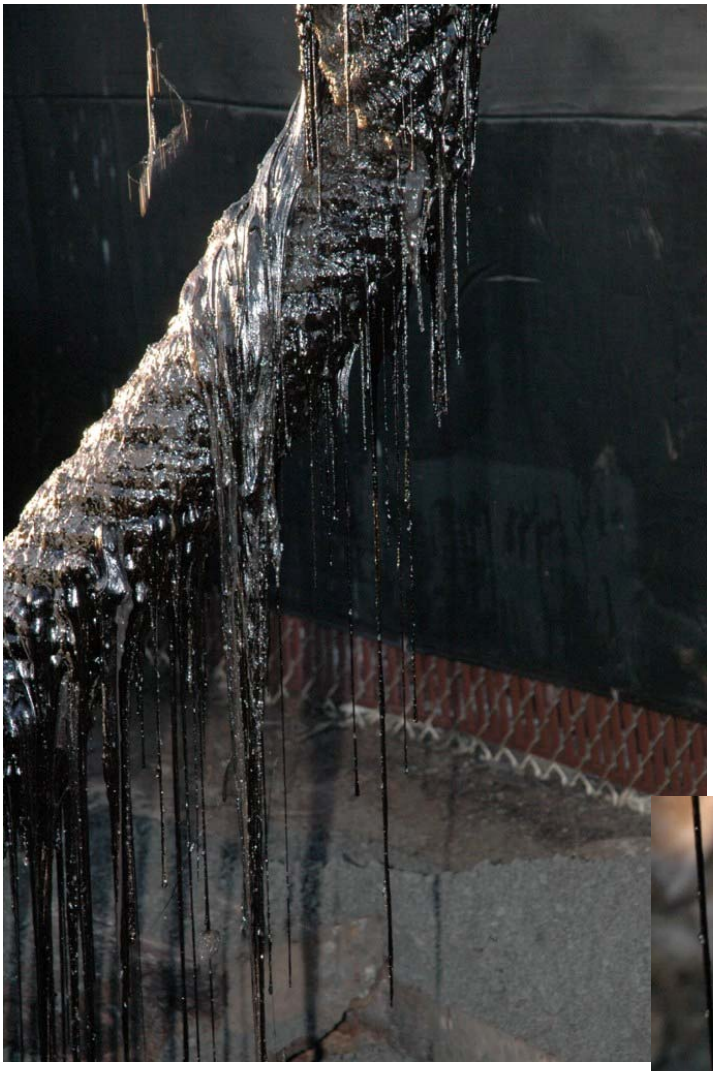
Closeup View of Metal Debris and Free Product in Sidewall of Excavation (01/18/06)

Metal Debris in Excavation (01/18/06)

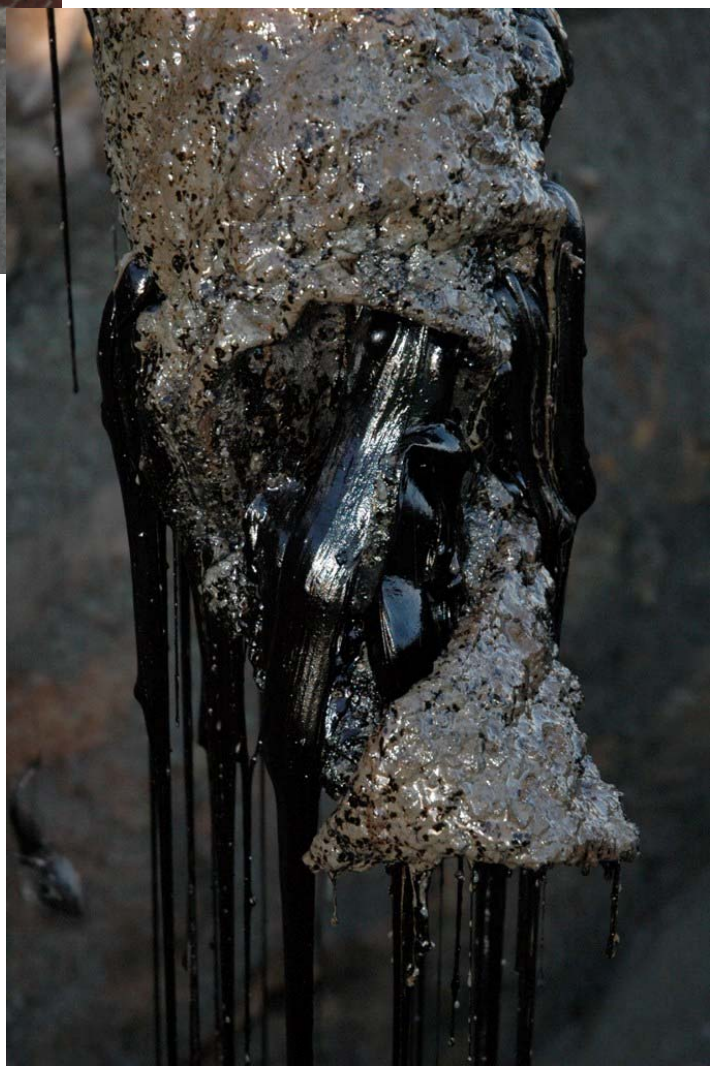
Closeup View of Metal Debris Excavation (01/18/06)

Metal Debris in Excavation (01/18/06)

Metal Debris Removed from Excavation (01/18/06)

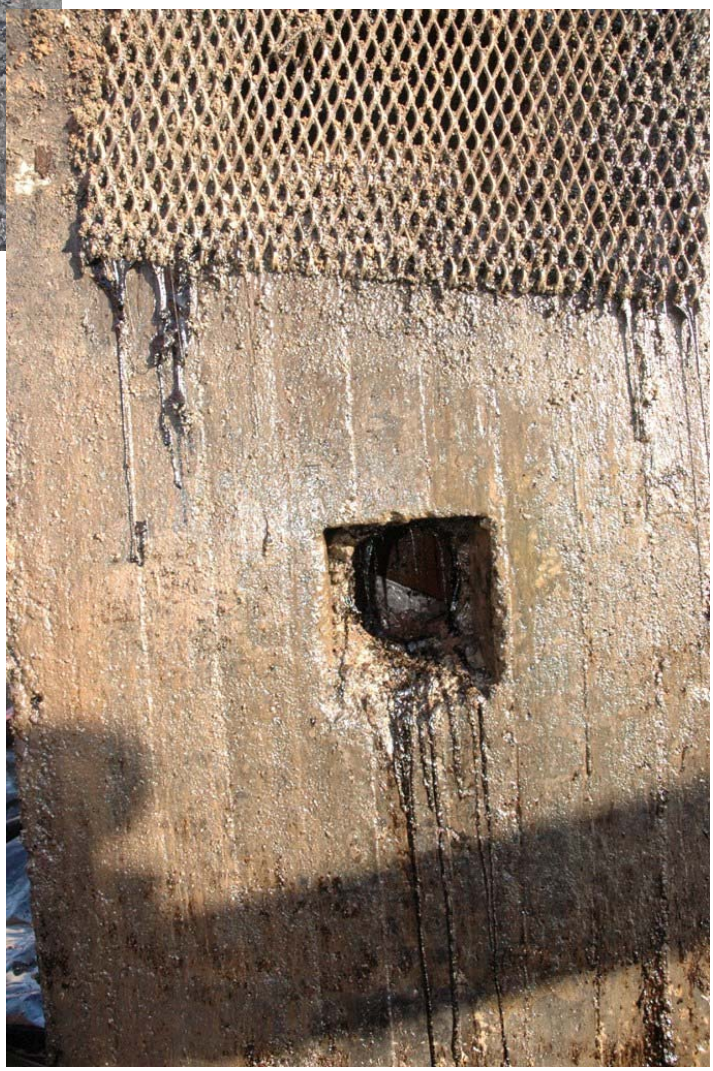


Free Product on 6-inch Perforated Pipe Associated with OSB (01/20/06)



Closeup of Free Product on 6-inch Perforated Pipe Associated with OSB (01/20/06)

North Wall of OSB Prior to Removal Showing Upper, Grated Opening (01/20/06)



Closeup of Southern Wall of OSB After Removal Showing Upper, Grated Opening and Lower Pipe Connection (01/20/06)

Wire and Other Debris and Free Product in Trench along Dump Road (06/19/06)

Closeup of View of Metal Debris and Free Product Removed from Trench along Dump Road (06/19/06)

Trench OSBTR13 along Dump Road (06/19/06)

Trench OSBTR14 along Dump Road (06/19/06)

Trench OSBTR15 along Dump Road (06/19/06)

Trench OSBTR16 along Dump Road (06/19/06)

Trench OSBTR16 along Dump Road (06/19/06)

Trench OSBTR17 along Dump Road (06/19/06)

APPENDIX E

Boring and Trench Logs from the Groundwater Investigation at the Former Crane Test Area

CH2MHILL

PROJECT NUMBER	BORING ID:	
264204.GW.NW	CTAMW0100-101 (trench)	Sheet 1 of 1

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~12 NORTHING: 1799775 EASTING: 6480830 DRILLING CONTRACTOR: Engineering/Remediation Resources Group

DRILLING METHOD AND EQUIPMENT USED: Backhoe, 2' x 12' x 6.5' deep trench

WATER LEVELS: Dry START: 11/20/2006 END: 11/20/2006 LOGGER: Eli Ludwig

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					Asphalt (0 to 0.5').	A 2' x 12' x 6.5' deep trench was excavated to
					SAND (SW). Buff to light brown (10YR 8/4), moist, firm,	log soil and debris layer and to clear location
1					well graded, medium grained, cemented, laminated, no debris.	of debris for well drilling and installation. A
						shallow well will be installed in the trench and
2						a deeper well will be drilled within the trench.
3					Asphalt (3 to 3.25').	
					Debris. Bricks (6 inches), asphalt debris, sand.	
4					SILTY CLAY (CL). Very dark brown (2.5Y 2.5/1), moist, soft,	
					medium plasticity, peat and organic material.	
5						
6					SANDY SILT (ML). Greenish gray (10Y 3/1), moist, soft, medium plasticity.	
					Total depth=6.5 ft. bgs.	Bottom of trench is dry.
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0101 Sheet 1 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~12 NORTHING: 1799775 EASTING: 6480830 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					0 to 6.5'. See CTAMW0100-1-1 trench soil log.	
1						
2						
3						
4						
5						
6						
7						
8	8-12	0%	GP		No recovery (8 to 12').	
9						
10						
11						
12	12-16	100%	GP		CLAY (CL). Dark greenish gray (10G 4/1), moist, soft, plastic, laminated grades downward to clay.	
13					CLAY (CL). Black (N 2.5/1), moist, soft, plastic, micaceous, peaty, laminated.	
14					CLAY (CL). Dark greenish gray (10G 4/1), moist, soft, plastic, laminated, upward fining to black clay,	
15					gradational with below. SAND (SW). Greenish black (10Y 2.5/1), loose, x-bdd, to laminated, fine to medium subangular quartz sand, bioclastic with oyster.	
16	16-20	0	GP		No recovery (16 to 20').	
17						
18						
19						
20	20-24	100%	GP		CLAY (CL). Dark olive gray (5Y 3/2), moist, soft, plastic, laminate, upward fining from base, silty clay at 21.5 and	
21					23.5, becomes firm, friable fracture, laminated, gradational contact with below.	
22						
23					SAND (SW). Gray, bioclastic, wet, loose, medium grained, subrounded quartz sand.	
24	24-28	0	GP			

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0101 Sheet 2 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~12 NORTHING: 1799775 EASTING: 6480830 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
25						
26						
27					SILT (ML). Dark greenish gray (5G 4/1), dry to slightly moist, firm, laminated, 50% oyster shells, friable (bedrock).	Description based on shoe.
28					Total depth=28 ft. bgs.	
29						

CH2MHILL

PROJECT NUMBER 264204.GW.NW

BORING ID: CTAMW0102-103 (trench)

SOIL BORING LOG

PROJECT: Mare Island

LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~11 NORTHING: 1799500 EASTING: 6481027 DRILLING CONTRACTOR: Engineering/Remediation Resources Group C

DRILLING METHOD AND EQUIPMENT USED: Backhoe, 2' x 7.5' x 6' deep trench

WATER LEVELS: ~6 ft. bgs. (trench) START: 11/20/2006 END: 11/20/2006 LOGGER: Eli Ludwig

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					Asphalt (0 to 0.7').	A 2' x 6' x 6' trench was excavated to log soil and debris layer and to clear location of debris for well drilling and installation. A shallow well will be installed within the trench and a deeper well will be drilled within the trench.
1					GRAVEL (GW). Brown, dry, coarse road base, A/B fill 1" to 2".	
2					SILTY SAND (SM). Buff to light brown (10YR 5/6), moist, firm, no debris.	
3						
4					Debris layer. Rust orange layer, includes mainly scrap sheet metal (12" x 6" x 1/16" odd shapes and sizes) wire, pipe (2" x 12') and other debris.	
5						Water. Very slight oily sheen. Does not appear to be free product.
6					Total depth=6 ft. bgs.	
6					SANDY SILT (ML). Greenish gray (10Y 3/1), wet, soft, medium plasticity.	
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0103 Sheet 1 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~11 NORTHING: 1799500 EASTING: 6481027 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					0 to 6'. See CTAMW0102-103 trench soil log.	
1						
2						
3						
4						
5						
6						
7						
8	8-12	0	GP		No recovery (8 to 12').	
9						
10						
11						
12	12-16	75%	GP		CLAY (CL). Dark greenish gray (10Y 3/1), moist, soft, plastic, laminated, grades downward to clayey silt.	
13						
14					CLAYEY SILT/SILT (ML). Dark greenish gray (10Y 3/1), moist, moderate dilatency, non plastic, micaceous, laminated, grades to below.	
15					SAND (SW). Greenish black (10Y 2.5/1), wet, laminated, fine to medium grained subrounded quartz sand, 30% mica.	
16	16-20	85%	GP		Slough.	
17					SILTY CLAY (CL). Dark gray (5Y 4/1), moist, soft, laminated, slightly micaceous, plastic, fine, wet sand at	
18					base.	
19					SAND (SW). Dark gray, wet. CLAY (CL). Very dark gray (10YR 3/1), moist, soft to firm, plastic with peat gradational with gray silty clay at base.	
20	20-24	100%	GP		CLAY (CL). Dark greenish gray (10Y 3/1), soft, laminated, plastic gradation with below.	
21					CLAY (CL). Very dark gray (10YR 3/1), moist, soft to firm, plastic, plant and wood fibers, strong H25.	
22					SILT (ML). Greenish gray (5GY 5/1), slightly moist, firm, low dilatency, laminated with root structures, micaceous, grades to brown sandy silt at base.	
23					SAND (SM). SILT (ML). Grayish green (5G 5/2), dry, firm, bioclastic, friable (top of bedrock).	

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0103 Sheet 2 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~11 NORTHING: 1799500 EASTING: 6481027 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
24	24-28	100%	GP		SILTY SAND (SM). Olive (5Y 5/4), firm to hard, med subangular quartz sand, in silty matrix, limonite mottled, weathered panoche siltstone, gradational with below.	
25						
26					SILTY SAND (SM). Olive yellow (2.5Y 6/6), mottled brownish yellow (10YR 6/8), dry, hard, plastic when wet, strong	
27					limonite staining at base, coarsening downward, weathered panoche fm sandstone/siltstone.	
28	28-32	5%	GP		Slough.	
29						
30						
31					SILTY SAND (SM). Greenish gray (5BG 5/1), dry, hard, friable gap graded subangular to subrounded quartz sand, silt matrix, massive, minor biotite.	Description based on shoe.
32					Total depth=32 ft. bgs.	
33						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0104-105 (trench) Sheet 1 of 1

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~13 NORTHING: 1799190 EASTING: 648061 DRILLING CONTRACTOR: Engineering/Remediation Resources Group

DRILLING METHOD AND EQUIPMENT USED: Backhoe, 2' x 12.5' x 10' deep trench

WATER LEVELS: ~7 ft. bgs. (trench) START: 11/20/2006 END: 11/20/2006 LOGGER: Eli Ludwig

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					Asphalt (0 to 8").	A 2' x 12.5' x 10' deep trench was dug to log
					SAND (SW). Buff to light brown (10YR 8/4), moist, firm,	soil and debris and to clear location of debris
1					laminated, no debris.	for well drilling and installation. A shallow
						well will be installed in the trench and a deep
2					CLAYEY SILT WITH SAND (ML). Light gray color (Gley 2 4/10	well will be installed within the trench.
					BG), moist, soft, laminated, medium plasticity, some brick material.	
3					Debris layer. Very dark brown to black (2.5Y 2.5/1), mainly organic fill material, wood chips, ground up wood or sawdust.	
4						
5					Debris layer. Moist, mainly metal debris including: scrap	
					sheet metal (12" x 10"-odd shapes and sizes), cable (3/4"	
6					diameter), pipe (metal), wire.	
7						Water at 7 ft. bgs. Free project, black color,
						oily.
8					CLAY (CL). Olive brown (5Y 2.5/1), wet, soft, plastic,	Contact difficult to measure since under water.
					sticky.	It is estimated to be between 7.5 and 8.5 ft. bgs.
9						
10					Total depth=10 ft. bgs.	
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

PROJECT NUMBER	BORING ID:	
264204.GW.NW	CTAMW0105	Sheet 1 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~13 NORTHING: 1799190 EASTING: 6480601 DRILLING CONTRACTOR: Precision Sampling, Inc., San Rafael, CA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: 10.85 TOC START: 11/28/2006 END: 11/28/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					0 to 10'. See CTAMW0104-105 trench soil log.	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10	10-15	50%	GP		CLAY (CL). Olive brown (5Y 2.5/1), moist, soft, sticky, plastic.	
11						
12						
13						
14						
15	15-20	65%	GP		SAND (SW). Greenish gray (10GY 5/1), and (5Y 6/1), moist, firm, fine grained with silt, quartz.	
16						
17					SILT (ML). Greenish gray (5Y 2.5/1), moist, laminated, plant material.	
18	18-18				CLAY (CL).	
19					SILT (ML). Greenish gray (5Y 2.5/1), moist, laminated, plant material.	
20		100%	GP			
21					PEAT (OL).	
22					SILTY SAND. Dark greenish gray (5Y 2.5/1), very wet, laminated, coarsens upward, sand is quartz, mica in silt, gradual contact.	
23						
24					CLAY WITH SILT (CL). Dark greenish gray (5Y 2.5/1), moist, plastic, mica, laminated, sharp contact with below. Contact at 2 inches above 25 ft. bgs.	

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0105 Sheet 2 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~13 NORTHING: 1799190 EASTING: 6480601 DRILLING CONTRACTOR: Precision Sampling, Inc., San Rafael, CA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: 10.85 TOC START: 11/28/2006 END: 11/28/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
25					CLAY (CL). Pale olive (5Y 6/3), dry, hard, oyster shells (top of bedrock). Total depth=25 ft. bgs.	
26						

CH2MHILL

PROJECT NUMBER	BORING ID:	
264204.GW.NW	CTAMW0106-107 (trench)	Sheet 1 of 1

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~9.5 NORTHING: 1799655 EASTING: 6480647 DRILLING CONTRACTOR: Engineering/Remediation Resources Group

DRILLING METHOD AND EQUIPMENT USED: Backhoe, 2' x 8' x 5' deep trench

WATER LEVELS: Dry START: 11/20/2006 END: 11/20/2006 LOGGER: Eli Ludwig

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					CLAYEY SILT (ML). Brown (10YR 4/3), damp, stiff.	A 2' x 8' x 5' deep trench was dug to log soil and debris and to clear location of debris for well drilling and installation. A shallow well will be installed in the trench and a deeper well will be drilled within the trench.
1					SILTY CLAY (CL). Brown to dark brown (7.5YR 4/2), dry, stiff, low plasticity, 30% silt, few debris-bricks.	
2						
3					CLAY (CL). Dark brown (10YR 3/2), dry to damp, stiff, high plasticity.	No debris.
4						
5					Total depth=5 ft. bgs.	
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0107 Sheet 1 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~9.5 NORTHING: 1799655 EASTING: 6480647 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: ~9.4 ft. bgs. TOC START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					0 to 5' . See CTAMW0106-107 trench soil log.	
1						
2						
3						
4						
5						
6						
7						
8	8-12	100%	GP		CLAY (CL). Grayish brown (2.5Y 5/2), mottled dark yellowish brown (10YR 4/4), moist, soft, plastic, massive to laminated, blocky fractured abundant amount of mica on laminated partings, grades to below.	
9						
10						
11					CLAY (CL). Olive (5Y 4/3) and black (2.5N), moist, soft, micaceous, plastic clay, laminated.	
12	12-16	0%	GP		No recovery (12 to 16')	
13						
14						
15						
16	16-20	75%	GP		CLAY (CL). Grayish black (10Y 2.5/1), wet, soft, plastic, laminated, 10% quartz sand, rapid dilatency, grades to below.	
17						
18					SAND (SW). Greenish gray (10GY 5/1) and gray (5Y 6/1), moist, firm, thin bdd with rounded quartz sand, upward coarse, grades to below.	
19					SILT (ML). Dark greenish gray (5G 4/1), dry to slightly moist, firm, laminated, 50% oyster shells.	
20	20-24	85%	GP		Slough.	
21						
22					SILT (ML). Same as above. Biogerenaceus, dark greenish gray, sharp contact with below (top of bedrock).	
23					CLAY (CL). Pale olive (5Y 6/3), mottled brownish yellow (10YR 6/6), dry, hard, laminated, steeply dipping claystone bedrock.	
24					Total depth=24 ft. bgs.	

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0107 Sheet 2 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~9.5 NORTHING: 1799655 EASTING: 6480647 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: ~9.4 ft. bgs. TOC START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
25						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0108-109 (trench) Sheet 1 of 1

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~10' NORTHING: 1799465 EASTING: 6480818 DRILLING CONTRACTOR: Engineering/Remediation Resources Group C

DRILLING METHOD AND EQUIPMENT USED: Backhoe, 2' x 8' x 6.5' deep trench

WATER LEVELS: ~6.5 ft. bgs. (trench) START: 11/20/2006 END: 11/20/2006 LOGGER: Eli Ludwig

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					SILTY SAND WITH GRAVEL (SW).	A 2' x 8' x 6.5' deep trench was dug to log soil and metal debris and to clear location of debris for well drilling and installation. A shallow well will be installed in the trench and a deeper well will be drilled within the trench.
					Asphalt (0.5 to 1').	
1					SAND WITH GRAVEL (SW). Brown (10YR 8/4), dry, loose.	
2					Debris layer: Rust orange color, includes scrap metal (12' x 12" odd shapes and sizes), brick, metal pipe, wire.	
3						
4						
5						
					At 5.9 ft. bgs: 1" thick peat layer, black color, water is dripping from this layer and from the lower few inches of the debris layer.	
6					CLAY (CL). Olive (Gley 1 3/10 GY), damp to wet, stiff, high plasticity, laminated, mica, plant debris.	
					Total depth=6.5 ft. bgs.	Standing water in the trench at ~6.5 ft. bgs.
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

CH2MHILL	PROJECT NUMBER 264204.GW.NW	BORING ID: CTAMW0109 Sheet 1 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~10' NORTHING: 1799465 EASTING: 6480818 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: 8.15 ft. TOC START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
0					0 to 6.5'. See CTAMW0108-109 trench soil log.	
1						
2						
3						
4						
5						
6						
7						
8	8-12	30%	GP		SILTY CLAY (CL). Grayish brown (5Y 3/2), moist, soft, massive to laminated, plant material, abundant mica.	
9						
10						
11						
12	12-16	0	GP		Slough. No recovery 12 to 16 ft. bgs.	
13					CLAY (CL). Dark brown (5Y 2.5/1), wet, soft.	
14						
15						
16	16-20	75%	GP		Slough.	
17					CLAY (CL). Dark brown (5Y 2.5/1), wet, soft.	
18					SILTY SAND (SM). Dark brown (5Y 2.5/1), wet, soft, fine grained. PEAT (OL) layer. Brown.	
19					SILTY CLAY (CL). SAND (SP). Moist, fine to medium grained.	
20	20-24	100%	GP		CLAY (CL) and SAND (SP). Black (N 2.5/1), moist, soft to firm, interbedded 1 cm intervals, upward fining, clay plastic.	
21					PEAT (PT). Very dark gray (10YR 3/1), moist, soft, micaceous, laminated with clay.	
22					CLAY (CL). Dark greenish gray (5GY 4/1), soft, plastic. PEAT (PT). Very dark gray (10YR 3/1), moist, soft, micaceous, laminated with clay.	
23					SILT (ML). Grayish green (5G 5/1), dry, firm, bioclastic, plastic when wet, friable, upward coarsening (top of bedrock). CLAY (CL). Greenish gray (10GY 5/1), firm, bioclastic, friable.	

PROJECT NUMBER	BORING ID:	
264204.GW.NW	CTAMW0109	Sheet 2 of 2

SOIL BORING LOG

PROJECT: Mare Island LOCATION: Crane Test Area, Azuar and Dump Road, IA B1

ELEVATION: ~10' NORTHING: 1799465 EASTING: 6480818 DRILLING CONTRACTOR: GREGG DRILLING AND TESTING, INC., SA

DRILLING METHOD AND EQUIPMENT USED: Direct Push Drilling, 2 inch diameter, Rhino, Track-mounted Marl Drilling Technologies DP/HSA Duel Purpose

WATER LEVELS: 8.15 ft. TOC START: 11/22/2006 END: 11/22/2006 LOGGER: M. Godwin

DEPTH BGS (ft)	INTERVAL (ft)	RECOVERY	TYPE-# (SS=Split Spoon ST=ShelbyTube)	STANDARD PENETRATION TEST RESULTS 6-6-6 (in) (N)	CORE DESCRIPTION: SOIL NAME (USCS GROUP SYMBOL), COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY.	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION.
24	24-28	50%	GP		Slough?	
25						
26					SAND (SP). Dark greenish gray (5GY 4/1), wet, loose, bioclastic, subangular to subrounded quartz and medium sand, trace mica, sharp contact with below.	
27					SILT (ML). Dark greenish gray (5G 4/1), moist, firm, laminated, micaceous, non plastic.	
28	28-32	25%	GP		No recovery.	
29						
30						
31					SAND (SM). Dark greenish gray (5G 4/1), dry, hard, friable, fine angular quartz sand and lith and mica, weathered sandstone.	
32	32-36	15%	GP		Slough.	
33					SILTY SAND (SM). Olive (5Y 4/3), dry, hard, friable, fine angular sand, weathered, panoche fm sandstone.	
34						
35						
36	36-40	100%	GP		Slough.	
37						
38					SAND (SW). Yellowish brown (10YR 5/6), dry, hard, very fine sand, limonite stained, caliche near top, weathered panoche	
39					fm sandstone/siltstone.	
40					Total depth=40 ft. bgs.	
41						

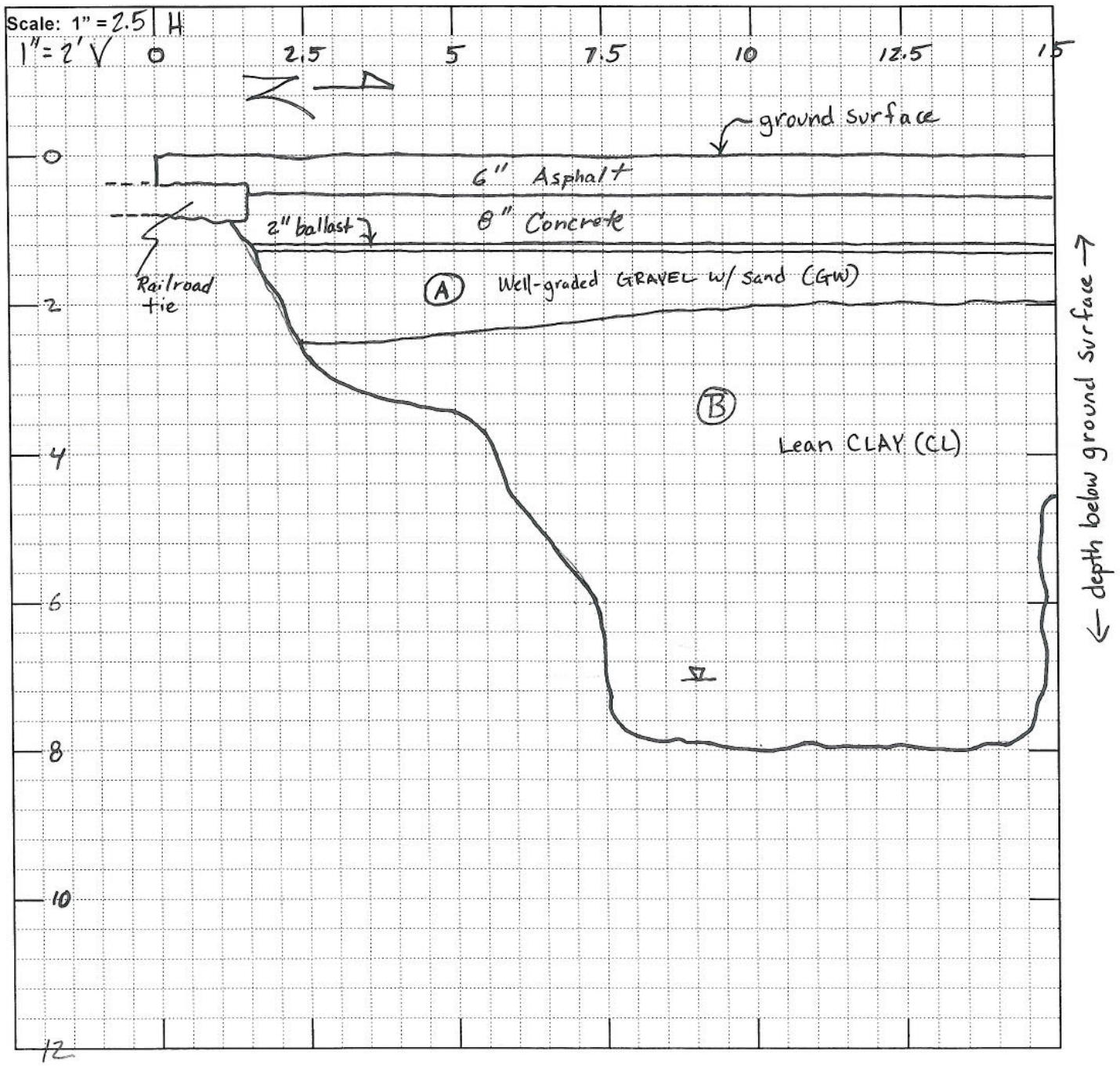
APPENDIX F

Documentation from the 2007 Field Investigation

APPENDIX F1

Trench Logs

Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-21-07
Project No. 273939.14.01	Site
Location Trench AD-1	
Lithologic Log on Page 2 of 2	
Begin Trench: 0855 11-21-07	
End Trench: 1100 11-21-07	
Depth to water: 7' bgs	
GPS Coords	
Trench View (west)	



Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-21-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL w/ Sand (GW) brown (7.5 YR 4/3) dry to moist, loose, fine to coarse sand, fine to coarse angular gravel, some angular cobbles, no TPH odor.

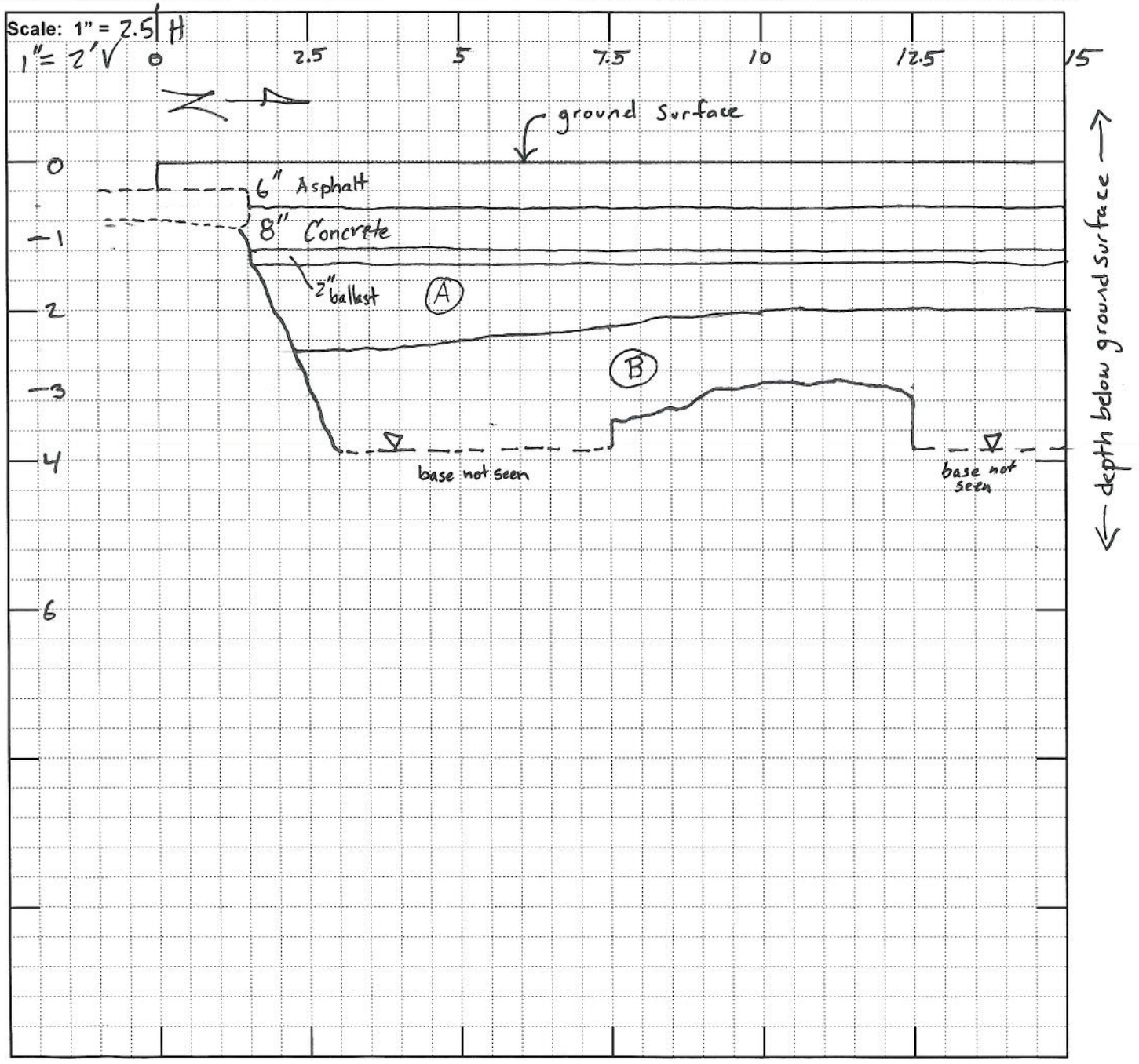
(B) Lean CLAY (CL) olive gray (5Y 4/2) mottled with yellowish brown (10YR 5/6), black (5Y 2.5/1) and dark greenish gray (5G 4/1), moist, low to med plasticity, soft to firm, plt material, wood fragments, some fine to coarse sand.

Station ≈ 5 to 10 @ 5' bgs. large pieces of metal plate, metal rod, wire rope/cable, some Free TPH on debris surface, Free TPH in voids surrounding metal

Station ~ 5 to 12.5 @ 6' bgs large pieces of metal continue. metal plate, metal box (2" x 1' x 4') (rectangular) containing Free TPH, at this depth metal debris is almost completely covered with free TPH, wood debris and wire rope/cable also continues.

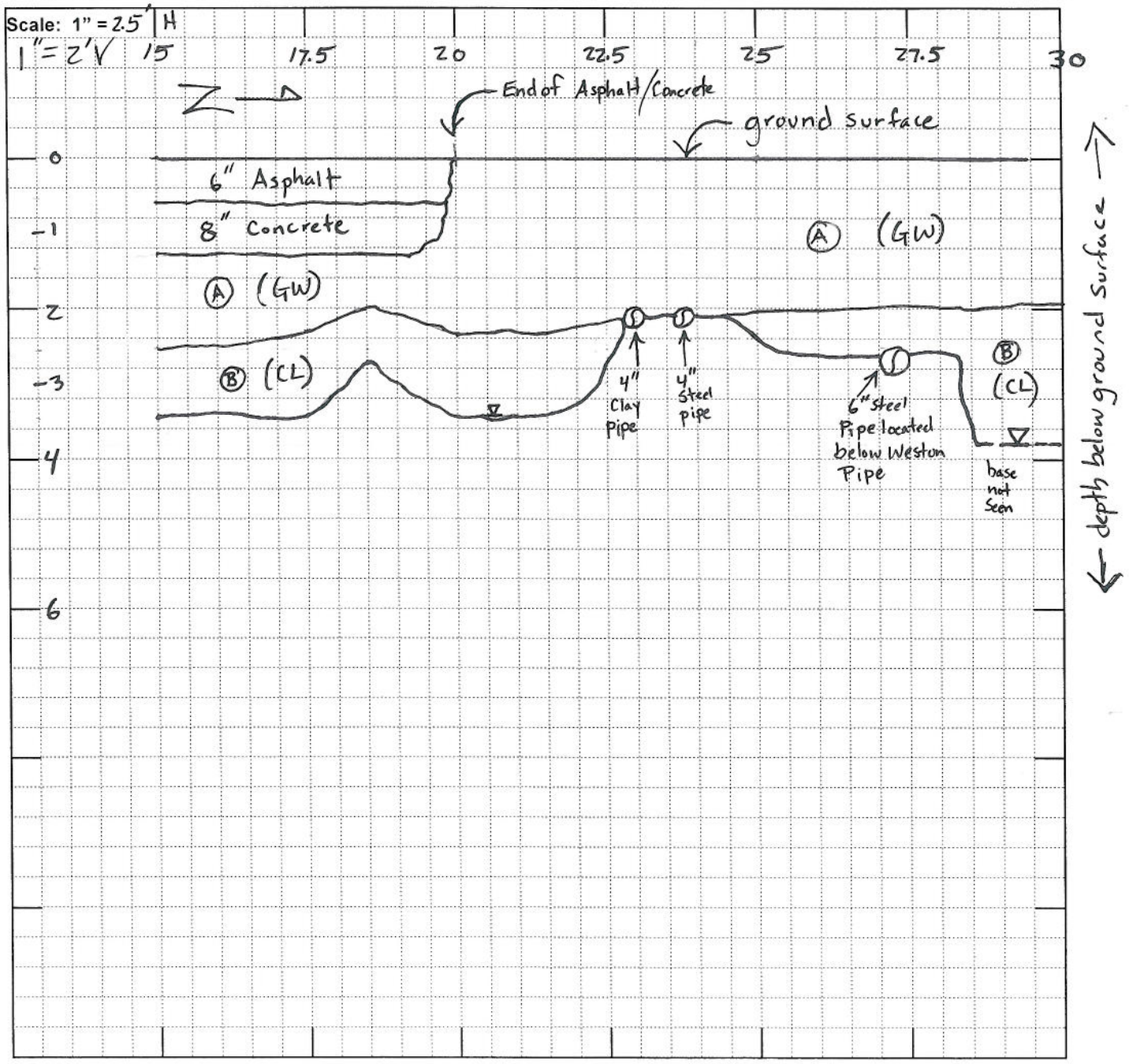
Station ~ 5 to 15 @ ≈7' bgs. out of metal debris. Still in Lean clay (CL) dark greenish gray (5GY 4/1), Free TPH in fractures and along plant material (roots) in clay. The oil in fractures is mm thick and fractures are less than 1" apart.

Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-20-07
Project No. 273939.14.01	Site
Location Trench AD-1	
Lithologic log on Page 4 of 5 and Page 5 of 5	
Begin trench: 0840 11-20-08	
End trench: 1530, 11-20-08	
Depth to Water: 3.5' bgs first encountered groundwater.	
GPS Coords	
Trench View (west)	



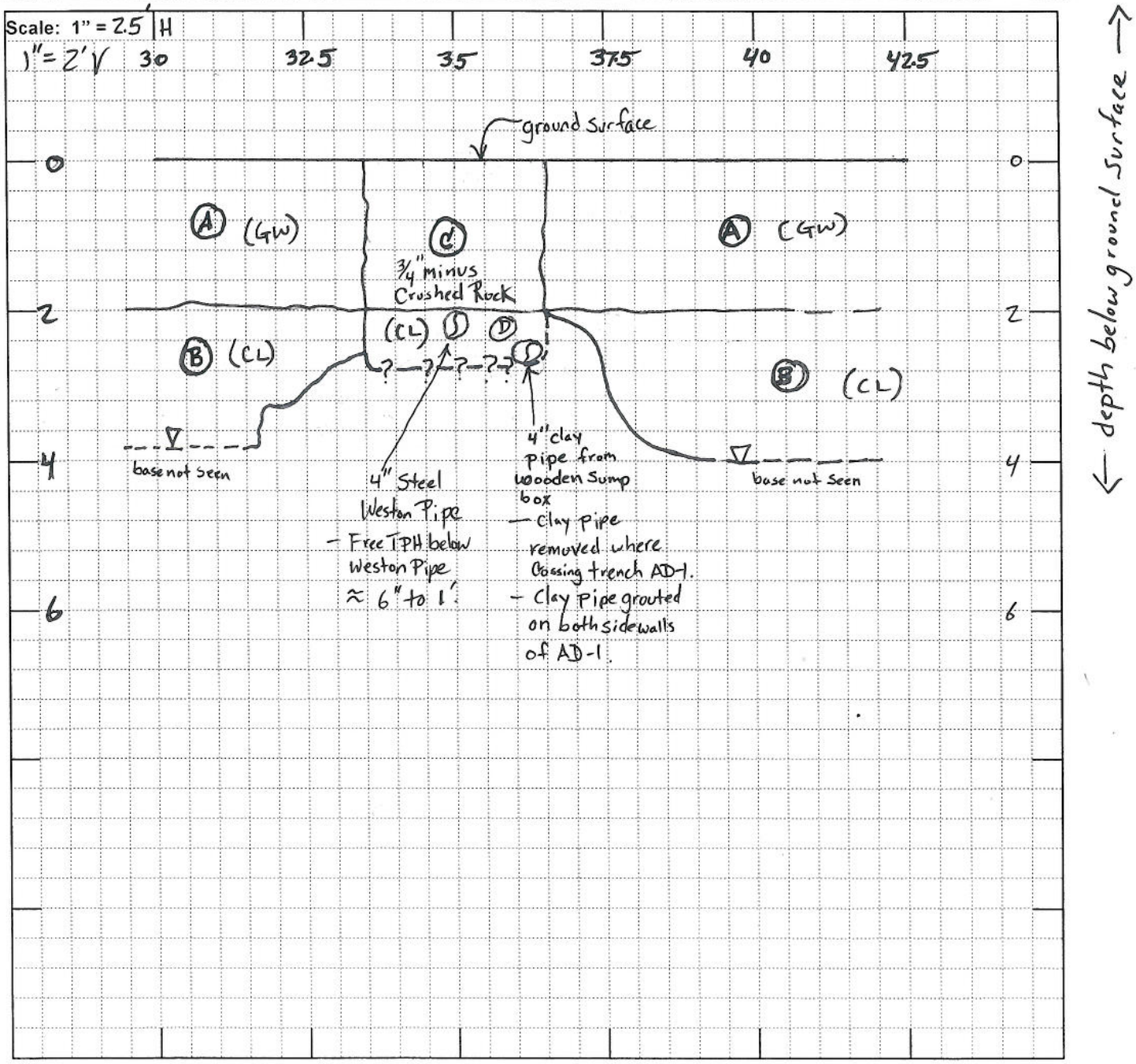
Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-20-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (west)



Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-20-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (west)



Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-20-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

Station 0 to 10

(A) Well graded gravel with Sand (GW) brown (7.5YR 4/3), dry to moist, loose, fine to coarse sand, fine to coarse angular gravel, some angular cobbles, no TPH odor.

(B) Lean CLAY (CL) olive gray (5Y 4/2) mottled with yellowish brown (10YR 5/6), black (5Y 2.5/1) and dark greenish gray (5G 4/1) moist, ~~med~~ SBa low to med plasticity, Soft to firm, Plant material, wood fragments, Some fine to coarse sand,

Station 2.5 to 7.5

@ 3.5' bgs debris starts: brick, wood, wire rope, ~~wood~~ SBa metal plate (thin), Free TPH on debris.
@ 4' bgs larger pieces of metal encountered.
voids with Free TPH visable at trench bottom. Only trace occurance of Free TPH in fractures of clay.
larger metal debris includes thick wire rope (3/4" thick) and metal plate (3/8" thick).

TPH Observations

Only Some metal at 3.5' Covered with oil. Below 3.9' gw; metal is Covered with oil.

Free TPH not present in sidewalls above groundwater, except where Specified.

Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-20-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology (Continued)

(C) 3/4" minus Crushed rock

(D) gravelly CLAY (CL) very dark greenish gray (10GY 3/1), moist, low to med plasticity, fine to coarse angular gravel, some fine to coarse sand, Free TPH along fractures (mm scale) and in voids created by various grain sizes.

Station 15 @ 3.5' bgs debris starts: metal plate, large # of cables, wood, metal plates stacked, Free TPH in voids created by debris and coated debris

Station 20 to 22.5 @ 3.5' bgs debris starts: metal stripping, metal plate angle iron, Free TPH in voids created by debris and TPH coating some debris

Station 30 to 32.5 @ 3.5' bgs debris starts: metal plate, rod, cable, Free TPH in voids, ends on metal, wood fragments created by metal

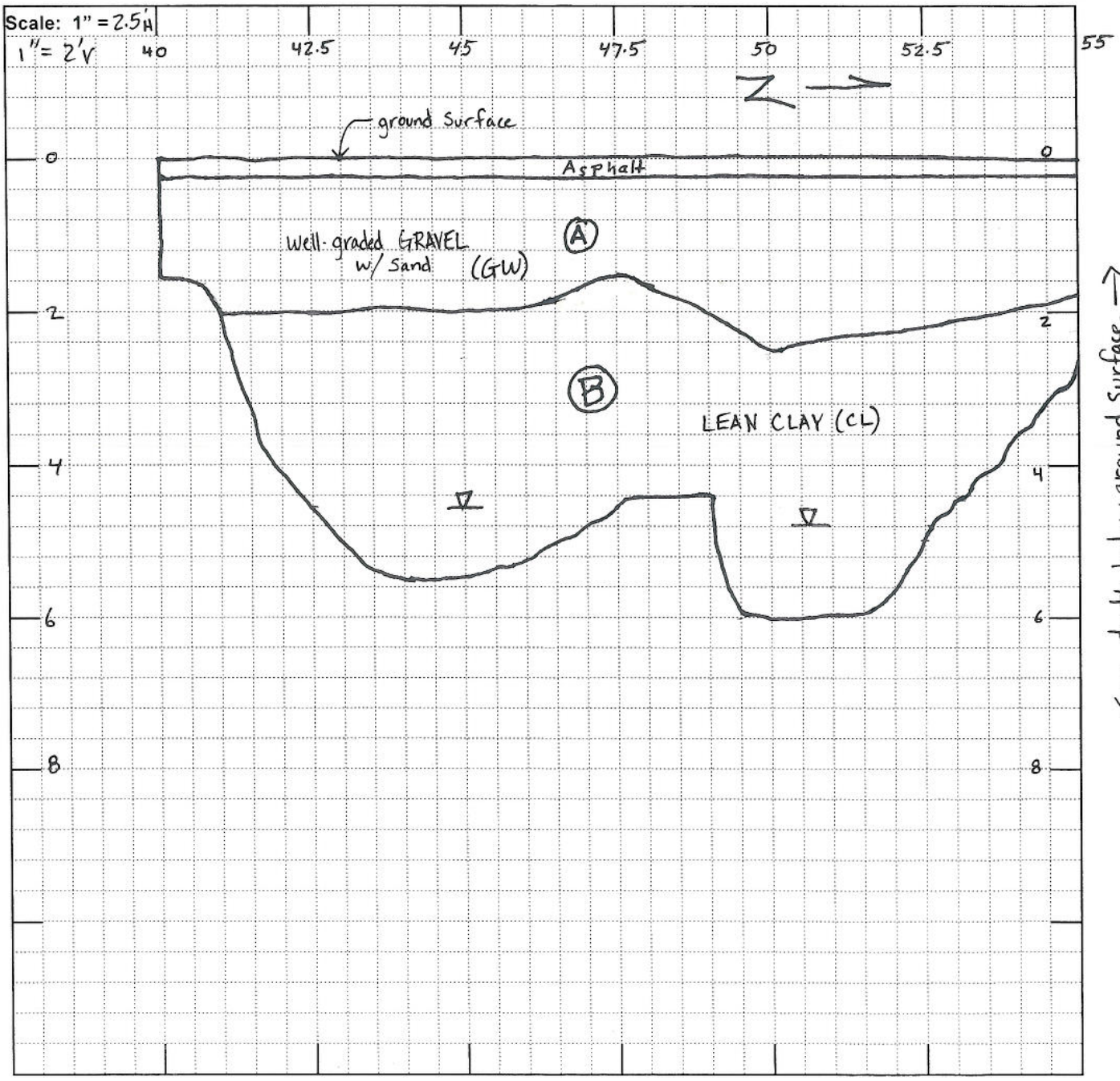
Free TPH prevelent along fractures and along wood fragments

Station 40 to 42.5 @ 3.5' bgs metal debris starts: metal rod, copper wire, wire rope, metal scrap, Free TPH in voids created by metal, TPH coating some metal debris

Free

Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-15-07
Project No. 273939.14.01	Site
Location Azuar Dr.	
Lithologic Log on Page 2 of 2	
Begin trench 1258 11-15-07	
End trench 1625, 11-15-07	
Depth to water: 4.5' bgs	
GPS Coords	

Trench View (West)



Trench Sidewall Record	Trench # AD-1
Contractor: Turn-Key Construction Services, Inc.	Date 11-15-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL with Sand (GW) brown (7.5YR 4/4) dry to moist, loose, fine to coarse sand, fine to coarse angular gravel, some angular cobbles, no TPH odor.

(B) Lean CLAY (CL) dark greenish gray (10GY 4/1) mottled with greenish gray (5G 5/1) and Black (5Y 2.5/1), moist, med. plasticity, soft to firm, plant material (roots), wood fragments.

@ 4' bgs debris starts, brick, wire rope, metal plate @ Station 42.5. Free TPH with metal debris.

(C) @ 5.5' bgs Station 51 Free TPH w/ metal debris.

Metal Occurance

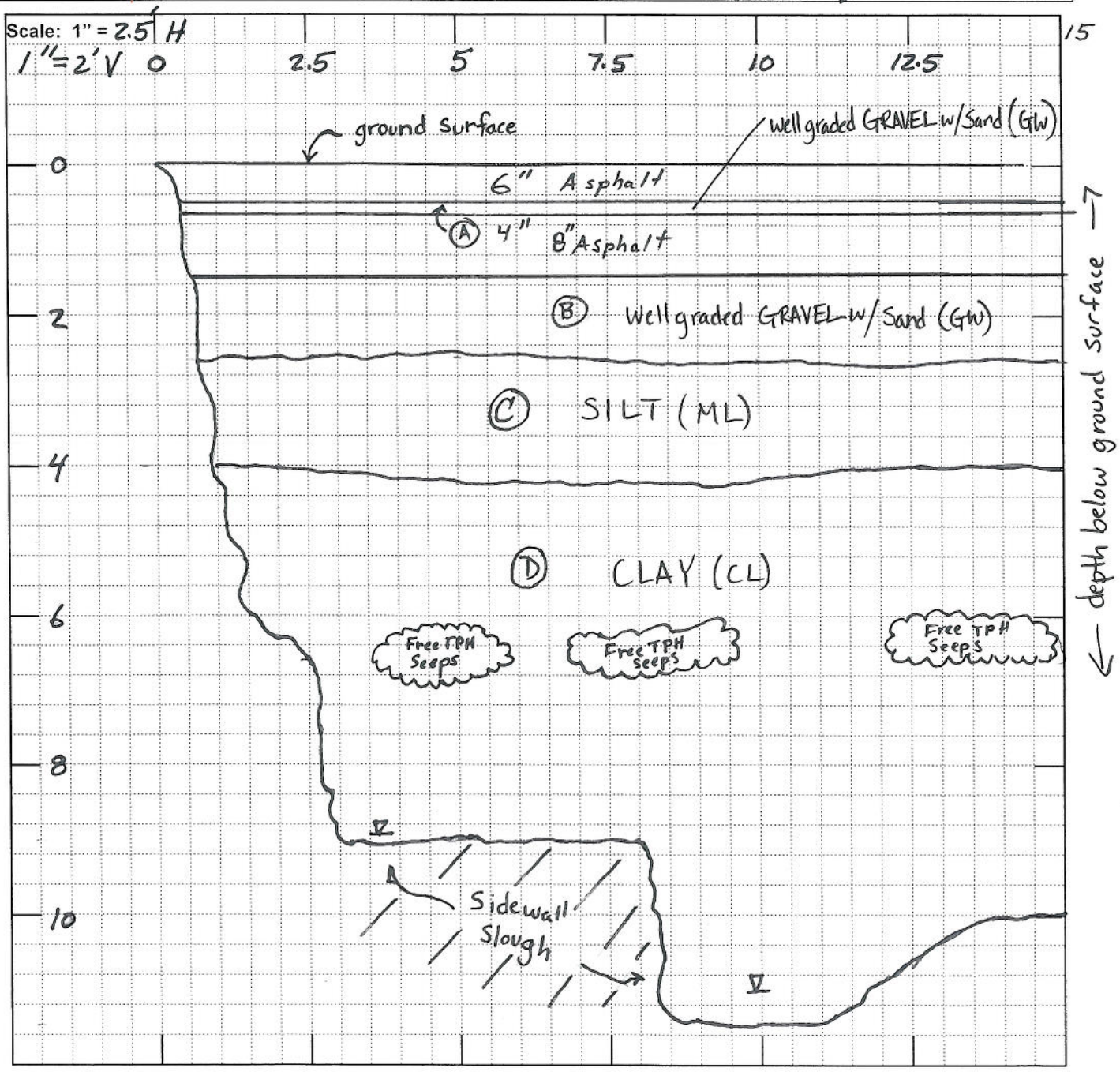
(1) Isolated metal debris at 4' bgs / Station 42.5 and 5.5' bgs / Station 51

TPH Occurance

(1) 4' bgs / Station 42.5. Free TPH covering metal debris. Trace free TPH in fractures along roots. TPH associated with metal debris and Surrounding Voids.

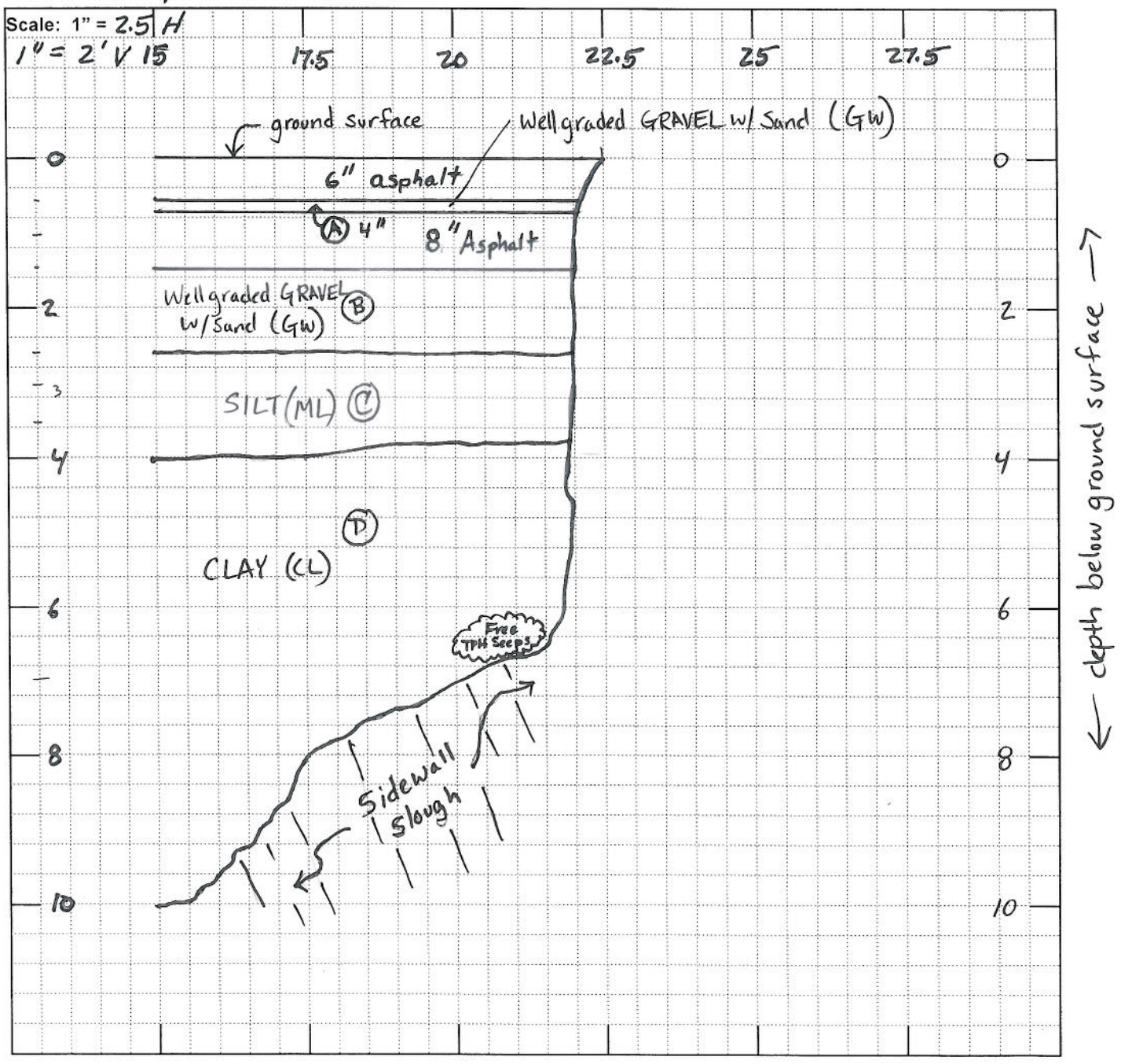
(2) 5.5' bgs / Station 51. Free TPH covering metal debris. Trace Free TPH in fractures along roots. TPH associated with metal debris and surrounding Voids.

Trench Sidewall Record	Trench # AD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location Trench AD-2	
Lithologic log on Page 3 of 4 and 4 of 4	
Begin trench: 1105 11-28-07	
End trench: 1530 11-28-07	
Depth to water: 6' bgs first encountered gw @ Sta. 2.5	
GPS Coords	
Trench View (East)	



Trench Sidewall Record	Trench # AD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded Gravel w/ Sand (GW) brown (7.5YR 4/3) dry to moist, loose, fine to coarse angular gravel, fine to coarse Sand, no TPH odor.

(B) Well graded GRAVEL w/ Sand (GW) dark reddish brown (5YR 3/2), moist, loose, fine to coarse angular gravel, fine to coarse Sand, no TPH odor.

(C) SILT (ML) Olive (5Y 5/4) mottled w/ yellowish brown (10YR 5/8) and dark greenish gray (5G 4/1) moist, low to med plasticity, soft, no TPH odor

(D) CLAY (CL) dark greenish gray (5G 4/1) mottled w/ yellowish brown (10YR 5/6) moist, med plasticity, Soft to firm, Some fine to coarse sand, plant material.

@ Station 2.5 encountered groundwater ≈ 6' bgs

@ Station 2.5 to Station 20 Consistent top of metal debris and Free TPH ~~around~~ in voids created by metal @ depth of 5.5' bgs.

Metal debris consists of metal plate, wire rope/cable, metal strap,

@ Station 2.5 to 7.5 ; ~~do~~ excavated to 10' bgs out of metal debris @ ≈ 8' bgs. However, in Clay material from ≈ 9 to 10' bgs Free TPH Continues to be observed in fractures and along plant material.

@ Station 7.5 to Station 20 Excavated to max depth of ~~11' bgs~~ 11.5' bgs

- Bottom of metal Consistent @ 8' bgs ~~from Station 2.5 to Station 20.~~ along access trench

Trench Sidewall Record	Trench # AD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

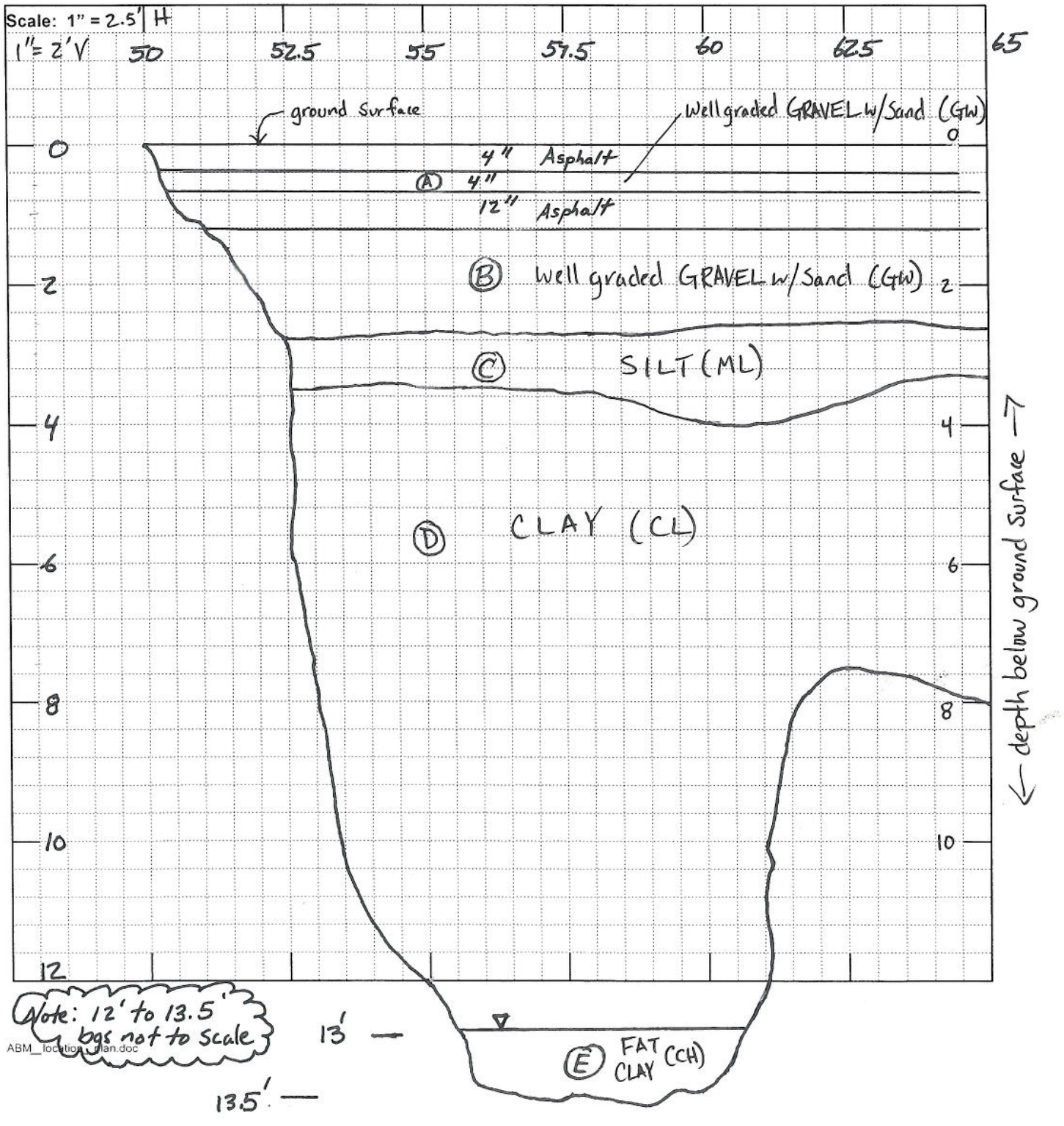
Scale: 1" =

Lithology Continued ...

@ Station 17.5' to Station 20 Clay material from ≈ 10' bgs. Free TPH Continues to be observed in some fractures and along plant material.

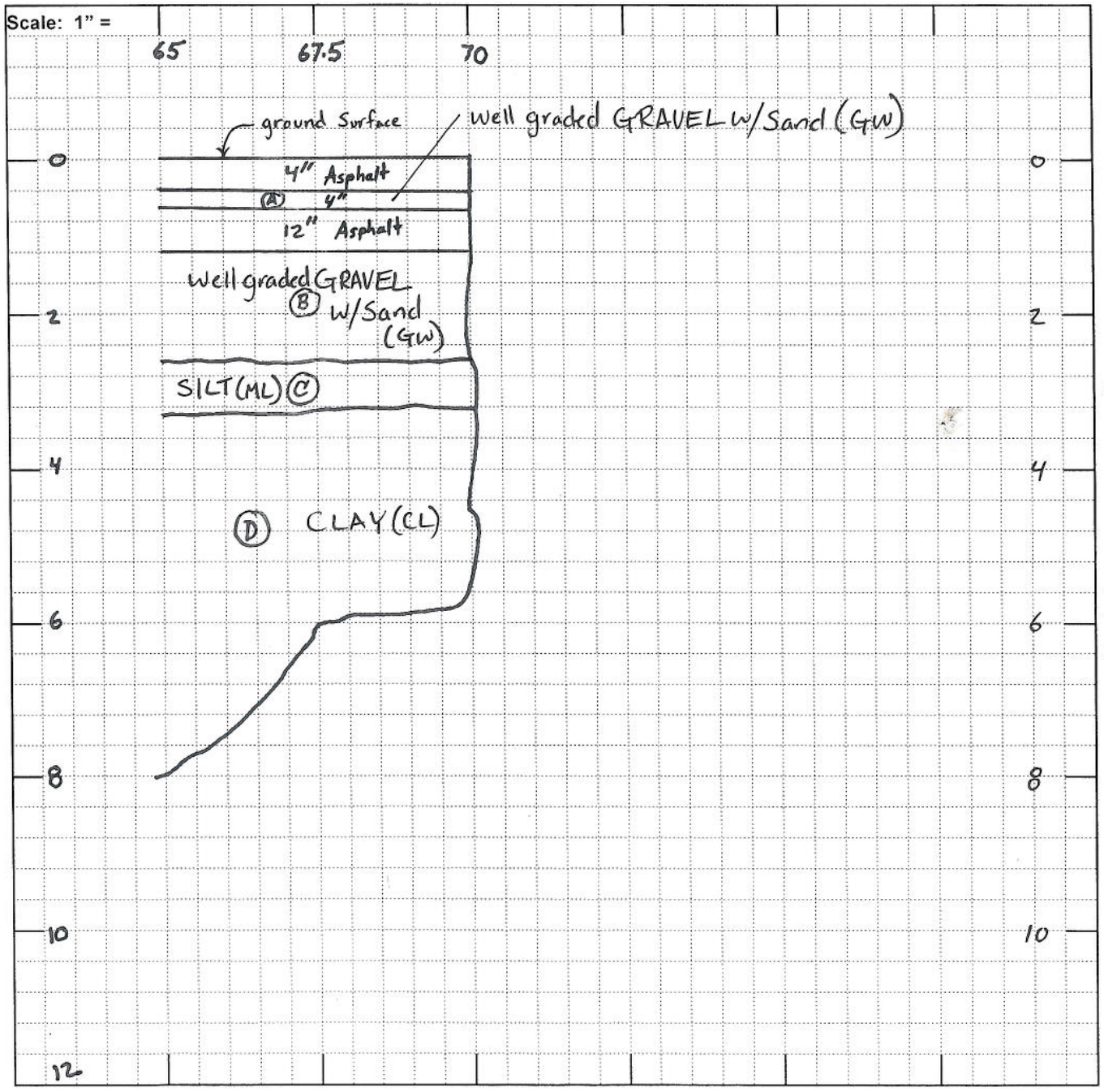
Some Sloughing of sidewall after excavation to total depth of 11.5 max @ Station 10.

Trench Sidewall Record	Trench # AD-2 (Station 50 to 70)
Contractor: Turn-Key Construction Services, Inc.	Date 11-29-07
Project No. 273939.14.01	Site
Location Trench AD-2 (Sta. 50 to 70)	
Lithologic log on Page 3 of 4 and 4 of 4	
Begin trench: 1230 11-29-~~00~~ 07	
End trench: 1540 11-29-07	
Depth to Water: 6' bgs first encountered gw sta. 52.5 to 57.5	
GPS Coords	
Trench View (East)	



Trench Sidewall Record	Trench # AD-2 (Station 50 to 70)
Contractor: Turn-Key Construction Services, Inc.	Date 11-29-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-2 (Station 50 to 70)
Contractor: Turn-Key Construction Services, Inc.	Date 11-29-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded Gravel w/ Sand (GW) Brown (7.5YR 4/3), dry to moist, loose, fine to Coarse angular gravel, fine to Coarse Sand,

(B) Well graded Gravel w/ Sand (GW) dark reddish brown (5YR 3/2) moist, loose, fine to Coarse Sand,

(C) Silt (ML) olive (5Y 5/4) mottled with yellowish brown (10YR 5/8) and dark greenish gray (5G 4/1), moist, low to med plasticity, Soft.

(D) CLAY (CL) dark greenish gray (5G 4/1) mottled with very dark greenish gray (10Y 3/1) ~~and silt~~, moist, med Plasticity, firm, Some fine to Coarse Sand,

@ Station 52.5 to Station 60 encountered metal debris (Steel plate/Scrap) at 5' bgs. Free TPH in voids surrounding metal. Free TPH present along fractures of Clay material.

@ Station 52.5 to Station 57.5 encountered groundwater at 6' bgs.

@ Station 56 to Station 61 Free TPH Seeping from Side walls @ ≈ 5.5' bgs. and forming puddles of Free TPH on trench bottom.

Metal debris consists of: Steel plate, Steel scrap, Corrigated metal, Ships bulk heads,

- Metal debris Consistent thickness ≈ AD-2 Station 50 to 70.
- Out of metal debris @ ≈ 8' bgs across ~~½~~ Length of trench

Trench Sidewall Record	Trench # AD-2 (Station 50 to 70)
Contractor: Turn-Key Construction Services, Inc.	Date 11-29-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology Continued

@ 10.5' bgs : below metal Clay material with Free TPH present in some fractures.
@ 11.5' bgs Clay material with free TPH present in some fractures.

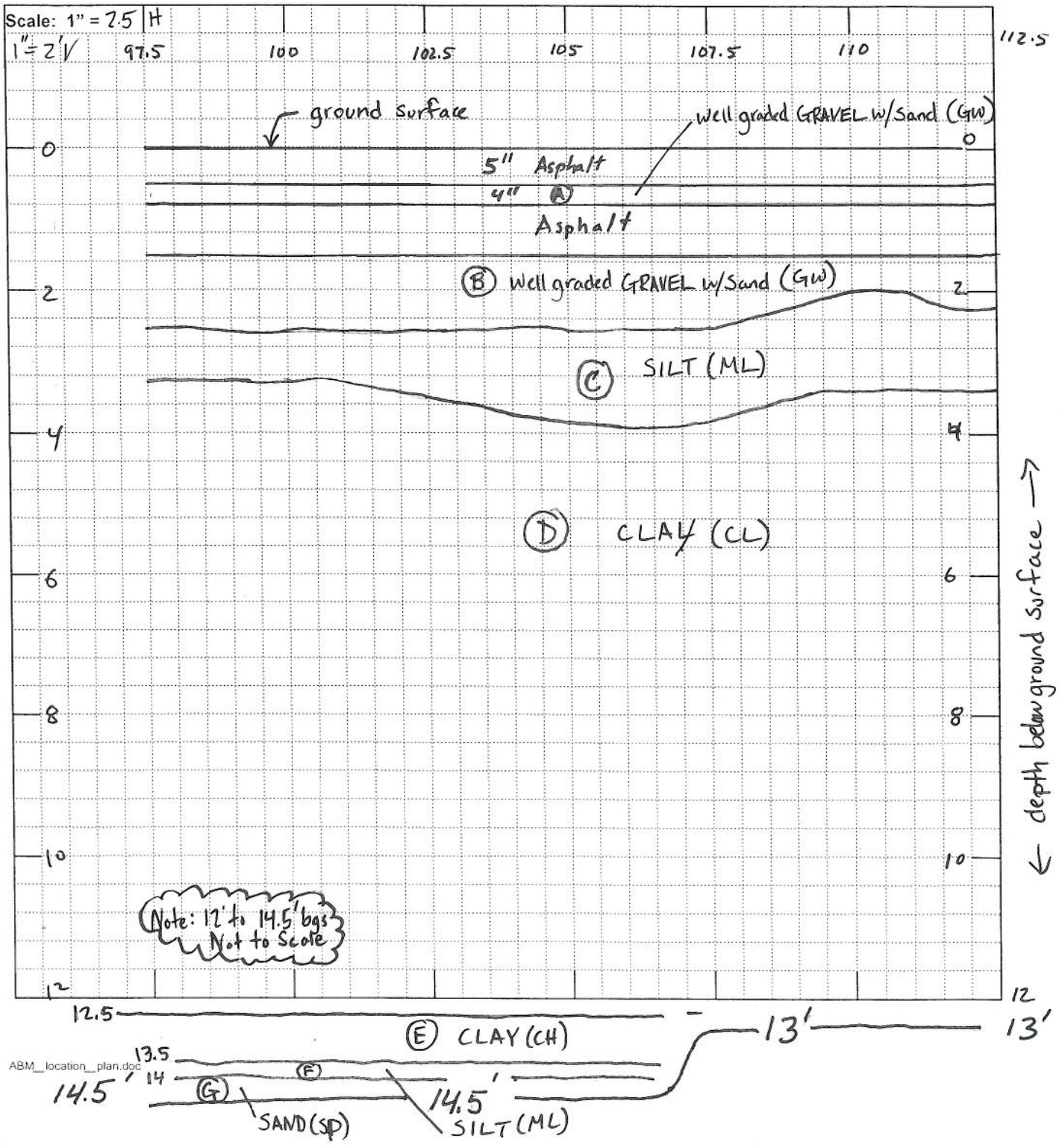
(E) (D) SEA

@ ≈13' bgs Fat CLAY (CH) very dark greenish gray (5GY 3/1), moist, Soft, high plasticity, Shell fragment, laminated thin (mm to cm), Sand lenses, no TPH odor, appears to be native fine material.

@ 13 to 13.5' bgs No evidence of Free TPH in fractures of Clay or along laminated Sand lenses.

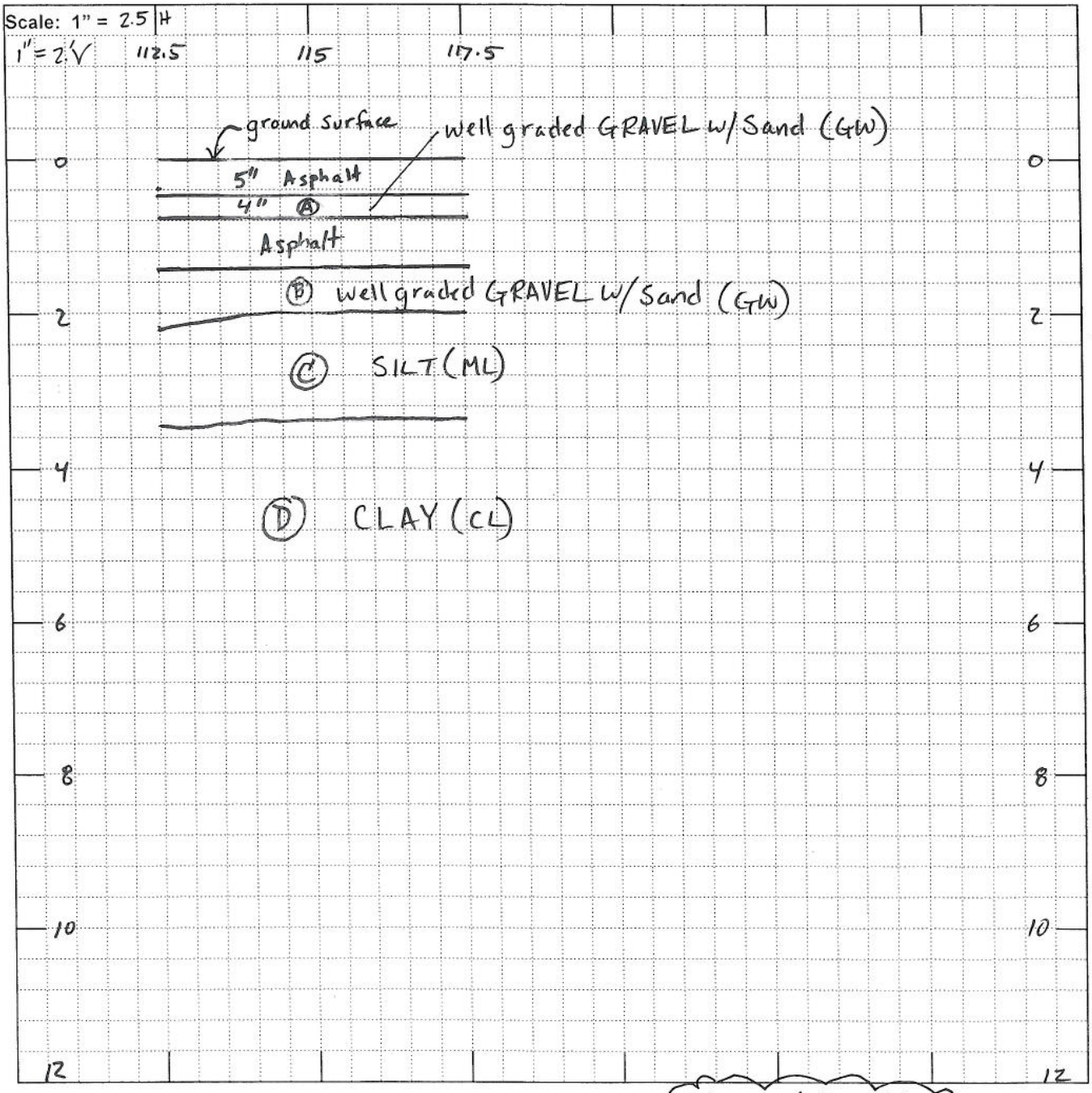
Trench Sidewall Record	Trench # AD-2 (Station 97.5 to 117.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location Trench AD-2 (sta. 97.5 to 117.5)	
Lithologic log on Page 3 of 4 and 4 of 4	
Begin trench: 0830 12-3-08	
End trench: 1100 12-3-08	
Depth to Water:	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-2 (Station 97.5 to 117.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-2 (station 97.5 to 117.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel with Sand (GW) brown (7.5YR 4/3), dry to moist, loose, fine to coarse angular gravel, fine to Coarse sand.

(B) Well graded gravel with Sand (GW) dark reddish brown (5YR 3/2), moist, loose, fine to coarse Sand,

(C) Silt (ML) olive (5Y 5/4) mottled with yellowish brown (10YR 5/8) and dark greenish gray (5GY 4/1), moist, low to med. plasticity, soft.

(D) CLAY (CL) very dark greenish gray (5GY 3/1), moist, soft, low to med plasticity, blocky fracture, play material, to firm ↑ Free TPH and Metal as described below.

@ 5.5' bgs

@ Station 107.5 to 110; beginning of Free TPH and isolated metal debris and wire rope/Cable

~~Free TPH prevelent~~ 9' bgs

@ Station 102.5; 9' bgs Free TPH Continues, no metal observed. Free TPH prevelent in fractures of Clay. Clay at this depth has blockly fractures and in some areas fractures along a horizontal plane.

@ Station 112.5; 10.5' bgs Out of Free TPH No TPH observed in fractures.

@ Station 102.5 to 105; 12.5' bgs, Free TPH Continues in fractures of clay material.

@ Station 102.5 to 105; 14.5' bgs. Silt (ML) above Sand layer w/ shells. Collected Sample from Silt (ML).

Trench Sidewall Record	Trench # AD-2 (station 97.5 to 117.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology Continued...

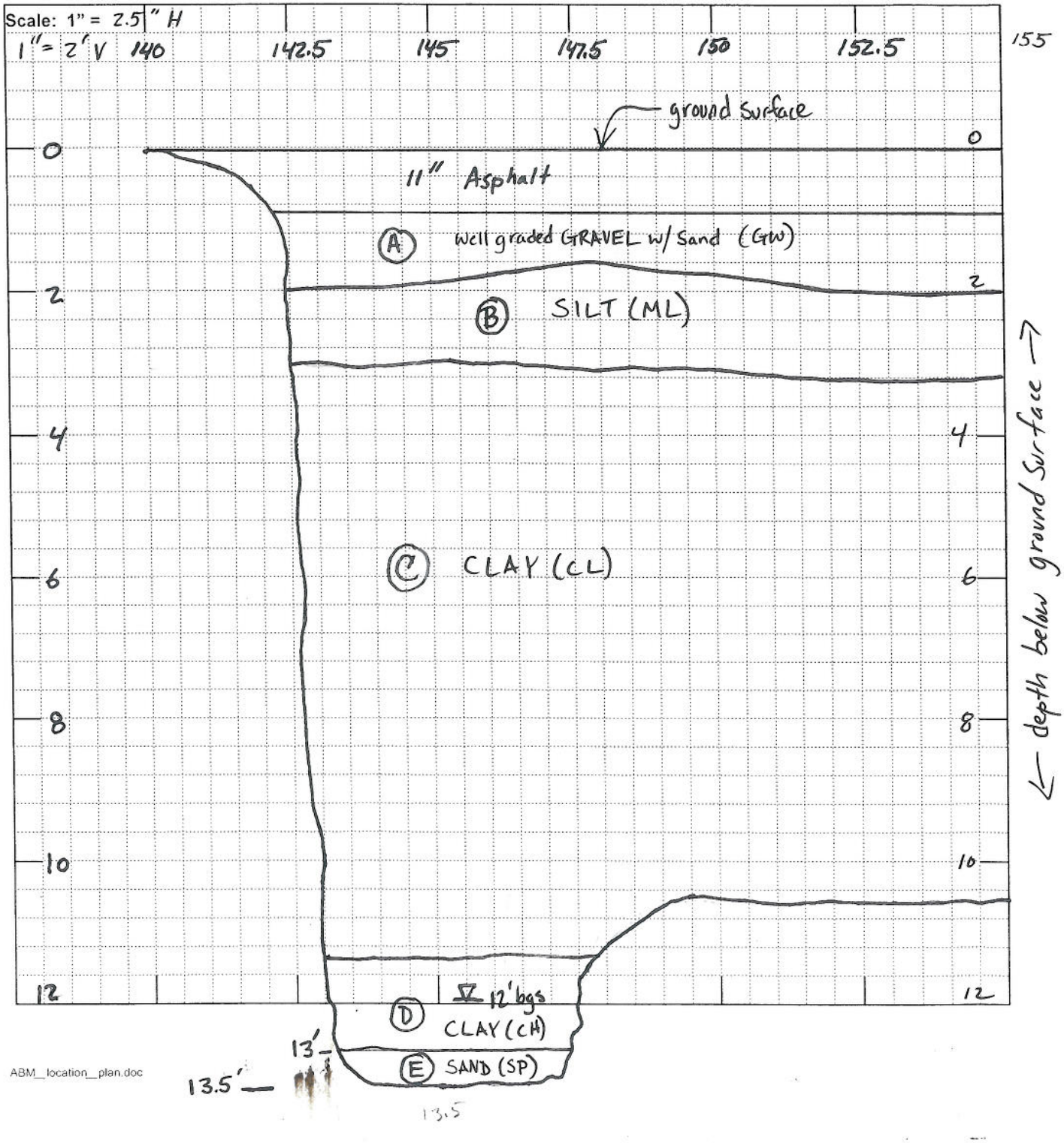
≈ 12.5 to 13.5' bgs (E) CLAY (CH) dark greenish gray (10Y 4/1), mottled w/ black (5Y 2.5/1), moist, Soft, high plasticity, sly. dialatancy, Some Silt, trace mica, Some Free TPH in fractures, Free TPH less pervalive than Clay (CL) above.

13.5 to 14' bgs (F) SILT (ML) very dark greenish gray (10Y 3/1), ~~wet~~ moist, Soft, some mica flakes, low plasticity, sly dialtancy, no Free TPH, no TPH odor,

14' to 14.5' bgs (G) SAND (SP) dark greenish gray (5GY 4/1), wet, loose, fine Sand, Some shells, no TPH odor, no Free TPH.

Trench Sidewall Record	Trench # AD-2 (Station 140 to 162.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location Trench AD-2 (Sta. 140 to 162.5) Lithologic log on Page 3 of 3 Begin trench: 1100 12-3-07 End trench: 1320 12-3-07 Depth to water: 12' bgs	
GPS Coords	

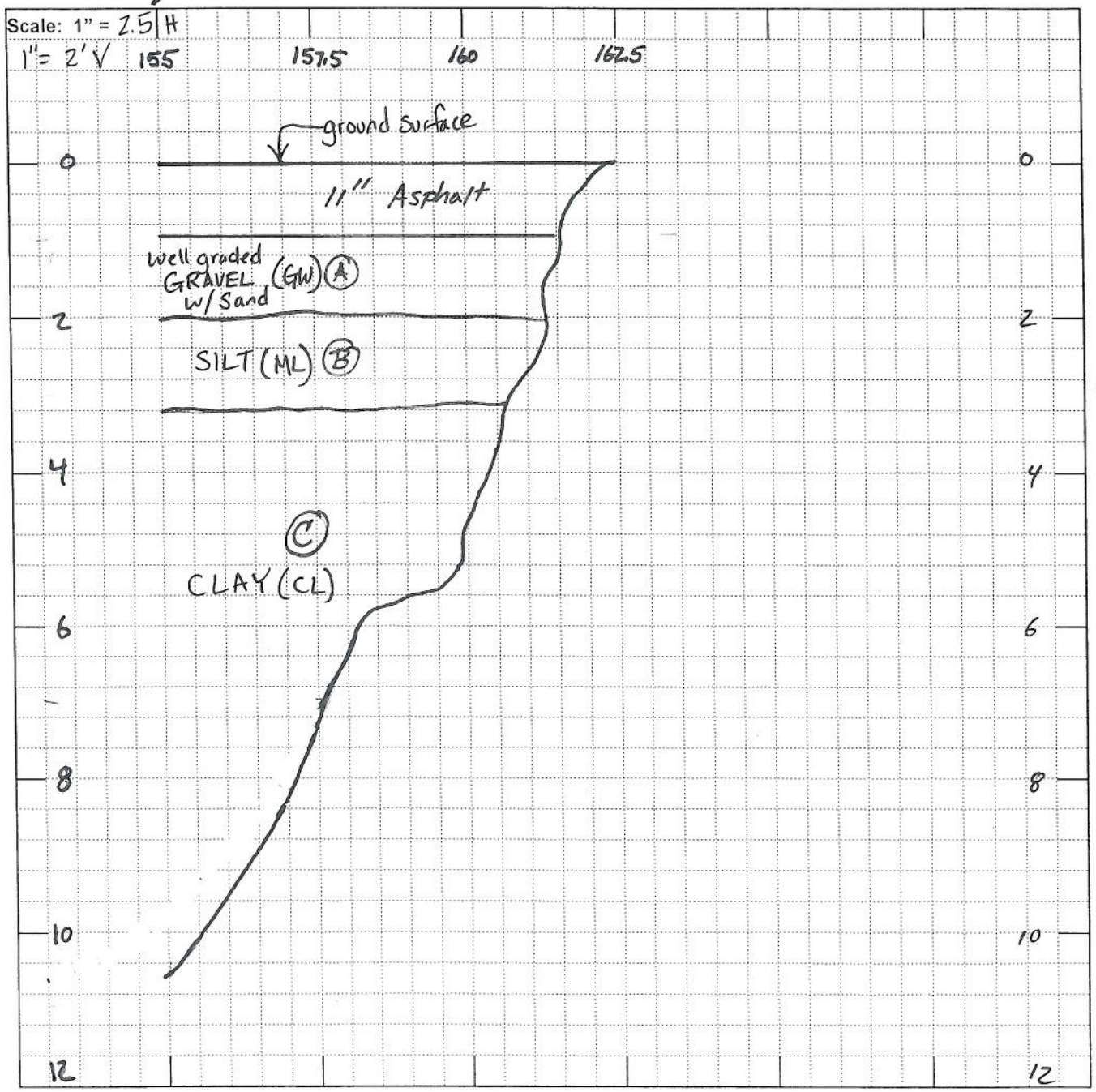
Trench View (East)



ABM_location_plan.doc

Trench Sidewall Record	Trench # AD-2 (Station 140 to 162.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-2 (Station 140 to 162.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-3-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel with Sand (GW) dark reddish brown (5YR 3/2), moist, loose, fine to Coarse Sand, fine to coarse gravel,

(B) Silt (ML) olive (5Y 5/4) moist, Soft, low plasticity,

(C) CLAY (CL) very dark greenish gray (10GY 3/1) moist soft to firm, low to med. plasticity, trace fine to coarse Sand ~~gravel~~, roots / plant material, Free TPH described below.

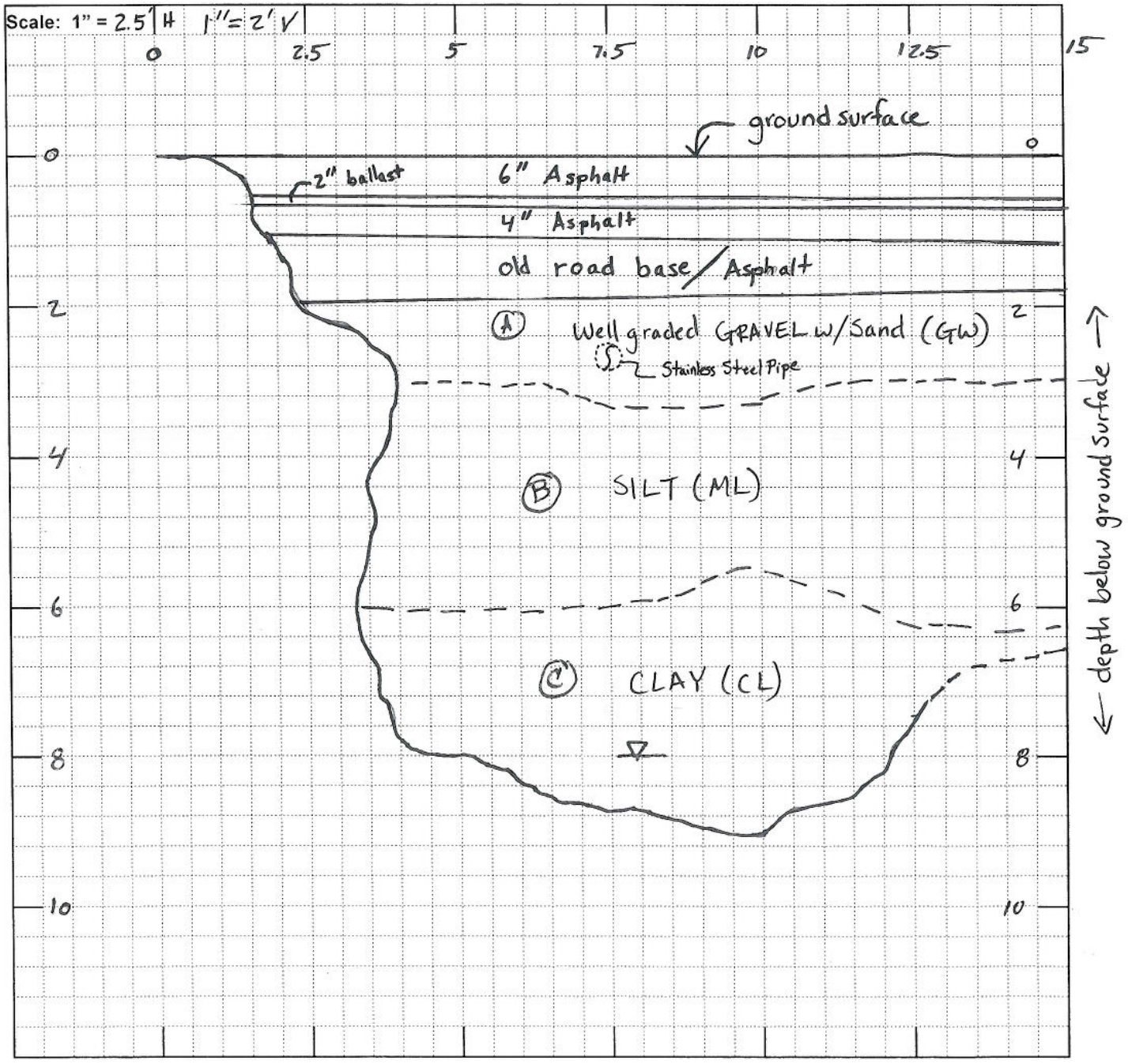
- C Station 145; 5' bgs into Clay material, Free TPH in fractures and along plant material, no metal debris,
- C Station 157.5; 5' bgs First Encountered water and piece of wood debris. (Perched water)
- C Station 150.5 and 154 wood debris C ≈ 7' bgs
- C Station 147 9.5' bgs Clay material w/ blocky fracture, Free TPH prevelent in fractures and along roots / plant material.
- C Station 147 10' bgs Clay material w/ blocky fracture, Free TPH prevelent in fractures and along roots / plant material.

Station 145 - 147 11.5 to 13.0' bgs (D) CLAY (CH) dark greenish gray (5GY 4/1) mottled w/ black (5Y 2.5/1), moist, high plasticity, sly dilatancy, some silt, trace mica, plant material / roots, Some Free TPH in fractures and along roots / plant material, Free TPH less pervasive than Clay (CL) above.

Station 145-147 13.0 to 13.5' bgs (E) Sand (SP) very dark greenish gray (5GY 3/1), wet, loose, fine Sand, Some Shell fragments, no TPH odor, no free TPH.

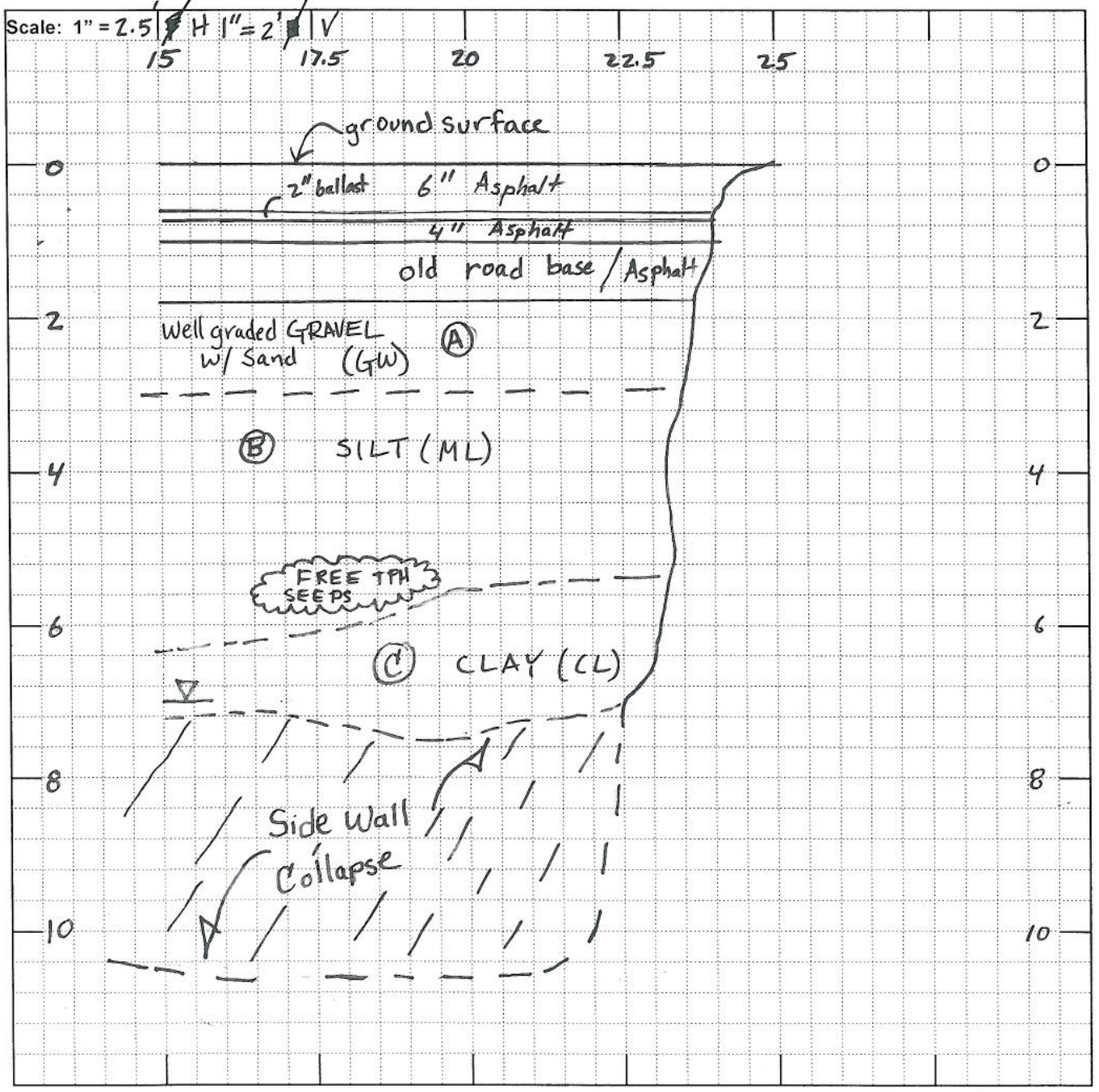
Trench Sidewall Record	Trench # AD-3
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location Trench AD-3	
Lithologic log on Page 3 of 4 and 4 of 4	
Begin trench: 0825 11-28-07	
End trench: 1100 11-28-07	
Depth to water: 8' bgs ≈ Sta. 7.5	
GPS Coords	

Trench View (North West)



Trench Sidewall Record	Trench # AD-3
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (North west)



Trench Sidewall Record	Trench # AD-3
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL with Sand (GW) dark reddish brown (5YR 3/2) moist, loose, fine to coarse angular gravel, fine to coarse sand, trace cobbles, no TPH odor.

(B) SILT (ML) yellowish brown (10YR 5/6) mottled with ~~very~~ dark greenish gray (5G 4/1) moist, low to med plasticity, soft to firm, TPH and debris as described per station location.

C Station 17.5 ; 4' bgs brick debris.
C station 20 ; 3' bgs one stran of wire rope/cable

@ Station 17.5 ; 5' bgs encountered metal debris (metal sheet/scrap and wire rope/cable) wood debris, groundwater and Free TPH.

(B) @ Station 17.5 to Station 20 6' bgs metal and Free TPH described above continues. Free TPH in fractures of silty material.

@ Station 13 to Station 20 7' bgs metal and Free TPH Continue. Free TPH in fractures of clay material.

(C) C Station 17 to 23 ; 10.5' bgs out of metal debris. However Free TPH continues to be observed in fractures and along wood fragments in some clay material.

Move SW along trench AD-3

Trench Sidewall Record	Trench # AD-3
Contractor: Turn-Key Construction Services, Inc.	Date 11-28-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology Continued...

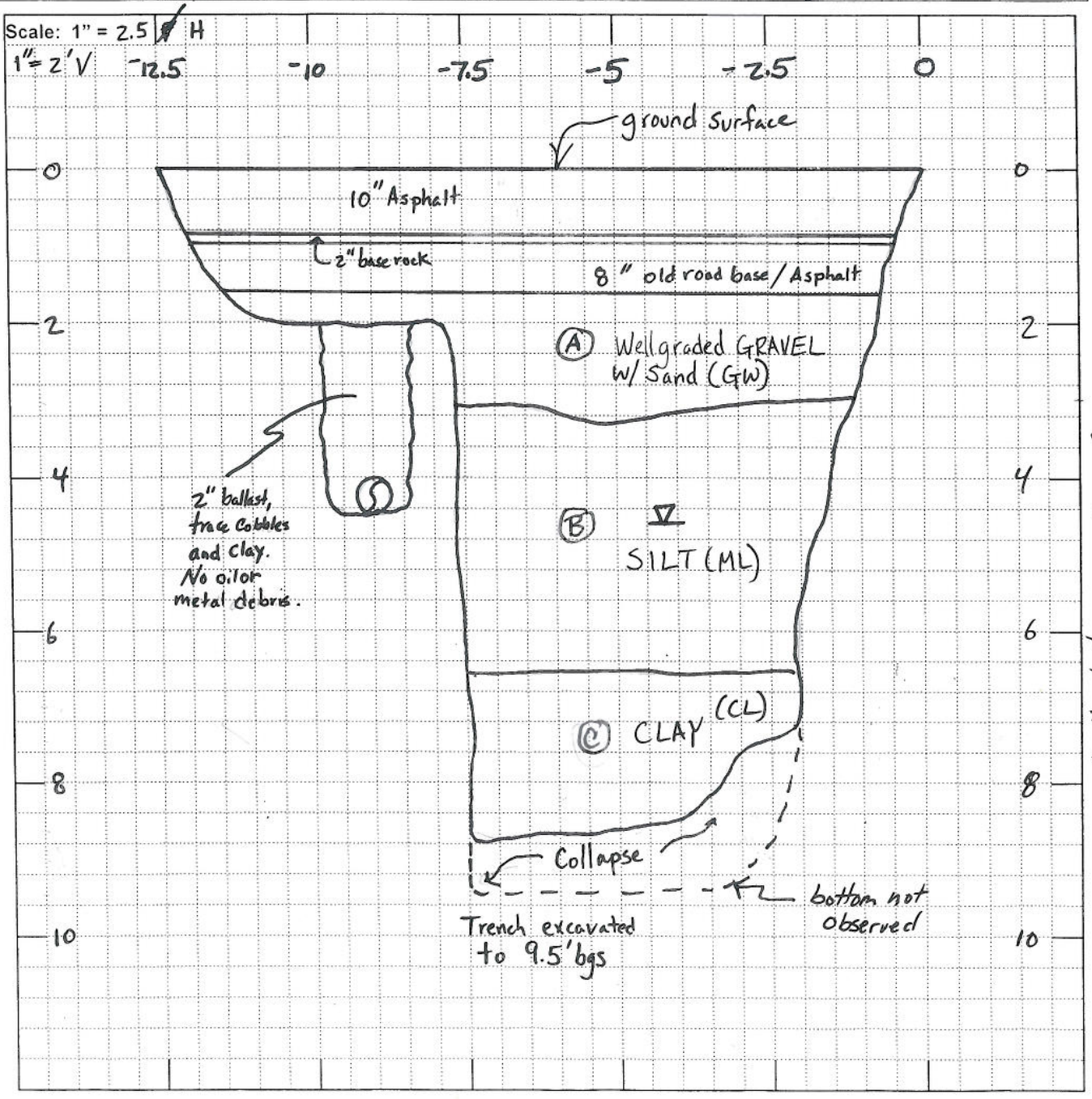
(C) CLAY(CL) very dark greenish gray (5G 3/1), moist, med plasticity, Soft to firm, Some fine to coarse sand, ~~trace~~ trace fine gravel, TPH and debris as described per station location

(B) ↑ (C) ↓

- Station 10, 5' bgs Metal debris (metal sheet/ Scrap, wire rope/ cable, wire, metal grate) and Free TPH surrounding metal. (in voids surrounding metal).
- Station 7.5 6.5' encountered free ground water,
- Station 7.5 7.5' bgs. Metal debris and Free TPH Continues. Free TPH observed in Some fractures and along wood ~~debris~~ fragments/ plant material in clay material.
- Station 7.5 to Station 10; 8.5' bgs end of metal debris.
- Station 7.5 to Station 10; 9.5' bgs. Free TPH observed in Some fractures and along wood fragments/ plant material.

Trench Sidewall Record	Trench # AD-3 (sta. -12.5 to 0)
Contractor: Turn-Key Construction Services, Inc.	Date 12-4-07
Project No. 273939.14.01	Site
Location Trench AD-3 (sta. -12.5 to sta. 0)	
Lithologic log on Page 2 of 3 and 3 of 3	
Begin trench: 0900 12-4-07	
End trench: 1150 12-4-07	
Depth to water: 5' bgs	
GPS Coords	

Trench View (North)



Trench Sidewall Record	Trench # AD-3 (Sta. -12.5 to 0)
Contractor: Turn-Key Construction Services, Inc.	Date 12-4-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) well graded gravel w/ Sand (GW) dark reddish brown (5YR 3/2) moist, loose, fine to coarse angular gravel, fine to coarse sand, trace cobbles, no TPH odor.

(B) Silt (ML) yellowish brown (10YR 5/6) mottled with dark greenish gray (5G 4/1), moist, low to med plasticity, soft to firm

Station 0 to -7.5; Free TPH @ 5.5' bgs. Operator could feel metal below 5.5' bgs w/ backhoe bucket. Water encountered @ 5.5' bgs

~~Station 0 to 7.5, Free TPH and metal debris~~ SBA

Station 0 to 6.5' Free TPH and metal debris. Debris includes scrap steel, metal plate. Metal debris not completely covered w/ Free TPH. However, Free TPH in voids surrounding ~~some of~~ SBA the majority the metal.

6.5' bgs lithology change

(C) Clay (~~CH~~ SBA CL) ~~Yerd~~ SBA Very dark greenish gray (5G 3/1), moist, med plasticity, soft to firm, some fine to coarse sand, trace fine gravel, Roots, plant material, blocky fracture and Free TPH as described below.

Station 0 to -7.5; 7.5' bgs; Free TPH and metal Contamines in clay material.

Trench Sidewall Record	Trench # AD-3 (Sta. 12.5 to 0)
Contractor: Turn-Key Construction Services, Inc.	Date 12-4-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology (Continued...)

Station 0 to -7.5 @ 8' bgs. cut off SBR ~~free~~ SBR metal debris.

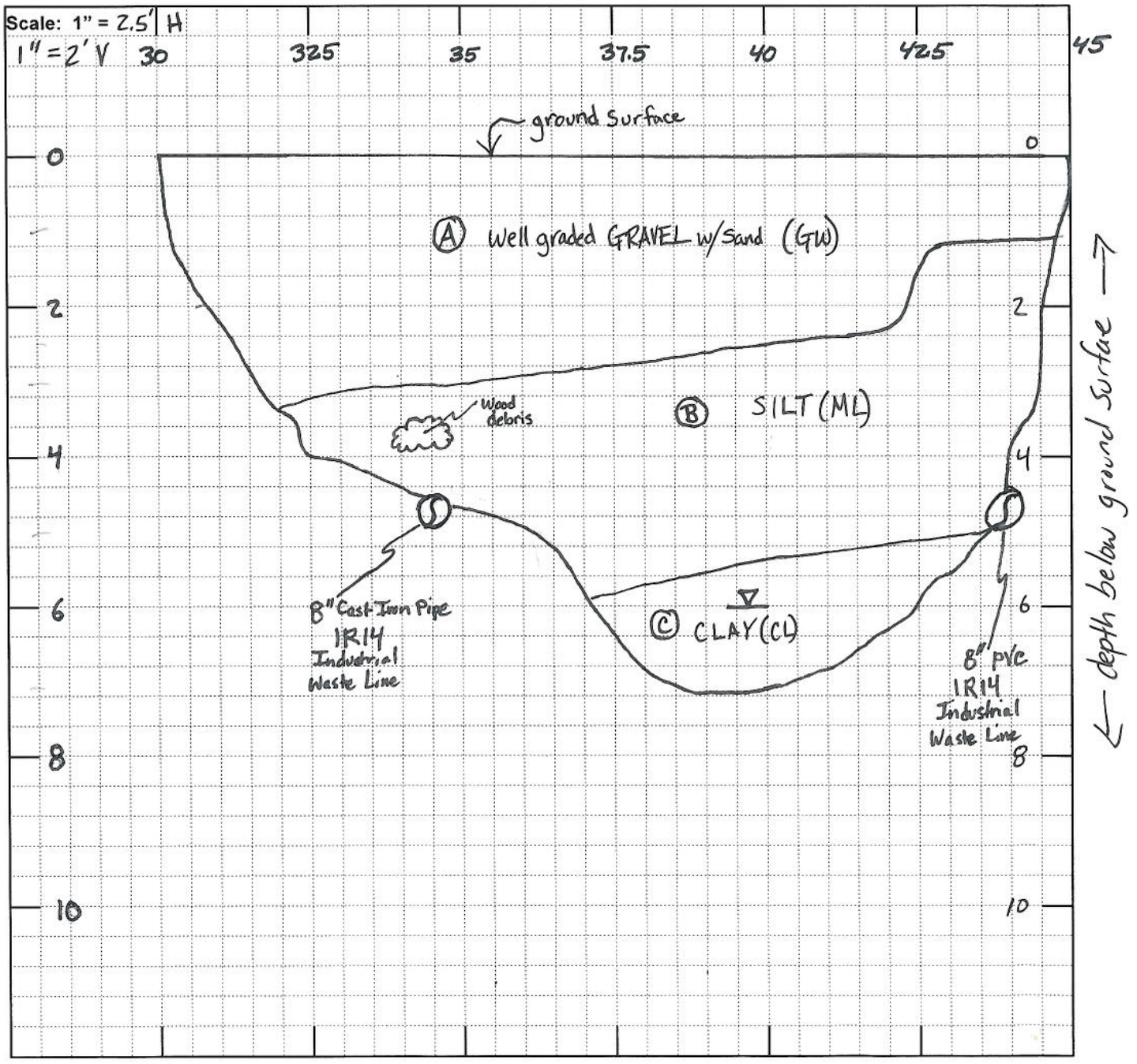
Station 0 to -7.5 8.5' bgs Clay material w/ free TPH prevelent in fractures of clay and along roots / plant material. Clay has blocky and in some locations ~~terminal~~ horizontal fractures. Some wood fragments present.

Station 0 to -7.5 9.5' bgs Clay material w/ Free TPH in some fractures and along roots / plant material. Clay has blocky fracture.

Stopped excavation @ 9.5' bgs ; Cannot adv. backhoe due to short length of trench.

Trench Sidewall Record	Trench # AD-3 (Station 30 to 45)
Contractor: Turn-Key Construction Services, Inc.	Date 12-4-07
Project No. 273939.14.01	Site
Location Trench AD-3 (Sta. 30 to Sta. 45) Lithologic Log on Page 2 of 2 Begin trench: 1250 12-4-08 End trench: 1600 12-4-08 Depth to Water: 6' bgs	
GPS Coords	

Trench View (North West)



Trench Sidewall Record	Trench # AD-3 (Station 30 to 45)
Contractor: Turn-Key Construction Services, Inc.	Date 12-4-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

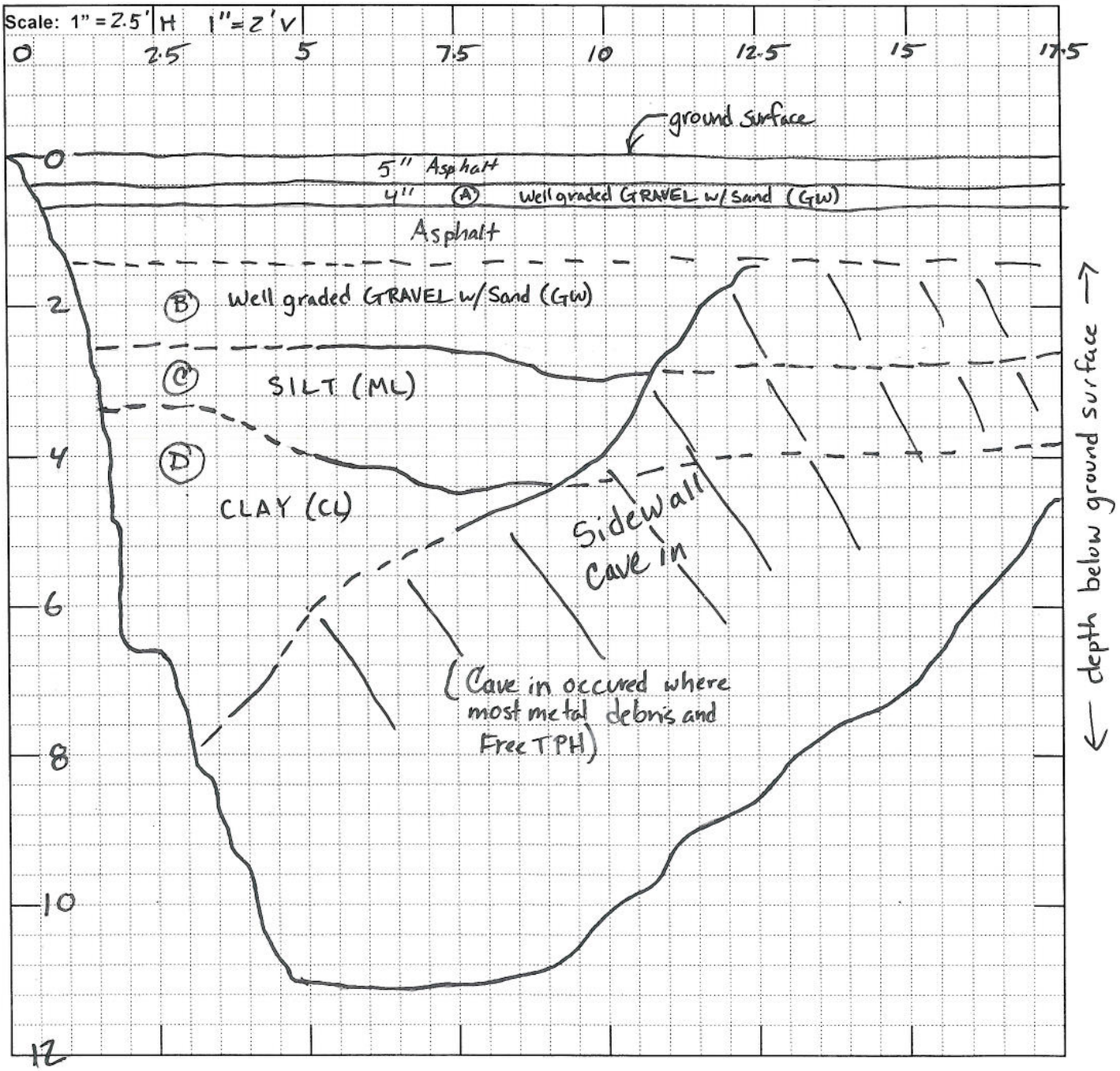
(A) Well graded Gravel w/ Sand (GW) dark yellowish brown (10YR 4/4), dry to moist, loose to med. dense, fine to coarse angular gravel, fine to coarse Sand, Some cobbles, trace glass shards and shards of glass plates, no Free TPH observed.

(B) Silt (ML) yellowish brown (10YR 5/6) mottled with dark greenish gray (5G 4/1) moist, low to med plasticity, Soft to firm, Some fine gravel, trace Coarse gravel, no free TPH observed.
(with Sand)

(C) CLAY (CL) very dark greenish gray (10GY 3/1) moist, low to med. plasticity, no plant material/roots, no free TPH observed.

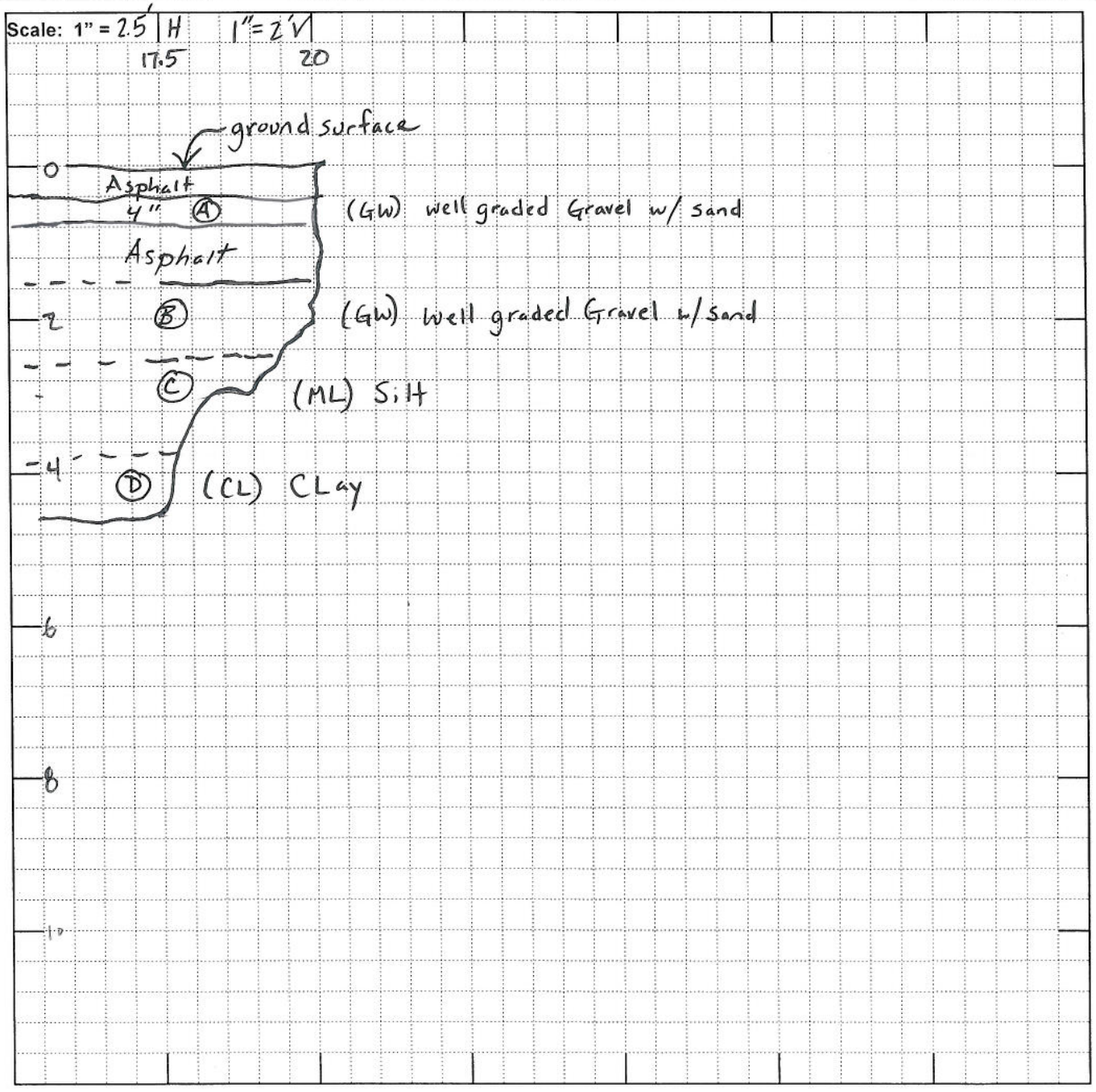
Trench Sidewall Record	Trench # AD-4
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location Trench AD-4	
Lithologic Log on Page 3 of 4 and 4 of 4	
Begin trench: 0835 11-26-07	
End trench: 1235 11-26-08	
Depth to water: Not measured due to Cave in of sidewall	
GPS Coords	

Trench View (North)



Trench Sidewall Record	Trench # AD-4
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View



Trench Sidewall Record	Trench # AD-4
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL with Sand (GW) brown 7.5YR 4/3) dry to moist, loose, fine to coarse angular gravel, fine to coarse Sand, no TPH odor.

(B) Well graded GRAVEL with Sand (GW) dark reddish brown (5YR 3/2), moist, loose, fine to coarse angular gravel, fine to coarse Sand, Some Cobbles, no TPH odor.

(C) SILT (ML) Yellowish brown (10YR 5/6) mottled with Olive (5Y 5/4) and dark greenish gray (5G 4/1), moist, low to med plasticity, Soft to firm, no TPH odor

(D) CLAY (CL) dark greenish gray (5G 4/1), mottled with Yellowish brown (10YR 5/6) moist, med. plasticity, Soft, Some fine to coarse Sand

@ Station 5; 6' bgs encountered Free TPH; no metal observed.

@ Station 12.5 to Station 16; 6' bgs encountered metal debris (wire rope, steel plate) and Free TPH in voids Surrounding metal debris.

1020 Collected Free Product Sample 5.5' bgs Station 16 to Station 17.5.

@ Station 5 to Station 17.5; 6.5' bgs metal debris continues (metal scrap and wire rope) Free TPH in voids Surrounding metal.

@ Station 0 to Station 5; ≈ 8' bgs Metal debris (metal Scrap 2 to 3' diameter; wire rope) Free TPH in voids Surrounding metal, Free TPH in fractures of clay material (mm scale).

Trench Sidewall Record	Trench # AD-4
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

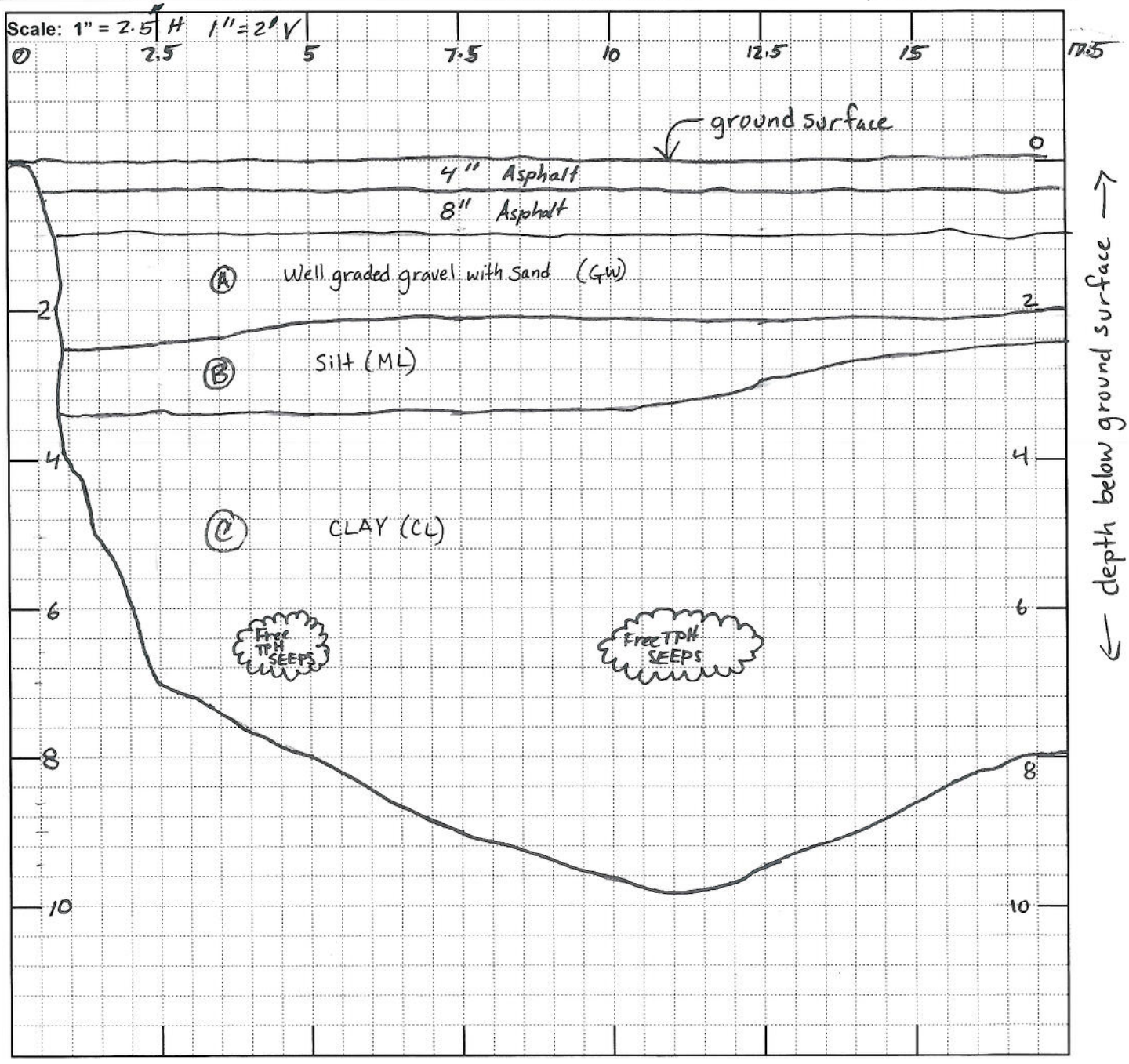
Lithology (Continued...)

@ Station 2.5 to Station 7.5 @ 9.5', out of metal, Free TPH prevelent in fractures of Clay material and along Plant material

@ Station 2.5 to Station 7.5 @ 12', still out of metal, Trace Free TPH in fractures of clay material and along plant material

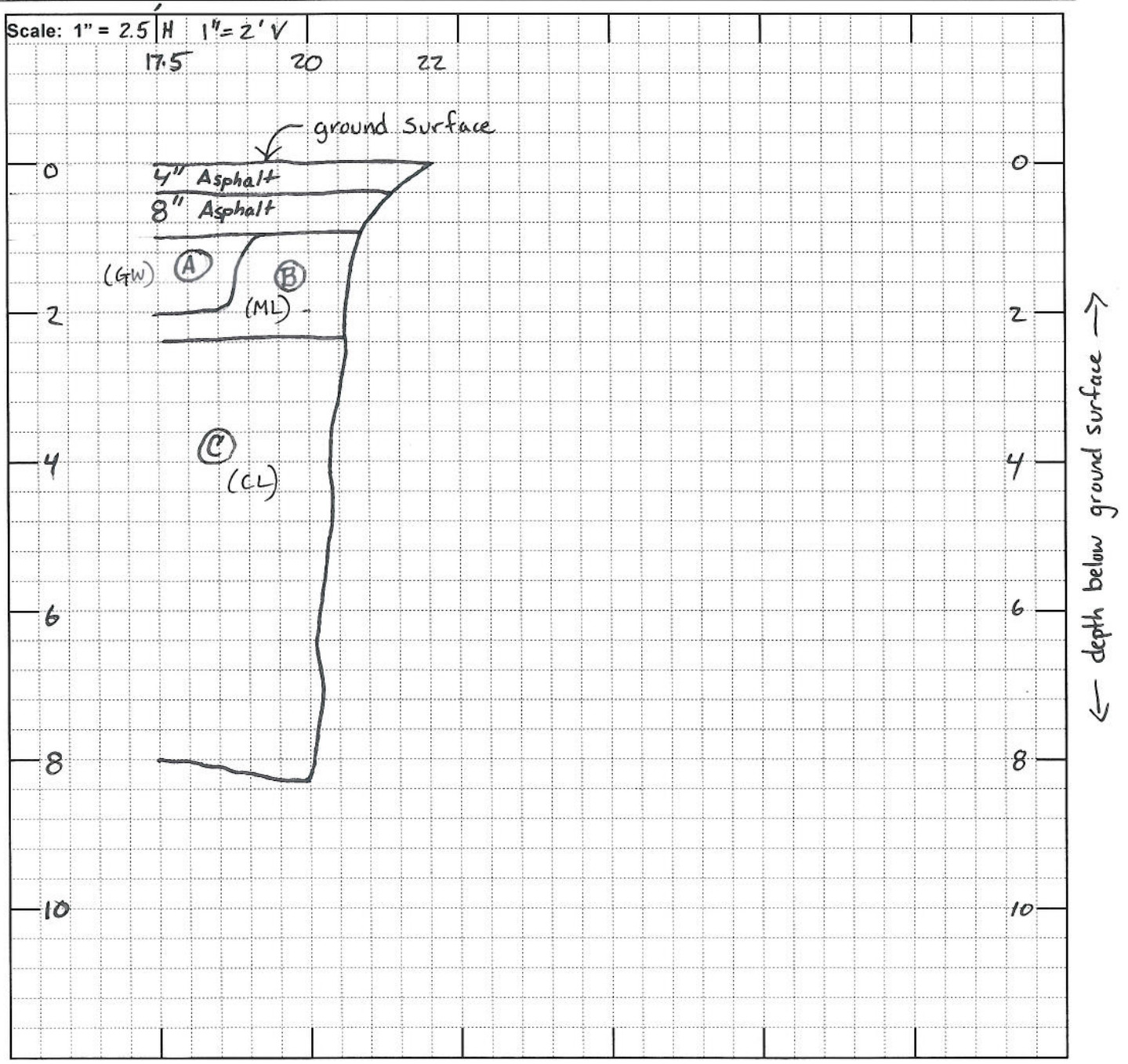
Trench Sidewall Record	Trench # AD-5
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location Trench AD-5	
Lithologic log on Page 3 of 3	
Begin Trench 1300 ~~AD-5~~ SBQ 11-26-07	
End trench 1615 11-26-07	
Depth to Water:	
GPS Coords	

Trench View (North)



Trench Sidewall Record	Trench # AD-5
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View (North)



Trench Sidewall Record	Trench # AD-5
Contractor: Turn-Key Construction Services, Inc.	Date 11-26-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

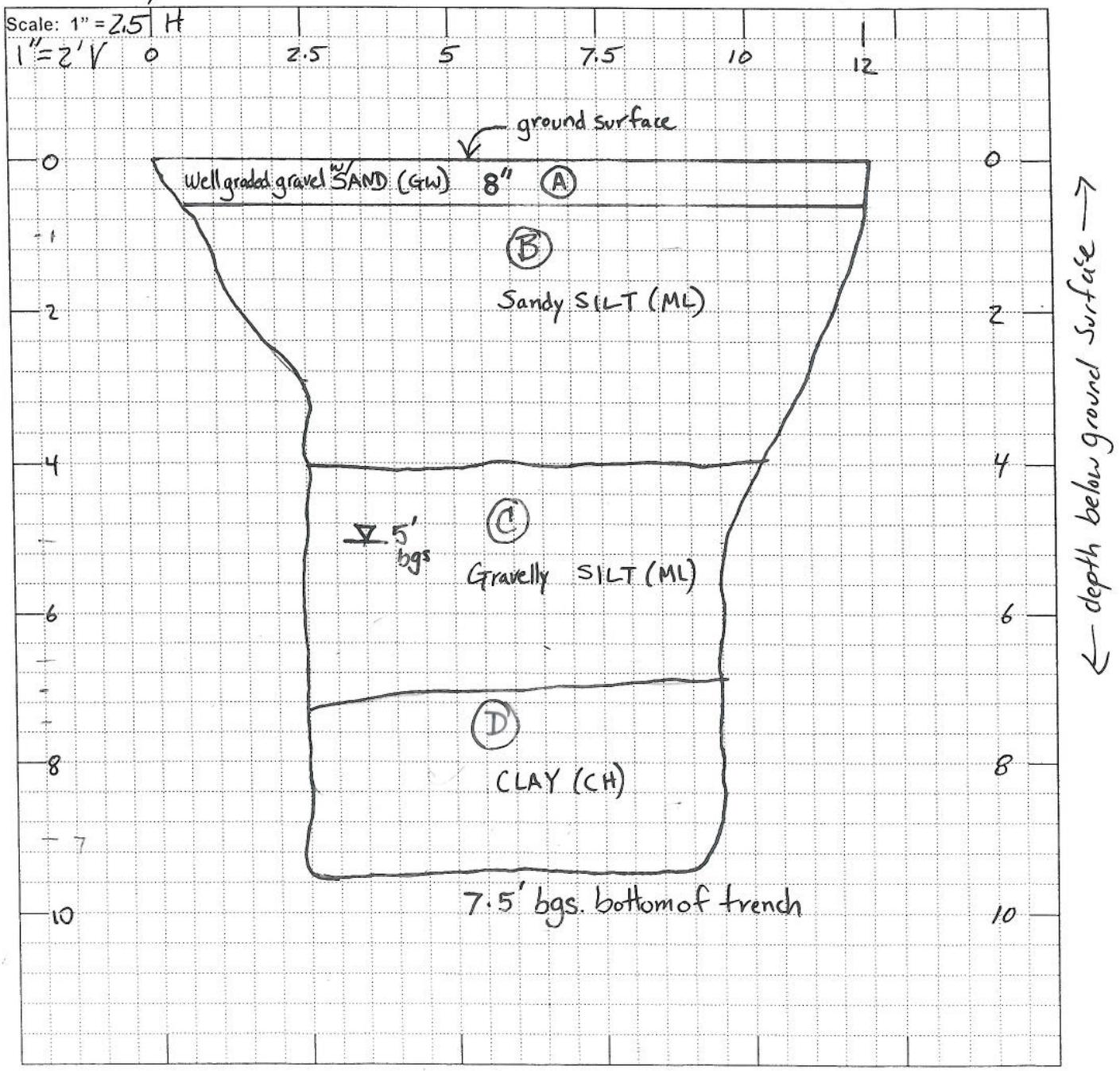
(A) Well graded GRAVEL with Sand (GW) dark reddish brown (5YR 3/2) moist, loose, fine to coarse angular gravel, fine to coarse Sand, Some Cobbles, no TPH odor.

(B) SILT (ML) olive (5Y 4/3), dry to moist, Soft, low plasticity, no TPH odor.

(C) CLAY (CL) very dark greenish gray (5G 3/1) mottled with gray (N 6/1) and olive (5Y 5/6) moist, Low to med plasticity, Some fine to med Sand, trace fine to coarse gravel, isolated metal and wood debris as described below

@ Station 15 to Station 17.5 ; 4.5' bgs. metal debris (Small metal barrel ≈ 5 to 10 gal.) Free TPH in voids surrounding metal debris.
@ Station 12.5 @ 6' bgs Sheet metal and wood debris. Free TPH in voids surrounding metal and wood.
@ Station 7.5 @ 6' bgs Sheet metal and wood debris. Free TPH in voids surrounding metal and wood.
@ ≈ 7 to 8' bgs out of metal and wood debris.
@ Station 15 to Station 17.5 @ 6.5' bgs Clay material with Free TPH in fractures.
@ Station 5 ≈ 9' bgs Clay material with Some Free TPH in fractures and along wood fragments.

Trench Sidewall Record	Trench # AD-6
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location Trench AD-6	
Lithologic log on Page 2 of 2	
Begin trench: 0810 12-10-07	
End trench: 1000 12-10-07	
Depth to Water: 5' bgs	
GPS Coords	
Trench View (South)	



Trench Sidewall Record	Trench # AD-6
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel w/ Sand (GW) olive gray (5Y 5/2), dry, fine to coarse Sand, fine to coarse gravel, no TPH odor.

(B) (ML) Sandy Silt dark yellowish brown (10YR 3/4), mottled w/ yellowish brown (10YR 5/6) moist, fine to Coarse sand, trace fine gravel, low to med plasticity, soft to firm.

(C) Gravelly Silt (ML) yellowish brown (10YR 5/6) mottled w/ dark greenish gray (5G 4/1) moist, low to med plasticity, firm, trace med to Coarse Sand, fine to coarse gravel, increasing gravel content with depth, No Free TPH, Trace metal and brick debris described below

@ Station 8; 4' bgs One piece of wire Cable, no Free TPH. Encounter Water @ 4' bgs.

@ Station 12; 4' bgs. Two bricks (red).

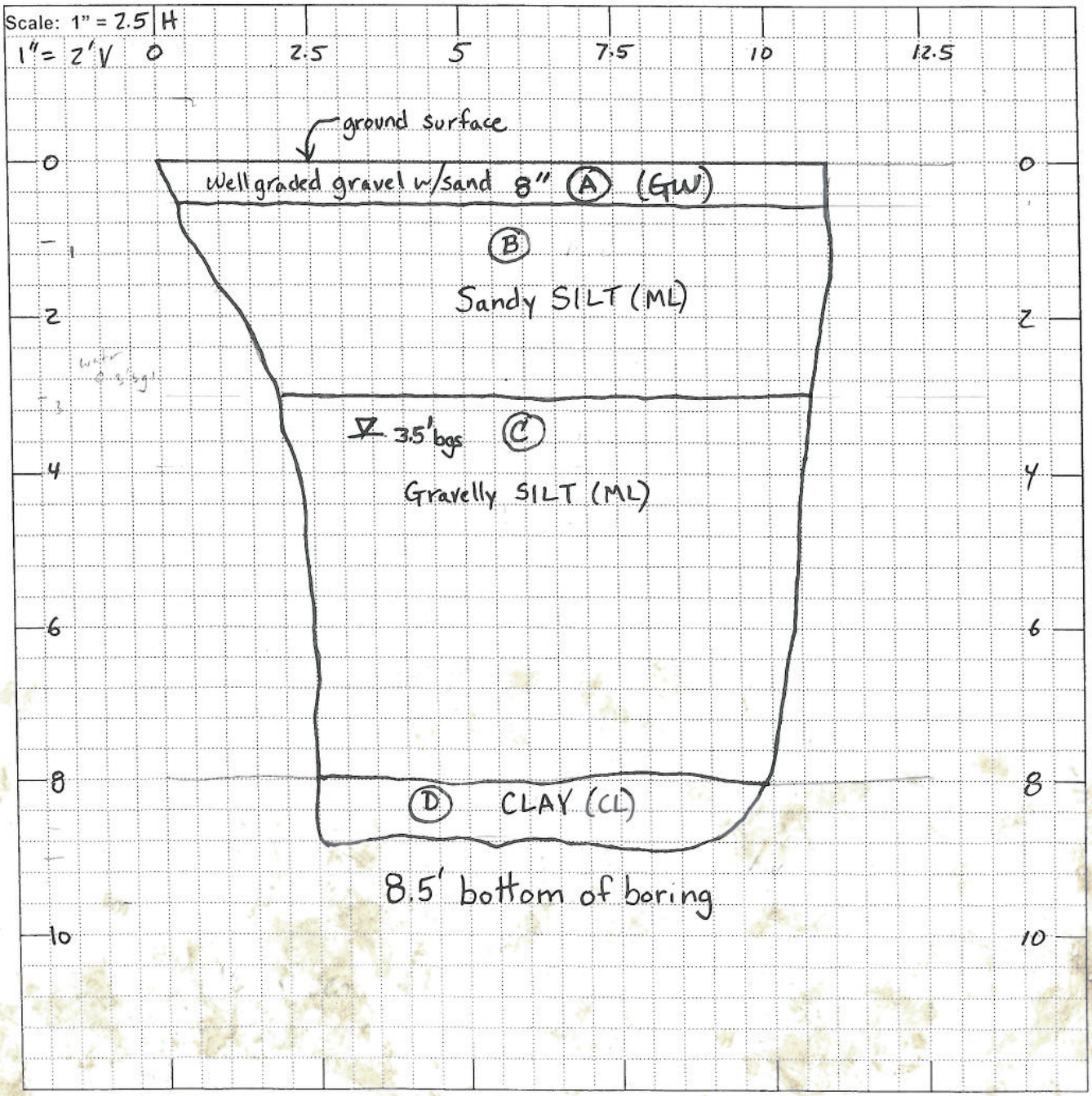
(D) CLAY (CH) black (N 2.5/), moist, Soft to firm, high plasticity, no metal debris, no free TPH.

7.5' bgs bottom of trench

Trace of sheen on water in trench

Trench Sidewall Record	Trench # AD-7
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location Trench AD-7	
Lithologic log on Page 2 of 2	
Begin trench: 1015 12-10-07	
End Trench: 1230 12-10-07	
Depth to water: 3.5' bgs	
GPS Coords	

Trench View (North)



Trench Sidewall Record	Trench # AD-7
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel w/ Sand (GW) olive gray (5Y 5/2), dry, fine to coarse Sand, fine to coarse angular gravel, no TPH odor.

(B) Sandy Silt (ML) dark yellowish brown (10YR 3/4) w/ mottled yellowish brown (10YR 5/6), fine to coarse sand, Soft to firm, med to low plasticity, trace fine gravel. No Free TPH, No metal debris. @ 3' bgs Sta. 5 encountered water, SBa

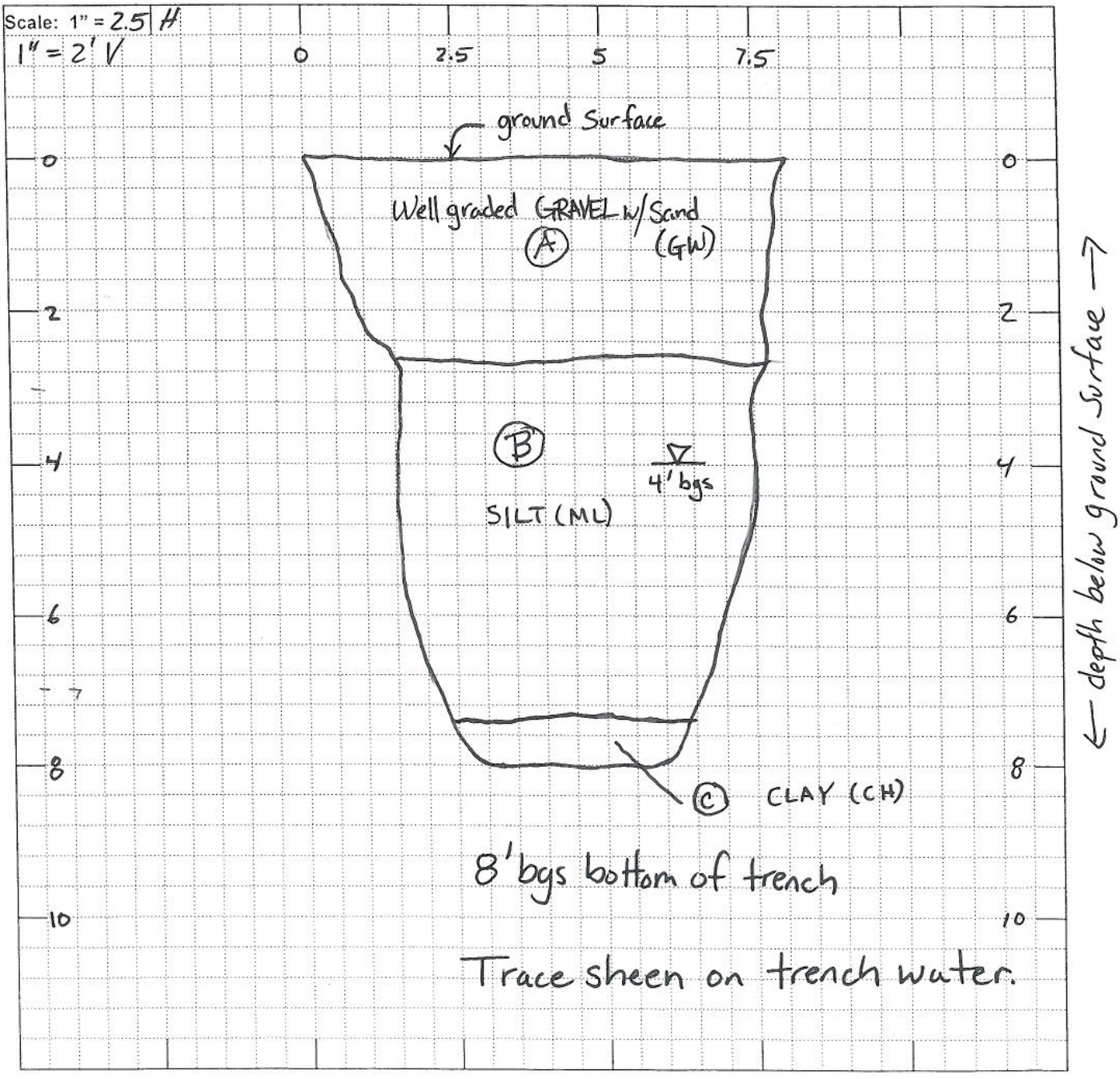
(C) Gravelly SILT (ML) ~~dark~~ yellowish brown (10YR 5/6) mottled with dark greenish gray (5G 4/1) and very dark gray (10Y 2.5/1), moist, low to med. plasticity, Soft to firm, trace fine to coarse sand, fine to coarse gravel, gravel content increased w/ depth, no Free TPH, Trace metal and brick as described below.
@ 6' bgs, Several Bricks (Trace), one metal bolt (5" in length), no Free TPH observed
@ 7.5' bgs, Several bricks (Trace), no Free TPH

8' bgs (D) CLAY (CL) very dark greenish gray (5GY 3/1) mottled w/ black (N 2.5/), moist, med plasticity, Soft to firm, mica flakes, no metal debris, no free TPH.

8.5 bottom of trench

No sheet on water in trench

Trench Sidewall Record	Trench # AD-8
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location Trench AD-8	
Lithologic log on Page 2 of 2	
Begin trench: 1300 12-10-07	
End trench: 1400 12-10-07	
Depth to Water: 4' bgs	
GPS Coords	
Trench View (East)	



Trench Sidewall Record	Trench # AD-8
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel with Sand (GW) dark grayish brown (2.5Y 4/2), moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor, (RR Ballast)

(B) Silt (ML) yellowish brown (10YR 5/6), mottled w/ olive (5Y 5/4) and dark greenish gray (5G 4/1), moist, ~~too~~ Silt to firm, low to med plasticity, Trace fine to coarse sand, Some fine to coarse gravel, no TPH odor, no Free TPH, no metal debris.

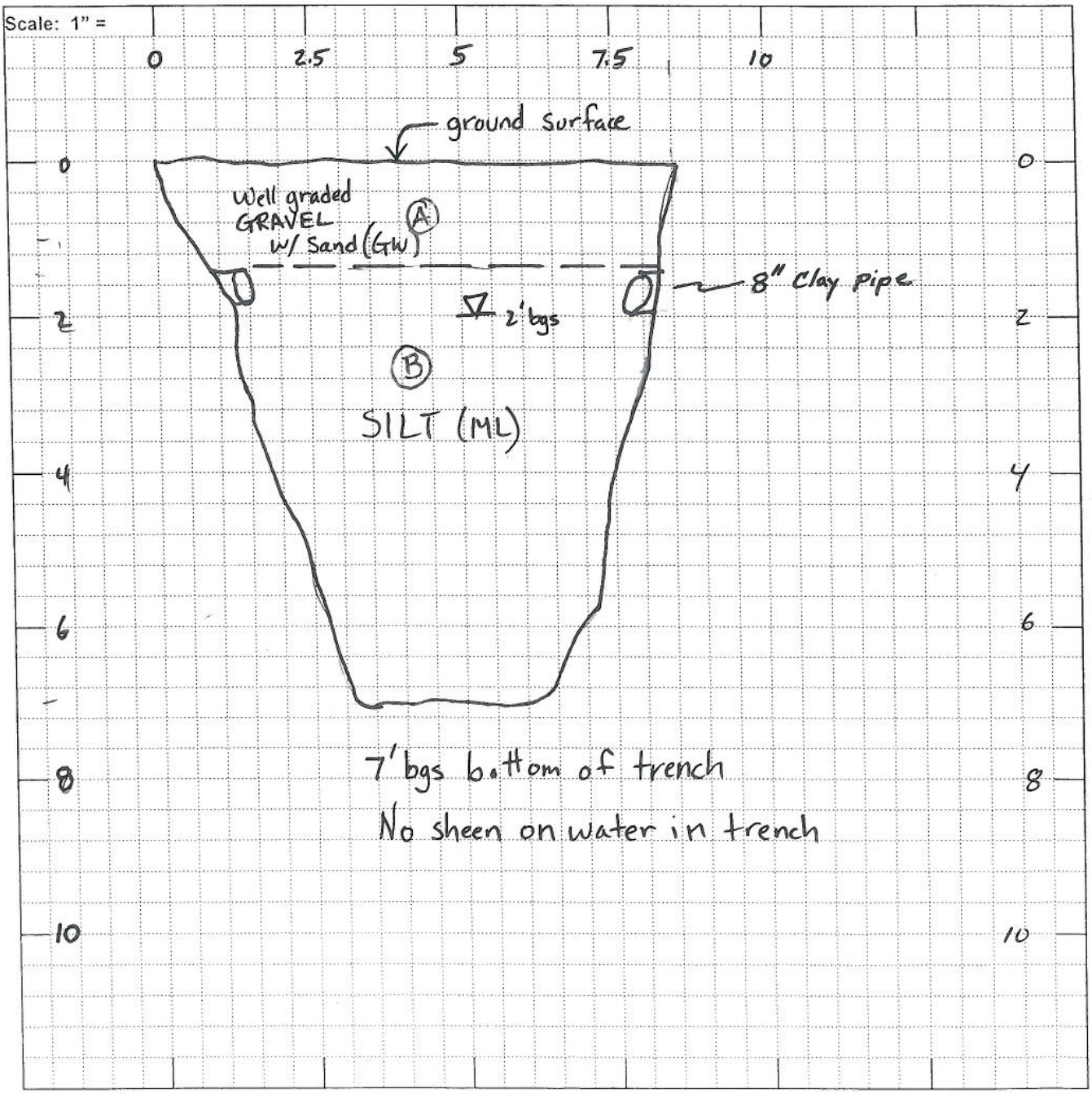
(C) CLAY (CH) very dark greenish gray (5GY 3/1), moist, Soft to firm, high plasticity, Some plant material/roots and wood fragments, no Free TPH, no metal debris, no TPH odor.

8' bgs bottom of trench

Trace sheen on trench water.

Trench Sidewall Record	Trench # AD-9
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location Trench AD-9 Lithologic log on Page 2 of 2 Begin trench: 1400 12-10-07 End trench: 1530 12-10-07 Depth to water: 2' bgs	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # AD-9
Contractor: Turn-Key Construction Services, Inc.	Date 12-10-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) well graded gravel with Sand (GW) dark grayish brown (2.5Y 4/2) moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor, no Free TPH; (R.R. ballast

@ 2' 1.5' bgs; 8" Clay pipe; broken; continued pot hole

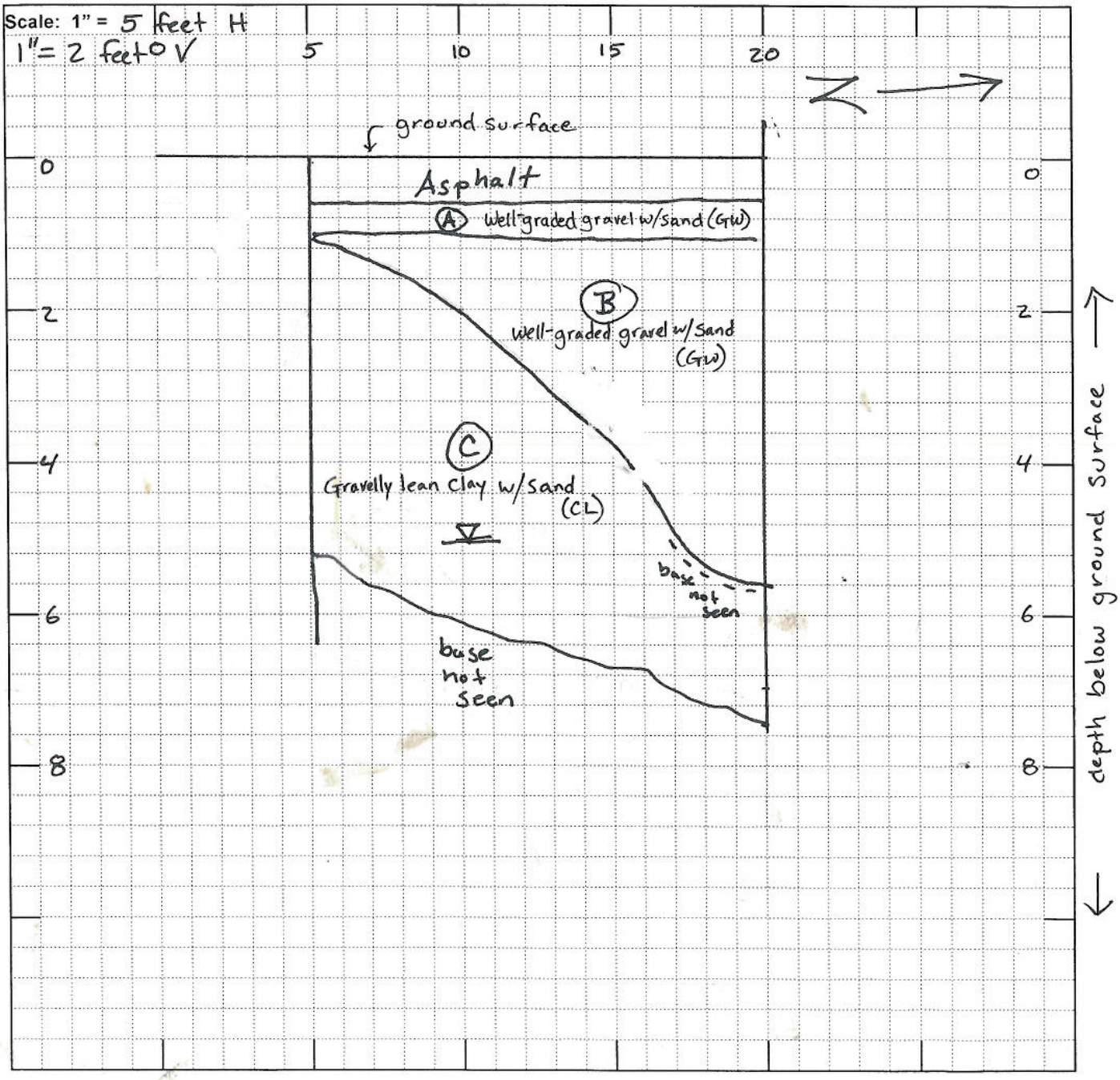
(B) Silt (ML) yellowish brown (10YR 5/6) mottled w/ olive (5Y 5/4), and dark gray (N 3/), moist, firm, low plasticity, trace fine to coarse sand, Some fine to coarse gravel, roots/plant material, no TPH odor, no Free TPH, no metal debris.

7' bgs bottom of trench

No sheen on water in trench.

Trench Sidewall Record	Trench # DR-1 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-7-07
Project No. 273939.14.01	Site
Location Trench DR-1	
Lithologic Log on Page 2 of 2	
Begin trench: 11-7-07 0805	
End trench: 11-7-07 1030	
Depth to water ≈ 5' bgs	
GPS Coords	

Trench View (West)



Trench Sidewall Record	Trench # DR-1 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-7-07
Project No. 273939.14.01	Site
Location Trench DR-1	
GPS Coords	

Trench View

Scale: 1" =

(A) Well-graded Gravel with SAND (GW) Brown (7.5YR 4/3) dry, loose, fine to coarse Sand, fine to coarse gravel.

(B) Well-Graded GRAVEL with Sand (GW) black (5Y 2.5/1), dry, loose, fine Sand to Cobble, brick, metal, hard tar, wood, white solid in layer @ 4.5', Springs, Copper/brass color shavings, Steel pipe, ~~meter~~ See Some material appeared burned, TPH odor, no free ~~of~~ See TPH observed

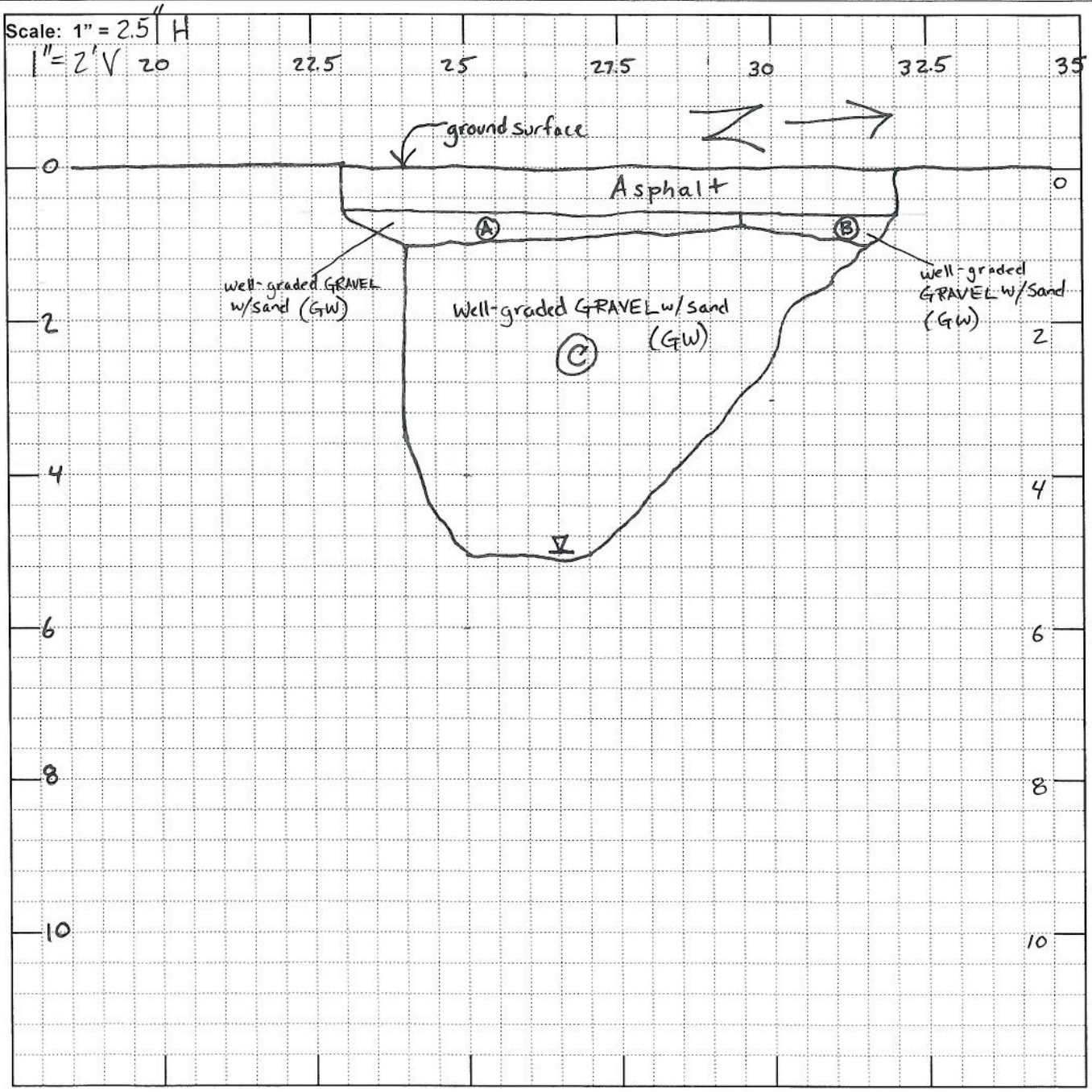
(C) Gravelly Lean CLAY with Sand (CL) dark greenish gray (5GY 4/1), moist, med plasticity, Soft, fine to Coarse Sand, fine to coarse gravel, HC odor, wood, sheet metal, wire ~~rope~~ rope, pipe, TPH in cracks of CLAY and free flowing See in some cases, TPH in voids of metal debris. metal debris in this unit began at 6' bgs from horizontal station 12 to horizontal station 18.

TPH observations

Starting @ ≈6' of See TPH observed in voids of metal and in Clay fractures. In some locations TPH was free-flowing from voids.

Trench Sidewall Record	Trench # DR-1 (Northern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-12-07
Project No. 273939.14.01	Site
Location Dump Rd	
Lithologic log on Page 2 of 2	
Begin trench: 11-12-07 0900	
End trench: 11-12-07 1030	
Depth to Water: 5' bgs	
GPS Coords	

Trench View (West)



Trench Sidewall Record	Trench # DR-1 (Northern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-12-02
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) well graded gravel with Sand (GW) olive gray (5Y 4/2), moist, fine to coarse Sand, fine to coarse gravel, angular gravel, loose, no TPH odor.

(B) well graded gravel with SAND (GW) yellowish brown (10YR 5/6), moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor.

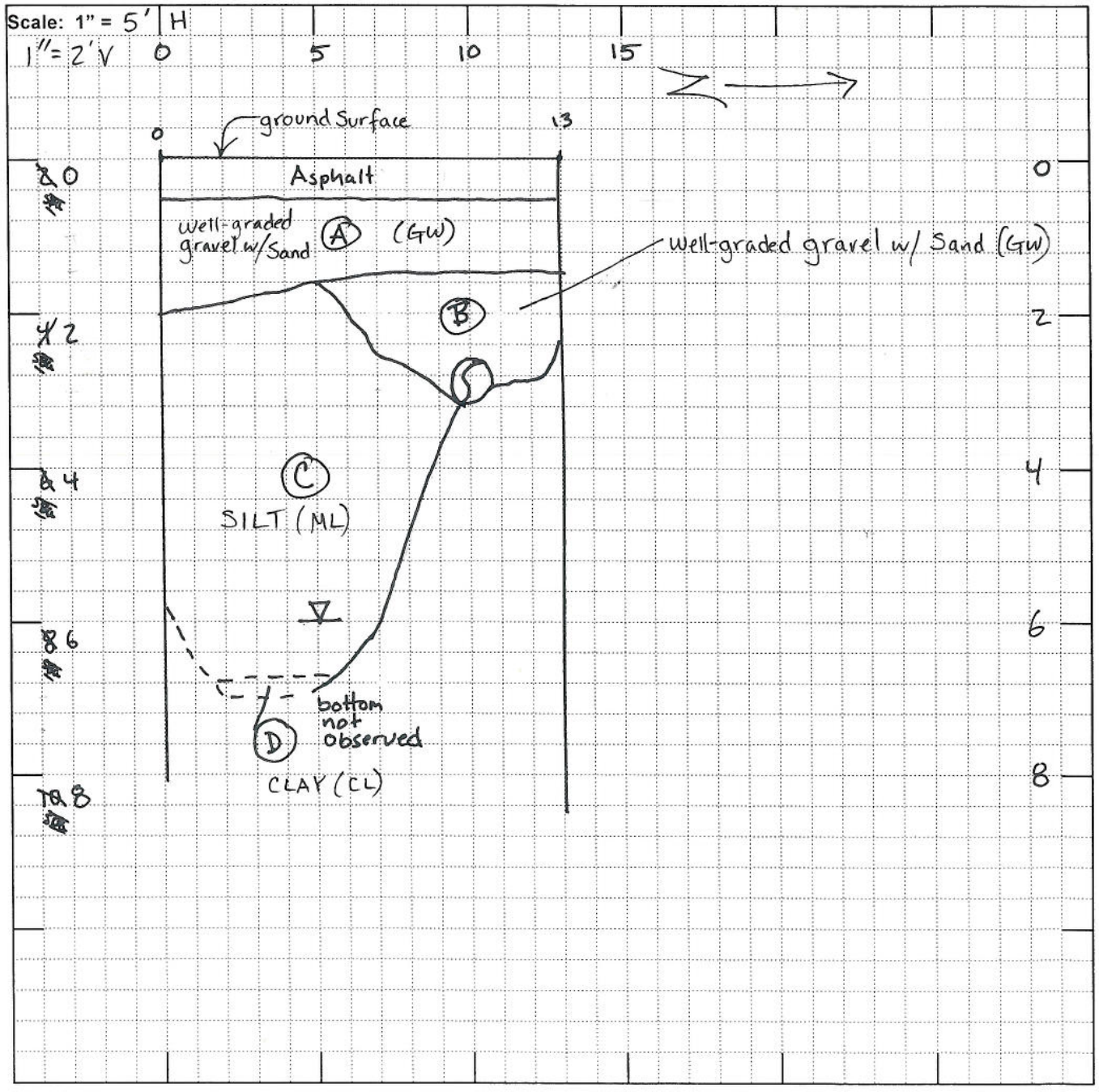
(C) well graded gravel with Sand (GW) black (5Y 2.5/1), moist, loose, fine Sand to cobble material, Some material appears ~~burned~~, see burned, brick, metal, wood, wood shavings, Springs, steel pipe, copper pipe, metal strapping, glass, TPH odor, Free TPH at ≈ 5' bgs. Below ≈ 5' TPH is present on debris and lithologic material.
(free)

TPH Observations

(1) At ≈ 5' bgs encountered rail road tie w/visable free ø (see) TPH on its surface. Below ≈ 5' TPH is present on debris and lithologic material.
(free)

Trench Sidewall Record	Trench # DR-2 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-7-07
Project No. 273939.14.01	Site
Location Dump Rd	
Lithologic Log on Page 2 of 2	
Begin trench: 11-7-07 1115	
End trench: 11-7-08 1320	
Depth to water: 6' bgs	
GPS Coords	

Trench View (west)



Trench Sidewall Record	Trench # DR-2 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-7-07
Project No. 273939.14.01	Site
Location Trench DR-2	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) well graded gravel with sand (GW) brown, (7.5 YR 4/4), moist, fine to coarse gravel, med to coarse sand, loose.

(B) well graded Gravel with Sand (GW) black (5Y 2.5/1) dry, loose, fine Sand to Cobble, brick, metal plate, aluminum, angle Iron, wire rope, white brick material, hard Tar, large pipe (8") crossing excavation (this pipe appears abandoned, cannot be removed from trench), TPH covering some of debris (PID = 12 ppm), TPH odor, Some material appears burned.

(C) SILT (ML) olive (5Y 5/3) mottled w/ yellowish brown (10YR 5/6) ^ moist, Soft to firm, low plasticity, no Free TPH, no TPH odor.

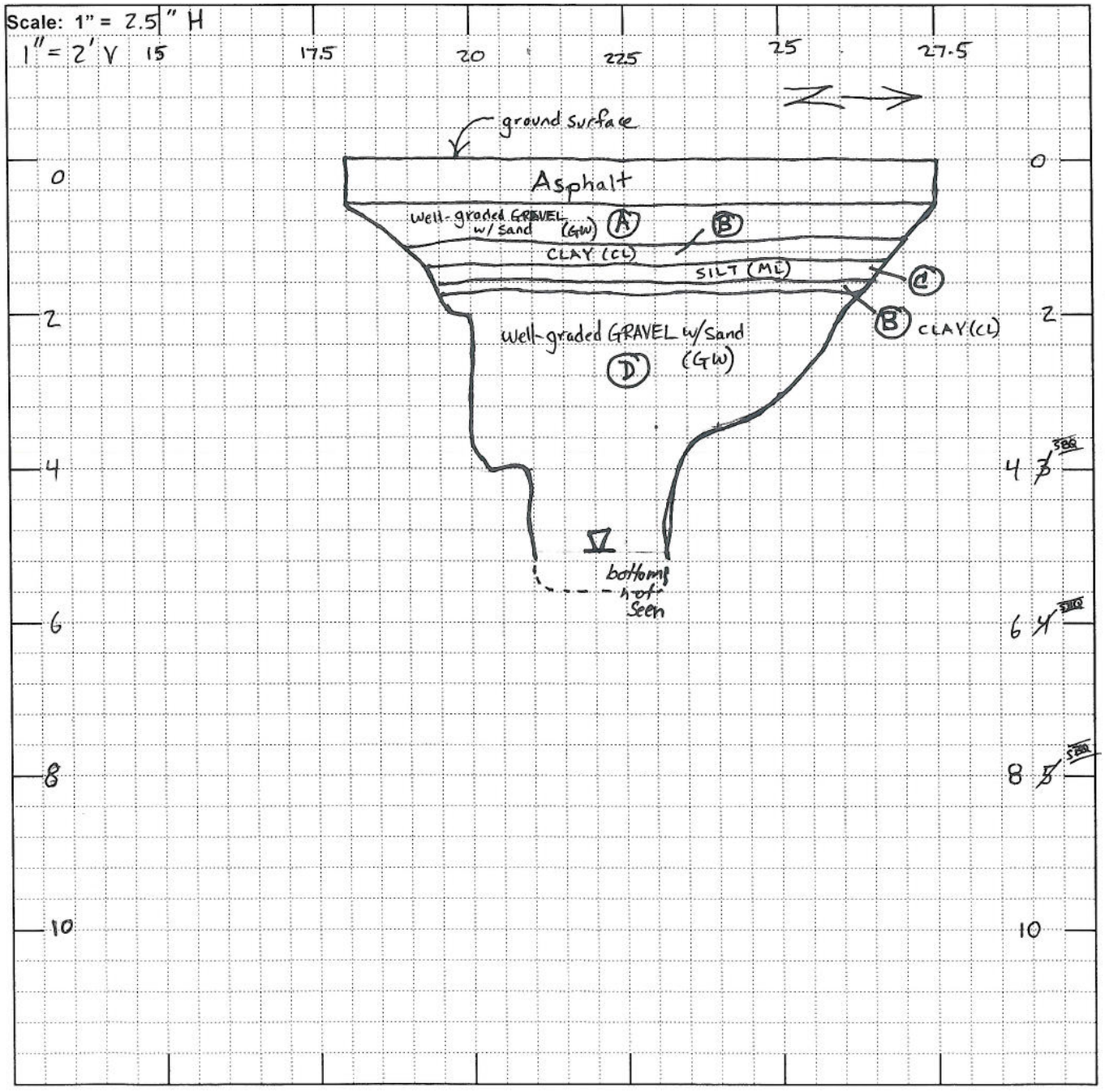
(D) CLAY (CL) dark greenish gray (10GY 4/1) mottled w/ black (5Y 2.5/1) ^ moist, firm, med plasticity, no Free TPH, no TPH odor.

TPH observations

(1) Between horizontal ^ Station 10 and 13 @ 3' bgs. Some brick material covered w/ TPH. TPH visable. TPH odor present. PID reading = 12 ppm when material placed into ziploc bag. Due to 8" pipe @ 25' we could no excavate any deeper at that location.

(2) No Free TPH or TPH odor in (C) SILT or (D) CLAY

Trench Sidewall Record	Trench # DR-2 (Northern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-12-07
Project No. 273939.14.01	Site
Location Dump Rd	
Lithologic Log on Page 2 of 2	
Begin trench: 1120 11-12-07	
End trench: 1330 11-12-07	
Depth to Water: 5' bgs	
GPS Coords	
Trench View West	



Trench Sidewall Record	Trench #	DR-2 (Northern)
Contractor: Turn-Key Construction Services, Inc.	Date	11-12-07
Project No. 273939.14.01	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

Lithology

(A) well graded gravel with Sand (GW) brown (7.5Y 4/4) moist, fine to coarse angular gravel, fine to coarse Sand, loose, no ~~AC~~ SBC TPH odor.

~~(C)~~ SBC ~~(B)~~ SBC (D) well graded gravel with Sand (GW) black (5Y 2.5/1), loose, fine Sand to cobble, brick, metal, rebar, wood, Charcol, (burned wood), white glass (6" to ½" pieces) metal, wire, white/yellow brick, wood shavings, 3/8" Steel plate, cloth, Copper pipe, Some material appears burned, Solvent odor, Trace TPH on debris and lithologic material, SBA ~~NO~~ SLY. TPH odor, debris continued... wire rope, ground water encountered @ ≈ 4.5' bgs. Below groundwater Some Free TPH visable on debris and lithologic material.

(B) CLAY (CL) Very dark greenish gray (10Y 3/1) moist, Soft to firm, low plasticity, no TPH odor, no Free TPH.

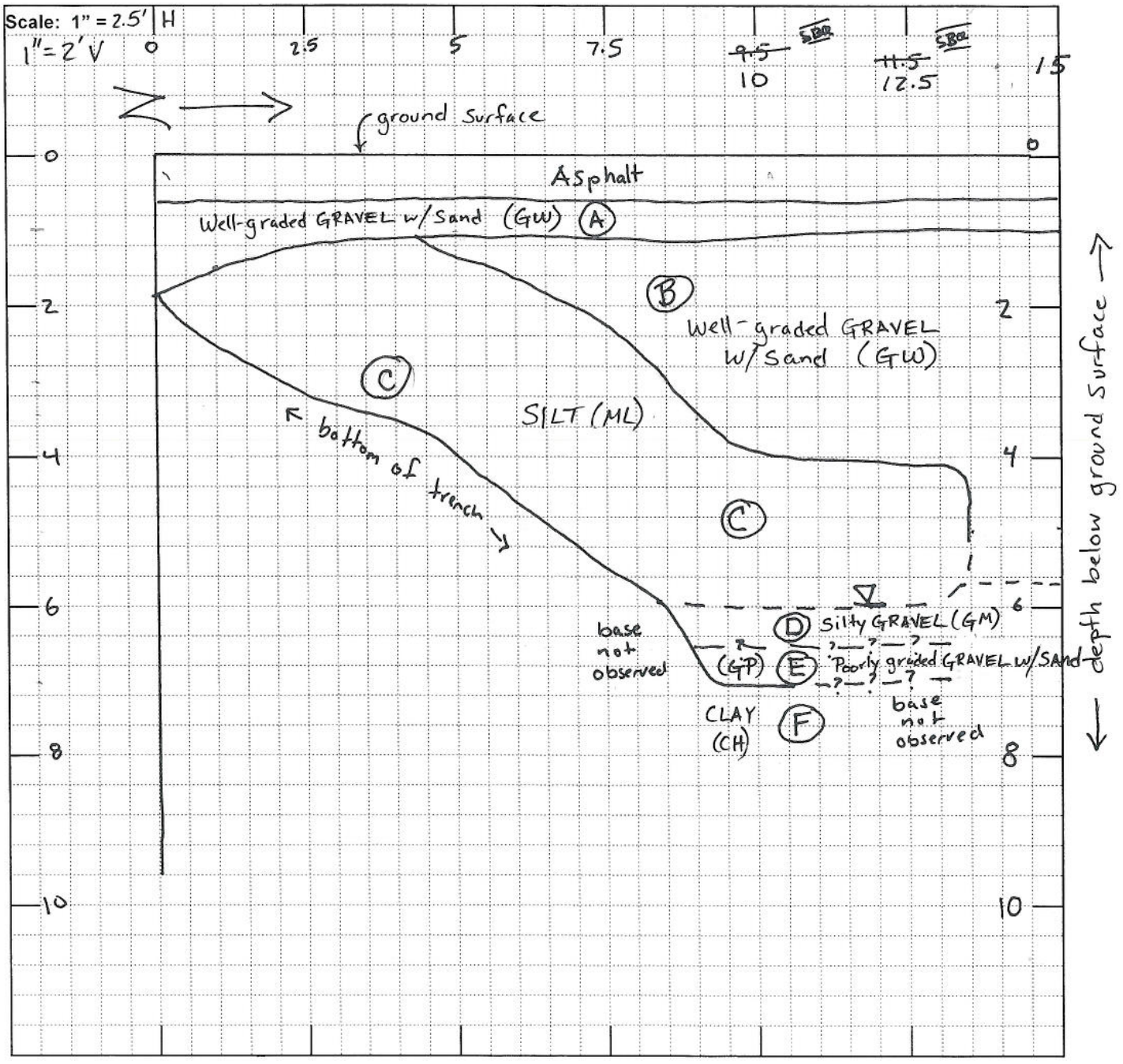
~~(D)~~ SBC (C) ~~(D)~~ SBA SILT (ML) olive (5Y 5/3) mottled w/ yellowish brown (10YR 5/6) low plasticity, no free TPH, no TPH odor.

TPH observations

See notes above.

Trench Sidewall Record	Trench # DR-3 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-8-07
Project No. 273939.14.01	Site
Location Dump Rd	
Lithologic log on Page 2 of 3 and 3 of 3	
Begin trench: 11-8-07 0830	
End trench: 11-8-07 1005	
Depth to water: 6' bgs	
GPS Coords	

Trench View (west)



Trench Sidewall Record	Trench # DR-3 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-8-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL with Sand (GW) Brown (7.5YR 4/4) moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor.

(B) Well graded GRAVEL ~~(GW)~~ with Sand (GW) Black (5Y 2.5/1) Sly moist, fine to coarse sand, fine to coarse gravel, gravel rounded to angular shape, Some cobbles, burned material, debris: wood, glass, fabric, metal scrap, bolts, wire, brick, metal pipe, Some TPH on debris, loose to med dense, TPH odor.

(C) SILT (ML) olive (5Y 5/3) mottled with yellowish brown (10YR 5/6), moist, Soft to firm, low plasticity, no Free TPH, no TPH odor.

(D) Silty Gravel (GM) olive gray (5Y 4/2 5/3) ~~Olive (5Y 5/3)~~ wet, loose, fine to Coarse gravel, Some cobbles, trace boulders, trace to Some TPH in fractures, this material is likely Panoche Fm.

- Next page for additional lithology

TPH Observations

(1) Some TPH observed on debris in Well graded Gravel with sand (GW) this is shown as unit "B" on trench log.

(2) Trace to Some TPH observed in fractures of Silty Gravel (GM) shown as unit "D" on trench log

(3) Pervasive TPH throughout debris in poorly graded gravel with Sand (GP) shown as unit "E" on trench log

TPH Observation Continued on next Page

Trench Sidewall Record	Trench # DR-3 (Southern)
Contractor: Turn-Key Construction Services, Inc.	Date 11-8-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology Continued

(E) Poorly graded gravel with Sand (GP), Black (5Y 2.5/1), wet, Fine gravel, fine to coarse sand, loose to med dense, debris (angular) material appears burned, debris material includes: metal, rail road spike and rust. TPH is pervasive throughout debris, TPH odor.

(F) ~~(G)~~ CLAY (CH) dark greenish gray (10GY 4/1) moist, Soft to firm, med plasticity, roots and plant material, Some TPH present in/along roots and plant material (≈ 5" between roots and plant material fractures containing (free) TPH), TPH odor.

TPH Observations-Continued

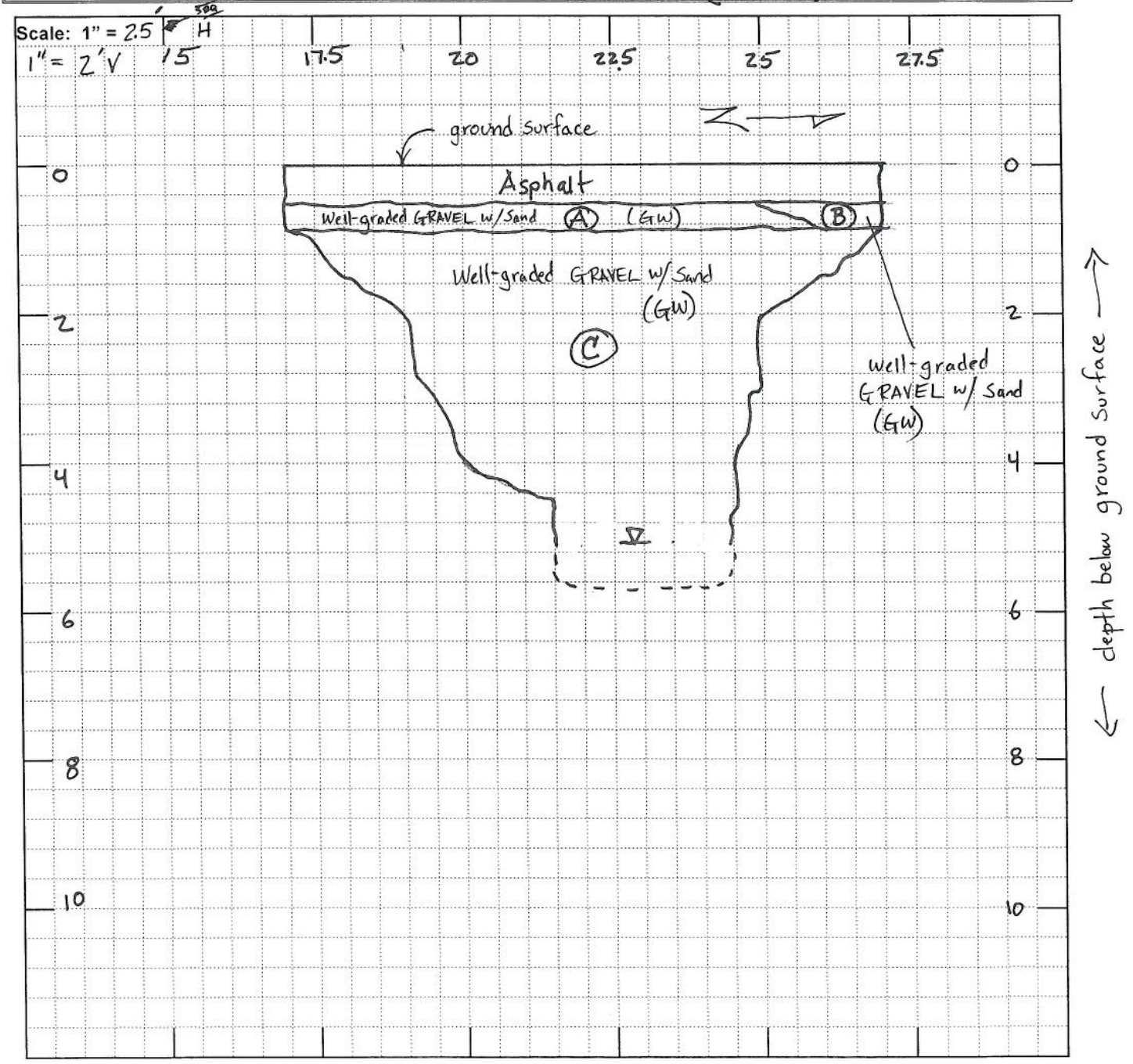
(4) Some TPH present along roots/plant material. ≈5" between root/plant materials fractures contains (free) TPH.

This unit is shown as "F" on the trench log

(northern)

Trench Sidewall Record	Trench # DR-3 (Page 1 of 2)
Contractor: Turn-Key Construction Services, Inc.	Date 11-12-07
Project No. 273939.14.01	Site
Location Dump Rd.	
Lithologic log on Page 2 of 2	
Begin trench: 1340 11-12-07	
End trench: 1450 11-12-07	
Depth to water: 5' bgs	
GPS Coords	

Trench View (west)



(northern)

Trench Sidewall Record	Trench # DR-3 (Page 2 of 2)
Contractor: Turn-Key Construction Services, Inc.	Date 11-12-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded Gravel with Sand (GW) yellowish brown (10YR 5/4), moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor.

(B) Well graded gravel with Sand (GW) olive gray (5Y 4/2), moist, fine to coarse sand, fine to coarse angular gravel, loose, no TPH odor.

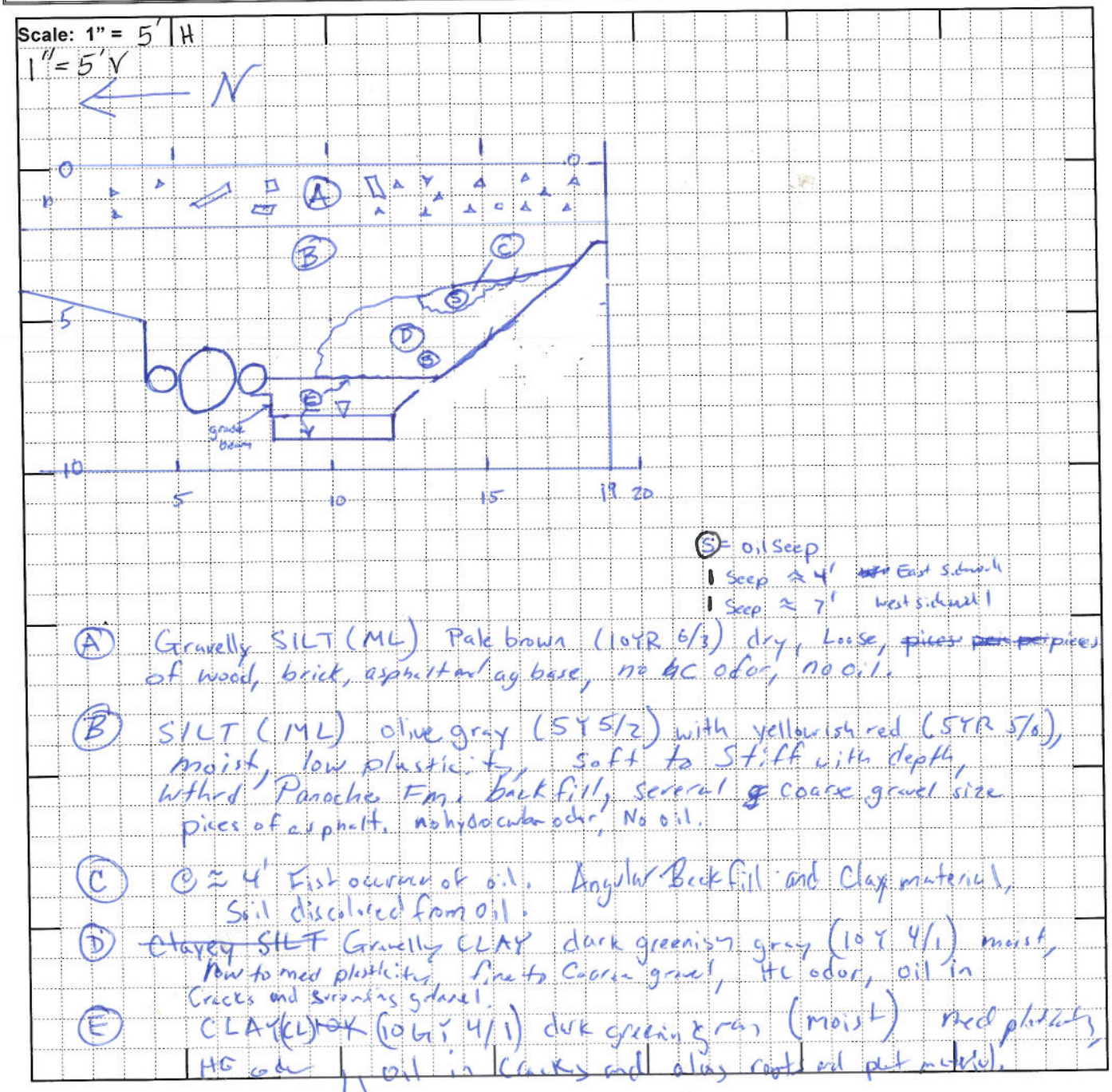
(C) Well graded gravel with Sand (GW) Black (5Y 2.5/1), moist, fine to coarse sand, fine to coarse gravel, gravel rounded to angular shape, Some cobbles, loose to med. dense, Some debris appears burned, debris: wood, metal, pipe, glass, pottery, white/yellow brick, orange brick, burned paper, wire rope, metal scrap, copper pipe, rust, metal shavings, melted glass, TPH odor, no free TPH observed, water encountered at 4.5' bgs. Below groundwater Some visable TPH observed on debris and lithologic material.

TPH observations

See notes above.

Trench Sidewall Record	Trench # SSL-1	Page 1 of 1
Contractor: Turn-Key Construction Services, Inc.	Date 11-5-07	
Project No. 273939.14.01	Site N of Dump Rd. West of CTA	
Location N. of dump Rd; W. of Crane test Area		
Begin trench: 11-1-07 End trench: 11-5-07 Depth to Water: 7.5' bgs 0920 11-5-07		
GPS Coords		
Trench View (East Wall)		

Scale: 1" = 5' H
1" = 5' V



S = oil seep
Seep ≈ 4' ~~East sidewall~~
Seep ≈ 7' West sidewall

(A) Gravelly SILT (ML) Pale brown (10YR 6/3) dry, Loose, ~~pieces~~ ~~per pc~~ pieces of wood, brick, asphalt and ag base, no HC odor, no oil.

(B) SILT (ML) olive gray (5Y 5/2) with yellowish red (5YR 5/6), moist, low plasticity, soft to Stiff with depth, w/trace Panoche Fm. backfill, several coarse gravel size pices of asphalt, no hydrocarbon odor, No oil.

(C) @ ≈ 4' First occurrence of oil. Angular Backfill and Clay material, Soil discolored from oil.

(D) ~~Clayey SILT~~ Gravelly CLAY dark greenish gray (10Y 4/1) moist, low to med plasticity, fine to Coarse gravel, HC odor, oil in Cracks and surrounding gravel.

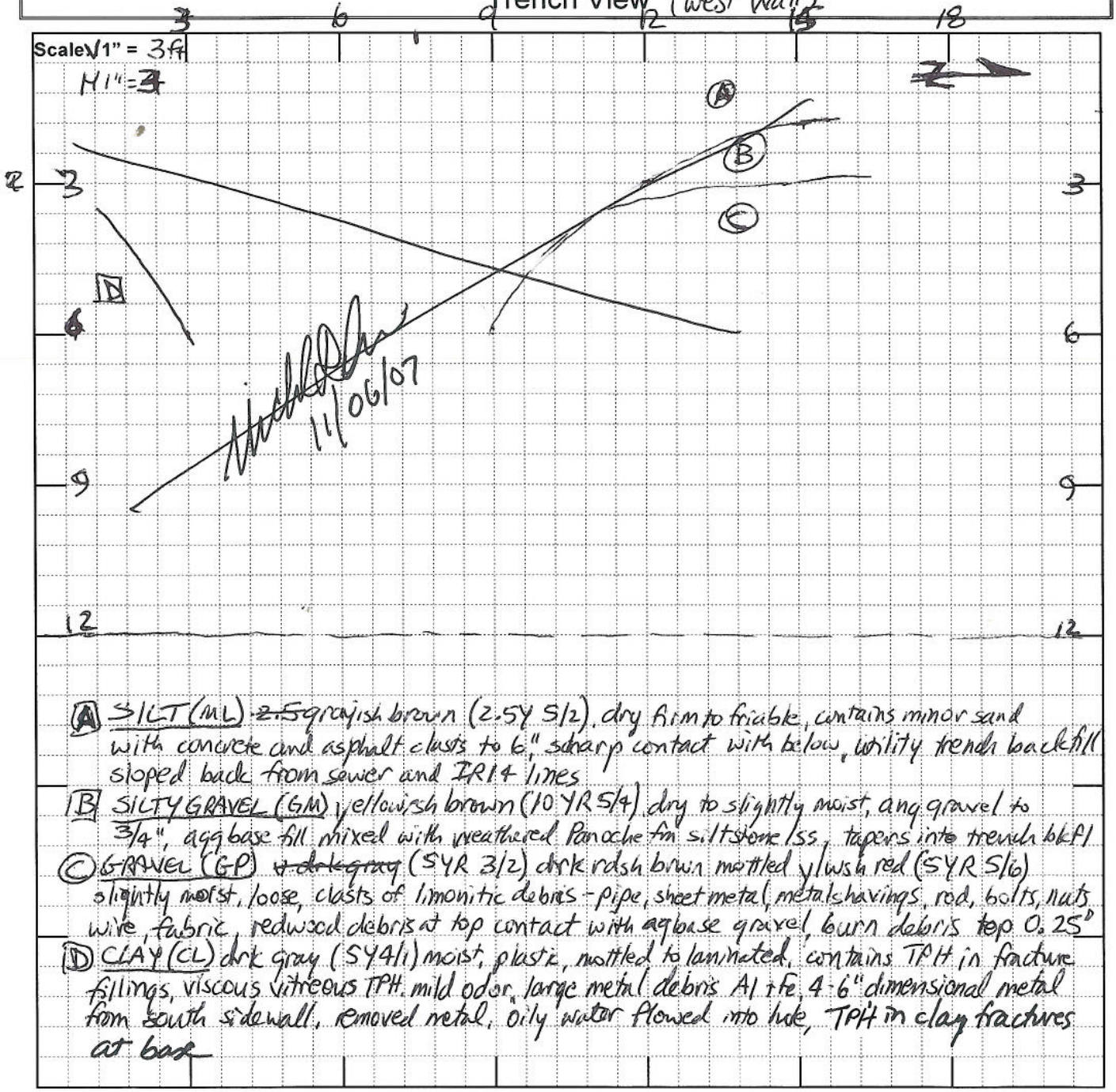
(E) CLAY ~~(CL) OK~~ (10GY 4/1) dark greenish gray (moist) med plasticity, HC odor, oil in Cracks and also roots and plant material.

roots and plant materi

ABM_location_plan.doc

Trench Sidewall Record	Trench # SSL-2 Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/5/07
Project No. 273939.14.01	Site Mid trench west of CTA, North Dup Rd
Location DUM RD, NORTH	
Begin trench 11/05/07 @ 1415	
END TRENCH 11/06/07 @ 1145	
DEPTH TO WATER- 6 ft bgs	
GPS Coords	

Trench View (west wall)



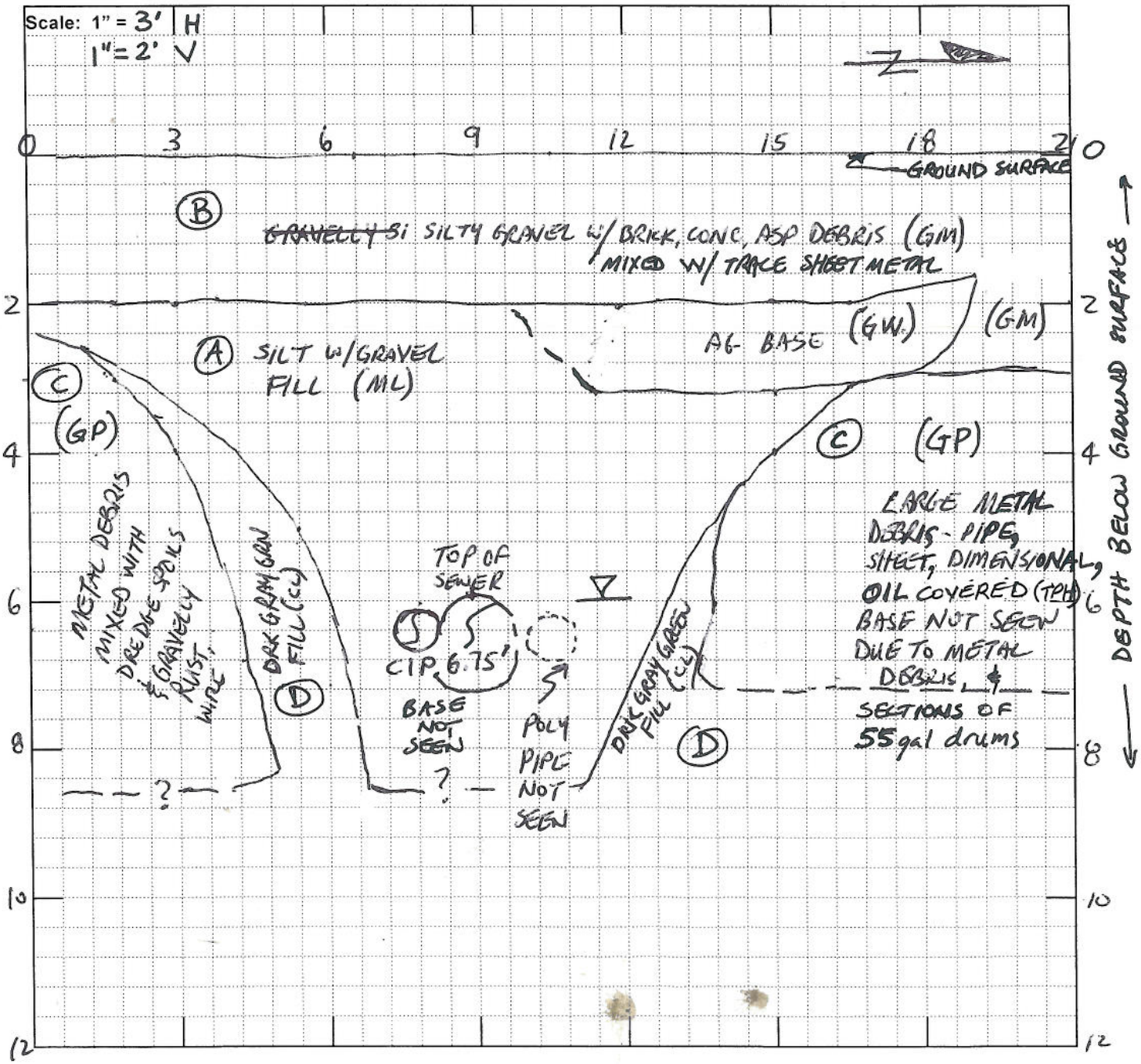
(A) SILT (ML) ~~2.5~~ grayish brown (2.5Y 5/2), dry firm to friable, contains minor sand with concrete and asphalt clasts to 6", sharp contact with below, utility trench backfill sloped back from sewer and IR14 lines

(B) SILTY GRAVEL (GM) yellowish brown (10YR 5/4) dry to slightly moist, ang gravel to 3/4", agg base fill mixed with weathered Pancake fm siltstone/ss, tapers into trench bkfl

(C) GRAVEL (GP) ~~+ dk gray~~ (5YR 3/2) dark rdsh brwn mottled y/wsh red (5YR 5/6) slightly moist, loose, clasts of limonitic debris - pipe, sheet metal, metal shavings, rod, bolts, nuts wire, fabric, redwood debris at top contact with agbase gravel, burn debris top 0.25'

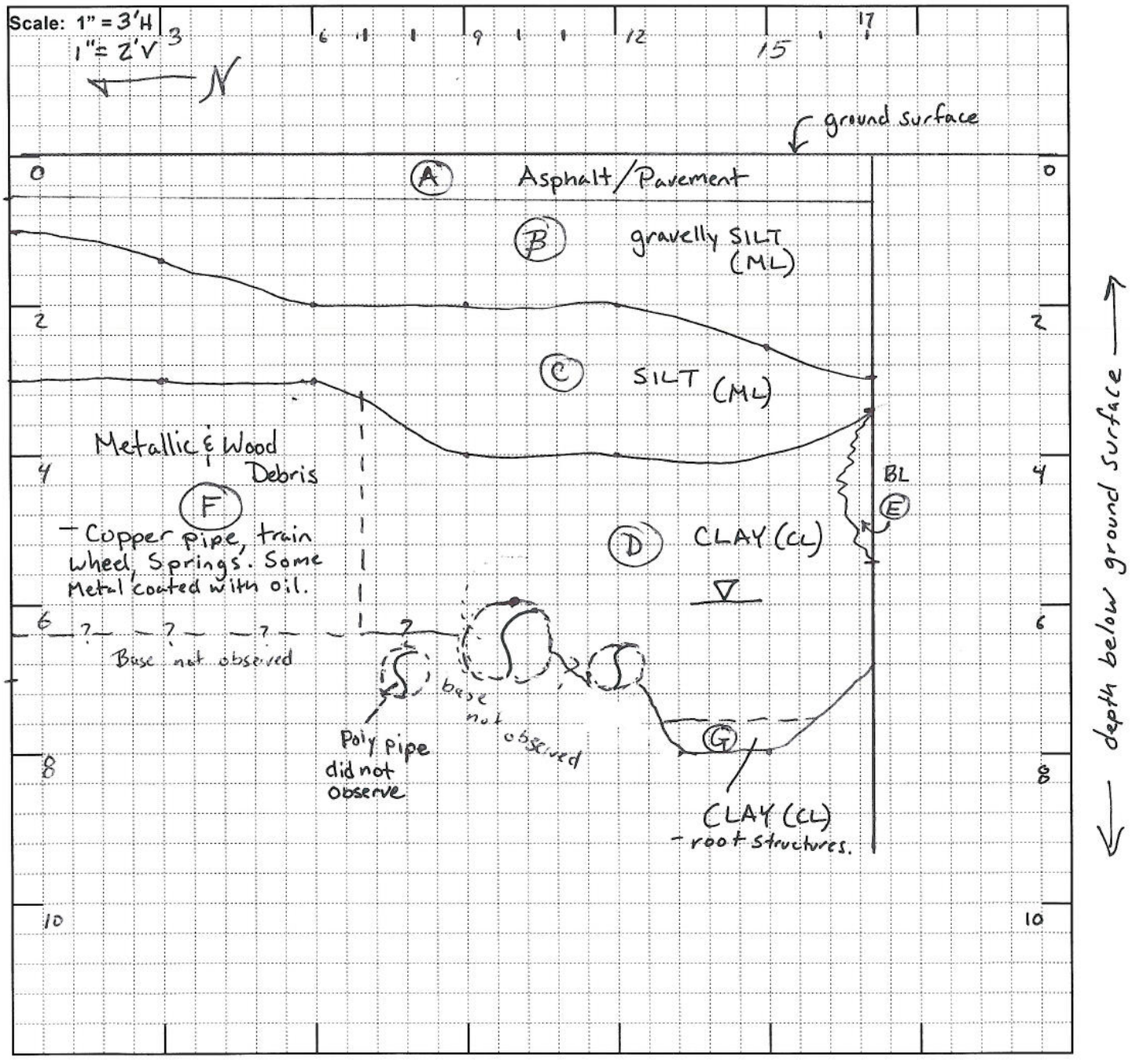
(D) CLAY (CL) dk gray (5Y4/1) moist, plastic, mottled to laminated, contains TPH in fracture fillings, viscous vitreous TPH mild odor, large metal debris Al + Fe, 4 6" dimensional metal from south sidewall, removed metal, oily water flowed into hole, TPH in clay fractures at base

Trench Sidewall Record	Trench # SSL-2	Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/05/07	
Project No. 273939.14.01	Site . . TRENCH SSL-2	
Location DUMP RD, NORTH		
LITHOLOGIC DESCRIPTION ON PAGE 1 of 2		
GPS Coords		
Trench View (WEST WALL)		



Trench Sidewall Record	Trench # SSL-3 Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-07
Project No. 273939.14.01	Site
Location N of Dump Rd; W of Crane Test Area	
Lithologic Log on Page 2 of 2	
Begin trench: 1300 11-6-07	
End trench: 1600 11-6-07	
Depth to water ~ 6' bgs	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # SSL-3	Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-07	
Project No. 273939.14.01	Site	
Location N of Dump Rd ; W of crane Test Area		
GPS Coords		

Trench View

Scale: 1" =

Lithology

(A) ½ inch asphalt

(B) gravelly SILT (ML) ~~dark~~ SBA yellowish brown (10YR 5/6), moist, firm, low plasticity, angular gravel up to 3 inches, w/thin Sandstone, Concrete and brick.

(C) SILT (ML) dark yellowish brown (10YR 4/6), Sly, moist, firm to stiff, low plasticity, gradational contact with above, Sharp contact with below.

(D) CLAY (CL) dark greenish gray (5GY 4/1), moist, soft, med plasticity,

(E) SAND (SW) (5Y 2.5/1) black, loose, dry, fine to coarse Sand, burn debris layer, with melted glass, metalic debris, and furnace ash.

(F) Metallic & wood debris with gravel, cobbles, Sand and clay matrix. Debris as follows: Copper pipes, brass/copper/steel shavings, train wheel, Springs, Some metal coated with oil.

(G) CLAY (CL) dark greenish gray (5GY 4/1), moist, soft, med plasticity, root structures and compressed vegetation

TPH Occurance:

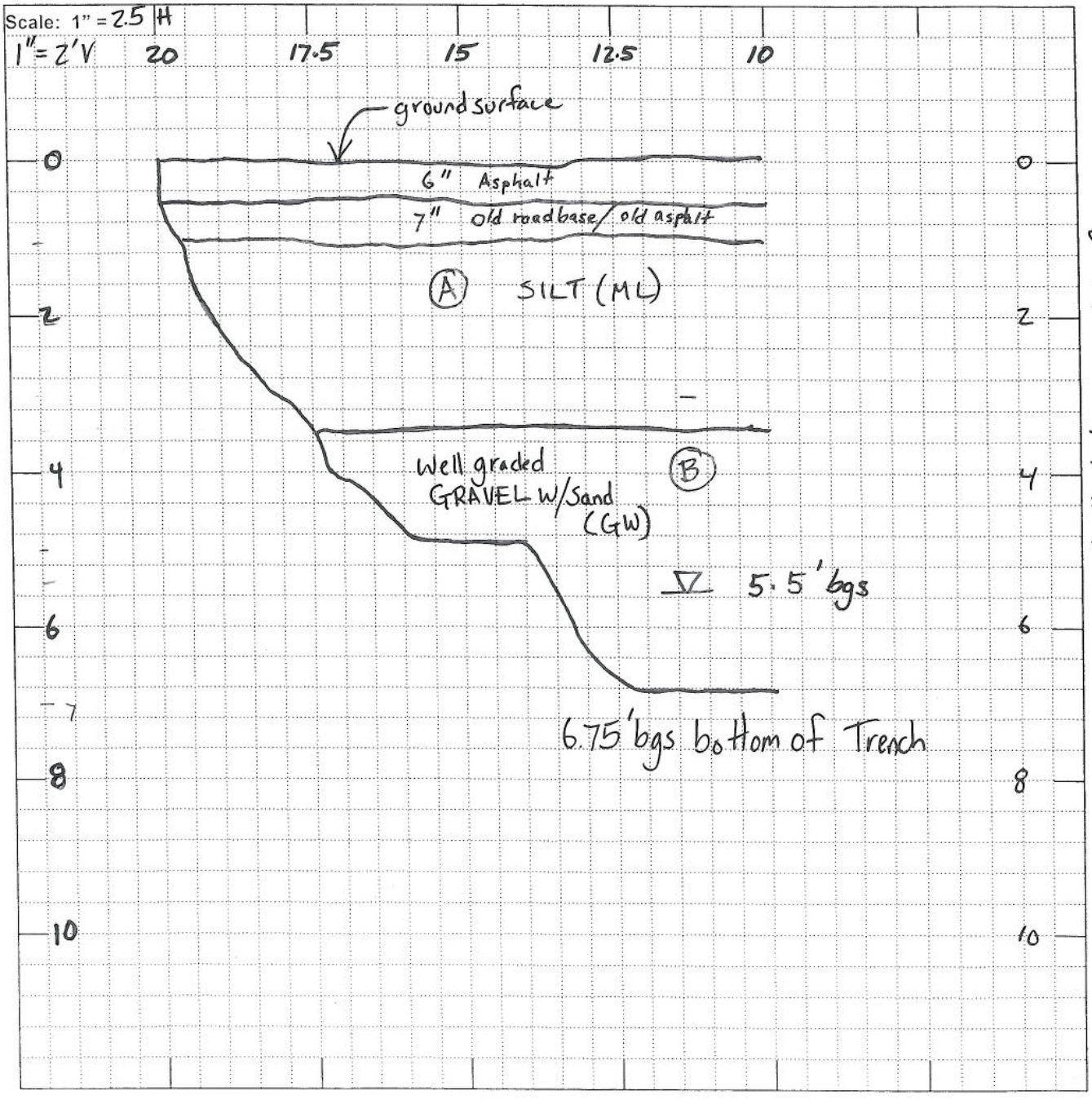
@ 7 feet in dark greenish gray clay, trace oil in cracks

@ 8 feet in dark greenish gray clay, ~~prevelent but not obico~~ SBA Prevelent in cracks, root structures, and compressed vegetation.

@ 3 feet in metallic & wooden debris oil covered Some of the debris.

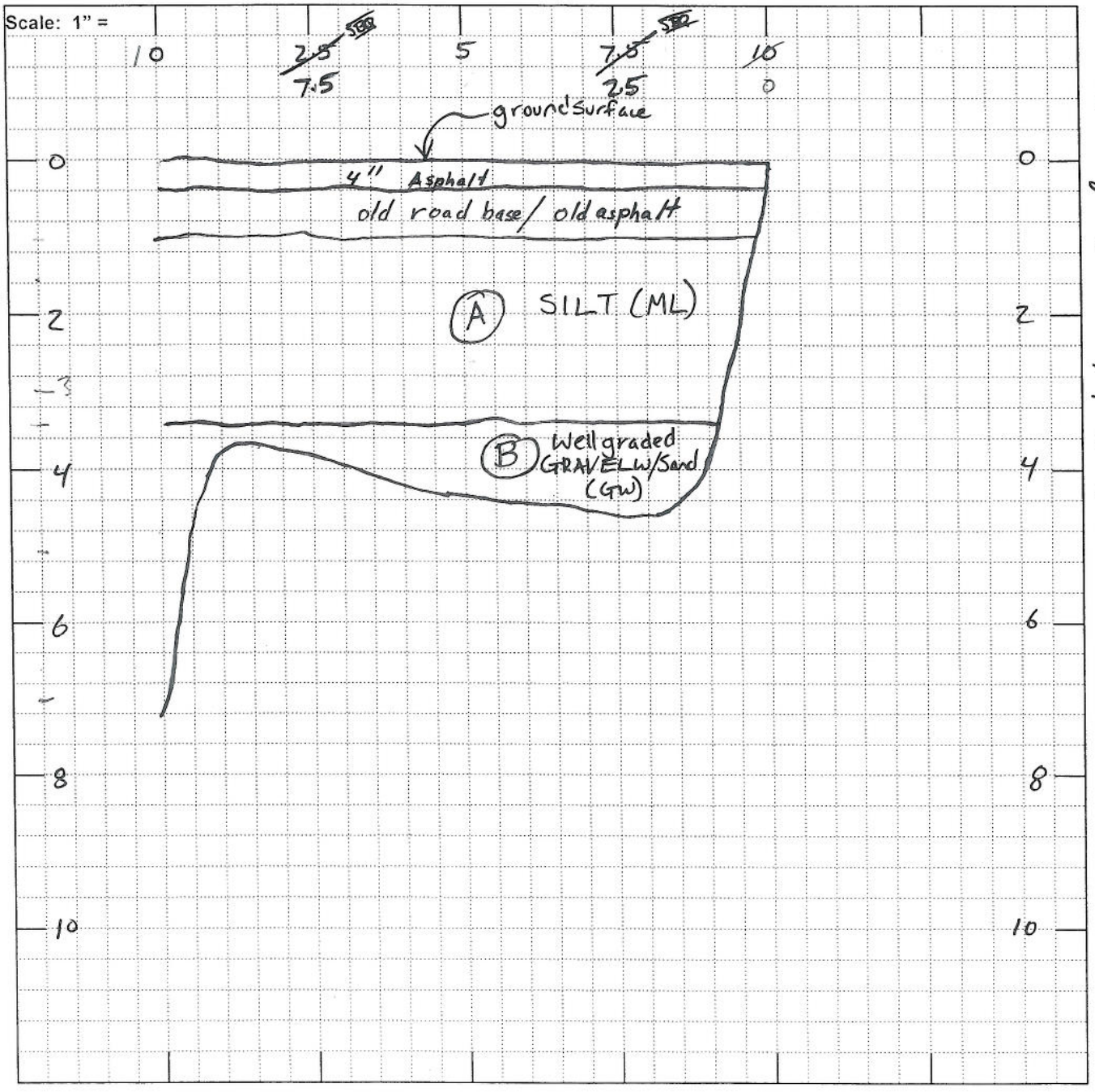
Trench Sidewall Record	Trench # SSL-4 (Sta. 0 to Sta. 20)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site ~~580~~
Location Trench SSL-4 (Sta. 0 to Sta. 20) Lithologic Log on Page 3 of 4 and 4 of 4 Begin Trench: 0840 12-11-07 End Trench: 1100 12-11-07 Depth to Water: 5.5' bgs	
GPS Coords	

Trench View (South)



Trench Sidewall Record	Trench # SSL-4 (sta. 0 to sta. 20) SBG
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location Trench SSL-4 (sta. 0 to sta. 20) Lithologic Log on Page 3 of 4 and 4 of 4 Begin Trench: End. Trench: Depth to Water: > See Page 1 of 4	
GPS Coords	

Trench View (South)



Trench Sidewall Record	Trench # SSL-4 (Sta. 0 to Sta. ~~10~~ 20)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silt (ML) yellowish brown (10YR 5/6) mottled with dark greenish gray (10Y 4/1), moist, firm, low plasticity, trace fine to coarse sand, trace fine gravel, no TPH odor, No debris, no Free TPH

(B) well graded gravel w/ Sand (GW) dark reddish brown (5YR 2.5/2) moist, loose, debris – wood, metal plate, copper, glass, pottery, wood fragments, fine to coarse Sand, fine to Coarse gravel, trace Cobbles

@ 3.5' bgs ; Sta. 4, Wood debris
@ 4' bgs Sta 0 to Sta. 10, debris increases and includes; metal plate, small (1" to 2" pieces of copper), glass, wood, pottery, Some larger pieces of wood have TPH odor, However, no Free TPH observed.
@ 4' bgs Sta 2.5 to Sta 5, large tree stump or telephone pole.

Refusal @ 4.5' bgs due to tree stump or large piece of wood. @ Sta. 0 to Sta. 10

@ Sta. 10 to Sta. 15 ; 3' bgs, metal debris, wood debris, small wood fragments some appear burned, nails, glass, wood debris is black, however no TPH odor.
@ Sta. 10 to Sta. 15 ; 3.5' bgs Stacks of tin/sheet metal, Some metal has thin visible Free TPH on its surface. Also some wire rope/cable
@ Sta. 10 ; 5.5' bgs Sheet metal debris continues, Free TPH visible on the majority of the metal.

Trench Sidewall Record	Trench # SSL-4 (Sta. 0 to Sta. 20)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

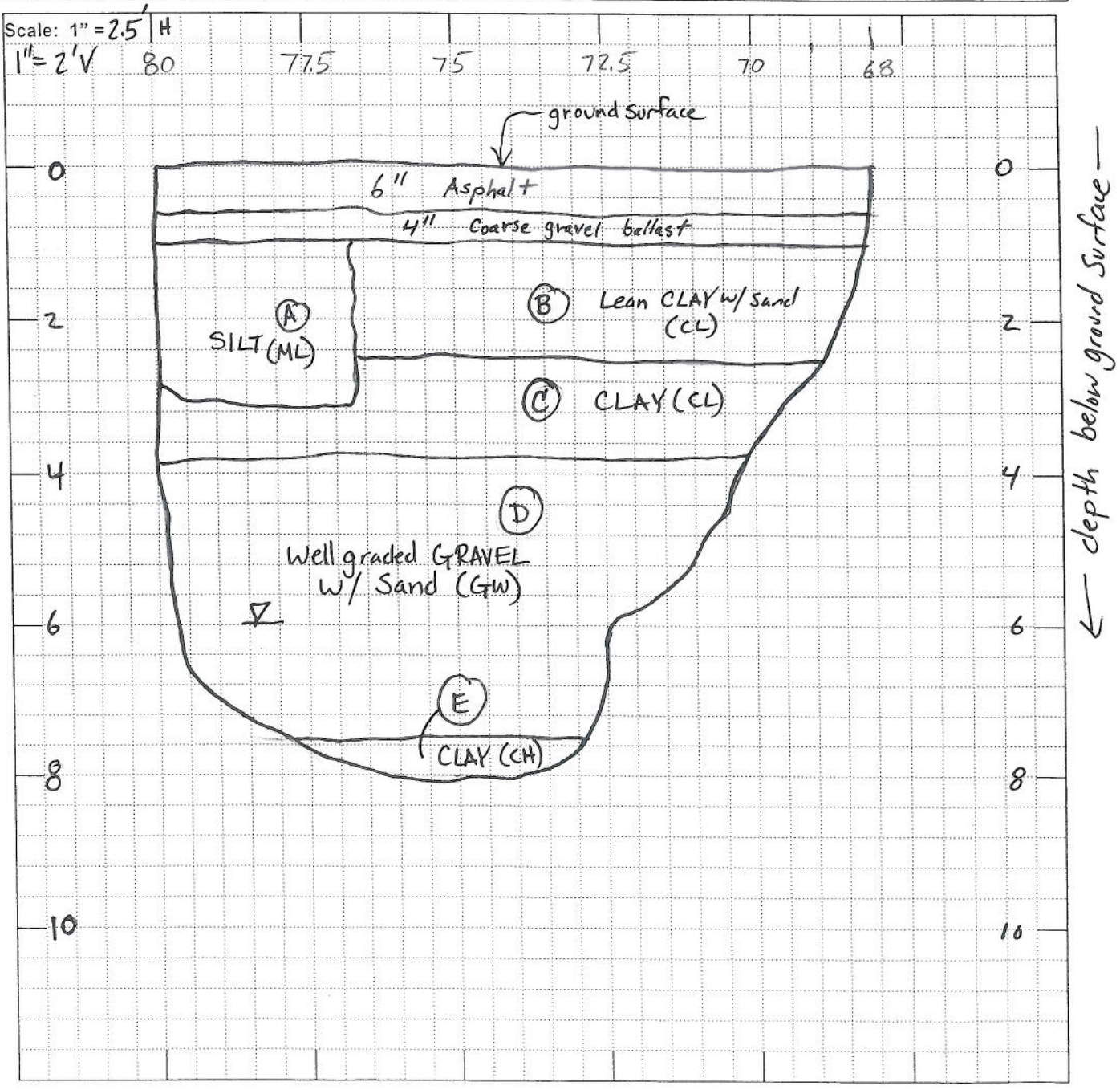
Lithology (Continued...)

@ 5.5 to 6' bgs encounted groundwater; Free TPH visible in water.

@ Sta. 10 to Sta. 13; 6 to 6.75' bgs metal debris (Sheet metal), wood, glass, Free TPH Covers debris. & wood fragments

6.75' bottom of boring @ Sta. 10 to Sta. 13.

Trench Sidewall Record	Trench # SSL-4 (Sta 68 to 80)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location Trench SSL-4 (Sta. 68 to Sta. 80)	
Lithologic Log on Pages 2 of 3 and 3 of 3	
Begin trench: 1100 12-11-07	
End trench: 1316 12-11-07	
Depth to Water: 6' bgs first encountered gw.	
GPS Coords	
Trench View (South)	



Trench Sidewall Record	Trench # SSL-4 (Sta. 68 to 80)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silt (ML) (2.5Y 5/4 → 4/3) olive brown, moist, soft, med plasticity, trace fine to coarse Sand, Some fine gravel, Concrete debris, no TPH odor.

(B) Lean Clay w/ Sand (CL) very dark greenish gray (5GY 3/1) moist, soft to firm, fine to coarse Sand, trace fine gravel, concrete debris, no TPH odor.

(C) CLAY (CL) black (N 2.5/), moist firm, low to med plasticity, trace fine Sand, red brick debris, no TPH odor

(D) Well graded gravel w/ Sand (GW) dark reddish brown. (5YR 2.5/2) moist, loose, fine to Coarse Sand, fine to Curse gravel, trace Cobbles, – debris – wood, wood log, Copper pipe, wire mesh, wire rope, rust, sheet metal, wood fragments,

Sta. 80 to Sta 73; 4 to 4.5' bgs, wood, wood log, Copper pipe, rust. No Free TPH observed.

6' bgs encountered groundwater.

Sta. 80 to Sta. 72; 6 to 7' bgs; Wood, glass, wire mesh, sheet metal. Free TPH observed covering the debris, Thick Free TPH found on wire mesh.

Trench Sidewall Record	Trench # SSL-4 (Sta. 68 to 80)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology (Continued...)

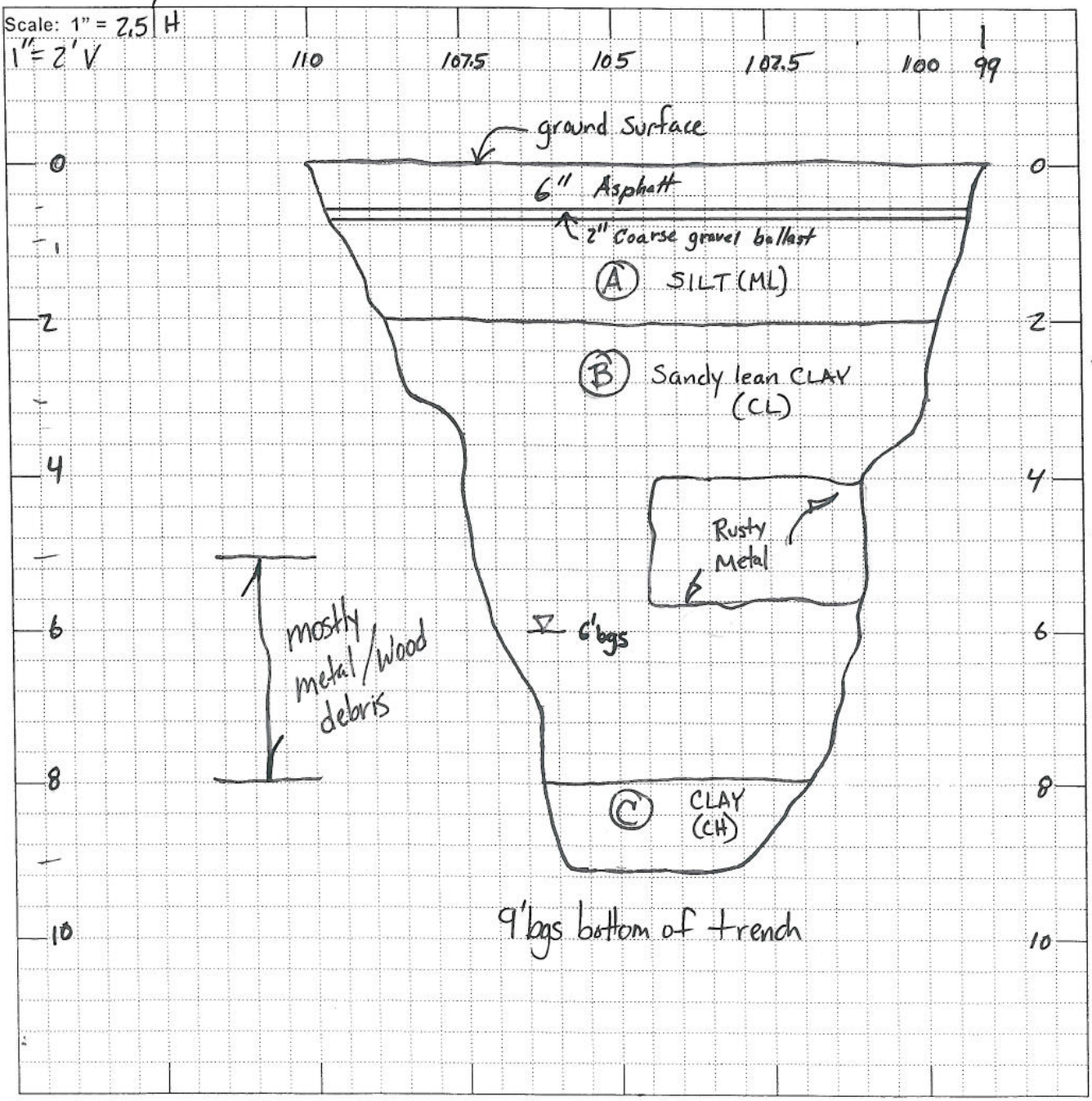
@ Sta. 75 7.5' bgs out of metal debris and Free TPH

@ 7.5' (E) Clay (CH) very dark greenish gray (5GY 3/1) moist, Soft to firm, high plasticity, plant material / roots. no Free TPH in fractures or along plant material. Some NO TPH odor.

8' bottom of excavation

Trench Sidewall Record	Trench # SSL-4 (Sta. 99 to Sta. 110)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location Trench SSL-4 (Sta. 99 to Sta. 110)	
Lithologic Log on Page 2 of 2	
Begin trench: 1316 12-11-07	
End trench: 1530 12-11-07	
Depth to Water: 6' bgs first encountered gw	
GPS Coords	

Trench View (South)



Trench Sidewall Record	Trench # SSL-4 (Sta. 99 to 110)
Contractor: Turn-Key Construction Services, Inc.	Date 12-11-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silt (ML) yellowish brown (10YR 5/6) mottled w/ olive (5Y 5/6), dry to moist, firm, low plasticity, no TPH odor, no Free TPH

(B) Sandy Lean Clay (CL) black (N 2.5/), moist, low to med plasticity, firm, fine to med. Sand, Some fine angular gravel, no TPH odor, debris - brick, wood, description of metal debris and Free TPH below.

@ Sta. 100 to 107 @ 2' bgs several inches of wood chips and wood fragments w/ TPH odor

@ Sta. 100 to 102 @ 4' bgs into metal debris. lots of brown rust above water table.

@ Sta 100 to 107 ≈ 4.5 to 5.5' metal debris, wire rope, wood, some debris had Free TPH on some areas, none coated w/ TPH

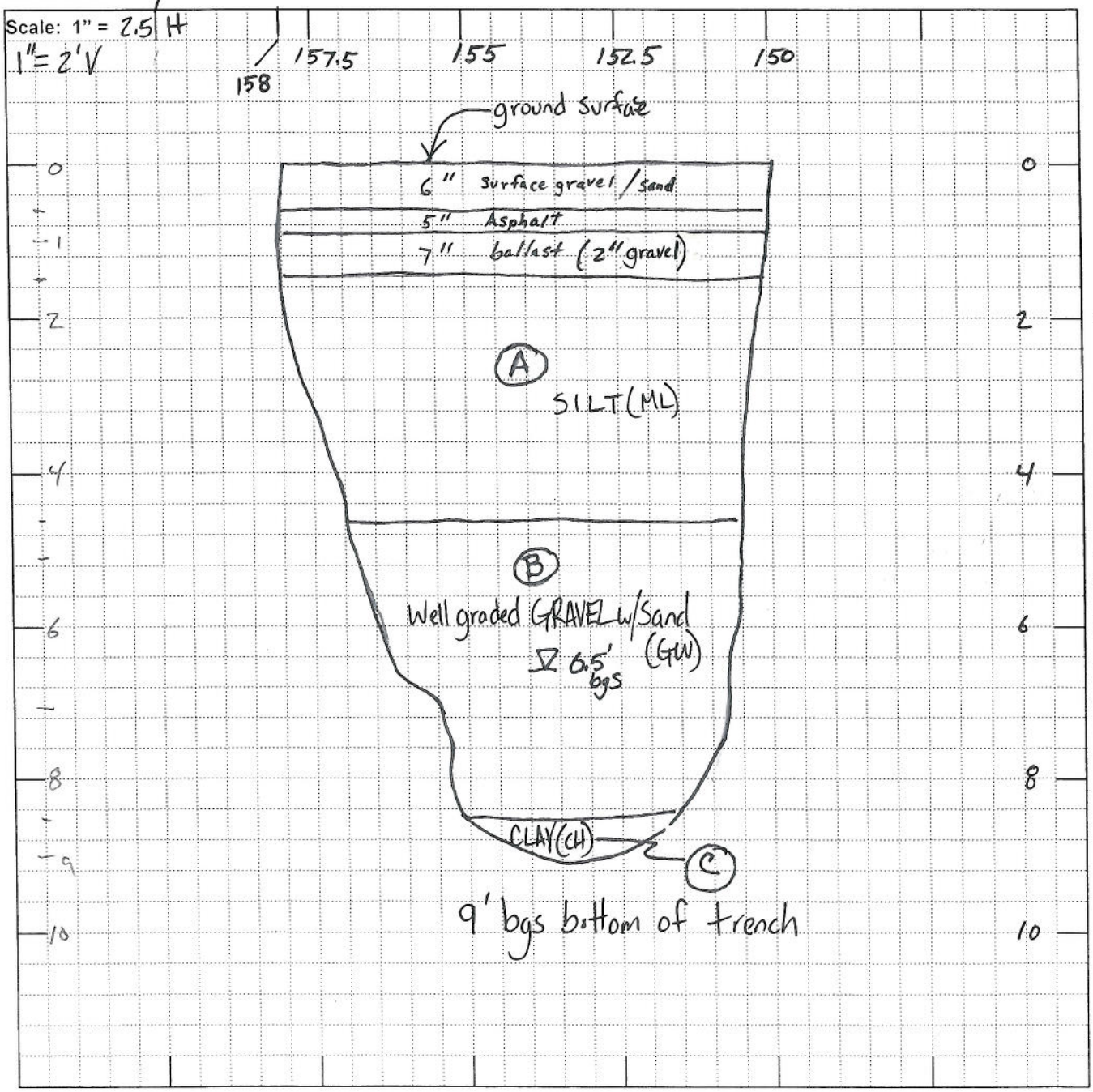
@ Sta 100 to 107. Encountered gwe 6' bgs Metal debris continues below 6' bgs This metal debris has a coating of Free TPH.

@ 8' bgs out of metal debris. Interval from 5 to 8' bgs is largely metal and wood debris.

@ 8' bgs (C) CLAY (CH) very dark greenish gray (5GY 3/1), Soft to firm, high plasticity, moist, Some plant material / roots. Some Free TPH present in fractures and along plant material / roots, TPH odor.

9' bgs bottom of Trench

Trench Sidewall Record	Trench # SSL-4 (Sta. 150 - 158)
Contractor: Turn-Key Construction Services, Inc.	Date 12-12-07
Project No. 273939.14.01	Site
Location Trench SSL-4 (Sta. 150 to Sta. 158)	
Lithologic log on Page 2 of 2	
Begin trench: ✓ 1230 12-12-07	
End trench: 1330 12-12-07	
Depth to water: 6.5' bgs, encountered gw first	
GPS Coords	
Trench View (South)	



Trench Sidewall Record	Trench # SSL-4 (Sta 150-159)
Contractor: Turn-Key Construction Services, Inc.	Date 12-12-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silt (ML) yellowish brown (10YR 5/6) mottled w/ olive (5Y 5/6) and dark greenish gray (10Y 4/1), moist, firm, low to med plasticity, No TPH odor, No Free TPH, trace metal debris (4-4.5' bgs) including wire, copper pipe, and angle iron.

(B) Well graded gravel w/ Sand (GW) dark reddish brown (5YR 2.5/2) moist, loose, fine to coarse sand, fine to coarse gravel, trace cobbles, debris — metal, rust, wire, metal strap, wood, brick, metal scrap parts, large metal plate and pipes, Free TPH as described below.

@ 5' bgs debris - wood chips, wire, copper pipe and wood debris. No Free TPH.

@ 6.5' bgs encountered groundwater. Blebs of free TPH on water surface, larger metal debris, metal debris not completely covered w/ Free TPH.

@ 7.5' metal debris continues, Covered w/ Free TPH (below water table)

@ 6 to 8' bgs mostly metal debris.

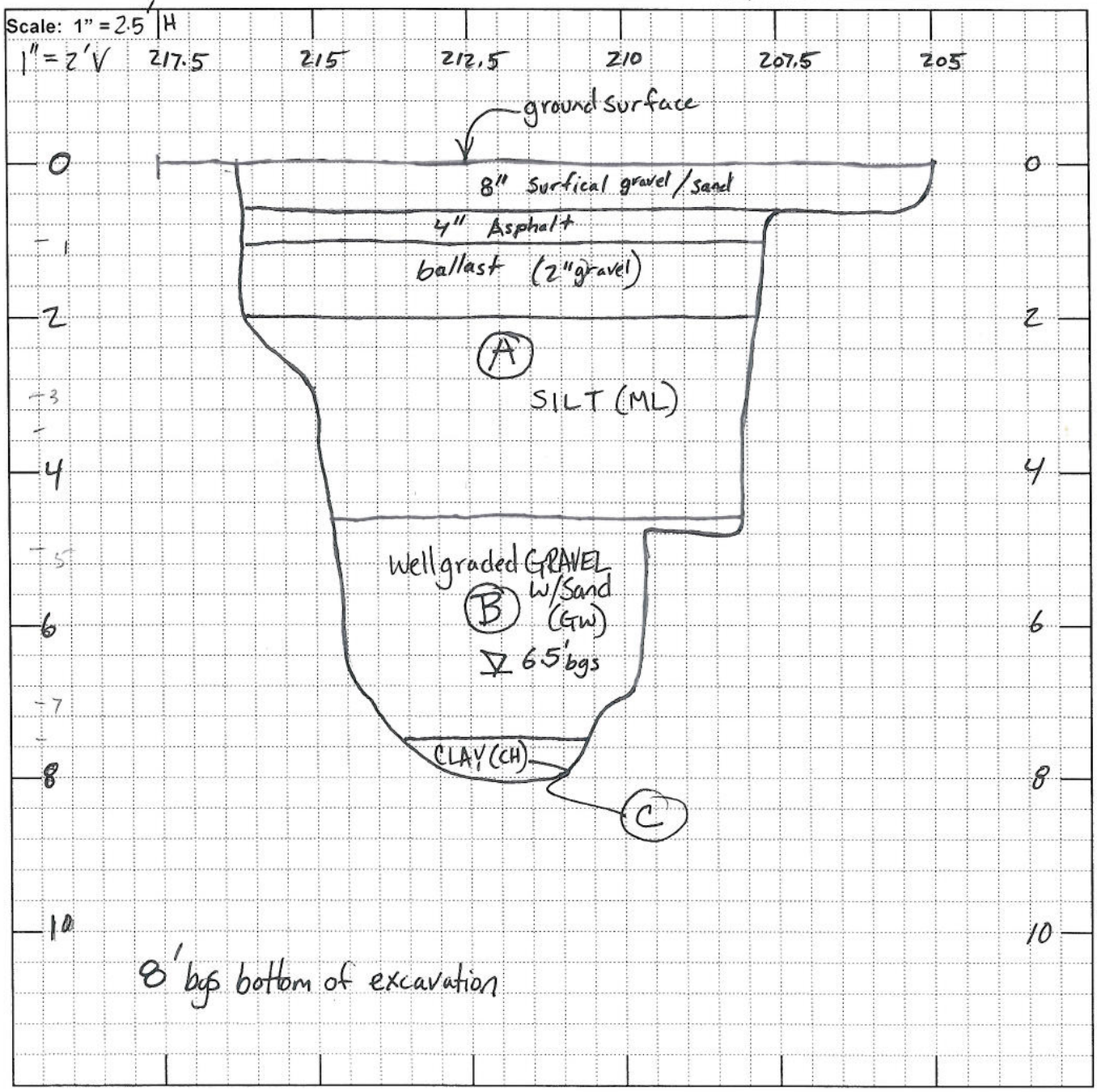
@ 8.5' bgs out of (GW) material. Free TPH and metal debris and

8.5' bgs (C) Clay (CH) very dark greenish gray (10GY 3/1) moist, high plasticity, firm, some plant material/roots, no Free TPH in fractures or along plant material/roots, mica flakes, no TPH odor.

9' bgs bottom of trench.

Trench Sidewall Record	Trench # SSL-4 (Sta. 205 to Sta. 217.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-12-07
Project No. 273939.14.01	Site
Location Trench SSL-4 (Sta. 205 to Sta. 217.5)	
Lithologic log on Page 2 of 2	
Begin trench 1340 12-12-07	
End trench 1445 12-12-07	
Depth to Water: 6' bgs first encountered gw	
GPS Coords	

Trench View (South)



Trench Sidewall Record	Trench # SSL-4 (sta. 205 to sta. 217.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-12-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silt (ML) very dark greenish gray (10Y 3/1), moist, low plasticity, some fine to coarse sand, trace fine gravel, no TPH odor, no Free TPH, metal/wood debris described below.

2 – 3.5' some metal, wood, brick debris, no free TPH.

3.5' layer of wood chips, no TPH odor. (↑ undetermined thickness)

@ 4.5' bgs (B) Well graded Gravel w/ Sand (GW) black (N 2.5Y) moist, loose, fine to coarse sand, fine to coarse gravel, trace cobbles, debris – metal debris (steel plate, sheet metal, wire rope/cable, pipe) wood debris, wood chips/wood fragments, No Free TPH observed

@ ~3' bgs black fine sand and cobble size chunks of melted material, no Free TPH.

@ 5.5' bgs rusted metal and black material (coal?) that appears to have been stuck together, no Free TPH

@ 6' bgs into groundwater, metal debris (sheet metal, steel plate) continues, metal debris is rusted, no Free TPH observed.

@ 7.5' bgs out of (GW) material

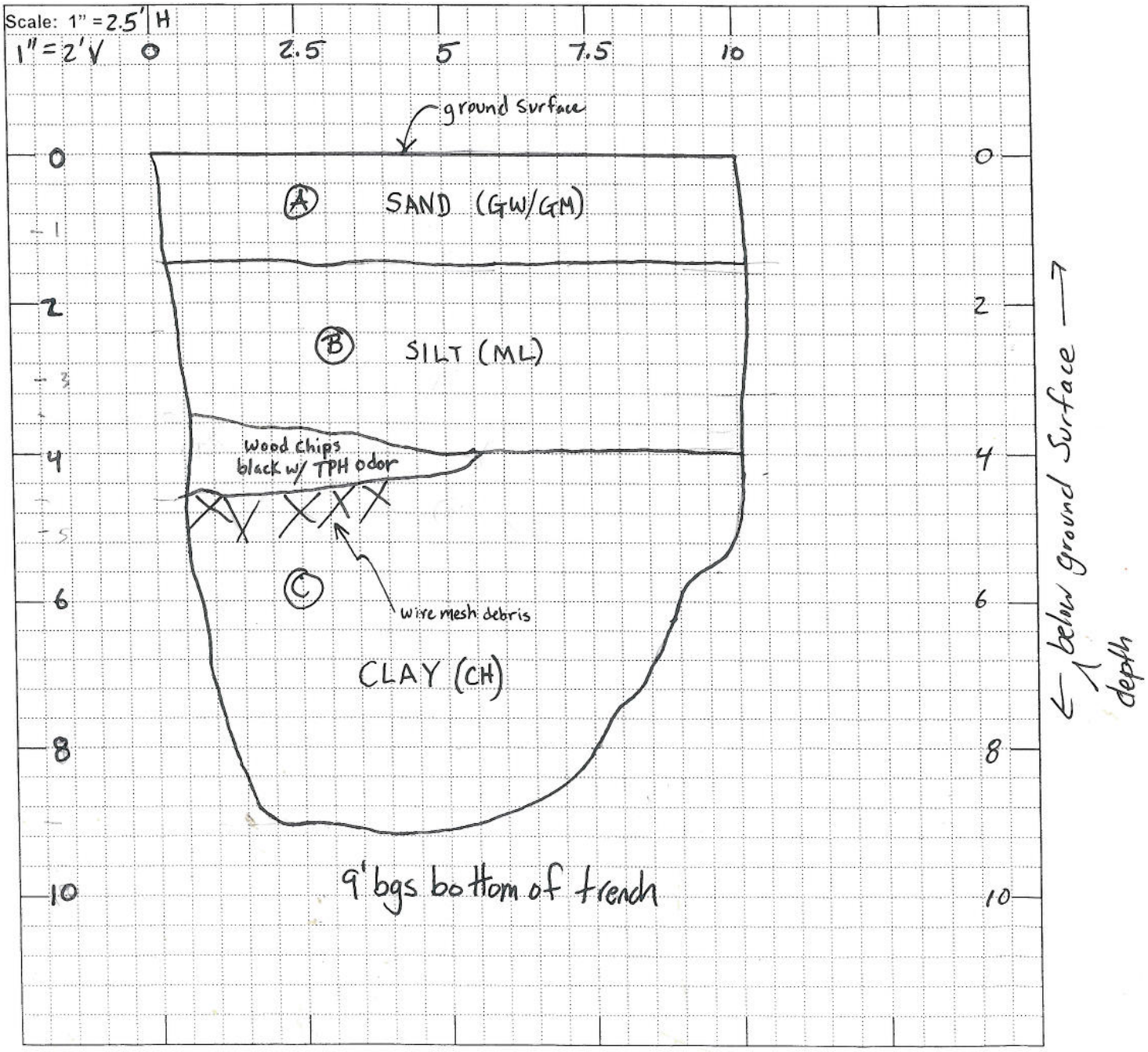
Interval from 5.5 to 7' bgs is mostly metal/wood debris

@ 7.5' bgs (C) CLAY (CH) very dark greenish gray (5GY 3/1) moist, firm, high Plasticity, some plant material/roots, mica flakes, no Free TPH in fractures, or along plant material/roots.

8' bgs bottom of trench

Trench Sidewall Record	Trench # FSA-1 (Sta. 0 to 10)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location Trench FSA-1 (Sta. 0 to Sta. 10) Lithologic log on Page 2 of 2 Begin trench: 0730 12-6-07 End trench: 0910 12-6-07 Depth to water:	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # FSA+1 (Sta. 0 to 10)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded gravel with silt and Sand (GW/GM) olive brown (2.5Y 4/3), moist, loose, fine to coarse gravel, fine to coarse sand, no TPH odor,

(B) SILT (ML) greenish gray (5G 5/1) w/ yellowish brown motting (10YR 5/4), Soft to firm, med plasticity, some fine to coarse sand, trace fine gravel, no Free TPH observed.

(C) Clay (CH) (10Y 4/1) dark greenish gray, moist, Soft to firm, ~~med to hi~~ high plasticity, roots and plant material, blocky fracture

Station 0 to 5 @ 4.5' bgs. Free TPH prevalent in blocky fractures and along roots and plant material. wire mesh metal debris @ 4.5' bgs.

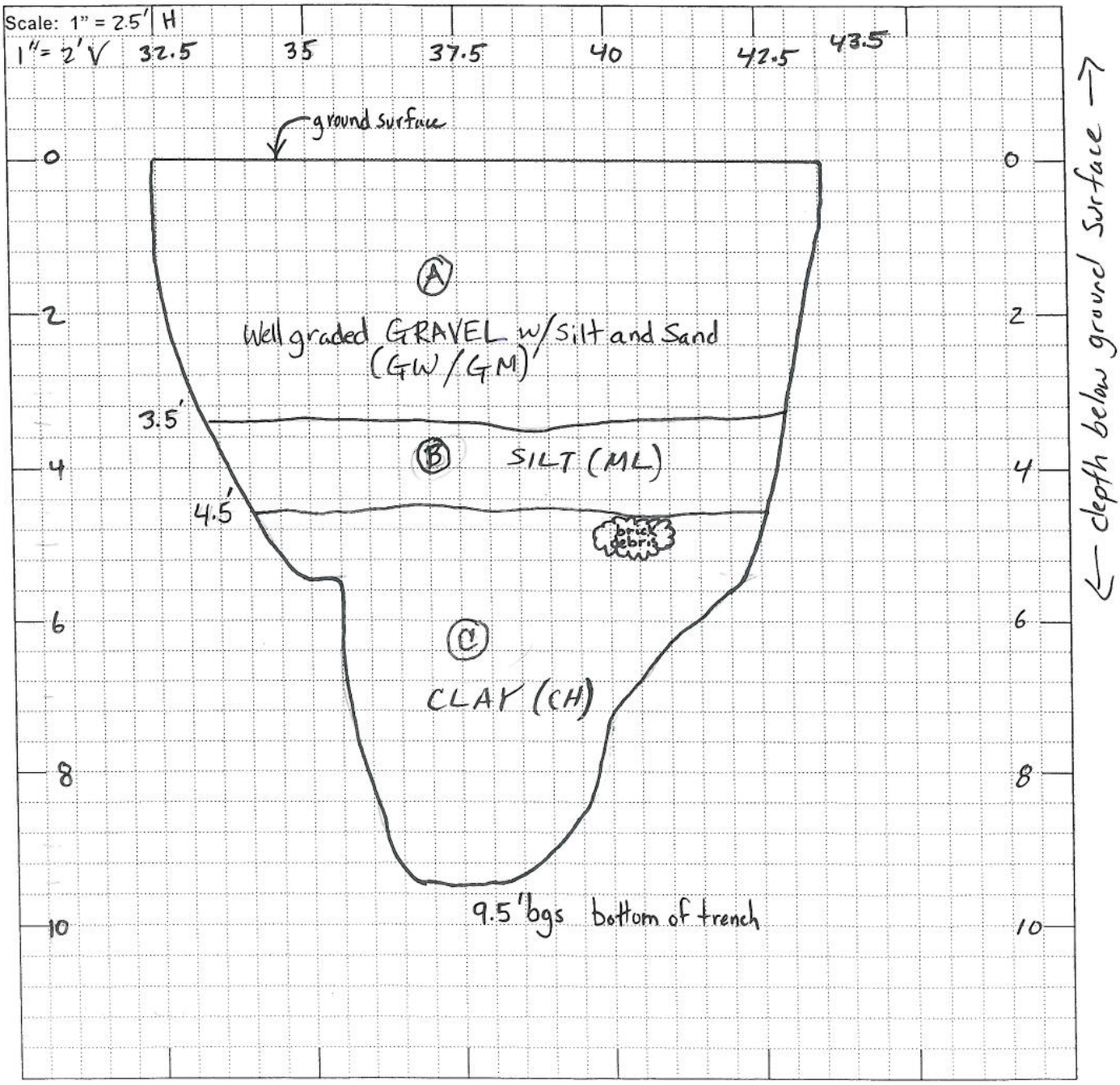
Only trace amount of metal debris (wire mesh @ 4.5' bgs) observed

Free TPH in blocky fractures and along roots plant material continued to bottom of excavation @ ≈ 9' bgs.

Bottom of free TPH not encountered.

Trench Sidewall Record	Trench # FSA-1 (Sta. 32.5 to 43.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location Trench FSA-1 (Sta. 32.5 to Sta. 43.5)	
Lithologic log on Page 2 of 2	
Begin trench: 0915 12-6-07	
End trench: 0940 12-6-07	
Depth to Water:	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # FSA-1 (Sta. 32.5 to 43.5)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Well graded GRAVEL w/ Silt and Sand (GW/GM) Olive Brown (2.5Y 4/3), moist, loose, fine to Coarse gravel, fine to Coarse Sand, no TPH odor.

(B) SILT (ML) greenish gray (5G 5/1) w/ yellowish brown mottling (10YR 5/4), soft to firm, med. plasticity, Some fine to Coarse Sand, trace fine gravel.

@ 4' bgs encountered Free TPH in SILT (ML)

(C) Clay (CH) dark greenish gray (10Y 4/1), moist Soft to firm, high plasticity, roots and plant material and blocky fracture.

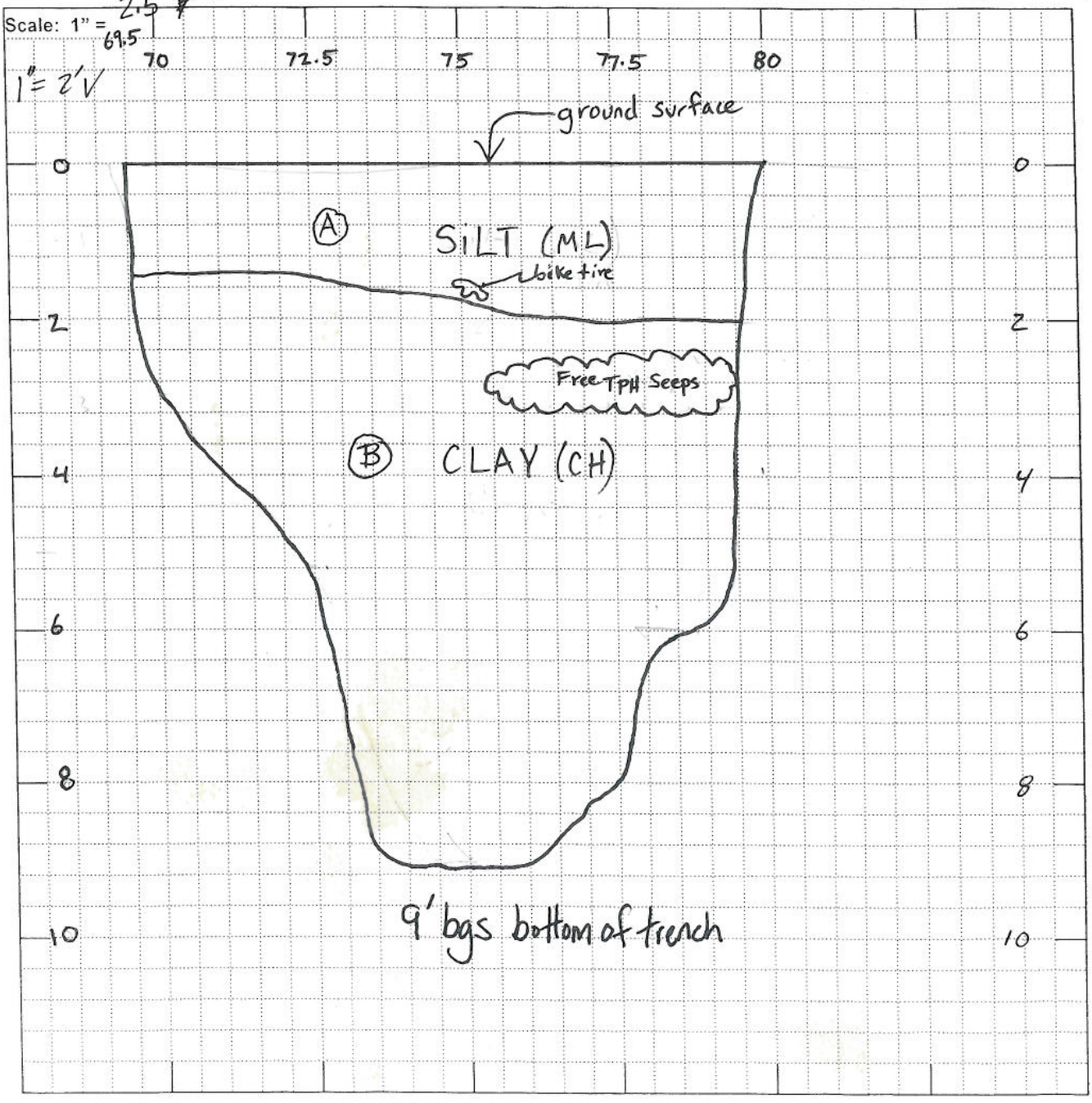
Free TPH in CLAY (CH) blocky fractures and along roots / plant material.

@ 7.5' bgs. Free TPH continues to be prevalent along blocky fractures and roots / plant material. No metal debris.

@ 9.5' bgs. Bottom of trench; did not reach the bottom of Free TPH in Clay (CH).

Trench Sidewall Record	Trench # FSA-1 (Sta. 69.5 to Sta. 80)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location Trench FSA-1 (Sta. 69.5 to Sta. 80)	
Lithologic log on Page 2 of 2	
Begin trench: 0950 12-6-07	
End trench: 1015 12-6-07	
Depth to Water:	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # FSA-1 (Sta. 69.5 to Sta. 80)
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) SILT (ML) greenish gray (5G 5/1) w/ yellowish brown mottling (10YR 5/4), soft to firm, med. plasticity, some fine to coarse sand, trace fine gravel, no Free TPH observed, no metal debris.

(B) CLAY (CH) dark greenish gray (10Y 4/1), moist, soft to firm, high plasticity, Free TPH prevalent in blocky fracture and along roots / plant material, No metal debris.

@ 4.5' bgs Sta. 72.5: one piece of steel bar (2" x ≈2')

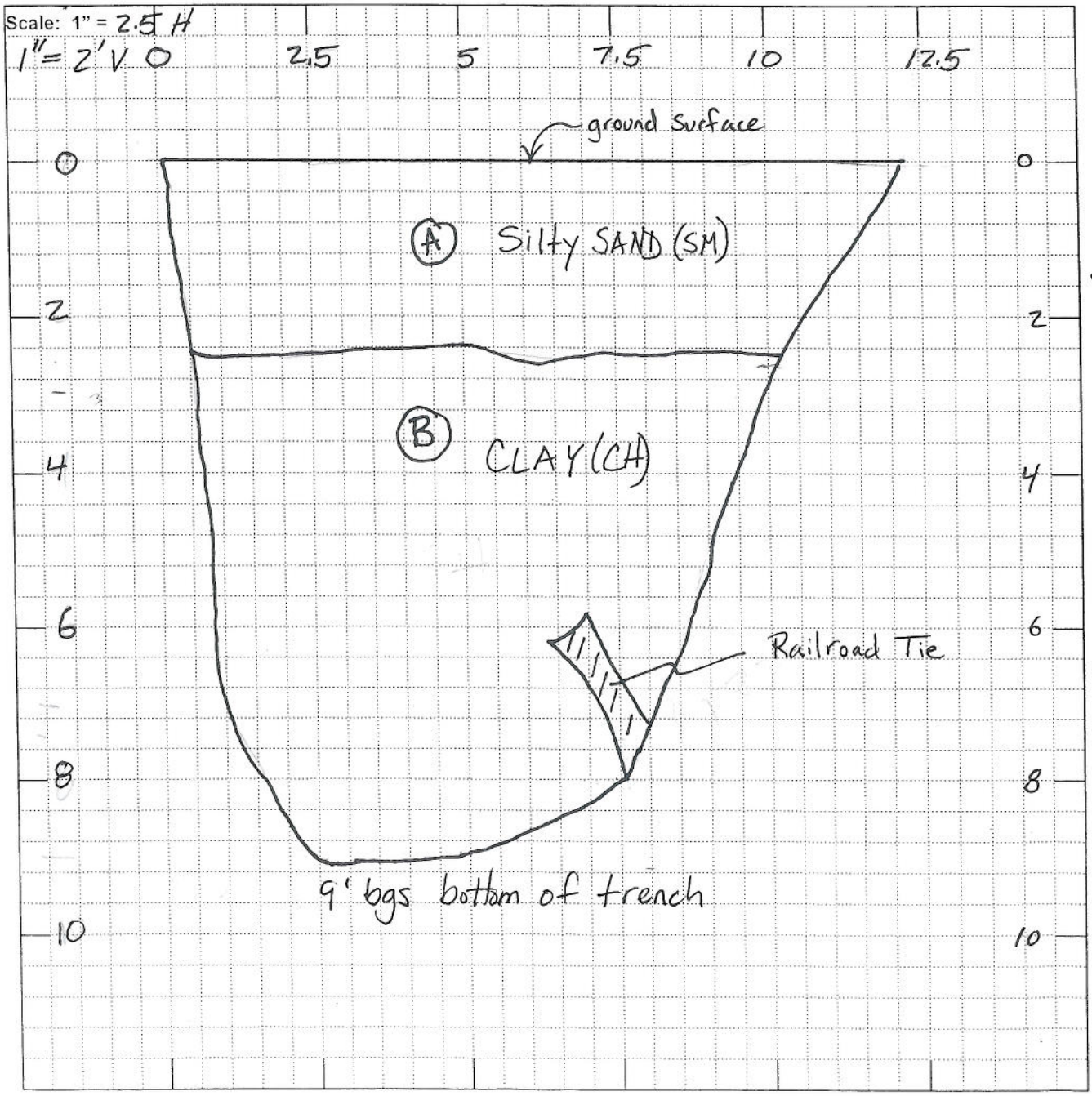
Prevalent free TPH in blocky fractures and along roots / plant material continues to ≈8' bgs. No metal debris.

@ 8' bgs. Amount of free TPH decreases from prevalent to some. However, mode remains the same (free TPH in blocky fractures and along plant materials / roots).

@ 9' bgs bottom of trench. Did not reach bottom limit of free TPH.

Trench Sidewall Record	Trench # FSA-2
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location Trench FSA-2 Lithologic log on Page 2 of 2 Begin trench: 1100 12-6-07 End trench: 1130 12-6-07 Depth to Water	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # FSA-2
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

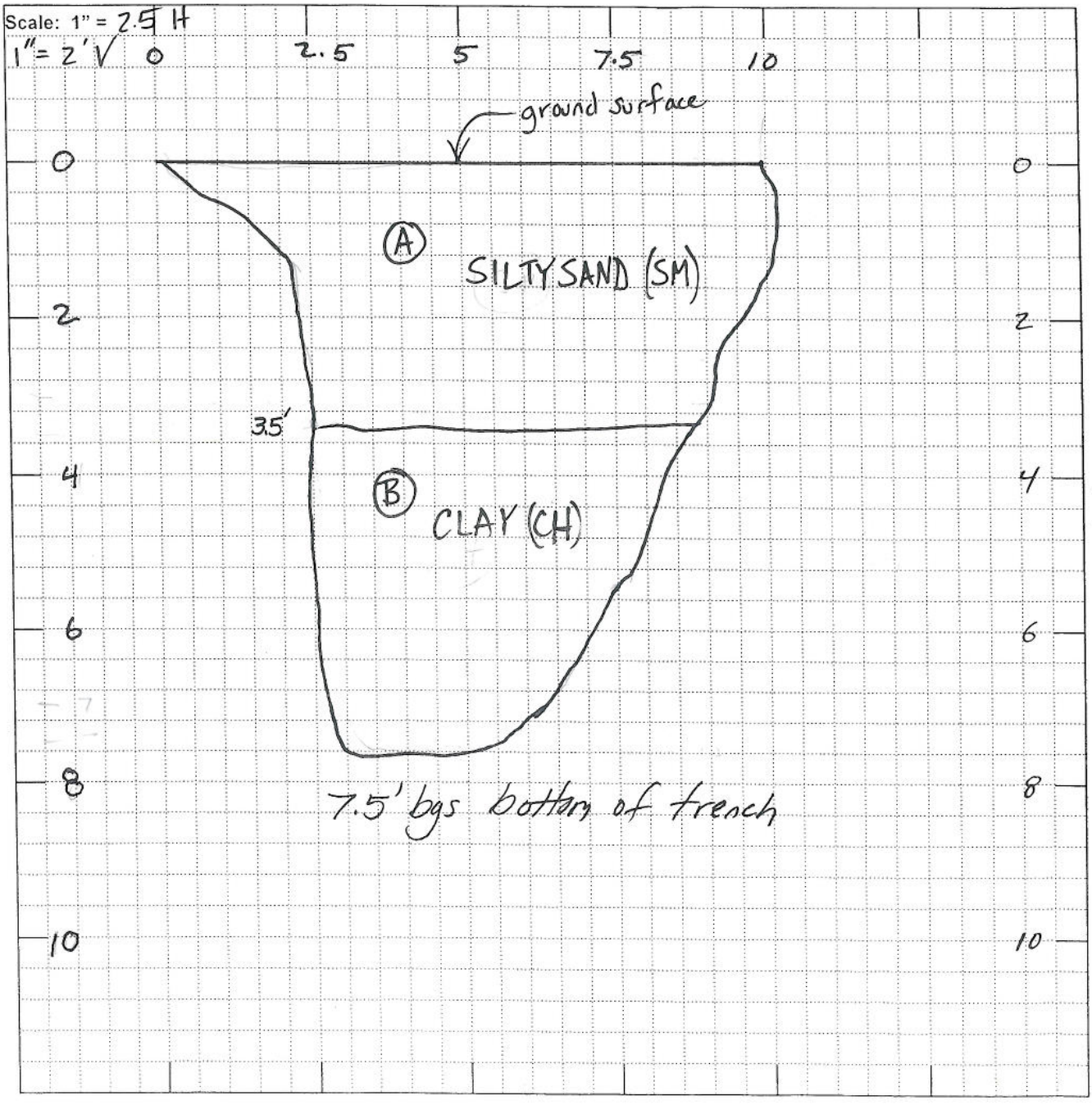
(A) Silty Sand (SM) yellowish brown (10YR 5/6), dry to moist, loose, fine Sand, trace med to coarse sand, trace fine to coarse gravel, w/thrd. Panoche FM, no Free TPH, no metal debris.

(B) CLAY (CH) dark greenish gray (5G 4/1) w/ mottling black (5Y 2.5/1) moist, Soft to firm, high plasticity, blocky fracture, roots/plant material, reed material (±0.25" thick), no Free TPH, no metal debris, One diameter rail road tie at Sta. 17.5 ≈ 6 to 8 feet bgs. Railroad tie appeared to be covered ~~with~~ w/ Creasote. SBC

9' bgs bottom of trench

Trench Sidewall Record	Trench # FSA-3
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location Trench FSA-3 Lithologic log on Page 2 of 2 Begin trench: 1130 12-6-07 End trench: 1200 12-6-07 Depth to water:	
GPS Coords	

Trench View (East)



Trench Sidewall Record	Trench # FSA-3
Contractor: Turn-Key Construction Services, Inc.	Date 12-6-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

Lithology

(A) Silty SAND (SM) yellowish brown (10YR 5/6), dry to moist, Loose, fine Sand, trace med. to Coarse sand, trace fine ~~gravel~~ SBA to Coarse gravel, w/thrd Pangche FM, no free TPH, no metal debris.

(B) CLAY (CH) dark green gray (5G 4/1), w/ mottling black (5Y 2.5/1), moist, Soft to firm, high plasticity,

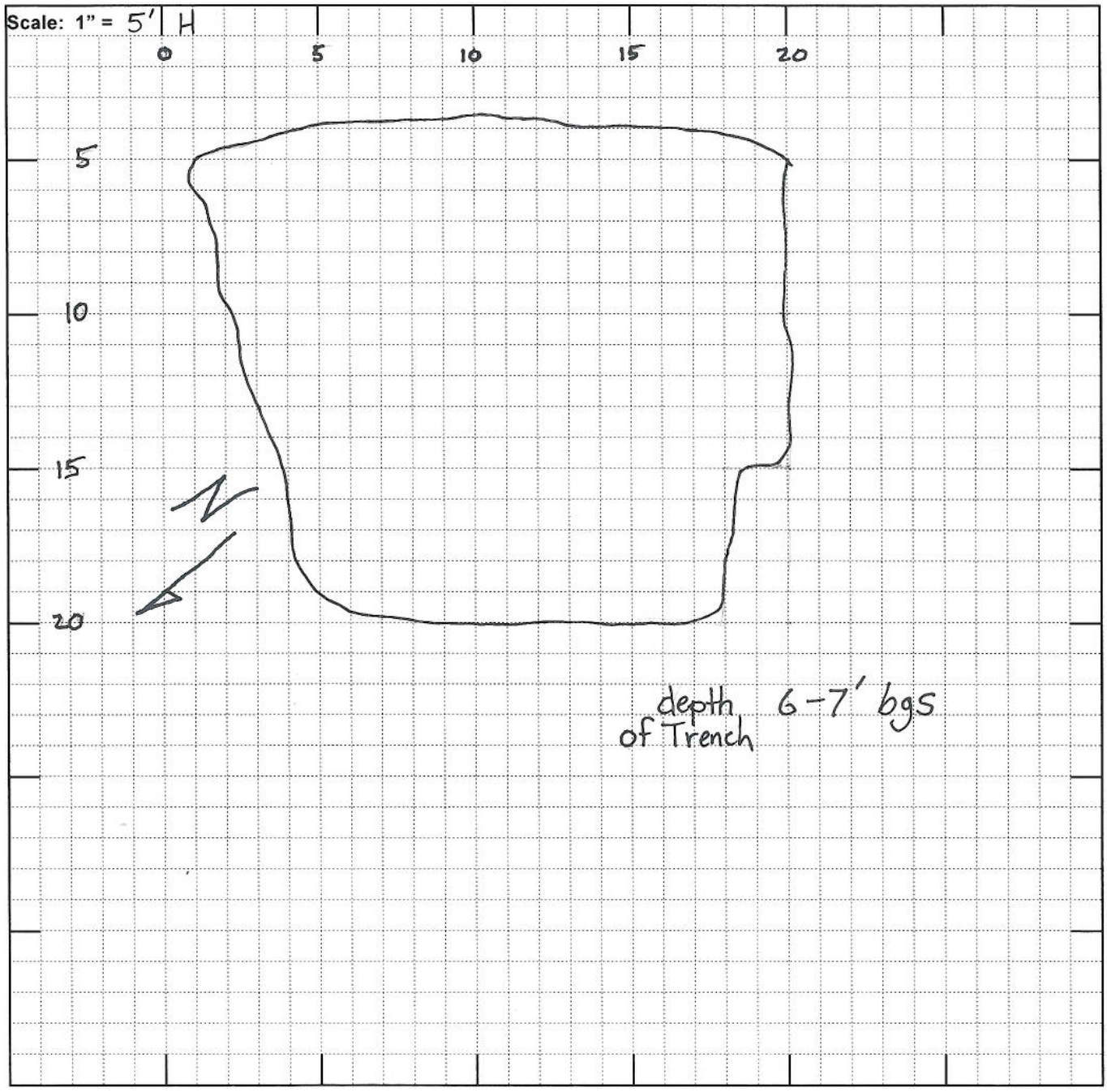
@ 4.5 to 5' bgs Layer of Clay (CH) with reed material. Free TPH observed along reed ~~material~~ SBA material. Free TPH Not observed in clay fractures.

@ 7' bgs Clay (CH) w/ reed veg. Still present (undetermined thickness) However, at this depth reed material does not contain free TPH.

7.5' bgs bottom of Trench

Trench Sidewall Record	Trench # Excavation at Wooden Sump Box
Contractor: Turn-Key Construction Services, Inc.	Date 11-14-07 & 11-15-07
Project No. 273939.14.01	Site
Location Dump Rd	
Lithologic Log on Page 2 of 3	
Begin Trench 1403 11-14-07	
End Trench 0955 11-15-07	
Depth of to water: Not encountered	
GPS Coords SBG	

Trench View



Trench Sidewall Record	Trench # Excavation at Wooden Sump Box
Contractor: Turn-Key Construction Services, Inc.	Date 11-14-07 & 11-15-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

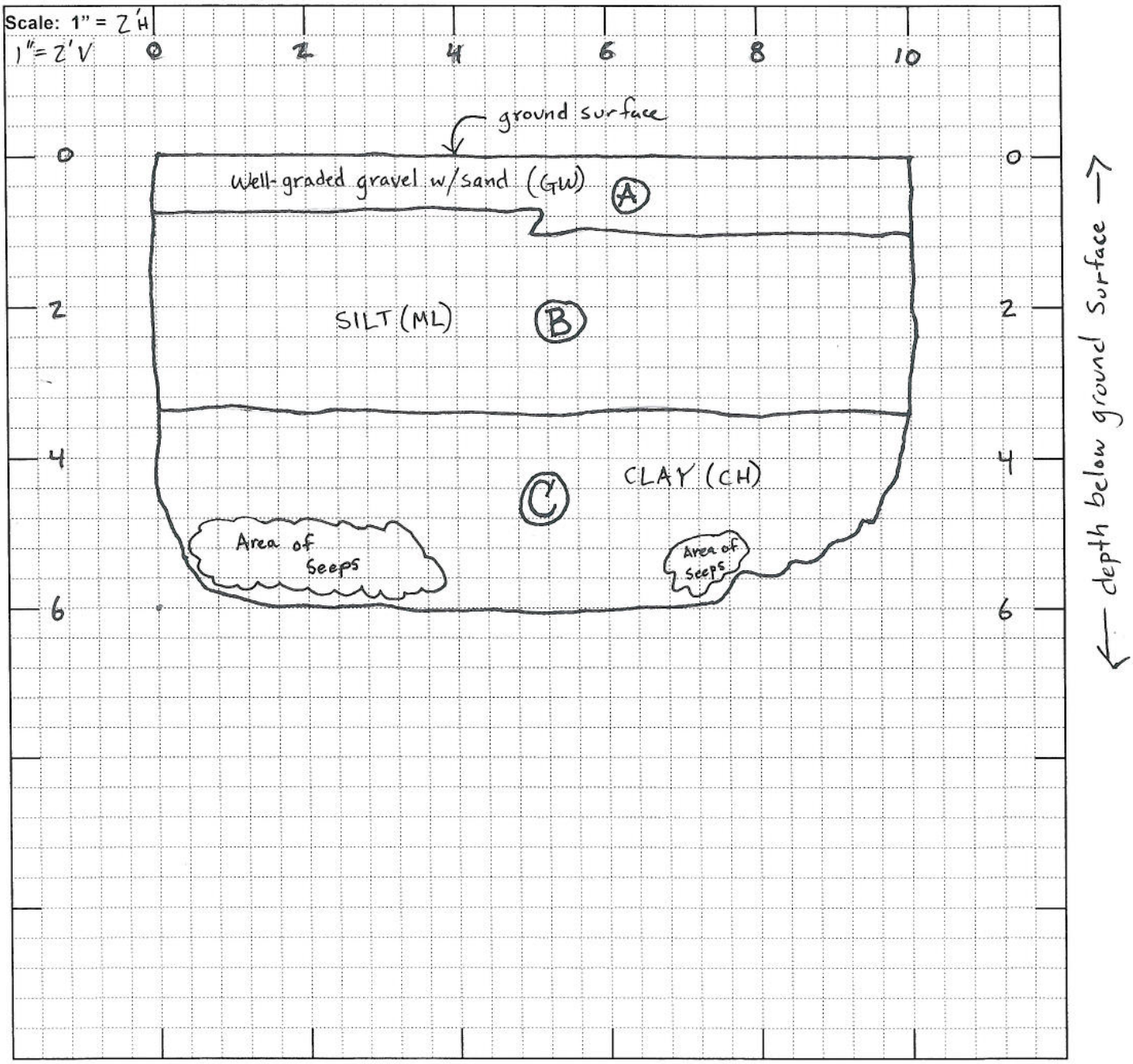
Lithology

(A) Well graded gravel with Sand (GW) brown (7.5YR 4/4), dry to moist, loose, fine to coarse Sand, fine angular gravel, no TPH odor,

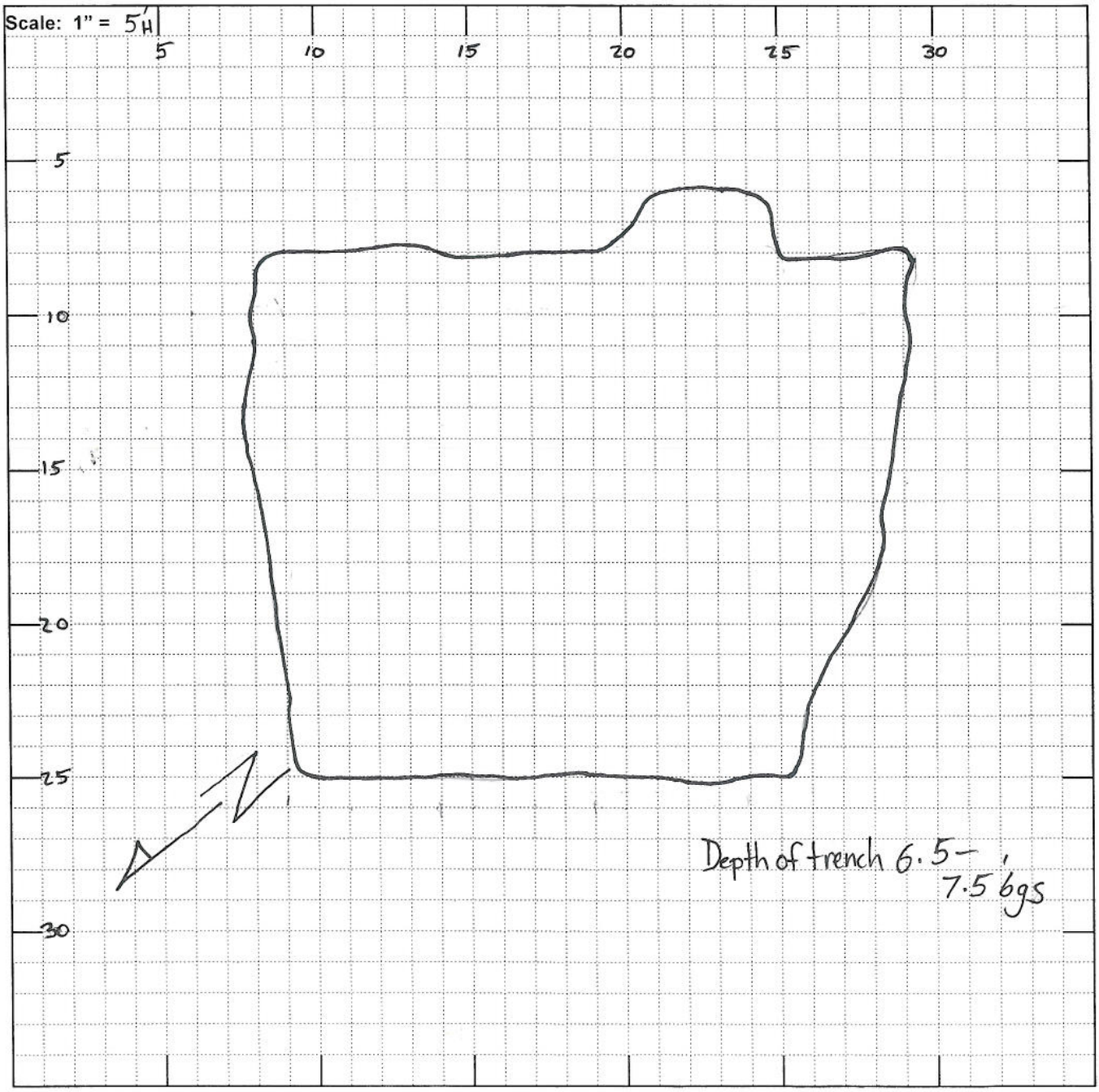
(B) SILT (ML) greenish gray (5G 5/1), with brown mottling (7.5YR 4/4) moist, Soft to firm, med plasticity, wood debris, Free TPH, TPH present in fractures,

(C) CLAY (~~CH~~) (CL) SBQ black (N 2.5/), moist, med. plasticity, Soft, Free TPH, TPH present in Clay fractures. The fractures are on the scale of ~~Centimeters~~ SBQ millimeters in thickness, Spacing of fractures is several. on the scale of 1" to several inches apart.

Trench Sidewall Record	Trench # Excavation at wooden Sump box
Contractor: Turn-Key Construction Services, Inc.	Date 11-14-07 & 11-15-07
Project No. 273939.14.01	Site
Location	
GPS Coords	
Trench View South West	

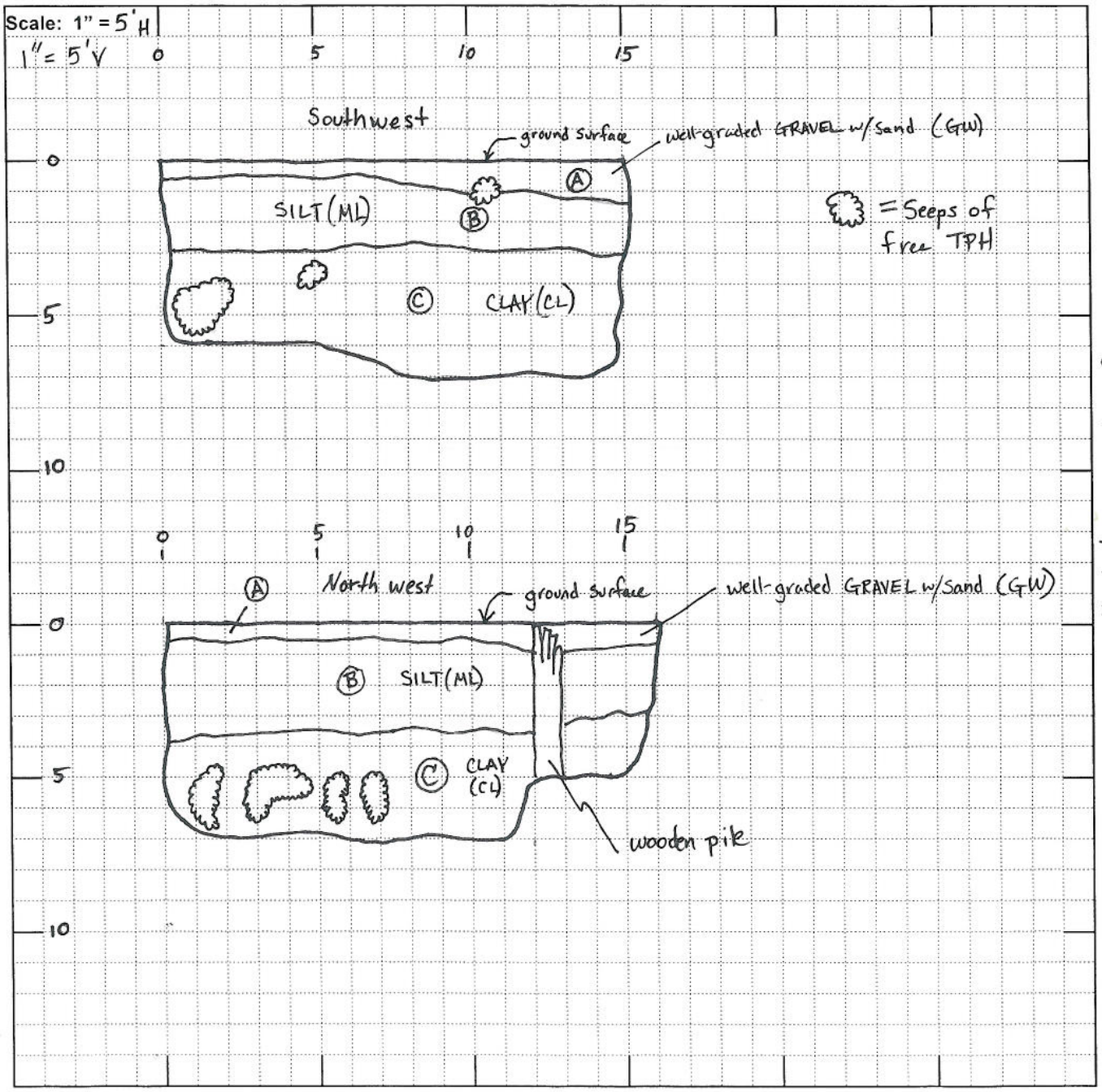


Trench Sidewall Record	Trench #	over excavation at Wooden Sump box
Contractor: Turn-Key Construction Services, Inc.	Date	11-19-07
Project No. 273939.14.01	Site	
Location FSA Wooden Sump Box		
Lithologic log on Page 2 of 3	Excavation of Wooden Sump box	
Begin trench 0805 11-19-07	dated 11-14-07 and 11-15-07	
End trench 1030 11-19-07		
Depth to water: Not Encountered		
GPS Coords		
Trench View plan view		



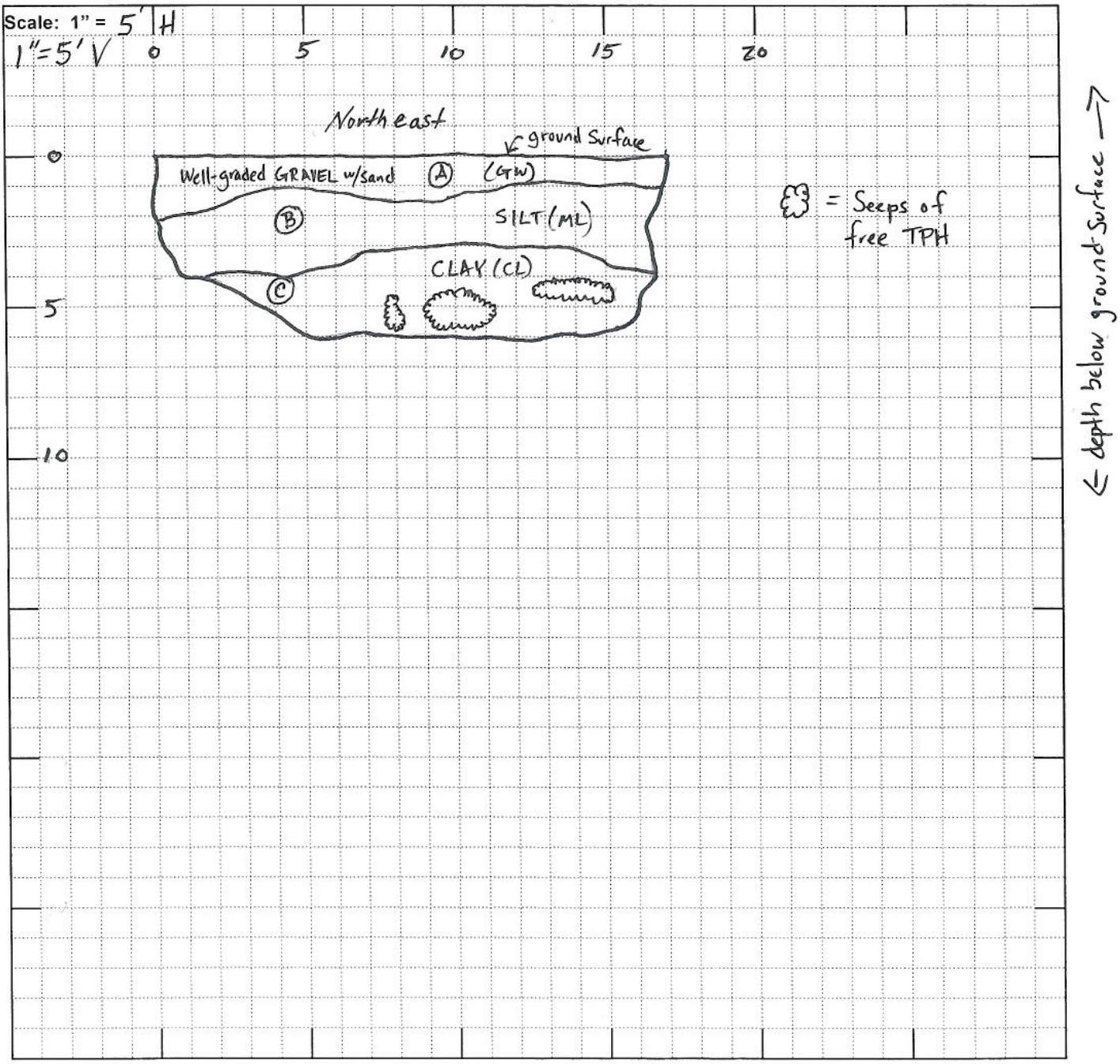
Trench Sidewall Record	Trench # over excavation at wooden Sump box
Contractor: Turn-Key Construction Services, Inc.	Date 11-19-07
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View



Trench Sidewall Record	Trench #	Over excavation at Wooden Sump box
Contractor: Turn-Key Construction Services, Inc.	Date	11-19-07
Project No. 273939.14.01	Site	
Location		
GPS Coords		

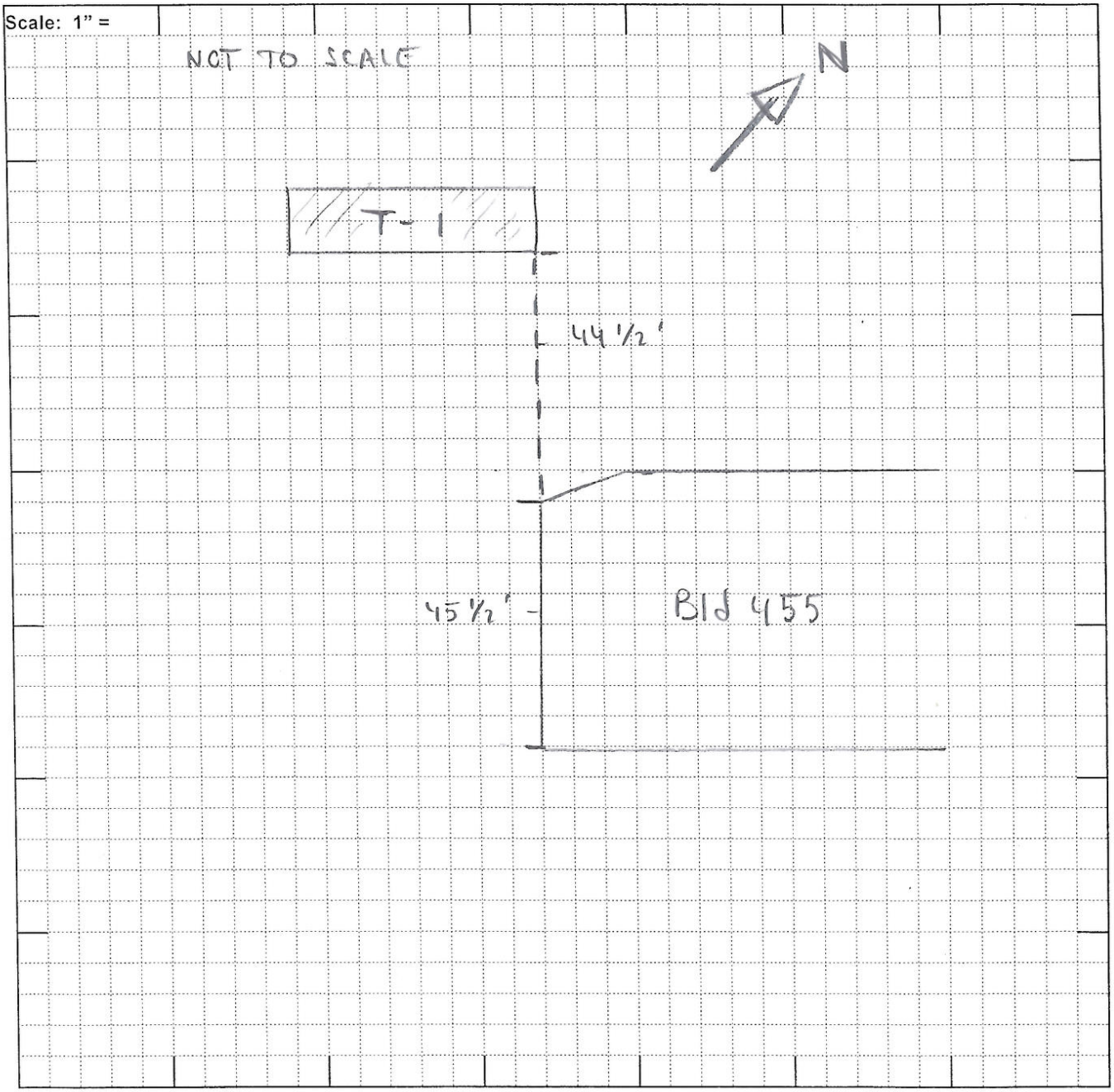
Trench View



Lennar Mare Island Trench Logs,
February and March 2008

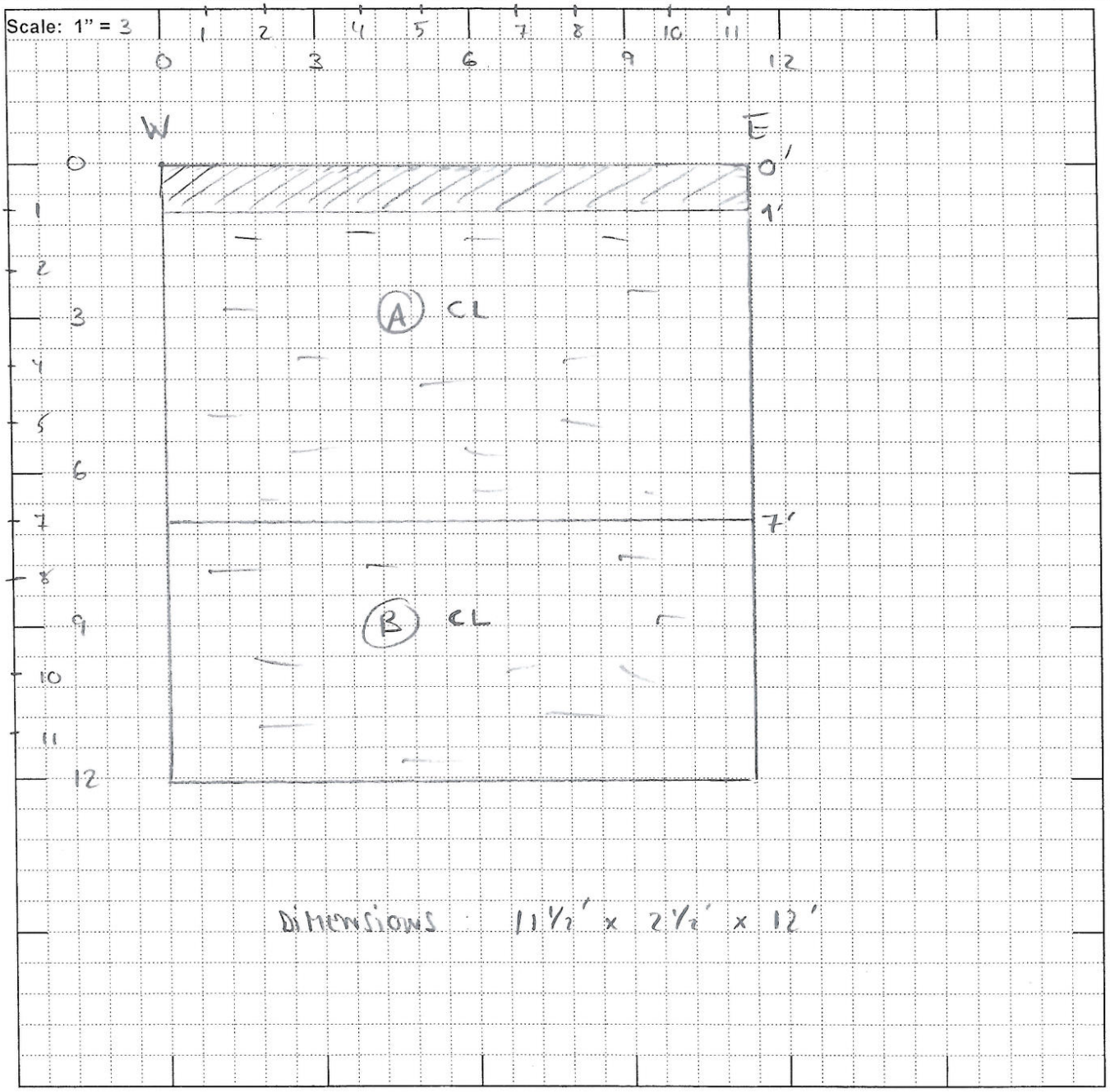
IA B.2-2 Trench Record	Trench/Excavation # T-1
Contractor : NRC Env. Services	Date : 2/29/08
Project No. : 264204.B0.20	
Trench Start (Date/Time) : 2/29/2008 12:42	
Trench End (Date/Time) : 2/29/2008 14:00	
Location: 44 1/2' FT TO THE NW OF BLD 455	
WEATHER : SUNNY, 60s TO 70s	
Depth to Water, ft., bgs. : 5 FT	Page 1 of 3

SITE PLAN



IA B.2-2 Trench Record	Trench/Excavation # T-1
Contractor : NRC Env. Services	Date : 2/29/08
Project No. : 264204. BO. 20	
Location : SEE PAGE 1	
Depth to Water, ft., bgs. :	Page 2 of 3

Trench View (Looking NORTHERLY)



IA B.2-2 Trench Record	Trench/Excavation # T-1
Contractor : NRC Env. Services	Date : 2/29/08
Project No. : 264204. BO. 20	
Location : SEE PAGE 1	
	Page 3 of 3

Lithology Log

Scale: 1" =

0'-1' TOP SOIL : VEGETATION COVER AND ORGANIC TOP SOIL

(A) SILTY CLAY (CL), YELLOWISH BROWN (10YR 5/6), DRY TO MOIST, MEDIUM PLASTICITY, MEDIUM SOFT, COHESIVE, MASSIVE, 70% CLAY 20% SILT, 10% SANDS AND GRAVEL, UP TO 2", ANGULAR TO ROUNDED WELL-GRADED SANDS AND GRAVEL, TRACE OF COBBLES UP TO 4" NO SIGN OF OIL OR DEBRIS. FIRST WATER AT 5 FT. (OIL TREE)

(B) CLAY (CL), OLIVE GRAY (5Y 4/2), WET, HIGH PLASTICITY, MEDIUM STIFF, COHESIVE, MASSIVE, BLOCKY. NO SIGNS OF OIL OR DEBRIS IN SOIL OR WATER IN TRENCH.

SOIL SAMPLE COLLECTED : IAB2T0151-S12 COLLECTED 2/29/08 @ 13:22 FROM 12 FT BGS.

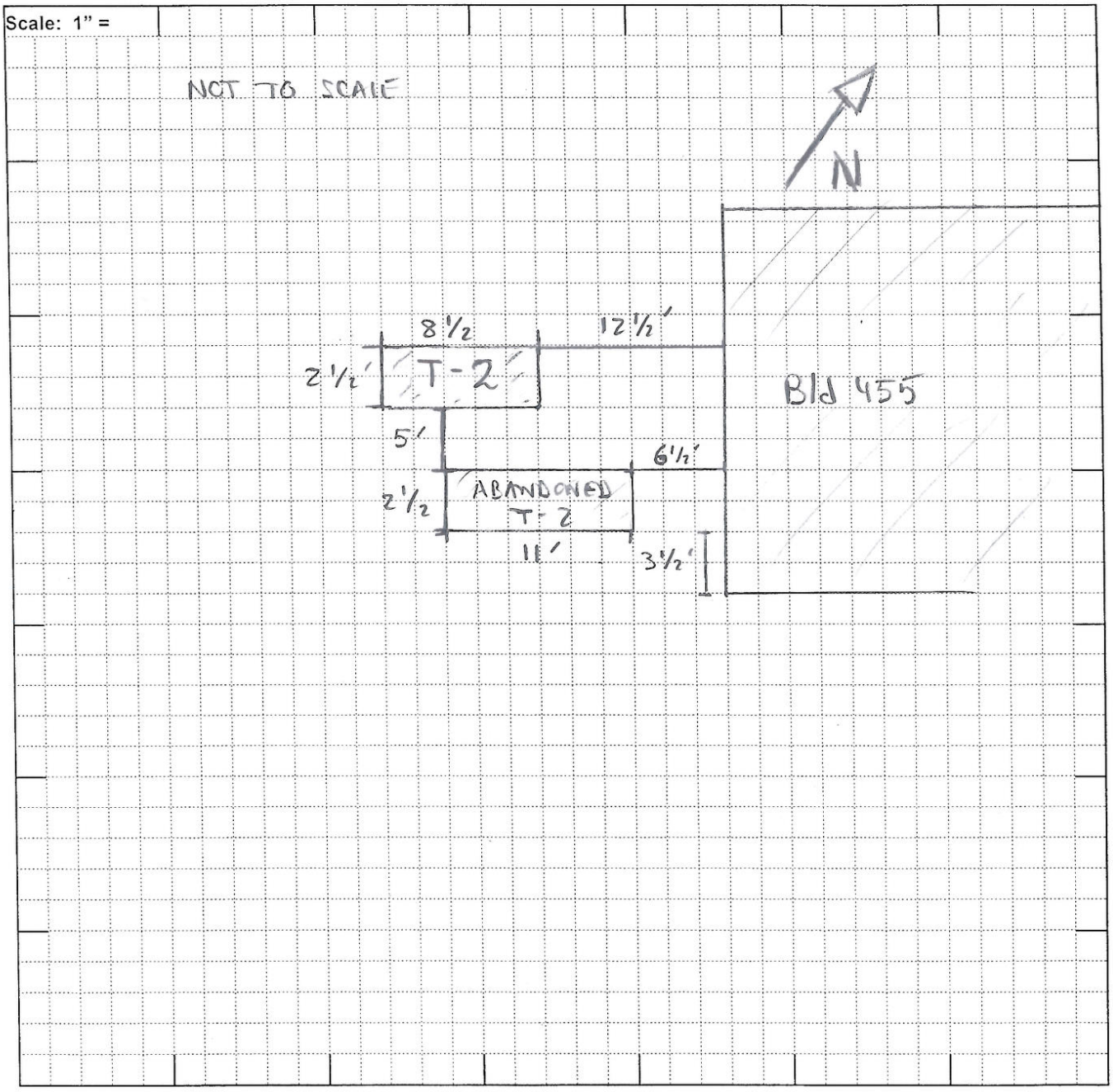
ANALYSIS:

- 8015 M
- SW 8260 B
- SW 8270-SIM
- D 2216

IA B.2-2 Trench Record	Trench/Excavation # T-2
Contractor : NRC Env. Services	Date : 3/3/08
Project No. : 264204. B0. 20	
Trench Start (Date/Time) : 3/3/2008 8:15	
Trench End (Date/Time) : 3/3/2008 11:30	
Location: FIRST ATTEMPT: 6½ FT SW OF BLD 455	
FINAL TRENCH : 12½ FT SW OF BLD 455, 11 FT FROM S CORNER.	
Depth to Water, ft., bgs. : FIRST WATER 3.5 FT	Page 1 of 4

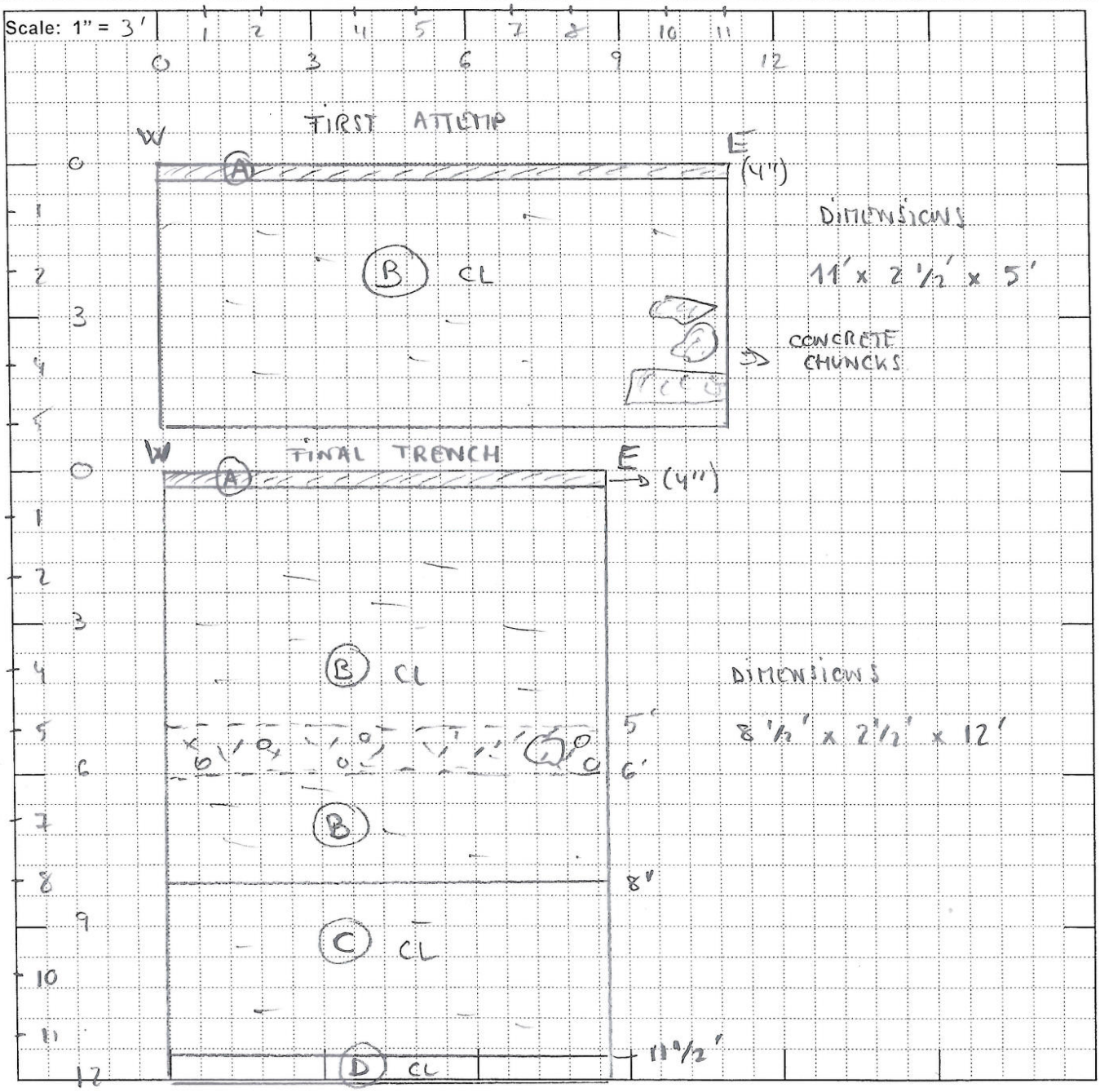
SITE PLAN

Scale: 1" =



IA B.2-2 Trench Record	Trench/Excavation # T-2
Contractor : NRC Env. Services	Date : 3/3/08
Project No. :. 264204.80.20	
Location : SEE PAGE 1	
Depth to Water, ft., bgs. : 3.5 TO 4.0	Page 2 of 4

Trench View (Looking NORTHERLY)



IA B.2-2 Trench Record	Trench/Excavation # T-2
Contractor : NRC Env. Services	Date : 3/3/08
Project No. : 264204.80.20	
Location : SEE PAGE 1	
	Page 3 of 4

Lithology Log

Scale: 1" =

FIRST ATTEMPT

(A) TOP SOIL : VEGETATION COVER (4")

(B) GRAVELLY CLAY (CL) BROWN TO DARK BROWN ( ), MOIST, MEDIUM PLASTICITY, MEDIUM STIFF, COHESIVE, MASIVE, 30% SMALL TO LARGE GRAVEL ANGULAR TRACE OF FINE TO COARSE SANDS, SUBANGULAR TO SUBROUNDED
AT 3.5 FT => WATER STARTS FILLING UP TRENCH FROM EASTERN CORNER VERY FAST. NO SIGN OF OIL IN WATER
AT 4.5 FT => PRESENCE OF WASH-OUT CONCRETE CHUNKS IN EASTERN CORNER. ALSO, POCKETS OF LIGHT GREENISH (GLEY 6/5G) CLAY ASSOCIATED TO MILD CHEMICAL ODOR (NOT SURE ABOUT TYPE OF SMELL AND WHETHER IT IS RELATED TO HYDROCARBON PRODUCTS)
AT 5.0 FT => WATER IS RISING UP FAST IN TRENCH COMING UP TO 2FT BGS. => DECIDE TO ABANDON TRENCH AND MOVE OVER.

FINAL TRENCH

(A) TOP SOIL : VEGETATION COVER (4")

(B) GRAVELLY CLAY (CL), BROWN TO DARK BROWN ( ), MOIST, MEDIUM PLASTICITY, MEDIUM STIFF, COHESIVE, MASIVE, 30% SMALL TO LARGE GRAVEL, ANGULAR. TRACE OF FINE TO COARSE SANDS, SUBROUNDED.
AT 3.5 FT => FIRST WATER SLOWLY FLOWING INTO TRENCH. NO OIL.
FROM 5.0 TO 6.0 => PRESENCE OF SMALL AMOUNTS OF METAL DEBRIS, WASH-OUT CONCRETE CHUNKS, PANOCHE SILTSTONE AND SANDSTONE ROCK FRAGMENTS UP TO 4", ANGULAR, BLACK-COLORED POORLY GRADED FINE SANDS, ROUNDED, PIECES OF FABRIC (ASBESTOS-LIKE), MICA LAMINATIONS (MAN-MADE MICA SHEET). POCKETS OF LIGHT GREENISH (GLEY 6/5G) CLAY ASSOCIATED WITH MILD CHEMICAL ODOR (UNKNOWN SOURCE). UNABLE TO DETECT PRESENCE OF OIL OR HYDROCARBONS IN SOIL. HOWEVER, FROM 5 TO 6, PRESENCE OF OIL SHEEN IN WATER IN THE TRENCH.

(C) CLAY (CL) OLIVE GRAY (5Y 4/2), MOIST, MEDIUM PLASTICITY, STIFF, MASSIVE, BLOCKY, VEGETATION FRAGMENTS
AT 10 1/2 FT => COLOR CHANGES TO DARK OLIVE GRAY (5Y 3/2) WITH HYDROCARBON ODOR. FROM 10 TO 11 1/2 => SMALL OIL SEEPS AND HYDROCARBON ODOR PRESENT IN VERTICAL CRACKS AND FRACTURES (CONT ON PAGE 4)

IA B.2-2 Trench Record	Trench/Excavation #
Contractor : NRC Env. Services	Date : 3/3/08
Project No. : 264204.B0.20	
Location : SEE PAGE 1	
	Page 4 of 4

Lithology Log

Scale: 1" =

(C) CONTINUED FROM PAGE 3.
CRACKS AND FRACTURES ARE NOT INTERCONNECTED AND ARE ASSOCIATED WITH SECONDARY POROSITY IN DESICCATION CRACKS, MUD CRACKS, AND ROOT INTRUSION. PRESENCE OF MICA. WATER PRESENT IN OIL SHEEN, NO FREE PRODUCT.

(D) CLAY (CL) GREY ( ), MOIST TO WET, HIGH PLASTICITY, MEDIUM STIFF, MASSIVE, BLOCKY. NO SIGN OF OIL IN SOIL.

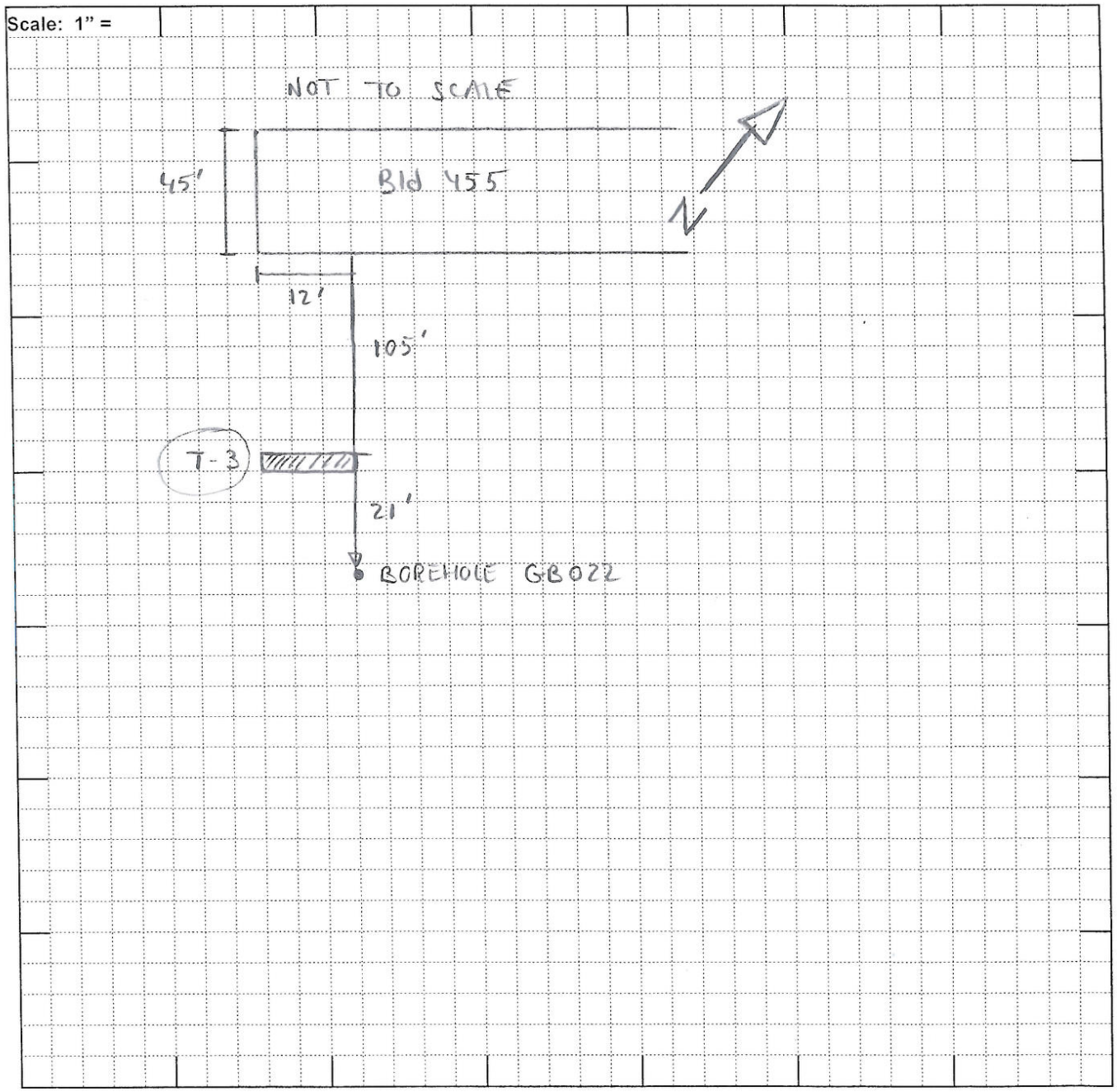
SOIL SAMPLE COLLECTED : IAB2TO2S1-S10 COLLECTED 3/3/08 AT 10:20 FROM 10 FT. SAMPLE DOESN'T SEEM TO BE AFFECTED BY HYDROCARBONS UNDER VISUAL INSPECTION/ ANALYSIS:

- 8015M
- D2216
- SW8260B
- SW8270-SIM

IA B.2-2 Trench Record	Trench/Excavation # T-3
Contractor : NRC Env. Services	Date : 3/3/2003
Project No. : 264204.BO.20	
Trench Start (Date/Time) : 3/3/2008 14:10	
Trench End (Date/Time) : 3/4/2008 10:45	
Location: 105 FT SOUTHEAST OF BLD 455 AND 21 FT NW OF BORING GB022	
Weather: sunny, 70s	
Depth to Water, ft., bgs. : FIRST WATER AT 5.0	Page 1 of 3

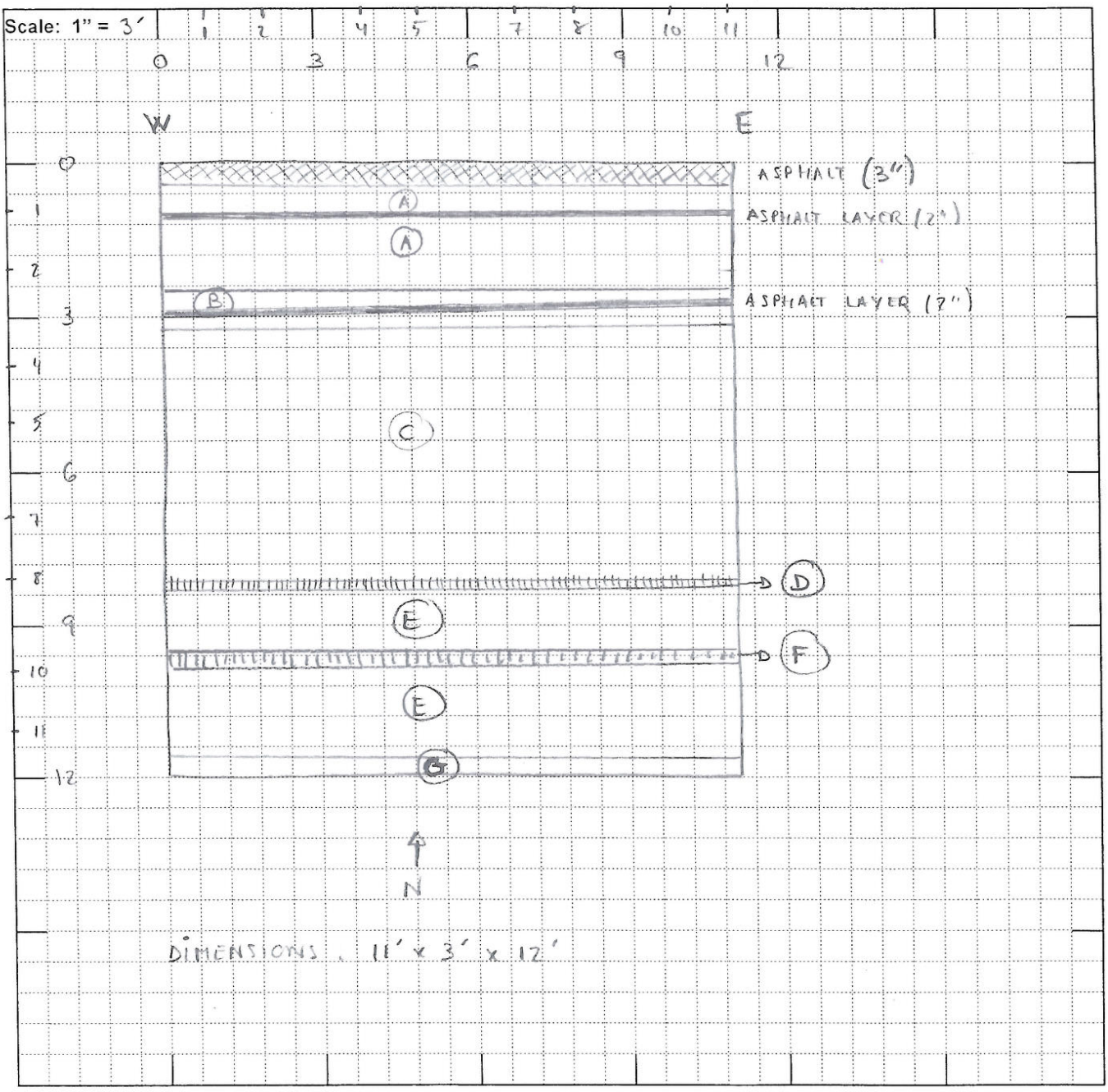
SITE PLAN

Scale: 1" =



IA B.2-2 Trench Record	Trench/Excavation # T-3
Contractor : NRC Env. Services	Date : 3/3/08
Project No. :. 264204.BO.20	
Location : SEE PAGE 1	
Depth to Water, ft., bgs. : STABLE AT 9.0 FT.	Page 2 of 3

Trench View (Looking NORTHERLY)



IA B.2-2 Trench Record	Trench/Excavation # T-3
Contractor : NRC Env. Services	Date : 3/3/08
Project No. : 264204.BO.20	
Location : SEE PAGE 1	
	Page 3 of 3

Lithology Log

Scale: 1" =

TRENCH VIEW ↓ | DEPTH ↓

0'-3" ASPHALT

3"-9" ROAD BASE

(A) 9"-2½': CLAY (CL) LIGHT YELLOWISH BROWN (10YR 6/4), MOIST, MEDIUM PLASTICITY, STIFF, COHESIVE, MASSIVE, TRACE SMALL GRAVEL SUBANGULAR TO SUBROUNDED. BRICK FRAGMENTS AT 2"

1': ASPHALT LAYER (2"), WEATHERED, SMALL GRAVEL TO SMALL SANDS.

2½': ASPHALT LAYER (2"), WEATHERED, SMALL GRAVEL TO MEDIUM SANDS

(B) 2½'-3': CLAY (CL) LIGHT YELLOWISH BROWN (10YR 6/4), MOIST, MEDIUM PLASTICITY, SOFT, COHESIVE, MASSIVE, FEW SILT AND SMALL GRAVEL, SUBANGULAR. AT 2½ → WATER COMING IN FROM SW CORNER

(C) 3'-8': GRAVELLY CLAY (CL), OLIVE GRAY (5Y 4/2), MOIST, MEDIUM PLASTICITY, SOFT TO MEDIUM STIFF, 70% FINES, 30% ROCK FRAGMENTS (PANOCHE SILTSTONE), UP TO 4" SUBANGULAR TO ANGULAR. FIRST WATER AT 5 FT BGS. NO ODOR, NO COLOR.

(D) 8'-8½': CLAY (CL) DARK OLIVE GRAY (5Y 3/2), VEGETATION BOUND, MOIST, HIGH PLASTICITY, STIFF, MASSIVE, HYDROCARBON ODOR, OIL IN GRASS HOLES AND VERTICAL CRACKS, OIL SHEEN IN WATER

(E) 8½'-9½': GRAVELLY CLAY (CL), DARK GREENISH GRAY (GLEY 4/5 GY) WET, MEDIUM TO HIGH PLASTICITY, MEDIUM STIFF, MASSIVE, 70% FINES, 30% ROCK FRAGMENTS (PANOCHE SILTSTONE + SANDSTONE) UP TO 4" ANGULAR STRONG HYDROCARBON ODOR OIL IN VERTICAL CRACKS AND VEGETATION HOLES

(F) 9½-10': CLAY (CL) DARK OLIVE GRAY (5Y 3/2), VEGETATION BOUND, MOIST, HIGH PLASTICITY, STIFF, MASSIVE, LAMINATED BEDS, STRONG HYDROCARBON ODOR. CLAY IS BOUND TOGETHER BY GRASS-TYPE VEGETATION. PRESENCE OF OIL IN VERTICAL CRACKS, ROOT HOLES.

(E) 10'-11½': GRAVELLY CLAY (CL) SAME SOIL SEEN FROM 8½' TO 9½'

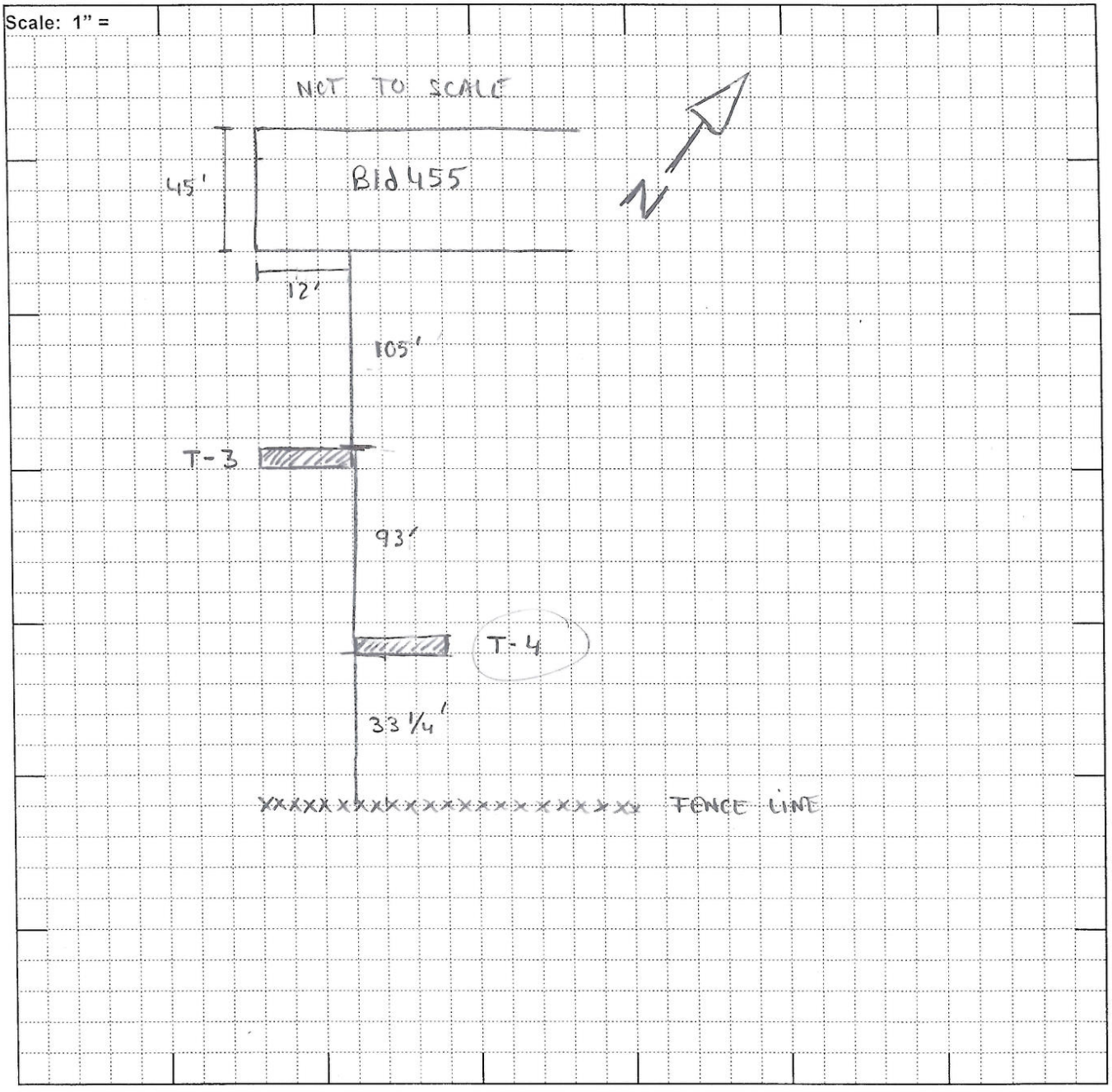
(G) 11½-12: CLAY (CL), OLIVE GRAY (5Y 4/2), WET, HIGH PLASTICITY, SOFT, MASSIVE, BLOCKY, VEGETATION FRAGMENTS (CATTAILS), WATER BUG, GREEN MOTTLING ASSOCIATED WITH POCKETS OF COARSER MATERIAL (FINE SANDS). NO SIGNS OF OIL BELOW 11½

SOIL SAMPLE COLLECTED: IAB2T0351-S11.5 ON 3/4/08 @ 10.05 FROM 11.5 FT BGS. ANALYSIS: D2216B, 8015M, 8270-SIM, D2216

IA B.2-2 Trench Record	Trench/Excavation # T-4
Contractor : NRC Env. Services	Date : 3/4/2008
Project No. : 264204.80.20	
Trench Start (Date/Time) : 3/4/2008 11.00 - REVISITED 3/6/2008 10:00 TO 12:00	
Trench End (Date/Time) : 3/4/2008 14:20 BACKFILLED :	
Location: SOUTH OF B455GB043 AND IRIGGB0107 . 198 FT SOUTHEAST OF BLD 455	
WEATHER : SUNNY , 70s	
Depth to Water, ft., bgs. : FIRST WATER : 3.5	Page 1 of 4

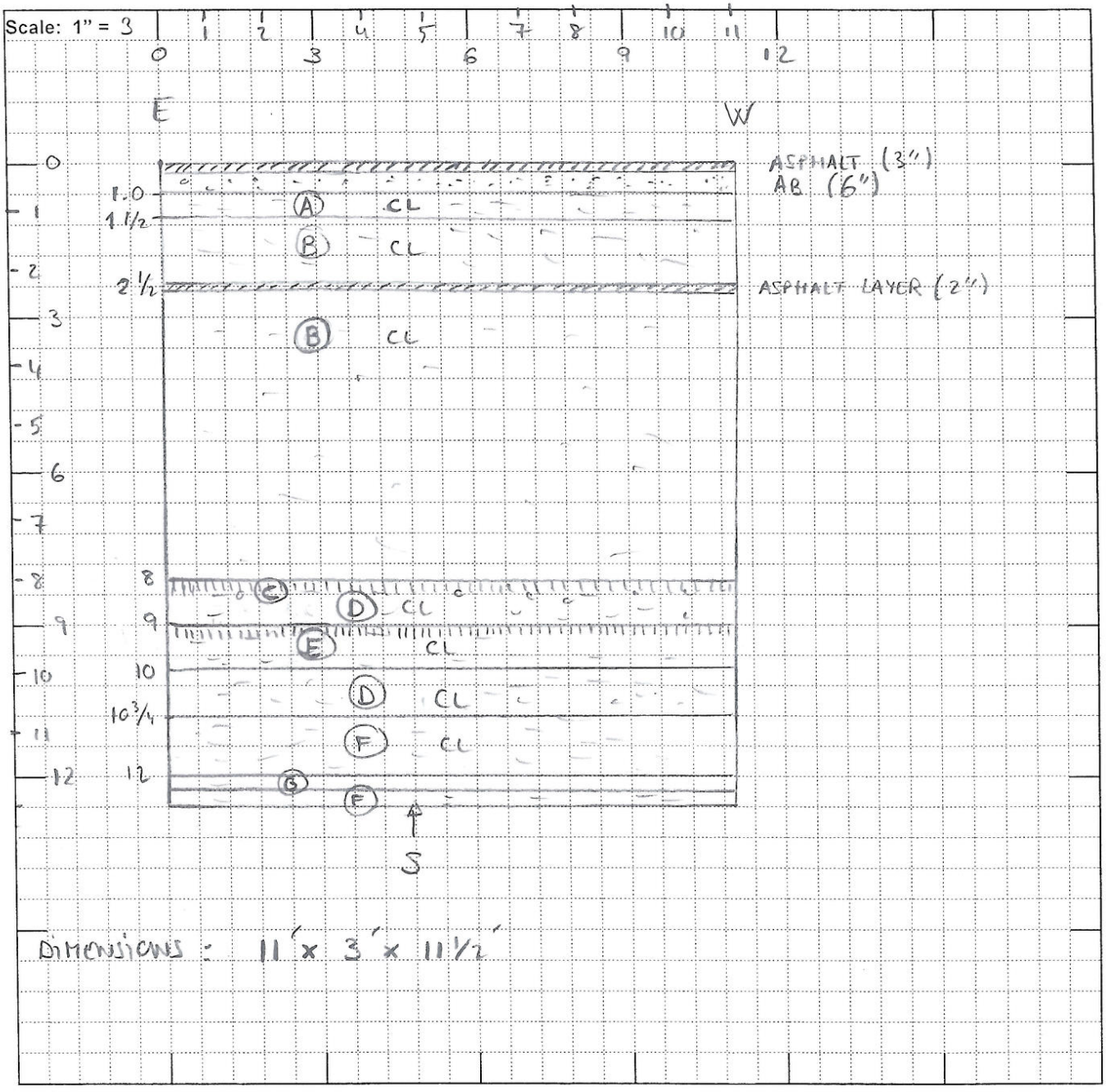
SITE PLAN

Scale: 1" =



IA B.2-2 Trench Record	Trench/Excavation # T-4
Contractor : NRC Env. Services	Date : 3/4/2008
Project No. : 264204 80.20	
Location : SEE PAGE 1	
Depth to Water, ft., bgs. : 3.5 TO 4.0	Page 2 of 4

Trench View (Looking SOUTHERLY)



IA B.2-2 Trench Record	Trench/Excavation # T-4
Contractor : NRC Env. Services	Date : 3/4/2008
Project No. : 204204.BG.20	
Location : SEE PAGE 1	
	Page 3 of 4

Lithology Log

Scale: 1" =

DEPTH ↓

TRENCH VIEW ↓

0 - 3" ASPHALT

3" - 9" AB

(A) - 9" - 1½' SANDY CLAY WITH GRAVEL (CL), BRONNISH YELLOW (10YR 6/8), DRY, 75% FINES, 15% FINE SAND, 5% SMALL GRAVEL, 5% ROCK FRAGMENTS (PANOCHE), MEDIUM PLASTICITY, SOFT, MASSIVE [FILL]. ROCK FRAGMENTS UP TO 3", SUBANGULAR.

(B) 1½' - 2½' : GRAVELLY CLAY (CL), DARK GRAY (2.5Y 4/1), MOIST 70½ FINES, 30% COARSE GRAVEL (ROCK FRAGMENTS), MEDIUM PLASTICITY, SOFT, MASSIVE, [FILL] ROCK FRAG. UP TO 2" SUBANGULAR

2½' : ASPHALT LAYER (2"), WEATHERED SMALL GRAVEL TO MEDIUM SAND

(B) 2¾' - 8.00' : SEE (B) ABOVE. BRICK FRAGMENTS FROM 3' TO 3½'

- AT 3.5' : FIRST WATER IN TRENCH ⇒ W.L. STABLE AT 4.0'
- AT 4.0' : OIL FOUND IN PORES AND CRACKS IN SOIL FROM WESTERN CORNER
- AT 4.5' : OIL FOUND IN PORES AND CRACKS IN SOIL ACROSS TRENCH ⇒ FREE PRODUCT IN WATER IN TRENCH (THIN LAYER). OIL ON TOP OF WATER
- AT 5.5' : COLOR GRADES TO DARK GREENISH GRAY (GLEY 4/10G) NO SIGNS OF OIL IN SOIL

(C) 8' - 8½' : DARK GRAY CLAY (2.5Y 4/1) VEGETATION BOUND. MOIST MEDIUM PLASTICITY, STIFF, DENSE, MASSIVE, NO LAMINATION, HYDROC. ODOR, OIL IN GRASS HOLES.

(D) 8½-9' : GRAVELLY CLAY (CL), DARK GREENISH GRAY (GLEY 4/5GY), WET, MEDIUM PLASTICITY, MEDIUM STIFF, NONCOHESIVE, MASSIVE, SOME ROCK FRAGMENTS (30%) UP TO 3", ANGULAR TO SUBANGULAR (PANOCHE SILTSTONE). STRONG HYDROCARBON ODOR (OIL TYPE). ALSO, PRESENCE OF POCKETS OR ISOLATED ROCK FRAGMENTS OF PANOCHE SILTSTONE WITH VERY STRONG HYDROCARBON ODOR (LIGHT HYDROCARBON - GASOLINE TYPE) ASSOCIATED TO PALE GREEN COLOR (GLEY 6/5G)

(E) 9' - 10' : CLAY (CL), BLACK (GLEY 2.5/N) VEGETATION-BOUND, MOIST, MEDIUM PLASTICITY, STIFF, COHESIVE, LAMINATED BEDS WITH VERTICAL CRACKS. STRONG HYDROCARBON ODOR. FIRST 6" ARE BOUND TOGETHER BY GRASS OR SIMILAR TYPE OF VEGETATION. PRESENCE OF OIL IN VERTICAL SECONDARY STRUCTURE SUCH AS CRACKS (1CM SPACING), ROOT HOLES, AND PLANT FRAGMENTS.

CONTINUED PAGE 4

IA B.2-2 Trench Record	Trench/Excavation # T-4
Contractor : NRC Env. Services	Date : 3/4/2008
Project No. : 264204.80.20	
Location : SEE PAGE 1	
	Page 4 of 4

Lithology Log

Scale: 1" =

DEPTH ↓

TRENCH VIEW ↓

(D) 10'-10 3/4': SAME SOIL AS SEEN FROM 8 1/2'-9' STRONG HYDRO CARBON ODOR (OIL TYPE - NO GASOLINE TYPE)

(F) 10 3/4'-12': CLAY (CL), DARK GREENISH GRAY (GLEY 4/10Y), WET, HIGH PLASTICITY, MEDIUM STIFF, COHESIVE, MASSIVE, BLOCKY, FRAGMENTS OF CATTAILS, SHELL FRAGMENTS, HYDROCARBON ODOR, POCKETS OF PLANT DEBRIS WITH OIL. PRESENCE OF OIL IN SECONDARY SOIL STRUCTURE SUCH AS ROOT HOLES, MUD CRACKS, VERTICAL SMALL FRACTURES.

(G) 12'-12 1/4': CLAY (CL), BLACK (GLEY 2.5/N), MOIST, MEDIUM PLASTICITY, VERY SOFT, COHESIVE, MASSIVE NO LAMINATION, HIGH VEGETATIONAL CONTENT (PLANT DEBRIS AND ROOTS). STRONG HYDROCARBON ODOR. ABUNDANT PRESENCE OF OIL IN VERTICAL SOIL STRUCTURES LIKE ROOT HOLES AND IN FREQUENT POCKETS OF PLANT DEBRIS.

(F) 12 1/4'-12 1/2': SAME SOIL AS SEEN FROM 10 3/4' TO 12'

IA B.2-2 Trench Record		Trench/Excavation # T-5	
Contractor : NRC Env. Services			Date : 3/5/2008
Project No. : 264204.B0.20		Continued	Continued
Trench Start (Date/Time) : 3/5/2008	8:20	3/6/2008	3/7/2008
Trench End (Date/Time) : 3/5/2008	12:00	3/6/2008	3/7/2008
Location:			
Weather Sunny, 70s			
Depth to Water, ft., bgs. : 3.5		Page 1 of 3	
5.6' bgs water observed entering trench (Pumping to dewater)		SITE PLAN	

Scale: 1" =

Additional Descriptions

3/6 SBQ

(H) Continued — Laminated, free TPH pervasive along roots and plant material, free TPH present along roots and plant material separated on cm scale, trace to some free TPH present in vertical and blocky fractures, No free TPH observed along laminated material. Base mottled w/ vegetation @ 11.25' bgs

Start

3/7 SBQ

(I) Continued — @ 11.8' bgs Several pieces of metal strap (3/4" thick to 1' long) Sand shows vertical features (balls) from compressional Free TPH pervasives at contact between H & I and in sand features, gravel to cobble size slag (30%)

(H) Continued — @ 8.5 bgs below (G) Vegetative bound clay, Terrestrial Veg. present,

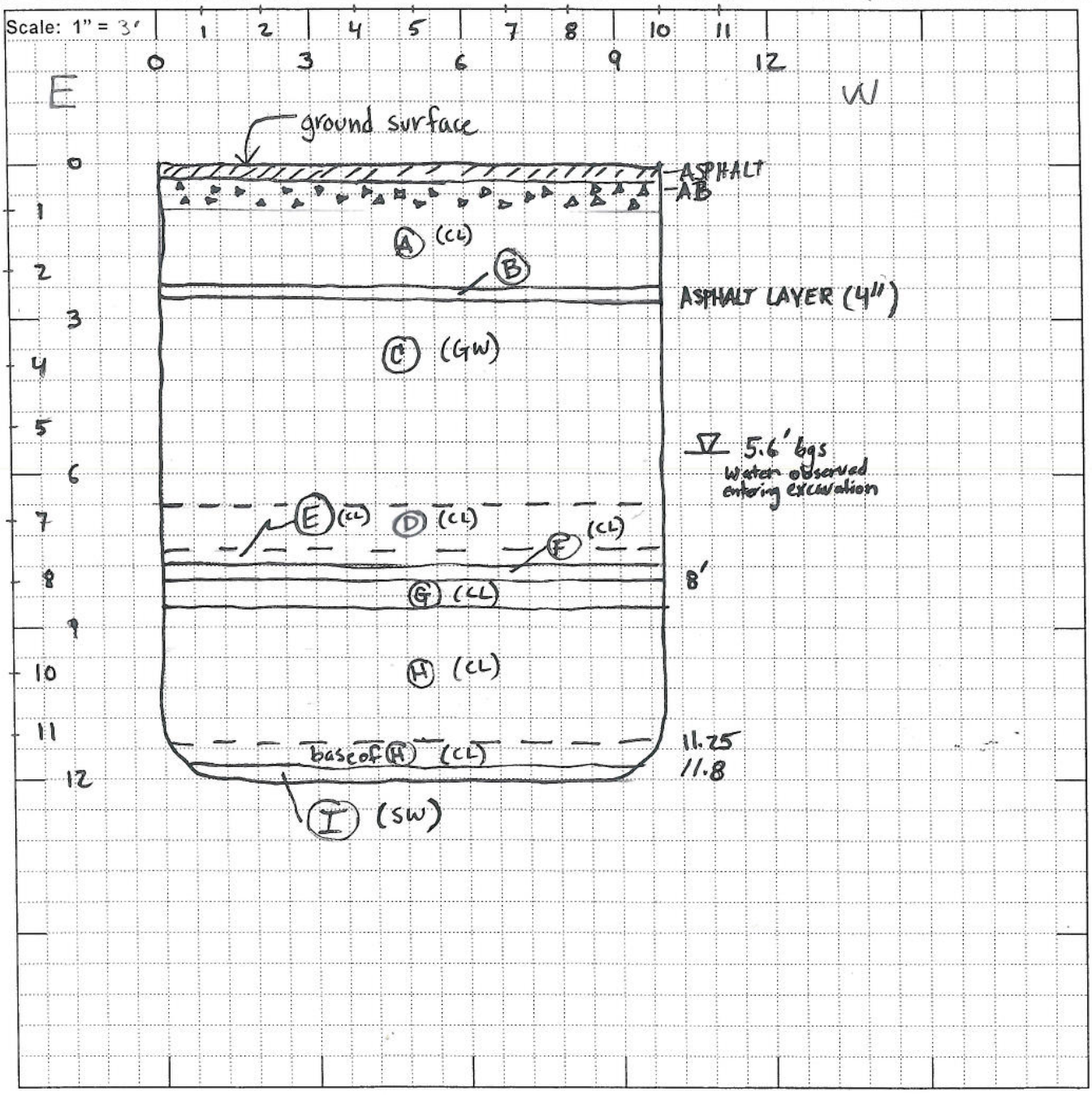
(F) Continued — oil coating vertical partings.

(G) Continued — Dense silty clay, firm, oil in vertical Partings. Vertical partings tend to be along plant veg.

End 3/7/2008 1110

IA B.2-2 Trench Record	Trench/Excavation # T-5
Contractor : NRC Env. Services	Date : 3/5/08
Project No. :. 264204.80.20	
Location : SEE PAGE 1	
Depth to Water, ft., bgs. : 3.5	Page 2 of 3

Trench View (Looking SOUTHERLY)



IA B.2-2 Trench Record	Trench/Excavation # T-5
Contractor : NRC Env. Services	Date : 3/5/08
Project No. : 264204. 80.20	
Location : SEE PAGE 1	
	Page 3 of 3

Lithology Log

Scale: 1" =

1-2.3' (A) CLAY (CL) YELLOWISH BROWN (10YR 5/6), MOIST, MEDIUM PLASTICITY, MEDIUM STIFF, COHESIVE, MASSIVE, TRACE OF FINE SAND AND GRAVEL [FILL]

2.3-2.5' (B) ASPHALT LAYER: WEATHERED, MOSTLY MEDIUM SAND TO SMALL GRAVEL (UP TO ¼")

(C) WELL-GRADED GRAVEL (GW), DARK GREENISH GRAY (GLEY 4/10Y), WET, VERY LOOSE. GRAVEL COMPOSED OF ROCK FRAGMENTS (PANOCHE SANDSTONE) RANGING FROM COARSE SAND (1/10") TO COBBLES (UP TO 10"), ANGULAR. TRACE (5%) OF GRAY CLAY MATRIX. 15% SAND, 20% GRAVEL 60% COBBLE, NO ODOR. MATRIX CONTENT (CLAY) INCREASES FROM 7.5 FT (15%) SLIGHT HYDROCARBON ODOR STARTS JUST ABOVE 8.0 FT

below 5.6' (D) 6" OF CLAY (CL) VERY DARK GREY (GLEY 3/N), MOIST, MEDIUM PLASTICITY, MEDIUM STIFF, COHESIVE, MASSIVE. HYDROCARBON ODOR. NO SIGN OF OIL

(E) 1½" OF CLAY (CL) BLACK (GLEY 2.5/N), MOIST, MEDIUM PLASTICITY, VERY SOFT, COHESIVE, MASSIVE, HIGH VEGETATION CONTENT AND PLANT DEBRIS. STRONG HYDROCARBON ODOR. PRESENCE OF OIL IN POCKETS OF PLANT DEBRIS AND THROUGH SECONDARY POROSITY IN VERTICAL ROOT HOLES AND CRACKS

(F) 3" OF CLAY (CL) OLIVE GRAY (5Y 4/2), DRY, MEDIUM STIFF, MEDIUM PLASTICITY, NON COHESIVE, LAMINATED. NO SIGNS OF VEGETATION. STRONG HYDROCARBON ODOR. PRESENCE OF OIL IN HORIZONTAL CONTACTS BETWEEN LAMINATIONS

8' to 8.5 (G) 5" OF VEGETATION-BOUND CLAY (CL), VERY DARK GRAY (5Y 3/1), MOIST, HIGH PLASTICITY, STIFF, COHESIVE, MASSIVE, PRESENCE OF MATTED GRASS BINDING CLAY TOGETHER. STRONG HYDROCARBON ODOR. PRESENCE OF OIL BELOW GRASS LEVEL IN ROOT HOLES AND CRACKS. OIL IN WATER.

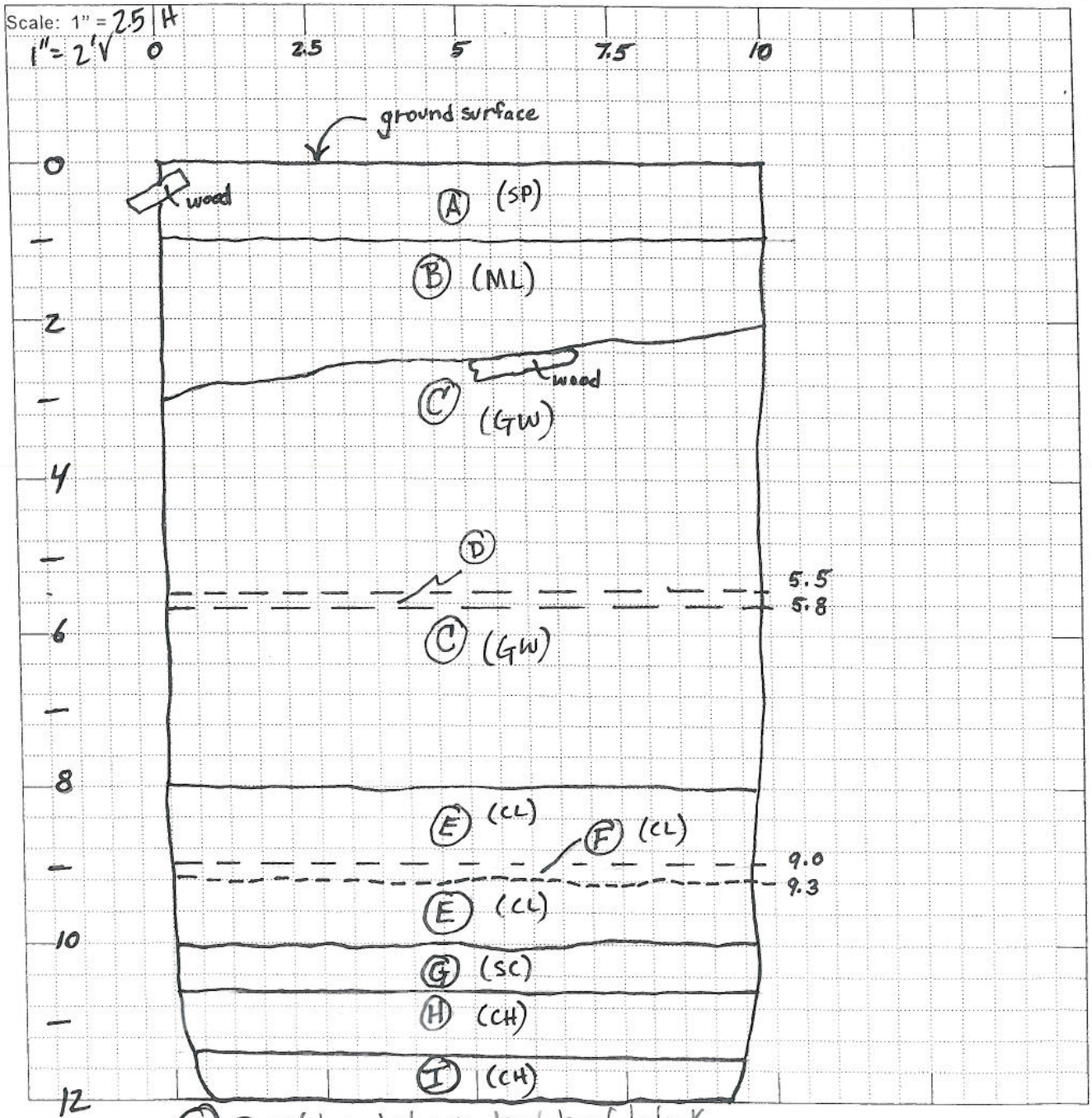
(H) CLAY (CL) VERY DARK GREY (GLEY 3/N), WET, MEDIUM PLASTICITY, SOFT, COHESIVE, MASSIVE, 15% ROCK FRAGMENTS (PANOCHE SANDSTONE), UP TO 3" SIZE, ANGULAR. BRICK FRAGMENTS AND VEGETATION AND PLANT DEBRIS. STRONG HYDROCARBON ODOR PRESENCE OF OIL IN POCKETS OF PLANT DEBRIS AND ALONG ROOT HOLES AND VERTICAL CRACKS. BLOCK OF CEMENT (2½ x 1½ x 1½) WITH CORRUGATED WALLS DUG OUT AT THIS LEVEL

(I) SEQUENCE OF 5" LAYERS (3) OF POORLY GRADED SANDS (SW) FROM GRAY (5Y 5/1) TO BLACK (7.5Y 2.5/1), WET, FINE GRAINED WITH TRACE OF SILT, ROUNDED, MEDIUM DENSE VEGETATION AND SHELL FRAGMENTS. STRONG HYDROCARBON ODOR. OIL IN ROOT HOLES, ASSOCIATED WITH SECONDARY POROSITY

(J) PIECE OF TWISTED THIN METAL STRIP (2½") COVERED IN OIL.

Trench Sidewall Record	Trench # T-7	Page 1 of 4
Contractor: ~~Turn Key Construction Services, Inc.~~ NRC Environmental Services → NRC Env. Services	Date 3-7-08	
Project No. ~~273939.14.01~~ → 264204.BO.20	Site	
Location Lithologic description on Page 2 of 4 & 3 of 4		
Begin: 3-7-08 1245		
End 3-7-08 1630		
Depth to Water: Pumping to dewater; 2.5' bgs FEGW		
GPS Coords		

Trench View (Looking South)



Trench Sidewall Record	Trench # T-7	Page 2 of 4
Contractor: ~~Turn Key Construction Services, Inc.~~ SDB	Date 3-7-08	
Project No. ~~273939.14.01~~ SDB	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

Lithology

(A) Poorly Graded SAND (SP) olive brown (2.5Y 4/3) dry to moist, loose, fine Sand, no TPH odor, 95% Sand, 5% fines.

(B) SILT (ML) yellowish brown (10YR 5/6), dry to moist, Soft, low plasticity, 90% Silt, 10% gravel, fine to Coarse gravel, trace Asphalt Chunks Coarse gravel to Cobble size, no TPH odor, trace brick. First Encountered groundwater @ 2.5' bgs; Sta, 2.5 to 5

(C) Well-graded gravel (GW) dark greenish gray (5GY 4/1) wet, loose, fine to Coarse gravel, Cobbles, Some brick (whole), Cobble Size Chunks of broken asphalt, Coarse gravel to Cobble Size Clasts of clay, trace metal debris (rods, bars), gravel is both rounded and angular, trace clinker clast, no free TPH within clay clasts, Free TPH pervasive surrounding gravel and cobbles, Wood fragments, 50% Cobble 40% gravel, 10% Sand
@ Sta. 2.5; 5.5 bgs. Piece of Corregated metal (2.5' x 3'). First large piece of metal encountered.

(D) Thin layer (.25') Organic material (sawdust?) Soaked with free TPH

(C) Back into material above. Well-graded gravel (GW)
@ 8' bgs, encountered wood debris (½ Circle pieces), rusted sheet metal (≈ 6" X 6"); Continues to be wet, Free TPH Continues to be pervasive.

@ 8' bgs sta. 7.5 to sta. 10 top of large piece of metal, looks like sheet pile from top.

Trench Sidewall Record	Trench # T-7	Page 3 of 4
Contractor: ~~Turn Key Construction Services, Inc.~~	Date 3-7-08	
Project No. ~~273939.14.01~~	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

8 to 10.0 (E) CLAY (CL) dark greenish gray (5GY 4/1), moist, soft, low to med plasticity, Some free TPH along blocky fractures, 95+ to 100% fines

9.0 to 9.3 (F) Clay (CL) dark greenish gray (5GY 4/1) mottled w/ black (N2.5/) high content of organics (plant material) Free TPH pervasive along. Vegetation, Some Free TPH in fractures. @ 10' bgs out of predominant metal debris.

10 to 10.5 (G) Clayey SAND (SC) black (N2.5/) mottled w/ dark greenish gray (10GY 4/1), wet, loose, fine Sand, trace shells, trace glass fragments, Free TPH pervasive around Sand grains.

10.5 to 11.5 (H) CLAY (CH) dark greenish gray (10GY 4/1), moist V. Soft to soft, 95% fines, trace fine Sand, trace shells, trace glass fragments, trace organics, Free TPH along Some fractures, Free TPH observed along organics and shells.

11.5 to 12 (I) CLAY (CH) dark greenish gray (5GY 4/1), moist to wet, V. Soft to Soft, Some organics Free TPH along organics, Free TPH also observed along Some fractures.

@ 12' (J) Wth. Bedrock (Panoche Fm), trace free TPH in fractures, 100% fines,

Trench Sidewall Record	Trench # T-7	Page 4 of 4
Contractor: ~~Turn-Key Construction Services, Inc.~~	Date 3-7-08	
Project No. ~~273939.14.01~~	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

TPH Occurance

3' bgs 1st Encountered Free TPH ≈ Sta. 7.5' observed in gravel material

≈ 3.5' bgs ; Sta 7.5 - 10 Free TPH observed seeping from gravel sidewall (C).

Free TPH pervasive surrounding gravel and Cobbles in unit (C) below 3.5' bgs

Clay Clasts in unit (C) do not contain free TPH when broken apart.

For remaining TPH descriptions see units (D) through (J).

Metal Occurance

@ 2.5' bgs In unit (C) trace metal observed. (debris, rods, bars)

@ 5.5' bgs Piece of Corrugated metal ; First large piece of metal encountered.

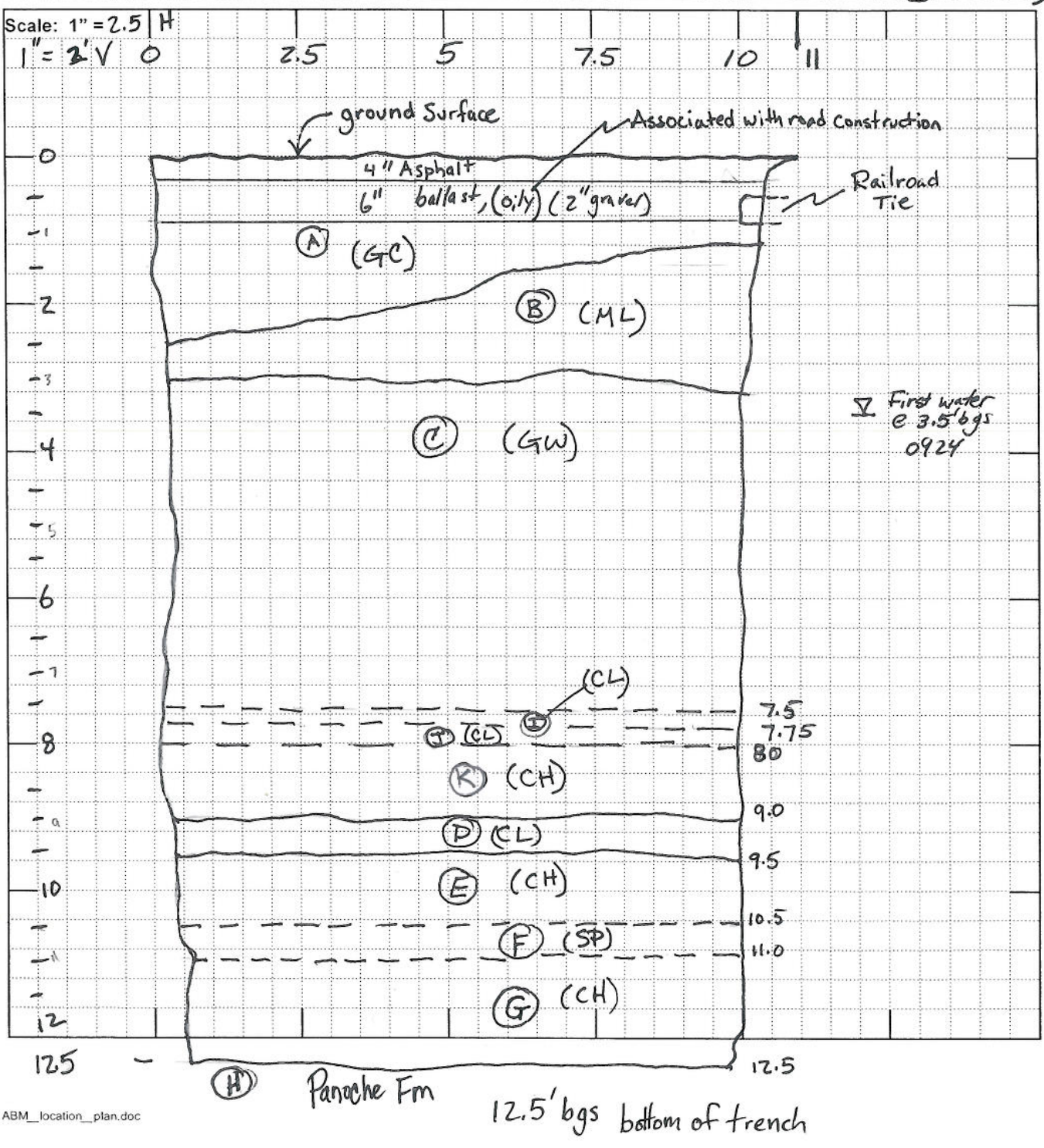
@ 8' bgs Rusted Sheet metal (≈ 6" x 6")

@ 8' bgs Sta. 7.5 to sta. 10 top of large piece of metal. Looks like top of sheet pile.

@ 10' bgs Out of predominant metal debris.

IAB2 Trench Record	Trench/Excavation T-8
Contractor : NRC Environmental Services	Date : 3-11-08
Project No. : 264204.B0.20	
Trench Start (Date/Time) : 3-11-08 0830	
Trench End (Date/Time) : 3-11-08 1430	
Location:	
Lithologic description on Page 2 of 4 & 3 of 4	
Depth to Water, ft., bgs. : 3.5' bgs First Enc. GW (Pumping to dewater)	Page 1 of 4

SITE PLAN Trench View (Looking North)



ABM_location_plan.doc

IAB2 Trench Record	Trench/Excavation T-8
Contractor : NRC Environmental Services	Date: 3-11-08
Project No. : 264204.B0.20	
Location :	
	Page 2 of 3 4
Trench View (Looking _____)	

Scale: 1" =

Lithology

(A) Clayey GRAVEL (GC) dark greenish gray (5GY 4/1), dry to moist, loose, fine to coarse gravel, fine to Coarse Sand, 25% fines, 65% gravel, 10% Sand, Some ballast size (≈2" gravel) covered w/ thin layer of oil, HC odor, trace yellow and red brick.

(B) Silt (ML) yellowish brown (10YR 5/6) mottled w/ olive (5Y 4/3), dry to moist, Soft, 80% fines, 10% fine Sand, no TPH odor.

First Encountered gw 3.5' bgs @ sta. 2.5

(C) Well graded gravel (GW) dark greenish gray (5GY 4/1) wet, loose, fine to Coarse gravel, Cobbles, Some fine to Coarse Sand, angular gravel, Cobble size clasts of Clay, no free TPH within Clay clasts, no free TPH on gravel, no TPH odor, 50% Cobble, 40% gravel, 10% Sand

@ 5' bgs sta. 5 ; No free TPH, No TPH odor
Continues as above.

See (B)(J)(K) below

@ 7.5' bgs ≈ Sta. 2.5 to sta. 5 ; Wood debris (Two 1"x2"x 4').

(D) Clay (CL) high organic Content (Plant material, roots, reed fragments) Clay bound by vegetative material, dark greenish gray (5GY 4/1), moist to wet, low to med plasticity, trace fine Sand, no free TPH, No TPH odor, mottled w/ black (N2.5)

IAB2 Trench Record	Trench/Excavation T-8
Contractor : NRC Environmental Services	Date: 3-11-08
Project No. : 264204.B0.20	
Location :	
	Page 3 of 3 (4)

Lithology Log

Scale: 1" =

Lithology (Cont)

(E) CLAY (CH) dark greenish gray (10Y 4/1), dry to moist, firm, high plasticity, blocky fracture, trace organics (Plant material, roots), no free TPH, No TPH odor. ← mica flakes

(F) SAND (SP) Very dark greenish gray (5G 3/1) wet, med. dense, fine sand, mica flakes, trace organics (fine roots), no free TPH, no TPH odor, high dilatency.

(G) CLAY (CH) dark greenish gray (10Y 4/1), dry to moist, firm to stiff, high plasticity, blocky fracture, some organics (Roots and plant material) mica flakes, no free TPH, No TPH odor, laminated, bioturbated, ← reed material,

(H) Panoche Fm. (Bedrock) Small amount found on tooth of bucket 12.5' bgs

(I) Clay (CL) Soft, dark greenish gray (5GY 4/1) mottled w/ light gray shells, wet, with crushed shells, trace organics (roots), no free TPH, no TPH odor.

(J) Clay (CL) very dark greenish gray (10GY 3/1) mottled w/ black (N 2.5/1), wet, high organic content (roots, reeds), clay bound by veg. material, low plasticity, no free TPH no TPH odor

(K) CLAY (CH) very dark greenish gray (10GY 3/1) moist, high plasticity, blocky fracture, trace organics (roots), firm, no TPH odor, No free TPH.

Free Water flowing into trench @ 7.5 bgs from N sidewall and E trenchend.

12.5' bgs bottom of trench

IAB2 Trench Record	Trench/Excavation T-8
Contractor : NRC Environmental Services	Date: 3-11-08
Project No. : 264204.B0.20	
Location :	
	Page 4 of 4
Trench View (Looking _____)	

Scale: 1" =

PID Readings Multi RAE C101490

Trench T-8

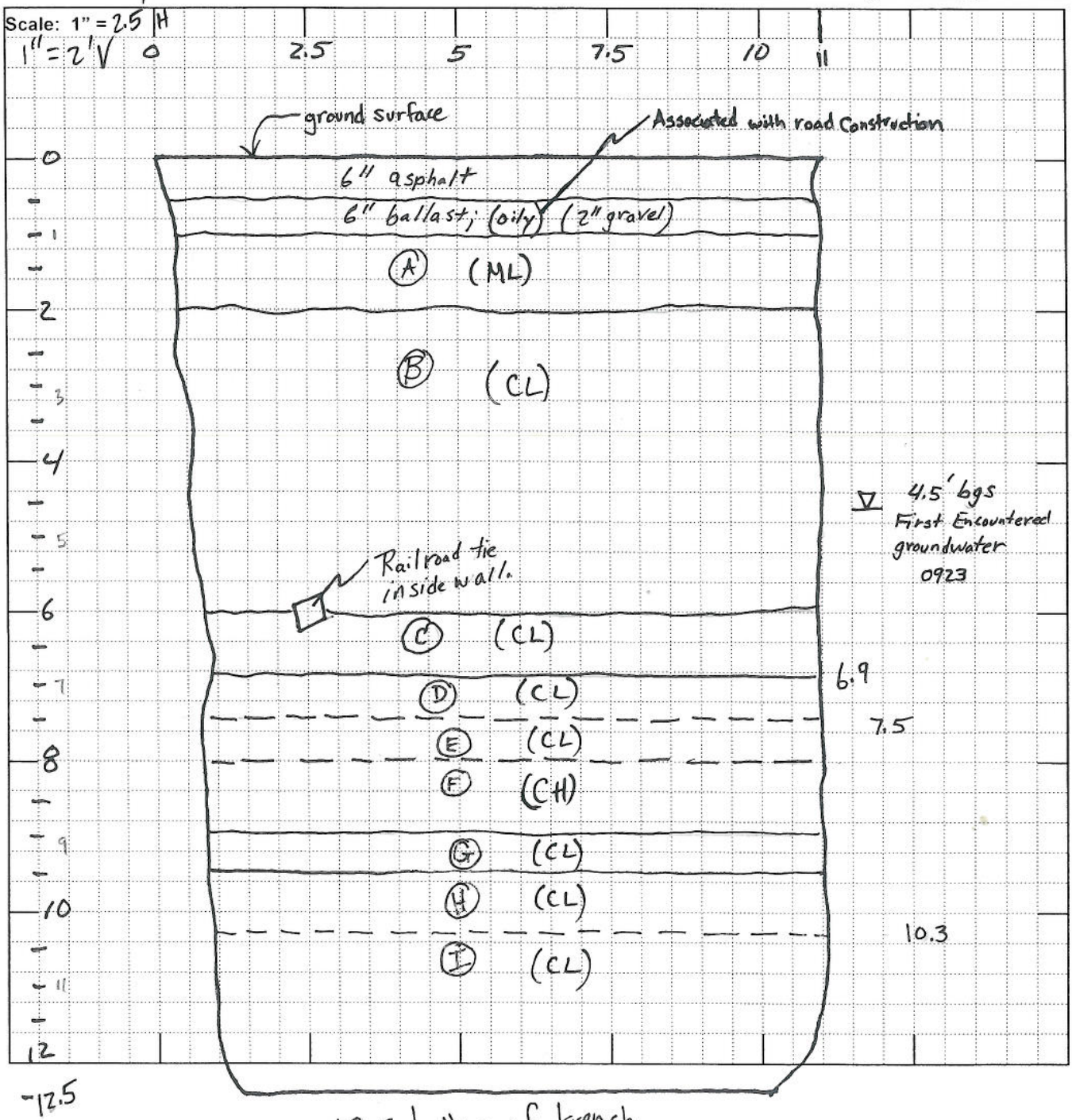
1330	0.0 ppm	Breathing Zone top of trench
1332	0.1 ppm	Inside top of trench
1334	0.0 ppm	Inside backhoe bucket
1336	0.0 ppm	Exterior of backhoe bucket
1338	0.0 ppm	Interior of truck bed drivers side (dump truck)
1340	0.0 ppm	Interior of truck bed Pas. Side (dump truck)
1342	0.0 ppm	Around exterior of truck. (dump truck).

Soil Samples Collected

1050	10.5 – 11' bgs IAB2T08$1-$10.5	1 – 8 oz Jar 1 – 8 oz Jar 3 – 5 gram Core in One	TPH-d/mo 8015 PAH 8270 SIM VOCs 8260
1117	12 – 12.5' bgs IAB2T08$2-$12	1 – 8 oz Jar 1 – 8 oz Jar 3 – 5 gram Core N One	TPH-d/mo 8015 PAH 8270 SIM VOCs 8260

IAB2 Trench Record	Trench/Excavation T-9
Contractor : NRC Environmental Services	Date : 3-12-08
Project No. : 264204.B0.20	
Trench Start (Date/Time) : 3-12-08 0845	
Trench End (Date/Time) : 3-12-08 1512	
Location: Lithologic description on Page 2 of 4 & 3 of 4	
Depth to Water, ft., bgs. : 4.5' bgs (Pumping to dewater)	Page 1 of ~~8~~ 4

First Enc. GW SITE PLAN Trench View (Looking W)



IAB2 Trench Record	Trench/Excavation T-9
Contractor : NRC Environmental Services	Date: 3-12-08
Project No. : 264204.B0.20	
Location :	
	Page 2 of ~~8~~ 4
Trench View (Looking _____)	

Scale: 1" =

Lithology

(A) Silt (ML) yellowish brown (10YR 5/4) dry, med dense, low plasticity, 90% fine 10% fine to coarse sand, trace fine gravel, no free TPH, no TPH odor. w/ mottled olive brown (2.5Y 4/3)

(B) Gravelly Lean clay with Sand (CL) moist to wet, dark greenish gray (5GY 4/1) mottled w/ yellowish brown (10YR 5/6) low plasticity, 20% gravel, 20% fine to coarse sand, 60% fines, no free TPH, no TPH odor, trace cobbles

@ 4.5' bgs First encountered gw @ Sta. 1.

@ Sta 2.5, 6 feet bgs railroad tie. (2' in length) possibly creosote treated, no odor, no free TPH.

@ 6' bgs, No Sheen present on accumulated groundwater.

- More small wood debris/fragments (inches to 1.5' long), no free TPH

(C) Clay (CL) dark greenish gray (10GY 4/1) wet, Soft, low to med plasticity, trace fine to coarse sand, mica flakes, trace organics (roots), no free TPH, no TPH odor.

(D) Silty Clay (CL) High organic content dark greenish gray (10GY 4/1) mottled w/ black (N 2.5/) wet, high dilatancy, soft to firm, Clay bound by veg (roots, reeds), mica flakes, no free TPH no TPH odor; organic debris (roots and reeds) floating on top of water at that interval.

IAB2 Trench Record	Trench/Excavation T-9
Contractor : NRC Environmental Services	Date: 3-12-08
Project No. : 264204.B0.20	
Location :	
	Page 3 of ~~8~~ 4
Lithology Log	

Scale: 1" =

Lithology (cont)

(E) Silty Clay (CL) dark greenish gray (10GY 4/1) trace black (N 2.5/), wet, med. dilatency, Soft, low plasticity, mica flakes, Some organics (thin roots), no free TPH, no TPH odor

(F) CLAY (CH) dark greenish gray (10Y 4/1), → mottled w/ black (N 2.5/) moist, firm, mica flakes, trace organics (thin roots), no free TPH, no TPH odor

(G) Silty Clay (CL) dark greenish gray (10GY 4/1) → mottled w/ black (N 2.5/) wet, Soft, mica flakes with organics (roots/reeds), Some fine Sand, high dilatency, no free TPH, no TPH odor

(H) Silty Clay (CL) dark greenish gray (10Y 4/1) w/ alternating laminations of olive brown (2.5Y 4/3) wet, firm, low Plasticity, high dilatency, mica flakes, Some fine Sand, no free TPH, no TPH odor.

(I) CLAY (CL) dark greenish gray (10GY 4/1), wet, Soft, mica flakes, low to med plasticity, with organics (roots and reeds), trace fine Sand, no Free TPH, no TPH odor.

Large caving of W. Sidewall after removal of Spoils to 12.5' bgs.

12.5' bgs bottom of trench

IAB2 Trench Record	Trench/Excavation T-9
Contractor : NRC Environmental Services	Date: 3-12-08
Project No. : 264204.B0.20	
Location :	

Page ~~3~~ 4 of ~~3~~ 4

SBG SBG

Lithology Log

Scale: 1" =

Soil Sample Collected

12 - 12.5' bgs
1215
Sample ID:
IAB2T09S1-S12

3 - 5g Encores VOCs 8260
1 - 8oz Jar TPH-d/mo 8015
1 - 8oz Jar PAHs 8270 SIM

APPENDIX F2

Photographs

NOVEMBER 5-9, 2007

Trench SSL-1 – View of Sanitary Sewer Line and two IR14 pipelines

Trench SSL-2 – View of metal debris and free product in excavation

DR-1 – View of metal and brick debris in excavation

NOVEMBER 12-16, 2007

Excavation of petroleum-contaminated soil from wooden sump in FSA

Conditions in excavation after removal of the wooden sump structure

Western sidewall of trench AD-1 with accumulation of water and free product in bottom of trench

NOVEMBER 19-21, 2007

Portion of FSA from which floating product was removed and water subsequently pumped (roughly corresponds to grid FS-38)

Conditions in trench AD-1 showing metal debris and free product

Close-up of free product in fine-grained soil from southern end of trench AD-1

NOVEMBER 26-30, 2007

Metal debris and free product in trench AD-2 (station 50 to station 70)

Metal debris and free product in trench AD-4

In trench AD-2 station 0 to station 22.5, clay material from below metal debris with free product observed in fractures and along plant material

DECEMBER 3-7, 2007

Trench FSA-2

Close-up of petroleum-impacted soil from trench FSA-2

Trench FSA-3

Close-up of petroleum-impacted soil in trench FSA-3

Close-up of unimpacted soil in trench FSA-3

DECEMBER 10-14, 2007

Metal debris above water table in trench SSL-4 station 99 to station 110

Metal debris, water, and free product in trench SSL-4 station 99 to station 110

Close-up of fine-grained soil beneath metal debris layer in trench SSL-4 station 99 to station 110

Example of geologic materials in trench AD-9 along the eastern side of Azuar Drive

APPENDIX F3

Analytical Results

Pesticides

1

PESTICIDE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023846

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.30 (g/mL) gm Lab File ID: QC030711.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/08/2007

Extraction: (Type) WASTE Date Extracted: 11/30/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/03/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
319-84-6	alpha-BHC	4.3	U
319-85-7	beta-BHC	4.3	U
319-86-8	delta-BHC	4.3	U
58-89-9	gamma-BHC	4.3	U
76-44-8	Heptachlor	4.3	U
309-00-2	Aldrin	4.3	U
1024-57-3	Heptachlor epoxide	4.3	U
959-98-8	Endosulfan I	4.3	U
60-57-1	Dieldrin	9.0	U
72-55-9	4,4'-DDE	9.0	U
72-20-8	Endrin	9.0	U
33213-65-9	Endosulfan II	9.0	U
72-54-8	4,4'-DDD	9.0	U
1031-07-8	Endosulfan sulfate	9.0	U
50-29-3	4,4'-DDT	9.0	U
72-43-5	Methoxychlor	43	U
7421-93-4	Endrin aldehyde	9.0	U
5103-71-9	alpha-Chlordane	4.3	U
53494-70-5	Endrin ketone	9.0	U
5103-74-2	gamma-Chlordane	4.3	U
8001-35-2	Toxaphene	570	U

Comments:

1

PESTICIDE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023846

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.42 (g/mL) gm Lab File ID: QC030712.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/14/2007

Extraction: (Type) WASTE Date Extracted: 11/30/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/03/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
319-84-6	alpha-BHC	3.1	U
319-85-7	beta-BHC	3.1	U
319-86-8	delta-BHC	3.1	U
58-89-9	gamma-BHC	3.1	U
76-44-8	Heptachlor	3.1	U
309-00-2	Aldrin	3.1	U
1024-57-3	Heptachlor epoxide	3.1	U
959-98-8	Endosulfan I	3.1	U
60-57-1	Dieldrin	6.4	U
72-55-9	4,4'-DDE	6.4	U
72-20-8	Endrin	6.4	U
33213-65-9	Endosulfan II	6.4	U
72-54-8	4,4'-DDD	6.4	U
1031-07-8	Endosulfan sulfate	6.4	U
50-29-3	4,4'-DDT	6.4	U
72-43-5	Methoxychlor	31	U
7421-93-4	Endrin aldehyde	6.4	U
5103-71-9	alpha-Chlordane	3.1	U
53494-70-5	Endrin ketone	6.4	U
5103-74-2	gamma-Chlordane	3.1	U
8001-35-2	Toxaphene	400	U

Comments:

1

PESTICIDE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS04 Run Sequence: R023982

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.24 (g/mL) gm Lab File ID: QC060719.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/26/2007

Extraction: (Type) WASTE Date Extracted: 12/05/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/06/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
319-84-6	alpha-BHC	110	U
319-85-7	beta-BHC	110	U
319-86-8	delta-BHC	110	U
58-89-9	gamma-BHC	110	U
76-44-8	Heptachlor	110	U
309-00-2	Aldrin	110	U
1024-57-3	Heptachlor epoxide	110	U
959-98-8	Endosulfan I	110	U
60-57-1	Dieldrin	230	U
72-55-9	4,4'-DDE	230	U
72-20-8	Endrin	230	U
33213-65-9	Endosulfan II	230	U
72-54-8	4,4'-DDD	230	U
1031-07-8	Endosulfan sulfate	230	U
50-29-3	4,4'-DDT	230	U
72-43-5	Methoxychlor	1100	U
7421-93-4	Endrin aldehyde	230	U
5103-71-9	alpha-Chlordane	110	U
53494-70-5	Endrin ketone	230	U
5103-74-2	gamma-Chlordane	110	U
8001-35-2	Toxaphene	14000	U

Comments:

Polychlorinated Biphenyls (PCBs)

1

AROCLOR ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023847

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.30 (g/mL) gm Lab File ID: QC030711.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/08/2007

Extraction: (Type) WASTE Date Extracted: 11/30/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/03/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
12674-11-2	Aroclor-1016	57	U
11104-28-2	Aroclor-1221	57	U
11141-16-5	Aroclor-1232	57	U
53469-21-9	Aroclor-1242	57	U
12672-29-6	Aroclor-1248	57	U
11097-69-1	Aroclor-1254	57	U
11096-82-5	Aroclor-1260	57	U
37324-23-5	Aroclor-1262	57	U
11100-14-4	Aroclor-1268	57	U

Comments:

1

AROCLOR ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023847

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.42 (g/mL) gm Lab File ID: QC030712.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/14/2007

Extraction: (Type) WASTE Date Extracted: 11/30/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/03/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
12674-11-2	Aroclor-1016	40	U
11104-28-2	Aroclor-1221	40	U
11141-16-5	Aroclor-1232	40	U
53469-21-9	Aroclor-1242	40	U
12672-29-6	Aroclor-1248	40	U
11097-69-1	Aroclor-1254	40	U
11096-82-5	Aroclor-1260	40	U
37324-23-5	Aroclor-1262	40	U
11100-14-4	Aroclor-1268	40	U

Comments:

1

AROCLOR ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS04 Run Sequence: R023983

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.24 (g/mL) gm Lab File ID: QC060719.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/26/2007

Extraction: (Type) WASTE Date Extracted: 12/05/2007

Concentrated Extract Volume: 10000.0(uL) Date Analyzed: 12/06/2007

Injection Volume: 0.5 (uL) Dilution Factor: 10.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
12674-11-2	Aroclor-1016	1400	U
11104-28-2	Aroclor-1221	1400	U
11141-16-5	Aroclor-1232	1400	U
53469-21-9	Aroclor-1242	1400	U
12672-29-6	Aroclor-1248	1400	U
11097-69-1	Aroclor-1254	1400	U
11096-82-5	Aroclor-1260	1400	U
37324-23-5	Aroclor-1262	1400	U
11100-14-4	Aroclor-1268	1400	U

Comments:

Metals

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS05

Matrix (soil/water): Soil Lab Sample ID: MINS05-001

Level (low/med): LOW Date Received: 12/06/2007

% Solids: 70.3

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
7429-90-5	Aluminum	21900			P	R024762
7440-36-0	Antimony	0.19	U	N	P	R024762
7440-38-2	Arsenic	7.9			P	R024762
7440-39-3	Barium	69.6			P	R024762
7440-41-7	Beryllium	0.073	J		P	R024762
7440-43-9	Cadmium	0.70	U	N	P	R024762
7440-70-2	Calcium	4950		E*N	P	R024762
7440-47-3	Chromium	61.6		N	P	R024762
7440-48-4	Cobalt	13.9			P	R024762
7440-50-8	Copper	22.0			P	R024762
7439-89-6	Iron	26800		E	P	R024762
7439-92-1	Lead	17.6			P	R024762
7439-95-4	Magnesium	7050			P	R024762
7439-96-5	Manganese	325			P	R024762
7439-97-6	Mercury	0.21			CV	R024115
7440-02-0	Nickel	55.6		E	P	R024762
7440-09-7	Potassium	1880			P	R024762
7782-49-2	Selenium	0.80	J		P	R024762
7440-22-4	Silver	0.061	U		P	R024762
7440-23-5	Sodium	2930			P	R024762
7440-28-0	Thallium	0.35	U		P	R024762
7440-62-2	Vanadium	55.6		EN	P	R024762
7440-66-6	Zinc	52.1		E	P	R024762

1/9/08

Color Before: Brown Clarity Before: Texture: Fine

Color After: Yellow Clarity After: Artifacts: No

Comment

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS06

Matrix (soil/water): Soil Lab Sample ID: MINS06-001

Level (low/med): LOW Date Received: 12/11/2007

% Solids: 78

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
7429-90-5	Aluminum	14800			P	R024762
7440-36-0	Antimony	0.92	U	N	P	R024762
7440-38-2	Arsenic	24.3			P	R024762
7440-39-3	Barium	487			P	R024762
7440-41-7	Beryllium	0.26	J		P	R024762
7440-43-9	Cadmium	0.68	U	N	P	R024762
7440-70-2	Calcium	5610			P	R024762
7440-47-3	Chromium	43.6		*N	P	R024762
7440-48-4	Cobalt	11.6			P	R024762
7440-50-8	Copper	402			P	R024762
7439-89-6	Iron	45200		*	P	R024762
7439-92-1	Lead	1170			P	R024762
7439-95-4	Magnesium	5250			P	R024762
7439-96-5	Manganese	997		*	P	R024762
7439-97-6	Mercury	7.5			CV	R024245
7440-02-0	Nickel	61.5		N	P	R024762
7440-09-7	Potassium	1870			P	R024762
7782-49-2	Selenium	1.2	U		P	R024762
7440-22-4	Silver	0.30	U		P	R024762
7440-23-5	Sodium	422	J	E	P	R024762
7440-28-0	Thallium	0.34	U		P	R024762
7440-62-2	Vanadium	52.0		N	P	R024762
7440-66-6	Zinc	867		*	P	R024762

BB 1/9/08

Color Before: Brown Clarity Before: Texture: Fine

Color After: Yellow Clarity After: Artifacts: No

Comment

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS06

Matrix (soil/water): Soil Lab Sample ID: MINS06-002

Level (low/med): LOW Date Received: 12/11/2007

% Solids: 78.1

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
7429-90-5	Aluminum	21800			P	R024762
7440-36-0	Antimony	0.94	U	N	P	R024762
7440-38-2	Arsenic	13.7			P	R024762
7440-39-3	Barium	197			P	R024762
7440-41-7	Beryllium	0.47	J		P	R024762
7440-43-9	Cadmium	0.69	U	N	P	R024762
7440-70-2	Calcium	19300			P	R024762
7440-47-3	Chromium	56.4		*N	P	R024762
7440-48-4	Cobalt	19.2			P	R024762
7440-50-8	Copper	48.4			P	R024762
7439-89-6	Iron	39400		*	P	R024762
7439-92-1	Lead	28.8			P	R024762
7439-95-4	Magnesium	7680			P	R024762
7439-96-5	Manganese	896		*	P	R024762
7439-97-6	Mercury	0.037	J		CV	R024245
7440-02-0	Nickel	68.2		N	P	R024762
7440-09-7	Potassium	1440			P	R024762
7782-49-2	Selenium	1.3	U		P	R024762
7440-22-4	Silver	0.30	U		P	R024762
7440-23-5	Sodium	333	J	E	P	R024762
7440-28-0	Thallium	0.35	U		P	R024762
7440-62-2	Vanadium	71.3		N	P	R024762
7440-66-6	Zinc	74.4		*	P	R024762

BD 1/9/08

Color Before: Brown Clarity Before: Texture: Fine

Color After: Yellow Clarity After: Artifacts: No

Comment

Volatiles

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: _____ Contract: _____

SDG No.: MINS03 Run Sequence: R023561

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 1.12 (g/mL) gm Lab File ID: Y1119034.D

Level: (LOW/MED) _____ Date Collected: 11/08/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/19/2007 20:52

GC Column: DB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 25 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	1800	U
74-87-3	Chloromethane	1800	U
75-01-4	Vinyl chloride	1800	U
74-83-9	Bromomethane	1800	U
75-00-3	Chloroethane	1800	U
75-69-4	Trichlorofluoromethane	1800	U
75-35-4	1,1-Dichloroethene	1800	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1800	U
67-64-1	Acetone	5400	JB
75-15-0	Carbon disulfide	1800	U
79-20-9	Methyl acetate	8900	U
75-09-2	Methylene chloride	1800	U
1634-04-4	Methyl tert-butyl ether	1800	U
156-60-5	trans-1,2-Dichloroethene	1800	U
75-34-3	1,1-Dichloroethane	1800	U
156-59-2	cis-1,2-Dichloroethene	1800	U
78-93-3	2-Butanone	8900	U
74-97-5	Bromochloromethane	1800	U
67-66-3	Chloroform	1800	U
71-55-6	1,1,1-Trichloroethane	1800	U
110-82-7	Cyclohexane	2200	
56-23-5	Carbon tetrachloride	1800	U
71-43-2	Benzene	1800	U
107-06-2	1,2-Dichloroethane	1800	U
79-01-6	Trichloroethene	1800	U
108-87-2	Methylcyclohexane	8800	
78-87-5	1,2-Dichloropropane	1800	U
75-27-4	Bromodichloromethane	1800	U
10061-01-	cis-1,3-Dichloropropene	1800	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: _____ Contract: _____

SDG No.: MINS03 Run Sequence: R023561

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 1.12 (g/mL) gm Lab File ID: Y1119034.D

Level: (LOW/MED) _____ Date Collected: 11/08/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/19/2007 20:52

GC Column: DB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 25 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	8900	U
108-88-3	Toluene	1800	U
10061-02-	trans-1,3-Dichloropropene	1800	U
79-00-5	1,1,2-Trichloroethane	1800	U
127-18-4	Tetrachloroethene	1800	U
591-78-6	2-Hexanone	8900	U
124-48-1	Dibromochloromethane	1800	U
106-93-4	1,2-Dibromoethane	1800	U
108-90-7	Chlorobenzene	1800	U
100-41-4	Ethylbenzene	450	J
630-20-6	1,1,1,2-Tetrachloroethane	1800	U
179601-23	m,p-Xylene	390	J
95-47-6	o-Xylene	520	J
100-42-5	Styrene	1800	U
75-25-2	Bromoform	1800	U
98-82-8	Isopropylbenzene	4600	
79-34-5	1,1,2,2-Tetrachloroethane	1800	U
541-73-1	1,3-Dichlorobenzene	1800	U
106-46-7	1,4-Dichlorobenzene	1800	U
95-50-1	1,2-Dichlorobenzene	1800	U
96-12-8	1,2-Dibromo-3-chloropropane	1800	U
120-82-1	1,2,4-Trichlorobenzene	1800	U
87-61-6	1,2,3-Trichlorobenzene	1800	U

Comments:

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: _____ Contract: _____

SDG No.: MINS03 Run Sequence: R023640

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.42 (g/mL) gm Lab File ID: Y1120034.D

Level: (LOW/MED) _____ Date Collected: 11/14/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/20/2007 18:58

GC Column: DB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	1200	U
74-87-3	Chloromethane	1200	U
75-01-4	Vinyl chloride	1200	U
74-83-9	Bromomethane	1200	U
75-00-3	Chloroethane	1200	U
75-69-4	Trichlorofluoromethane	1200	U
75-35-4	1,1-Dichloroethene	1200	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	1200	U
67-64-1	Acetone	2600	J
75-15-0	Carbon disulfide	1200	U
79-20-9	Methyl acetate	1900	J
75-09-2	Methylene chloride	1200	U
1634-04-4	Methyl tert-butyl ether	1200	U
156-60-5	trans-1,2-Dichloroethene	1200	U
75-34-3	1,1-Dichloroethane	1200	U
156-59-2	cis-1,2-Dichloroethene	1200	U
78-93-3	2-Butanone	6000	U
74-97-5	Bromochloromethane	1200	U
67-66-3	Chloroform	1200	U
71-55-6	1,1,1-Trichloroethane	1200	U
110-82-7	Cyclohexane	1200	U
56-23-5	Carbon tetrachloride	1200	U
71-43-2	Benzene	1200	U
107-06-2	1,2-Dichloroethane	1200	U
79-01-6	Trichloroethene	1200	U
108-87-2	Methylcyclohexane	2500	
78-87-5	1,2-Dichloropropane	1200	U
75-27-4	Bromodichloromethane	1200	U
10061-01-	cis-1,3-Dichloropropene	1200	U

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: _____ Contract: _____

SDG No.: MINS03 Run Sequence: R023640

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.42 (g/mL) gm Lab File ID: Y1120034.D

Level: (LOW/MED) _____ Date Collected: 11/14/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/20/2007 18:58

GC Column: DB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	6000	U
108-88-3	Toluene	1200	U
10061-02-	trans-1,3-Dichloropropene	1200	U
79-00-5	1,1,2-Trichloroethane	1200	U
127-18-4	Tetrachloroethene	1200	U
591-78-6	2-Hexanone	6000	U
124-48-1	Dibromochloromethane	1200	U
106-93-4	1,2-Dibromoethane	1200	U
108-90-7	Chlorobenzene	270	J
100-41-4	Ethylbenzene	1200	U
630-20-6	1,1,1,2-Tetrachloroethane	1200	U
179601-23	m,p-Xylene	2400	U
95-47-6	o-Xylene	290	J
100-42-5	Styrene	1200	U
75-25-2	Bromoform	1200	U
98-82-8	Isopropylbenzene	420	J
79-34-5	1,1,2,2-Tetrachloroethane	1200	U
541-73-1	1,3-Dichlorobenzene	1200	U
106-46-7	1,4-Dichlorobenzene	1200	U
95-50-1	1,2-Dichlorobenzene	1200	U
96-12-8	1,2-Dibromo-3-chloropropane	1200	U
120-82-1	1,2,4-Trichlorobenzene	1200	U
87-61-6	1,2,3-Trichlorobenzene	1200	U

Comments:

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: _____ Contract: _____

SDG No.: MINS04 Run Sequence: R023851

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 2.38 (g/mL) gm Lab File ID: B1129012.D

Level: (LOW/MED) _____ Date Collected: 11/26/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/29/2007 14:00

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	210	U
74-87-3	Chloromethane	210	U
75-01-4	Vinyl chloride	210	U
74-83-9	Bromomethane	210	U
75-00-3	Chloroethane	210	U
75-69-4	Trichlorofluoromethane	210	U
75-35-4	1,1-Dichloroethene	210	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	210	U
67-64-1	Acetone	1100	U
75-15-0	Carbon disulfide	210	U
79-20-9	Methyl acetate	1100	U
75-09-2	Methylene chloride	210	U
1634-04-4	Methyl tert-butyl ether	210	U
156-60-5	trans-1,2-Dichloroethene	210	U
75-34-3	1,1-Dichloroethane	210	U
156-59-2	cis-1,2-Dichloroethene	210	U
78-93-3	2-Butanone	1100	U
74-97-5	Bromochloromethane	210	U
67-66-3	Chloroform	210	U
71-55-6	1,1,1-Trichloroethane	210	U
110-82-7	Cyclohexane	720	
56-23-5	Carbon tetrachloride	210	U
71-43-2	Benzene	210	U
107-06-2	1,2-Dichloroethane	210	U
79-01-6	Trichloroethene	210	U
108-87-2	Methylcyclohexane	3800	
78-87-5	1,2-Dichloropropane	210	U
75-27-4	Bromodichloromethane	210	U
10061-01-	cis-1,3-Dichloropropene	210	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: _____ Contract: _____

SDG No.: MINS04 Run Sequence: R023851

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 2.38 (g/mL) gm Lab File ID: B1129012.D

Level: (LOW/MED) _____ Date Collected: 11/26/2007

% Moisture: not dec. 0.0 Date/Time Analyzed: 11/29/2007 14:00

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

Heated Purge: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	1100	U
108-88-3	Toluene	46	J
10061-02-	trans-1,3-Dichloropropene	210	U
79-00-5	1,1,2-Trichloroethane	210	U
127-18-4	Tetrachloroethene	210	U
591-78-6	2-Hexanone	1100	U
124-48-1	Dibromochloromethane	210	U
106-93-4	1,2-Dibromoethane	210	U
108-90-7	Chlorobenzene	210	U
100-41-4	Ethylbenzene	240	
630-20-6	1,1,1,2-Tetrachloroethane	210	U
179601-23	m,p-Xylene	650	
95-47-6	o-Xylene	650	
100-42-5	Styrene	210	U
75-25-2	Bromoform	210	U
98-82-8	Isopropylbenzene	710	
79-34-5	1,1,2,2-Tetrachloroethane	210	U
541-73-1	1,3-Dichlorobenzene	210	U
106-46-7	1,4-Dichlorobenzene	210	U
95-50-1	1,2-Dichlorobenzene	210	U
96-12-8	1,2-Dibromo-3-chloropropane	210	U
120-82-1	1,2,4-Trichlorobenzene	210	U
87-61-6	1,2,3-Trichlorobenzene	210	U

Comments:

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: _____ Contract: _____

SDG No.: MINS05 Run Sequence: R024296

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS05-001

Sample wt/vol: 5.08 (g/mL) gm Lab File ID: B1214014.D

Level: (LOW/MED) _____ Date Collected: 12/03/2007

% Moisture: not dec. 30.0 Date/Time Analyzed: 12/14/2007 13:53

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	4.2	U
74-87-3	Chloromethane	4.2	U
75-01-4	Vinyl chloride	4.2	U
74-83-9	Bromomethane	4.2	U
75-00-3	Chloroethane	4.2	U
75-69-4	Trichlorofluoromethane	2.1	J
75-35-4	1,1-Dichloroethene	4.2	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	4.2	U
67-64-1	Acetone	19	
75-15-0	Carbon disulfide	4.2	U
79-20-9	Methyl acetate	14	U
75-09-2	Methylene chloride	17	
1634-04-4	Methyl tert-butyl ether	4.2	U
156-60-5	trans-1,2-Dichloroethene	4.2	U
75-34-3	1,1-Dichloroethane	4.2	U
156-59-2	cis-1,2-Dichloroethene	4.2	U
78-93-3	2-Butanone	4.8	J
74-97-5	Bromochloromethane	4.2	U
67-66-3	Chloroform	4.2	U
71-55-6	1,1,1-Trichloroethane	4.2	U
110-82-7	Cyclohexane	4.2	U
56-23-5	Carbon tetrachloride	4.2	U
71-43-2	Benzene	4.2	U
107-06-2	1,2-Dichloroethane	4.2	U
79-01-6	Trichloroethene	4.2	U
108-87-2	Methylcyclohexane	4.2	U
78-87-5	1,2-Dichloropropane	4.2	U
75-27-4	Bromodichloromethane	4.2	U
10061-01-	cis-1,3-Dichloropropene	4.2	U

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: _____ Contract: _____

SDG No.: MINS05 Run Sequence: R024296

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS05-001

Sample wt/vol: 5.08 (g/mL) gm Lab File ID: B1214014.D

Level: (LOW/MED) _____ Date Collected: 12/03/2007

% Moisture: not dec. 30.0 Date/Time Analyzed: 12/14/2007 13:53

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	14	U
108-88-3	Toluene	4.2	U
10061-02-	trans-1,3-Dichloropropene	4.2	U
79-00-5	1,1,2-Trichloroethane	4.2	U
127-18-4	Tetrachloroethene	4.2	U
591-78-6	2-Hexanone	14	U
124-48-1	Dibromochloromethane	4.2	U
106-93-4	1,2-Dibromoethane	4.2	U
108-90-7	Chlorobenzene	4.2	U
100-41-4	Ethylbenzene	4.2	U
630-20-6	1,1,1,2-Tetrachloroethane	4.2	U
179601-23	m,p-Xylene	8.4	U
95-47-6	o-Xylene	4.2	U
100-42-5	Styrene	4.2	U
75-25-2	Bromoform	4.2	U
98-82-8	Isopropylbenzene	4.2	U
79-34-5	1,1,2,2-Tetrachloroethane	4.2	U
541-73-1	1,3-Dichlorobenzene	4.2	U
106-46-7	1,4-Dichlorobenzene	4.2	U
95-50-1	1,2-Dichlorobenzene	4.2	U
96-12-8	1,2-Dibromo-3-chloropropane	4.2	U
120-82-1	1,2,4-Trichlorobenzene	4.2	U
87-61-6	1,2,3-Trichlorobenzene	4.2	U

Comments:

1

VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: _____ Contract: _____

SDG No.: MINS06 Run Sequence: R024391

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS06-001

Sample wt/vol: 5.91 (g/mL) gm Lab File ID: B1218030.D

Level: (LOW/MED) _____ Date Collected: 12/10/2007

% Moisture: not dec. 22.0 Date/Time Analyzed: 12/18/2007 21:25

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	3.3	U
74-87-3	Chloromethane	3.3	U
75-01-4	Vinyl chloride	3.3	U
74-83-9	Bromomethane	3.3	U
75-00-3	Chloroethane	3.3	U
75-69-4	Trichlorofluoromethane	3.3	U
75-35-4	1,1-Dichloroethene	3.3	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	3.3	U
67-64-1	Acetone	13	
75-15-0	Carbon disulfide	3.3	U
79-20-9	Methyl acetate	11	U
75-09-2	Methylene chloride	3.3	U
1634-04-4	Methyl tert-butyl ether	3.3	U
156-60-5	trans-1,2-Dichloroethene	3.3	U
75-34-3	1,1-Dichloroethane	3.3	U
156-59-2	cis-1,2-Dichloroethene	3.3	U
78-93-3	2-Butanone	1.8	J
74-97-5	Bromochloromethane	3.3	U
67-66-3	Chloroform	3.3	U
71-55-6	1,1,1-Trichloroethane	3.3	U
110-82-7	Cyclohexane	3.3	U
56-23-5	Carbon tetrachloride	3.3	U
71-43-2	Benzene	3.3	U
107-06-2	1,2-Dichloroethane	3.3	U
79-01-6	Trichloroethene	3.3	U
108-87-2	Methylcyclohexane	3.3	U
78-87-5	1,2-Dichloropropane	3.3	U
75-27-4	Bromodichloromethane	3.3	U
10061-01-	cis-1,3-Dichloropropene	3.3	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: _____ Contract: _____

SDG No.: MINS06 Run Sequence: R024391

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS06-001

Sample wt/vol: 5.91 (g/mL) gm Lab File ID: B1218030.D

Level: (LOW/MED) _____ Date Collected: 12/10/2007

% Moisture: not dec. 22.0 Date/Time Analyzed: 12/18/2007 21:25

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	11	U
108-88-3	Toluene	3.3	U
10061-02-	trans-1,3-Dichloropropene	3.3	U
79-00-5	1,1,2-Trichloroethane	3.3	U
127-18-4	Tetrachloroethene	3.3	U
591-78-6	2-Hexanone	11	U
124-48-1	Dibromochloromethane	3.3	U
106-93-4	1,2-Dibromoethane	3.3	U
108-90-7	Chlorobenzene	3.3	U
100-41-4	Ethylbenzene	3.3	U
630-20-6	1,1,1,2-Tetrachloroethane	3.3	U
179601-23	m,p-Xylene	6.5	U
95-47-6	o-Xylene	3.3	U
100-42-5	Styrene	3.3	U
75-25-2	Bromoform	3.3	U
98-82-8	Isopropylbenzene	3.3	U
79-34-5	1,1,2,2-Tetrachloroethane	3.3	U
541-73-1	1,3-Dichlorobenzene	3.3	U
106-46-7	1,4-Dichlorobenzene	3.3	U
95-50-1	1,2-Dichlorobenzene	3.3	U
96-12-8	1,2-Dibromo-3-chloropropane	3.3	U
120-82-1	1,2,4-Trichlorobenzene	3.3	U
87-61-6	1,2,3-Trichlorobenzene	3.3	U

Comments:

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VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: _____ Contract: _____

SDG No.: MINS06 Run Sequence: R024391

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS06-002

Sample wt/vol: 5.54 (g/mL) gm Lab File ID: B1218031.D

Level: (LOW/MED) _____ Date Collected: 12/10/2007

% Moisture: not dec. 22.0 Date/Time Analyzed: 12/18/2007 21:51

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
75-71-8	Dichlorodifluoromethane	3.5	U
74-87-3	Chloromethane	3.5	U
75-01-4	Vinyl chloride	3.5	U
74-83-9	Bromomethane	3.5	U
75-00-3	Chloroethane	3.5	U
75-69-4	Trichlorofluoromethane	3.5	U
75-35-4	1,1-Dichloroethene	3.5	U
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	3.5	U
67-64-1	Acetone	3.1	J
75-15-0	Carbon disulfide	3.5	U
79-20-9	Methyl acetate	12	U
75-09-2	Methylene chloride	6.0	
1634-04-4	Methyl tert-butyl ether	3.5	U
156-60-5	trans-1,2-Dichloroethene	3.5	U
75-34-3	1,1-Dichloroethane	3.5	U
156-59-2	cis-1,2-Dichloroethene	3.5	U
78-93-3	2-Butanone	12	U
74-97-5	Bromochloromethane	3.5	U
67-66-3	Chloroform	3.5	U
71-55-6	1,1,1-Trichloroethane	3.5	U
110-82-7	Cyclohexane	3.5	U
56-23-5	Carbon tetrachloride	3.5	U
71-43-2	Benzene	3.5	U
107-06-2	1,2-Dichloroethane	3.5	U
79-01-6	Trichloroethene	3.5	U
108-87-2	Methylcyclohexane	3.5	U
78-87-5	1,2-Dichloropropane	3.5	U
75-27-4	Bromodichloromethane	3.5	U
10061-01-	cis-1,3-Dichloropropene	3.5	U

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VOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: _____ Contract: _____

SDG No.: MINS06 Run Sequence: R024391

Matrix: (SOIL/SED/WATER) Soil Lab Sample ID: MINS06-002

Sample wt/vol: 5.54 (g/mL) gm Lab File ID: B1218031.D

Level: (LOW/MED) _____ Date Collected: 12/10/2007

% Moisture: not dec. 22.0 Date/Time Analyzed: 12/18/2007 21:51

GC Column: ZB-624 20m ID: 0.18 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Heated Purge: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
108-10-1	4-Methyl-2-pentanone	12	U
108-88-3	Toluene	3.5	U
10061-02-	trans-1,3-Dichloropropene	3.5	U
79-00-5	1,1,2-Trichloroethane	3.5	U
127-18-4	Tetrachloroethene	3.5	U
591-78-6	2-Hexanone	12	U
124-48-1	Dibromochloromethane	3.5	U
106-93-4	1,2-Dibromoethane	3.5	U
108-90-7	Chlorobenzene	3.5	U
100-41-4	Ethylbenzene	3.5	U
630-20-6	1,1,1,2-Tetrachloroethane	3.5	U
179601-23	m,p-Xylene	6.9	U
95-47-6	o-Xylene	3.5	U
100-42-5	Styrene	3.5	U
75-25-2	Bromoform	3.5	U
98-82-8	Isopropylbenzene	3.5	U
79-34-5	1,1,2,2-Tetrachloroethane	3.5	U
541-73-1	1,3-Dichlorobenzene	3.5	U
106-46-7	1,4-Dichlorobenzene	3.5	U
95-50-1	1,2-Dichlorobenzene	3.5	U
96-12-8	1,2-Dibromo-3-chloropropane	3.5	U
120-82-1	1,2,4-Trichlorobenzene	3.5	U
87-61-6	1,2,3-Trichlorobenzene	3.5	U

Comments:

Polynuclear Aromatic Hydrocarbons

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS05 Run Sequence: R024107

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS05-001

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: T1210006.D

Level: (LOW/MED) Date Collected: 12/03/2007

% Moisture: 30.0 Decanted: (Y/N) N Date Extracted: 12/07/2002

Concentrated Extract Volume: 500 (uL) Date Analyzed: 12/10/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) CONT

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
91-20-3	Naphthalene	9.6	U
91-57-6	2-Methylnaphthalene	9.6	U
208-96-8	Acenaphthylene	9.6	U
83-32-9	Acenaphthene	9.6	U
86-73-7	Fluorene	9.6	U
85-01-8	Phenanthrene	9.6	U
120-12-7	Anthracene	9.6	U
206-44-0	Fluoranthene	4.3	J
129-00-0	Pyrene	5.4	J
56-55-3	Benzo(a)anthracene	9.6	U
218-01-9	Chrysene	9.6	U
205-99-2	Benzo(b)fluoranthene	9.6	U
207-08-9	Benzo(k)fluoranthene	9.6	U
50-32-8	Benzo(a)pyrene	5.4	J
193-39-5	Indeno(1,2,3-cd)pyrene	9.6	U
53-70-3	Dibenzo(a,h)anthracene	9.6	U
191-24-2	Benzo(g,h,i)perylene	9.6	U

Comments:

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5RX

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS06 Run Sequence: R024485

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-001RX

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: T1220019.D

Level: (LOW/MED) Date Collected: 12/10/2007

% Moisture: 22.0 Decanted: (Y/N) N Date Extracted: 12/18/2007

Concentrated Extract Volume: 500 (uL) Date Analyzed: 12/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) CONT

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
91-20-3	Naphthalene	8.6	U
91-57-6	2-Methylnaphthalene	3.8	J
208-96-8	Acenaphthylene	8.6	U
83-32-9	Acenaphthene	8.6	U
86-73-7	Fluorene	8.6	U
85-01-8	Phenanthrene	13	
120-12-7	Anthracene	8.6	U
206-44-0	Fluoranthene	13	
129-00-0	Pyrene	13	
56-55-3	Benzo(a)anthracene	5.1	J
218-01-9	Chrysene	10	
205-99-2	Benzo(b)fluoranthene	8.0	J
207-08-9	Benzo(k)fluoranthene	8.6	U
50-32-8	Benzo(a)pyrene	8.6	U
193-39-5	Indeno(1,2,3-cd)pyrene	8.6	U
53-70-3	Dibenzo(a,h)anthracene	8.6	U
191-24-2	Benzo(g,h,i)perylene	8.6	U

Comments:

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS06 Run Sequence: R024271

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-001

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: T1214029.D

Level: (LOW/MED) Date Collected: 12/10/2007

% Moisture: 22.0 Decanted: (Y/N) N Date Extracted: 12/11/2007

Concentrated Extract Volume: 500 (uL) Date Analyzed: 12/14/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) CONT

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
91-20-3	Naphthalene	8.6	U
91-57-6	2-Methylnaphthalene	8.6	U
208-96-8	Acenaphthylene	8.6	U
83-32-9	Acenaphthene	8.6	U
86-73-7	Fluorene	8.6	U
85-01-8	Phenanthrene	5.8	J
120-12-7	Anthracene	8.6	U
206-44-0	Fluoranthene	4.2	J
129-00-0	Pyrene	7.4	J
56-55-3	Benzo(a)anthracene	3.5	J
218-01-9	Chrysene	3.8	J
205-99-2	Benzo(b)fluoranthene	3.5	J
207-08-9	Benzo(k)fluoranthene	8.6	U
50-32-8	Benzo(a)pyrene	8.6	U
193-39-5	Indeno(1,2,3-cd)pyrene	8.6	U
53-70-3	Dibenzo(a,h)anthracene	8.6	U
191-24-2	Benzo(g,h,i)perylene	8.6	U

Comments:

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7RX

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS06 Run Sequence: R024485

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-002RX

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: T1220020.D

Level: (LOW/MED) Date Collected: 12/10/2007

% Moisture: 22.0 Decanted: (Y/N) N Date Extracted: 12/18/2007

Concentrated Extract Volume: 500 (uL) Date Analyzed: 12/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) CONT

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
91-20-3	Naphthalene	8.6	U
91-57-6	2-Methylnaphthalene	7.4	J
208-96-8	Acenaphthylene	8.6	U
83-32-9	Acenaphthene	8.6	U
86-73-7	Fluorene	8.6	U
85-01-8	Phenanthrene	8.6	U
120-12-7	Anthracene	8.6	U
206-44-0	Fluoranthene	8.6	U
129-00-0	Pyrene	8.6	U
56-55-3	Benzo(a)anthracene	8.6	U
218-01-9	Chrysene	8.6	U
205-99-2	Benzo(b)fluoranthene	8.6	U
207-08-9	Benzo(k)fluoranthene	8.6	U
50-32-8	Benzo(a)pyrene	8.6	U
193-39-5	Indeno(1,2,3-cd)pyrene	8.6	U
53-70-3	Dibenzo(a,h)anthracene	8.6	U
191-24-2	Benzo(g,h,i)perylene	8.6	U

Comments:

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS06 Run Sequence: R024271

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-002

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: T1214028.D

Level: (LOW/MED) Date Collected: 12/10/2007

% Moisture: 22.0 Decanted: (Y/N) N Date Extracted: 12/11/2007

Concentrated Extract Volume: 500 (uL) Date Analyzed: 12/14/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) CONT

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
91-20-3	Naphthalene	8.6	U
91-57-6	2-Methylnaphthalene	3.8	JB
208-96-8	Acenaphthylene	8.6	U
83-32-9	Acenaphthene	8.6	U
86-73-7	Fluorene	8.6	U
85-01-8	Phenanthrene	7.4	J
120-12-7	Anthracene	8.6	U
206-44-0	Fluoranthene	3.8	J
129-00-0	Pyrene	4.2	J
56-55-3	Benzo(a)anthracene	8.6	U
218-01-9	Chrysene	8.6	U
205-99-2	Benzo(b)fluoranthene	8.6	U
207-08-9	Benzo(k)fluoranthene	8.6	U
50-32-8	Benzo(a)pyrene	8.6	U
193-39-5	Indeno(1,2,3-cd)pyrene	8.6	U
53-70-3	Dibenzo(a,h)anthracene	8.6	U
191-24-2	Benzo(g,h,i)perylene	8.6	U

Comments:

Semivolatile Organics

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120007.D

Level: (LOW/MED) Date Collected: 11/08/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
100-52-7	Benzaldehyde	66000	U
108-95-2	Phenol	66000	U
111-44-4	Bis(2-Chloroethyl)ether	66000	U
95-57-8	2-Chlorophenol	66000	U
95-48-7	2-Methylphenol	66000	U
108-60-1	Bis(2-chloroisopropyl)ether	66000	U
98-86-2	Acetophenone	66000	U
108-39-4/	3 & 4-Methylphenol	66000	U
621-64-7	N-Nitroso-di-n-propylamine	66000	U
67-72-1	Hexachloroethane	66000	U
98-95-3	Nitrobenzene	66000	U
78-59-1	Isophorone	66000	U
88-75-5	2-Nitrophenol	66000	U
105-67-9	2,4-Dimethylphenol	66000	U
111-91-1	Bis(2-chloroethoxy)methane	66000	U
120-83-2	2,4-Dichlorophenol	66000	U
91-20-3	Naphthalene	66000	U
606-20-2	2,6-Dinitrotoluene	66000	U
106-47-8	4-Chloroaniline	66000	U
87-68-3	Hexachlorobutadiene	66000	U
105-60-2	Caprolactam	66000	U
59-50-7	4-Chloro-3-methylphenol	66000	U
91-57-6	2-Methylnaphthalene	220000	
77-47-4	Hexachlorocyclopentadiene	66000	U
88-06-2	2,4,6-Trichlorophenol	66000	U
95-95-4	2,4,5-Trichlorophenol	66000	U

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120007.D

Level: (LOW/MED) Date Collected: 11/08/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
92-52-4	1,1'-Biphenyl	66000	U
91-58-7	2-Chloronaphthalene	66000	U
88-74-4	2-Nitroaniline	66000	U
131-11-3	Dimethylphthalate	66000	U
208-96-8	Acenaphthylene	66000	U
99-09-2	3-Nitroaniline	66000	U
83-32-9	Acenaphthene	57000	J
51-28-5	2,4-Dinitrophenol	130000	U
100-02-7	4-Nitrophenol	66000	U
132-64-9	Dibenzofuran	66000	U
121-14-2	2,4-Dinitrotoluene	66000	U
84-66-2	Diethylphthalate	66000	U
86-73-7	Fluorene	62000	J
7005-72-3	4-Chlorophenyl-phenylether	66000	U
100-01-6	4-Nitroaniline	66000	U
534-52-1	4,6-Dinitro-2-methylphenol	66000	U
101-55-3	4-Bromophenyl-phenyl ether	66000	U
118-74-1	Hexachlorobenzene	66000	U
1912-24-9	Atrazine	66000	U
87-86-5	Pentachlorophenol	66000	U
85-01-8	Phenanthrene	280000	
120-12-7	Anthracene	53000	J
86-74-8	Carbazole	66000	U
84-74-2	Di-n-butylphthalate	66000	U
206-44-0	Fluoranthene	120000	
129-00-0	Pyrene	310000	
85-68-7	Butylbenzylphthalate	66000	U
91-94-1	3,3'-Dichlorobenzidine	66000	U

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120007.D

Level: (LOW/MED) Date Collected: 11/08/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
56-55-3	Benzo(a)anthracene	62000	J
117-81-7	Bis(2-ethylhexyl)phthalate	66000	U
218-01-9	Chrysene	79000	
117-84-0	Di-n-octylphthalate	66000	U
205-99-2	Benzo(b)fluoranthene	57000	J
207-08-9	Benzo(k)fluoranthene	23000	J
50-32-8	Benzo(a)pyrene	53000	J
193-39-5	Indeno(1,2,3-cd)pyrene	22000	J
53-70-3	Dibenzo(a,h)anthracene	66000	U
191-24-2	Benzo(g,h,i)perylene	23000	J

Comments:

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SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120008.D

Level: (LOW/MED) Date Collected: 11/14/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
100-52-7	Benzaldehyde	66000	U
108-95-2	Phenol	66000	U
111-44-4	Bis(2-Chloroethyl)ether	66000	U
95-57-8	2-Chlorophenol	66000	U
95-48-7	2-Methylphenol	66000	U
108-60-1	Bis(2-chloroisopropyl)ether	66000	U
98-86-2	Acetophenone	66000	U
108-39-4/	3 & 4-Methylphenol	66000	U
621-64-7	N-Nitroso-di-n-propylamine	66000	U
67-72-1	Hexachloroethane	66000	U
98-95-3	Nitrobenzene	66000	U
78-59-1	Isophorone	66000	U
88-75-5	2-Nitrophenol	66000	U
105-67-9	2,4-Dimethylphenol	66000	U
111-91-1	Bis(2-chloroethoxy)methane	66000	U
120-83-2	2,4-Dichlorophenol	66000	U
91-20-3	Naphthalene	66000	U
606-20-2	2,6-Dinitrotoluene	66000	U
106-47-8	4-Chloroaniline	66000	U
87-68-3	Hexachlorobutadiene	66000	U
105-60-2	Caprolactam	66000	U
59-50-7	4-Chloro-3-methylphenol	66000	U
91-57-6	2-Methylnaphthalene	49000	J
77-47-4	Hexachlorocyclopentadiene	66000	U
88-06-2	2,4,6-Trichlorophenol	66000	U
95-95-4	2,4,5-Trichlorophenol	66000	U

1

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120008.D

Level: (LOW/MED) Date Collected: 11/14/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
92-52-4	1,1'-Biphenyl	66000	U
91-58-7	2-Chloronaphthalene	66000	U
88-74-4	2-Nitroaniline	66000	U
131-11-3	Dimethylphthalate	66000	U
208-96-8	Acenaphthylene	66000	U
99-09-2	3-Nitroaniline	66000	U
83-32-9	Acenaphthene	8900	J
51-28-5	2,4-Dinitrophenol	130000	U
100-02-7	4-Nitrophenol	66000	U
132-64-9	Dibenzofuran	66000	U
121-14-2	2,4-Dinitrotoluene	66000	U
84-66-2	Diethylphthalate	66000	U
86-73-7	Fluorene	16000	J
7005-72-3	4-Chlorophenyl-phenylether	66000	U
100-01-6	4-Nitroaniline	66000	U
534-52-1	4,6-Dinitro-2-methylphenol	66000	U
101-55-3	4-Bromophenyl-phenyl ether	66000	U
118-74-1	Hexachlorobenzene	66000	U
1912-24-9	Atrazine	66000	U
87-86-5	Pentachlorophenol	66000	U
85-01-8	Phenanthrene	42000	J
120-12-7	Anthracene	11000	J
86-74-8	Carbazole	66000	U
84-74-2	Di-n-butylphthalate	66000	U
206-44-0	Fluoranthene	8100	J
129-00-0	Pyrene	41000	J
85-68-7	Butylbenzylphthalate	66000	U
91-94-1	3,3'-Dichlorobenzidine	66000	U

1

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS03 Run Sequence: R023615

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: T1120008.D

Level: (LOW/MED) Date Collected: 11/14/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 11/20/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 11/20/2007

Injection Volume: 2.0 (uL) Dilution Factor: 2.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
56-55-3	Benzo(a)anthracene	66000	U
117-81-7	Bis(2-ethylhexyl)phthalate	66000	U
218-01-9	Chrysene	13000	J
117-84-0	Di-n-octylphthalate	66000	U
205-99-2	Benzo(b)fluoranthene	66000	U
207-08-9	Benzo(k)fluoranthene	66000	U
50-32-8	Benzo(a)pyrene	66000	U
193-39-5	Indeno(1,2,3-cd)pyrene	66000	U
53-70-3	Dibenzo(a,h)anthracene	66000	U
191-24-2	Benzo(g,h,i)perylene	66000	U

Comments:

1

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS04 Run Sequence: R024069

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: F1211023.D

Level: (LOW/MED) Date Collected: 11/26/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 12/06/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/11/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
100-52-7	Benzaldehyde	33000	U
108-95-2	Phenol	33000	U
111-44-4	Bis(2-Chloroethyl)ether	33000	U
95-57-8	2-Chlorophenol	33000	U
95-48-7	2-Methylphenol	33000	U
108-60-1	Bis(2-chloroisopropyl)ether	33000	U
98-86-2	Acetophenone	33000	U
108-39-4/	3 & 4-Methylphenol	33000	U
621-64-7	N-Nitroso-di-n-propylamine	33000	U
67-72-1	Hexachloroethane	33000	U
98-95-3	Nitrobenzene	33000	U
78-59-1	Isophorone	33000	U
88-75-5	2-Nitrophenol	33000	U
105-67-9	2,4-Dimethylphenol	33000	U
111-91-1	Bis(2-chloroethoxy)methane	33000	U
120-83-2	2,4-Dichlorophenol	33000	U
91-20-3	Naphthalene	9900	J
606-20-2	2,6-Dinitrotoluene	33000	U
106-47-8	4-Chloroaniline	33000	U
87-68-3	Hexachlorobutadiene	33000	U
105-60-2	Caprolactam	33000	U
59-50-7	4-Chloro-3-methylphenol	33000	U
91-57-6	2-Methylnaphthalene	170000	
77-47-4	Hexachlorocyclopentadiene	33000	U
88-06-2	2,4,6-Trichlorophenol	33000	U
95-95-4	2,4,5-Trichlorophenol	33000	U

1

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS04 Run Sequence: R024069

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: F1211023.D

Level: (LOW/MED) Date Collected: 11/26/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 12/06/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/11/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
92-52-4	1,1'-Biphenyl	33000	U
91-58-7	2-Chloronaphthalene	33000	U
88-74-4	2-Nitroaniline	33000	U
131-11-3	Dimethylphthalate	33000	U
208-96-8	Acenaphthylene	33000	U
99-09-2	3-Nitroaniline	33000	U
83-32-9	Acenaphthene	22000	J
51-28-5	2,4-Dinitrophenol	67000	U
100-02-7	4-Nitrophenol	33000	U
132-64-9	Dibenzofuran	33000	U
121-14-2	2,4-Dinitrotoluene	33000	U
84-66-2	Diethylphthalate	33000	U
86-73-7	Fluorene	48000	
7005-72-3	4-Chlorophenyl-phenylether	33000	U
100-01-6	4-Nitroaniline	33000	U
534-52-1	4,6-Dinitro-2-methylphenol	33000	U
101-55-3	4-Bromophenyl-phenyl ether	33000	U
118-74-1	Hexachlorobenzene	33000	U
1912-24-9	Atrazine	33000	U
87-86-5	Pentachlorophenol	33000	U
85-01-8	Phenanthrene	120000	
120-12-7	Anthracene	27000	J
86-74-8	Carbazole	33000	U
84-74-2	Di-n-butylphthalate	33000	U
206-44-0	Fluoranthene	33000	U
129-00-0	Pyrene	65000	
85-68-7	Butylbenzylphthalate	33000	U
91-94-1	3,3'-Dichlorobenzidine	33000	U

1

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract:

SDG No.: MINS04 Run Sequence: R024069

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: F1211023.D

Level: (LOW/MED) Date Collected: 11/26/2007

% Moisture: 0.0 Decanted: (Y/N) N Date Extracted: 12/06/2007

Concentrated Extract Volume: 1000 (uL) Date Analyzed: 12/11/2007

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Extraction: (Type) WASTE

CAS NO.	COMPOUND	CONCENTRATION UNITS: ug/kg	Q
56-55-3	Benzo(a)anthracene	18000	J
117-81-7	Bis(2-ethylhexyl)phthalate	33000	U
218-01-9	Chrysene	30000	J
117-84-0	Di-n-octylphthalate	33000	U
205-99-2	Benzo(b)fluoranthene	33000	U
207-08-9	Benzo(k)fluoranthene	33000	U
50-32-8	Benzo(a)pyrene	33000	U
193-39-5	Indeno(1,2,3-cd)pyrene	33000	U
53-70-3	Dibenzo(a,h)anthracene	33000	U
191-24-2	Benzo(g,h,i)perylene	5500	J

Comments:

TPH - Gasoline

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS03 Run Sequence: R023791

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.1 (g/mL) gm Lab File ID: IB28707.d

pH: _____ Decanted: (Y/N) N Date Collected: 11/08/2007

Percent Moisture: 0.00 Date Prepared: 11/19/2007

Extraction: (Type) PURGETRAP Date Analyzed: 11/28/2007

Soil Extract Volume: 10000 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 20 (ul) AKB 11/29/07

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	8700	

Comments: The hydrocarbon pattern does not resemble a gasoline.

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS03 Run Sequence: R023791

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.1 (g/mL) gm Lab File ID: IB28706.d

pH: _____ Decanted: (Y/N) N Date Collected: 11/14/2007

Percent Moisture: 0.00 Date Prepared: 11/19/2007

Extraction: (Type) PURGETRAP Date Analyzed: 11/28/2007

Soil Extract Volume: 10 000 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 100 (ul) AKB 11/29/07

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	720	

Comments: The hydrocarbon pattern does not resemble a gasoline.

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS04 Run Sequence: R023951

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.10 (g/mL) gm Lab File ID: IC05707.d

pH: _____ Decanted: (Y/N) N Date Collected: 11/26/2007

Percent Moisture: 0 Date Prepared: 11/28/2007

Extraction: (Type) PURGETRAP Date Analyzed: 12/05/2007

Soil Extract Volume: 10000 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 25 (ul)

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	1800	

Comments:

The hydrocarbon pattern does not resemble a gasoline.

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS05 Run Sequence: R024179

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS05-001

Sample wt/vol: 5.20 (g/mL) gm Lab File ID: KC11709.d

pH: _____ Decanted: (Y/N) N Date Collected: 12/03/2007

Percent Moisture: 30 Date Prepared: 12/11/2007

Extraction: (Type) PURGETRAP Date Analyzed: 12/11/2007

Soil Extract Volume: ~~10000~~ 11600 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 100 (ul)

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	7.9	U

Comments:

Date Printed: 12/13/2007 13:17

8015Bmod-GRO

FORM I GRO

TPHG - 7

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS06 Run Sequence: R024326

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-001

Sample wt/vol: 6.00 (g/mL) gm Lab File ID: KC26706.d

pH: _____ Decanted: (Y/N) N Date Collected: 12/10/2007

Percent Moisture: 22 Date Prepared: 12/11/2007

Extraction: (Type) PURGETRAP Date Analyzed: 12/26/2007

Soil Extract Volume: ~~10000~~ 11300 AA 27 DEC 07 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 100 (ul)

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	6.0	U

Comments:

1

GASOLINE ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: Laucks Testing Laboratories, Inc. Contract: N/A

SDG No.: MINS06 Run Sequence: R024326

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-002

Sample wt/vol: 5.50 (g/mL) gm Lab File ID: KC17709.d

pH: _____ Decanted: (Y/N) N Date Collected: 12/10/2007

Percent Moisture: 22 Date Prepared: 12/11/2007

Extraction: (Type) PURGETRAP Date Analyzed: 12/17/2007

Soil Extract Volume: ~~10000~~ 11200 AA 27 DEC 07 (ul) Dilution Factor: 1.00

Soil Aliquot Volume: 100 (ul)

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Gasoline	Gasoline Range Organics	6.5	U

Comments:

8015Bmod-GRO Date Printed: 12/27/2007 10:51

TPHG - 11

FORM 1 GRO

TPH Diesel & Motor Oil

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-DR-DR1-6.5

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023697

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-001

Sample wt/vol: 0.17 (g/mL) gm Lab File ID: EB21712.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/08/2007

Extraction: (Type) WASTE Date Extracted: 11/20/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 11/21/2007

Injection Volume: 1.0 (uL) Dilution Factor: 20.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	150000	B
TPH-Oil	Oil Range Organics	180000	B

Comments: The hydrocarbon pattern partially resembles a diesel and partially resembles a motor oil.

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-FSA-1-3

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS03 Run Sequence: R023697

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS03-002

Sample wt/vol: 0.20 (g/mL) gm Lab File ID: EB21717.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/14/2007

Extraction: (Type) WASTE Date Extracted: 11/20/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 11/22/2007

Injection Volume: 1.0 (uL) Dilution Factor: 20.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	67000	B
TPH-Oil	Oil Range Organics	120000	B

Comments: The hydrocarbon pattern partially resembles a diesel and partially resembles a motor oil.

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-FP-AD-4

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS04 Run Sequence: R023922

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS04-001

Sample wt/vol: 0.17 (g/mL) gm Lab File ID: EC03713.d

% Moisture: 0.0 Decanted: (Y/N) N Date Collected: 11/26/2007

Extraction: (Type) WASTE Date Extracted: 12/03/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 12/04/2007

Injection Volume: 1.0 (uL) Dilution Factor: 20.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	90000	
TPH-Oil	Oil Range Organics	130000	B

Comments: The hydrocarbon pattern partially resembles a diesel and partially resembles a motor oil.

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS05 Run Sequence: R024257

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS05-001

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: EC11742.d

% Moisture: 30.0 Decanted: (Y/N) N Date Collected: 12/03/2007

Extraction: (Type) PFEX Date Extracted: 12/07/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 12/12/2007

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	7.1	U
TPH-Oil	Oil Range Organics	29	U

Comments:

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS06 Run Sequence: R024257

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-001

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: EC11760.d

% Moisture: 22.0 Decanted: (Y/N) N Date Collected: 12/10/2007

Extraction: (Type) PFEX Date Extracted: 12/11/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 12/13/2007

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	6.4	U
TPH-Oil	Oil Range Organics	26	U

Comments:

1

DIESEL ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: Laucks Testing Laboratories, Contract: N/A

SDG No.: MINS06 Run Sequence: R024257

Matrix: (SOIL/WATER) Soil Lab Sample ID: MINS06-002

Sample wt/vol: 20.0 (g/mL) gm Lab File ID: EC11761.d

% Moisture: 22.0 Decanted: (Y/N) N Date Collected: 12/10/2007

Extraction: (Type) PFEX Date Extracted: 12/11/2007

Concentrated Extract Volume: 2000.0 (uL) Date Analyzed: 12/13/2007

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: mg/Kg	Q
TPH-Diesel	Diesel Range Organics	6.4	U
TPH-Oil	Oil Range Organics	26	U

Comments:

Cyanide

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD2-S13.5

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS05

Matrix (soil/water): Soil Lab Sample ID: MINS05-001

Level (low/med): LOW Date Received: 12/06/2007

% Solids: 70.3

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
57-12-5	Cyanide	0.14	J		AS	R024711

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts: No

Comment

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD6-S6.5

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS06

Matrix (soil/water): Soil Lab Sample ID: MINS06-001

Level (low/med): LOW Date Received: 12/11/2007

% Solids: 78

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
57-12-5	Cyanide	0.16	J		AS	R024711

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts: No

Comment

ILM
1-IN
INORGANIC ANALYSES DATA SHEET

SAMPLE NO.

FTPH-TS-AD7-S7

Lab Name: Laucks Laboratories Contract:

Lab Code: LAUCKS SDG No.: MINS06

Matrix (soil/water): Soil Lab Sample ID: MINS06-002

Level (low/med): LOW Date Received: 12/11/2007

% Solids: 78.1

Concentration Units : mg/Kg

CAS No.	Analyte	Concentration	C	Q	M	Run Seq.
57-12-5	Cyanide	0.30	J		AS	R024711

Color Before: Clarity Before: Texture:

Color After: Clarity After: Artifacts: No

Comment

APPENDIX F4

Supplemental Investigation and Removal Action Documentation Provided by Weston Solutions, Inc., June 2009

LEGEND

- 2006/2007 OVEREXCAVATED AREAS MEETS TARGET CLEANUP GOALS AT THE NOTED DEPTH IN FEET
- AREA MEETS TARGET CLEANUP GOALS AT THE NOTED DEPTH IN FEET
- AREA 1 OVEREXCAVATED 6.0 FEET
- AREA 2 OVEREXCAVATED 7.0 FEET
- AREA 3 OVEREXCAVATED 6.0 FEET
- AREA 4 OVEREXCAVATED 5.5 FEET
- AREA 5 OVEREXCAVATED 5.5 FEET

N

100 0 100

Feet

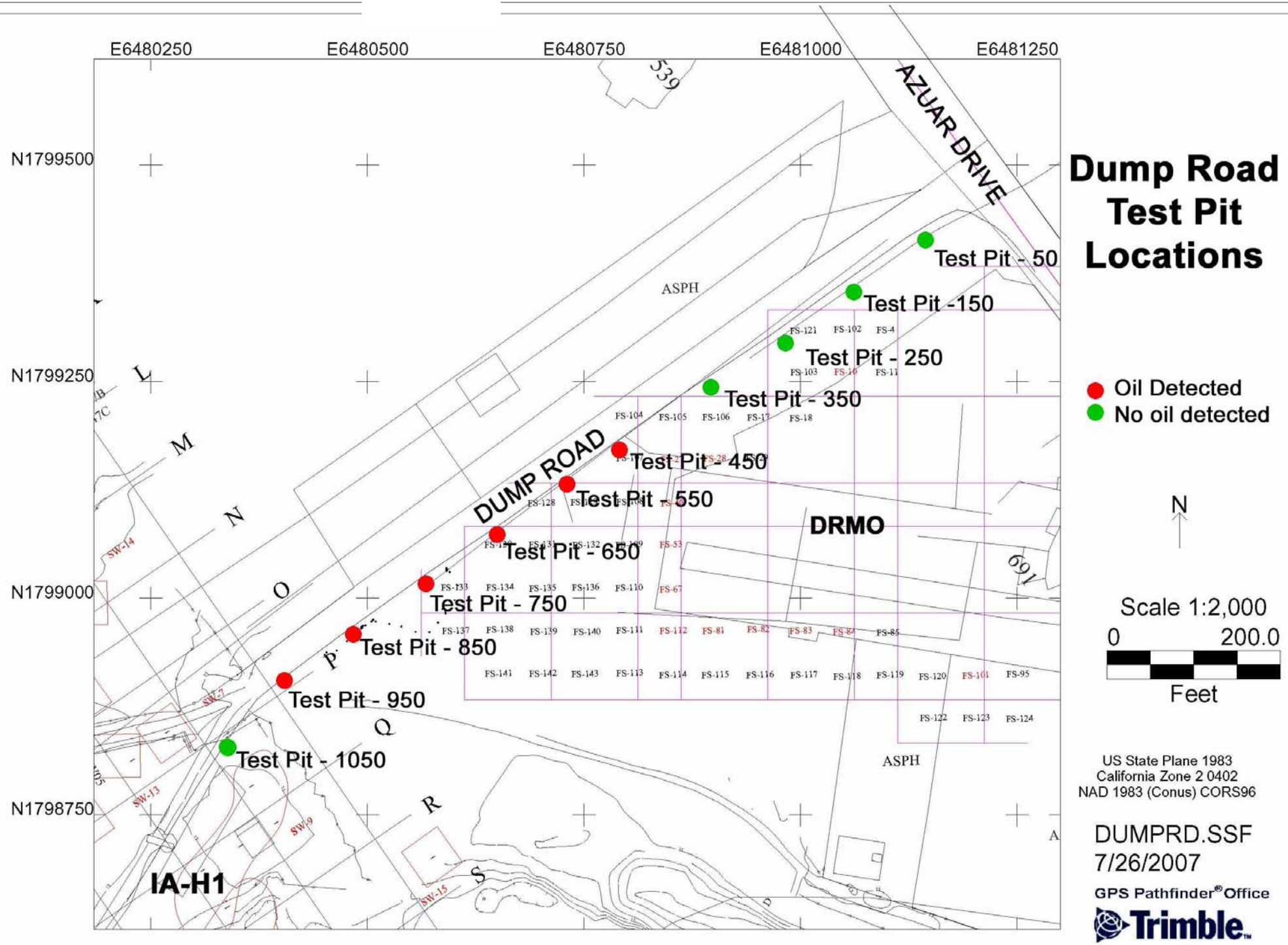
BRAC Program Management Office West
San Diego, California

Non-Time Critical Removal Action Completion Report
Defense Reutilization and Marketing Office (DRMO)

FIGURE 2-5
2007 EXCAVATION MAP

Mare Island, Vallejo, California

WESTON SOLUTIONS, INC.


E6480250
E6480500
E6480750
E6481000
E6481250
N1799500
N1799250
N1799000
N1798750
AZUAR DRIVE
DUMP ROAD
DRMO
ASPH
ASPH
539
691
Test Pit - 50
Test Pit -150
Test Pit - 250
Test Pit - 350
Test Pit - 450
Test Pit - 550
Test Pit - 650
Test Pit - 750
Test Pit - 850
Test Pit - 950
Test Pit - 1050
IA-H1
L
M
N
O
P
Q
R
S
Dump Road
Test Pit
Locations
Oil Detected
No oil detected
N
Scale 1:2,000
0
200.0
Feet
US State Plane 1983
California Zone 2 0402
NAD 1983 (Conus) CORS96
DUMPRD.SSF
7/26/2007
GPS Pathfinder® Office
Trimble

Dump Road Test Pit – 050’ West of Azuar
Depth – 5’ bgs
Description – Brick, metal debris, groundwater at 5’ bgs, no visible oil

Dump Road Test Pit – 150’ West of Azuar
Depth – 5’ bgs
Description – Metal debris, groundwater at 5’ bgs, no visible oil

Dump Road Test Pit – 250’ West of Azuar
Depth – 7.5’ bgs
Description – Wire, debris, black-stained soil, groundwater at 7.5’ bgs, no visible free product

Dump Road Test Pit – 350’
Depth – 6.5’ bgs
Description – Railroad metal debris, dark black discolored soil, no TPH-odor noted, groundwater at 6.5’ bgs

Dump Road Test Pit – 450’ West of Azuar
Depth – 5’ bgs
Description – Metal debris, heavy free product in debris and at groundwater

Dump Road Test Pit – 550’ West of Azuar
Depth – 4.5’ bgs
Description – Metal debris, cobbles, heavy free product in debris and at groundwater (at 4.5 ‘ bgs).

Dump Rd
Test Pit 55

Dump Rd
Test Pit-550

Dump Road Test Pit – 650’ West of Azuar
Depth – 6.5’ bgs
Description – Metal debris, heavy free product in debris and at groundwater (at 6.5’ bgs).

Dump Rd
Test Pit - 650'

Dump Road Test Pit – 750’ West of Azuar
Depth – 4’ bgs
Description – Metal, brick, wood, & misc debris, heavy free product in debris and at groundwater (at 4’ bgs).

Dump Rd
Test Pit-750'

Dump Road Test Pit – 850’ of Azuar
Depth – 4.5’ bgs
Description – Metal, & wood, debris, heavy free product in debris and at groundwater (at 4.5’ bgs).

Dump Rd
Test Pit-850'

Dump Rd
Test Pit-850'

Dump Road Test Pit – 950’ West of Azuar
Depth – 4.5’ bgs
Description – Metal, brick, cable, & wood, debris, heavy free product in debris and at groundwater (at 4.5’ bgs).

Dump Rd
Test Pit - 950'

Dump Rd
Test Pit - 950'

Dump Road Test Pit – 1050’ West of Azuar
Depth – 8’ bgs
Description – Brown-colored soil, no debris, staining, or oil present. No TPH odor noted.

Dump Rd
Test Pit

WESTERN

APPENDIX G

Documentation from the 2008 Geophysical Survey

NORCAL GEOPHYSICAL CONSULTANTS, INC.

May 20, 2008

Mr. Mike Godwin
CH2M HILL
Mare Island Office
690 Walnut Avenue
Suite 230
Vallejo, California 94592

Subject: Geophysical Investigation at the Former Mare Island Naval Shipyard, Mare Island, Vallejo, California
NORCAL Project No. 08-106.46

Dear Mr. Godwin:

This report presents the findings of a geophysical investigation performed by NORCAL Geophysical Consultants, Inc. (NORCAL) at the former Mare Island Naval Shipyard site, located in Vallejo, California. The field survey was conducted during the period March 13th, 2008 through March 24th, 2008. NORCAL personnel participating in the field activities included:

- David T. Hagin, Professional Geophysicist PGp 1033
- Sierra Boyd, Professional Geophysicist PGp 1060
- David Bissiri, Professional Geophysicist PGp 1009

Logistical support and site information were provided by Mr. Stephen Quayle and Mr. Mike Godwin of CH2M HILL. The geophysical investigation was authorized under CH2M HILL work Order No. 810093 & CO#1, and was conducted in compliance with the CH2M HILL Health and Safety Plan, as well as NORCAL Geophysical Consultants' Job Safety Analysis.

This survey is part of the Follow-on Total Petroleum Hydrocarbon (TPH) Investigation at the former Defense Reutilization and Marketing Office (DRMO) by CH2M HILL. Investigations to date indicate that areas with large accumulations of buried metallic debris may be providing preferential pathways for the migration of TPH contaminants.

To aid in locating potential contaminant pathways, geophysical techniques were used to characterize the general subsurface conditions in regards to locations of buried metallic debris.

The survey area, site conditions, work plan and purpose of the investigation were discussed at a brief preparatory meeting between NORCAL, CH2M HILL, and US Navy representatives on March 4, 2008. Part of the discussions included the increase in survey area from the original 2.35 acres to 10.2 acres. Several additional areas were also included during the time of data acquisition at the request of CH2M HILL personnel.

1.0 SITE DESCRIPTION

Plate 1 is a detailed site map of the survey area provided by CH2M HILL. This map shows many site features that may be important during data evaluation and interpretation. These features include roadways, buildings, railroad tracks, fences, utilities and other items that may affect vertical magnetic gradient (VMG) and electromagnetic (EM) data.

NORCAL personnel also identified many other on-site features that may influence data values. The locations of these features were determined in the field using a GPS system. The GPS system was also used to locate other points of interest and the limits of the geophysical survey. The locations of these features are referenced to benchmark BM CA174 HCN11. Separate legends are provided on Plate 1 to differentiate between the CH2M HILL and NORCAL identified site features.

The revised study area is an L shaped semi-continuous area, extending 1,450 feet along Azuar Drive and 1,030 feet along Dump Road, including the intersection of the roads and selected adjacent areas (Plate 1). Along Dump Road the grid extends approximately 150 feet from the road to the north and approximately 150 feet to the south, except for the excluded pond area. On the west side of Azuar Drive the grid extends to approximately 130 feet from the centerline of the road. The grid boundary on the eastern side of Azuar Drive is irregular and discontinuous due to limited access and obstacles.

The geologic setting generally consists of 13 to 20+ feet of artificial fill over former tidal marsh and mud flat deposits (RFP, CH2M HILL December, 2007). Most of the debris discovered to date has been within the mid to lower portions of the fill, ranging from 5 to 10 feet below ground surface.

It should be noted that many existing cultural features which typically create strong magnetic fields and high-EM response (signal noise) are located within the survey area, particularly along Azuar Drive. These features include railroad tracks, buildings,

utilities, chain-link fences, fire hydrants, light posts, manhole covers, large steel plates and numerous other items.

2.0 OBJECTIVES AND APPROACH

According the Request for Proposal (RFP, CH2M HILL December, 2007), the purpose of this surface geophysical investigation is "to develop a map that shows the gross accumulation and lateral extent of metallic debris in the subsurface from historic site operations."

We conducted VMG and EM surveys to characterize the shallow subsurface conditions. These techniques are sensitive to metallic sources and are utilized to determine the probable locations of buried metallic debris.

3.0 GEOPHYSICAL METHODS

The VMG and the EM methods have been selected for this geophysical investigation because of their ability to detect buried metal objects. The VMG is designed to eliminate regional and temporal magnetic variations, and focus on localized ferrous sources. Both ferrous and non-ferrous metallic objects are typically highly conductive, and may be detected through analysis of in-phase EM data. A more detailed discussion of these methods, data analysis, geophysical instrumentation, and limitations is presented in Appendix A.

4.0 GEOPHYSICAL SURVEYS

4.1 Field Investigation

Initially, a survey grid was established to provide horizontal position control for data acquisition. The grid extends 1,450 feet parallel to Azuar Drive (plan northing is toward the northwest), and 1,030 feet parallel to Dump Road (plan easting is toward the northeast). We established the grid in the field using a fiberglass measuring tape and marking paint. The grid was based on a rectangular coordinate system with the origin (0E, 0N) located in the southwest corner of the survey area. In order to keep all grid values positive, the grid origin was placed approximately 1,270 feet south and 850 feet west of the center of the intersection of Azuar Drive and Dump Road. The limits of the VMG and EM surveys are depicted by green dashed lines, as shown on Plate 1.

Daily safety meetings were held and quality control tests were performed on the VMG and EM instruments prior to data acquisition each day. Results of these tests were provided to CH2M HILL on a daily basis along with our daily report; copies of daily reports and daily test results have been included for reference in Appendix B.

Data acquisition consisted of a series of traverses spaced 10 feet apart with measurements taken along grid lines at approximately 5-foot intervals. Along Azuar Drive and adjacent areas the traverses were parallel to the northing grid lines; along Dump Road and adjacent areas the traverses were parallel to the easting grid lines. Due to the large grid size and many fences, the data were acquired in smaller blocks which were subsequently concatenated for gridding, contouring, analysis and interpretation. A general description of VMG and EM contour maps, as well as how they are interpreted, is included in Appendix A.

4.2 Data Analysis

The VMG data were carefully evaluated, edited, and contoured as VMG maps for review and interpretation. These contour maps were then assessed for magnetic variations which cannot be explained by known magnetic sources; unexplained variations in the magnetic field are interpreted as potential areas for further exploration.

The EM data were reviewed for quality control, edited and contoured for interpretation. EM contour maps were interpreted based on variation in measured values and the potential causes for these variations.

A detailed description of methodology, instrumentation, software, interpretation and inherent limitations are included as Appendix A.

4.3 Results

The results of the respective EM and VMG computer data processing as described in Appendix A are presented as color coded contour maps.

The EM In-Phase Contour Map is presented as Plate 2. The colored contour scale shows that measured in-phase values range from -45 to +65 parts per thousand (ppt).

This significantly exceeds background values that typically range from about -2 to +2 ppt and suggests the presence of metallic sources. The results are characterized by broad zones of elevated in-phase values that encompass a majority of the survey area.

Along the north side of Dump Road, the zones are defined as generally linear with localized scattered smaller zones. South of Dump Road the zones are not as linear and characterized as irregularly shaped and more uniform in intensity. An irregularly shaped zone is also located at the northern portion of the intersection with Azuar Drive. Along the east side of Azuar Drive, the intensities are variable from relatively uniform elevated values to high values that occur as relatively irregularly shaped to linear. Along the west side of Azuar Drive, the values are predominately uniform with localized zones of higher intensity. There are also areas where the values are near background suggesting a general lack of metallic sources.

The Vertical Magnetic Gradient (VMG) Contour Map is presented as Plate 3. The color-coded contour scale indicates that values range from about -4500 to +5000 nanoteslas per meter (nT/m). This large range indicates the presence of metallic sources. Similar to the In-Phase contour map, the VMG map also shows increased intensities over broad areas that cover a majority of the survey area. Due to the sensitivity of the VMG, measured parameters, and the operation of the instrumentation, the data are more highly variable than the EM. This is manifested on the VMG contour map as a complex series of closely spaced contours and contour closures that are color-coded according to intensity. However, the general results are similar to the EM results as described above. The MAG data also shows linear features, broad zones, localized variations, as well as zones that are free from contours suggesting the absence of metallic sources. These features are generally in the same locations as described above for the In-Phase contour map.

As previously described in the site description and shown on Plate 1, there are numerous above and below ground site features that are metallic and are expected to have an influence on the EM and VMG results. We performed an analysis of the locations of observed and documented site features and the locations of defined EM and VMG variations to determine general information regarding the potential metallic sources as shown on the Site Map. During this analysis we defined areas where there are no observable or documented metallic sources on Plate 1, but there are definable variations on Plates 2 and 3. These areas are interpreted as being buried metallic debris areas that may or may not also include other documented subsurface features. Based on the intensity of the variations and the configuration of the EM and VMG color-coded contours, an interpretation can be made regarding the general dimensions of the debris and a qualitative assessment of the amount of debris.

4.4 Interpretation

VMG and EM Anomalies

Based on our comparison of Plate 1 with the results shown on Plate 2 and 3 we have made a general interpretation regarding the possible sources of the various VMG and EM variations and the possible locations of significant amounts of buried debris. The results of this analysis are presented as an Anomaly Map, Plate 4.

The Anomaly Map shows the lateral extent of various areas of increased magnetic intensity and elevated in-phase values that are referred to as anomalies. The magnetic anomalies are shown in stippled red and the in-phase are cross-hatched blue. When comparing both magnetic and in-phase anomaly location and lateral extent with the site location map, it is apparent that there is a correlation between the anomaly locations and the locations, boundaries or trend of many of the mapped site features. Based on this comparison as well as our visual observations during the data acquisition we have designated various anomalies with probable magnetic sources. The magnetic anomalies are designated by the letters A through O and the in-phase anomalies by the numbers 1 through 26 to indicate the possible magnetic sources. For reference separate tables are presented on the Anomaly Map, Plate 4 to show the various magnetic anomaly designations and probable sources. Generally the probable sources include mapped underground utilities, fences, buildings, railroad tracks, surface debris, and foundation materials. However, there are also some anomalous areas that do not appear to be related to any noted surface features and therefore interpreted to be due to undocumented buried debris.

Generally the magnetic anomalies are more widespread than the in-phase however, there are a greater number of in-phase anomalies. This may be due to the VMG having a greater sensitivity than the EM in-phase. Additionally, many of both types of anomalies occur in the same general locations suggesting that they are both probably caused by the same source.

Clear or Scattered Debris Areas

Areas that are not designated as anomalous on Plate 4 are interpreted to either contain scattered localized debris or generally lacking debris. Areas defined as having scattered debris are manifested on the VMG contour map (Plate 3) as having scattered localized contour closures with low magnetic intensity values that generally range from -500 to+1000 nanoteslas/meter. Example areas are located within the intersection of Azure and Dump Roads, south of Dump Road, along portions of the western side of

Azuar Drive between buildings 679 and 831, portions of areas along the east side of Azuar Drive, and other localized areas to name a few.

There are also zones on Plate 3 that have very scattered contours or a lack of contours. These areas are interpreted as being generally free of site features and metallic debris. The most notable area is located on the south side of Dump Road and east of the pond area, and along the northern extent of Azuar Drive and north of building 661. These areas may indicate where buried debris has been previously removed. Other localized areas occur northeast of Azuar Drive.

Possible Fill Variations

There are broad zones on the EM In-Phase Contour Map, Plate 2 that are uniform in intensity and do not have localized variations as indicated by closely spaced or closed contours. These areas are defined by the uniform brown and white zones along the south side of Dump Road and the west site of Azuar Drive, near buildings 661 and 275. We interpret these zones as representing changes in the fill materials that may have been placed at different times, and may to be related to clear and scattered debris zones as described above, based on location and lateral extent.

Interpreted Buried Debris Zones and Utilities

As previously described, there are significant magnetic and in-phase anomalies that only partially correspond to mapped site features and are interpreted to be due to the effects of buried metallic debris. The approximate locations and limits are based on the EM In-Phase results. These areas are described as:

1.) West end of Dump Road, south side, approximately 350 feet east-west by 40 to 80 feet north-south and extending beyond the western limits of the survey area;

2.) West end of Dump Road, north side, approximately 150 by 40 feet and extending beyond the western survey limits – VMG data suggest this area may also extend offsite to the north;

3.) Intersection of Dump Road and Azuar Drive, irregularly shaped area about 80 by 80 feet;

4.) Central portion of Azuar Drive, north of Building 661, approximately 250 by 50 feet.

Additionally there are three linear anomalies that trend parallel to Dump Road on the north side. The site map indicates only one utility within this area, and therefore, we interpret that these may be additional pipelines within this area. These interpreted lines may be related to the item #2 described above.

5.0 STANDARD OF CARE

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate the opportunity to provide our services to CH2M HILL for this project. Should you require additional geophysical services or have questions regarding this survey, please do not hesitate to call.

Sincerely,

NORCAL Geophysical Consultants, Inc.

David T. Hagin
Geophysicist PGp No. 1033

Kenneth G. Blom
Geophysicist PGp No. 887

KGB/DTH/tt

Enclosures: Plates 1-4

Appendix A - Geophysical Methodology, Instrumentation, Data Analysis, and Limitations
Appendix B - Daily Field Reports, Daily Instrument Test Results

Appendix A

GEOPHYSICAL METHODOLOGY

Appendix A

VERTICAL MAGNETIC GRADIENT (VMG)

METHODOLOGY

Vertical magnetic gradient (VMG) surveys are used to determine the presence of buried ferrous objects. The vertical gradient of the earth's magnetic field is measured using a magnetic gradiometer. This instrument consists of two total field magnetic sensors separated vertically by one-half meter. The magnetic field strength is measured simultaneously at both of these sensors. The difference in magnetic intensity between these measurements is proportional to the vertical gradient of the earth's magnetic field. VMG surveys provide better resolution of near surface objects than those that measure only the total intensity of the earth's magnetic field. In addition, they are less affected by surface objects than total field surveys. Furthermore, because the vertical gradient is constant with respect to time, the effect of diurnal variations is eliminated. Therefore, a gradiometer provides higher sensitivity and better resolution of near surface sources than total field magnetometers.

DATA ACQUISITION

We acquire VMG data using a Geometrics G-858 cesium vapor magnetometer. This instrument consists of a console, an aluminum staff that is held in the horizontal position, and two magnetic sensors that are mounted vertically with a 0.5-m separation at one end of the staff. The console features a built-in memory that stores the vertical magnetic gradient and survey grid information. The information can be down loaded to a computer for further processing.

DATA ANALYSIS

The VMG data are downloaded to a personal computer and converted into a format suitable for contouring using the program ***MagMap2000*** by Geometrics, Inc. We then contour the VMG data using the program ***Surfer*** (Version 8.0) by Golden Software. This program calculates an evenly spaced array of values (grid) based on the observed field data. The gridded values are smoothed and then contoured to produce a VMG contour map. The contour intervals are typically selected based upon the specific intensities, as well as for clarity of presentation. The contour maps are then analyzed to identify magnetic variations (anomalies) that may be caused by buried ferrous metal.

CONTOUR MAP INTERPRETATION

The distribution and configuration of VMG contours depict the distribution and intensity of VMG values within the area covered by the contour map. Areas where the VMG contours are absent or widely spaced indicate a general absence of significant quantities of buried ferrous metal. Areas where the contours are closely spaced indicate

steep magnetic gradients (vertical) caused by nearby ferrous metal. If the source of a steep gradient is linear (e.g. underground utilities, railroad spurs, culvert, etc.), then the contours tend to parallel the object, and are closely spaced in close proximity to the object. If a buried object is localized (e.g. buried drum, isolated metal debris, etc.), then the contours tend to form circular or elliptical closures that enclose the object. The larger the object is and the closer it is to the VMG sensors (shallow), the more contours there are in a given area. Variations that cannot be attributed to known above and/or below ground objects (metal well casings, reinforced concrete surface drain, above ground 55 gallon drums, utilities, etc.) are caused by unknown buried objects and are considered anomalous.

Buried landfill material is often characterized by circular to elliptical contour closures. These closures can vary from large circular closures that cover broad areas, to clusters of small closures that occur in zones. If the composition of the landfill is generally homogenous and nonmetallic, the contours tend to form large closures representing low values. If the fill material consists of both nonmetallic and metallic debris that varies significantly throughout the landfill, the contours tend to occur as numerous small closures representing both high and low values.

LIMITATIONS

There are inherent limitations associated with the VMG technique that may preclude the detection of some subsurface objects. These limitations are related to the composition of the object, its size and depth of burial, and its proximity to other above or below ground features. In general, as the distance between a subsurface object and the respective geophysical instrument increases, the intensity of the associated field decreases, thereby making detection more difficult. In addition, above and below ground objects, such as buildings, debris, utilities, above ground electric lines, etc., typically produce interference that may mask effects from nearby buried features (targets).

Apart from the physical limitations of the instruments and the unwanted effects from secondary objects, the ability to detect subsurface features is also dependent upon the density of data acquisition points. If the distance between data acquisition points is significantly larger than the size of the subsurface feature the object may not be detected.

ELECTROMAGNETIC (EM) INDUCTION

METHODOLOGY

Electromagnetic (EM) induction surveys are used to delineate variations in the electrical conductivity of the shallow subsurface. These variations can be caused by variations in the lithology or moisture content of the strata or by the presence of buried metallic objects. We typically conduct EM surveys using a Geonics, Ltd. EM-31 DL conductivity meter. This instrument consists of an instrument console with two horizontal booms attached to either side. The booms are 6-ft long and contain a multi-turn coil at the end furthest from the console. A hand-held data logger attached to the EM-31 records the measured data as well as annotations regarding the locations of the measurements.

In operation, a time varying electromagnetic signal is transmitted from one of the coils (transmitter). This signal induces the flow of electrical current in the earth that is referred to as the primary field. This field gives rise to a secondary magnetic field that is detected by the other (receiver) coil. The strength of the secondary field is directly proportional to the electrical conductivity of the volume of material sampled. The secondary signal has two components which are referred to as quadrature and in-phase. The quadrature component is measured in units of milliSiemans per meter (mS/m). The in-phase component is a ratio and is presented as parts per thousand (ppt). Both components are sensitive to variations in the electrical conductivity of the subsurface. However, of the two, the in-phase component is more sensitive to buried metal.

DATA ACQUISITION

In operation, the EM-31DL is carried at hip level along each survey traverse (line). EM data can be acquired using either the horizontal or vertical dipole with the booms oriented parallel to or perpendicular to the traverse. For most applications we collect EM data using the vertical dipole with the booms oriented parallel to the traverse. At specified intervals a button mounted on one of the booms is depressed to take a measurement. The measurement locations are typically determined by pacing with reference to pre-positioned survey markers. The data logger connected to the instrument can be programmed to record the line number and the location of each measurement along the line. It can also be programmed to record either the quadrature or in-phase component of the EM signal. We typically record both.

DATA ANALYSIS

At the end of the field day, the EM data and survey annotations stored recorded by the data logger are downloaded to a computer for processing and archival using the program ***DAT31W*** by Geonics, Ltd. This program converts the measured voltages to units of mS/m (quadrature) and ppt (in-phase) and arranges them into a format suitable for contouring. The processed EM data are then contoured using the program ***Surfer*** (Version 8.0) by Golden Software. This program calculates an evenly spaced array of

values (grid) based on the observed field data. The gridded values are smoothed and then contoured to produce quadrature and/or in-phase contour maps. The contour intervals are typically selected based upon the specific intensities, as well as for clarity of presentation. The contour maps are then analyzed to identify magnetic variations (anomalies) that may be caused by buried ferrous metal.

CONTOUR MAP INTERPRETATION

The distribution and configuration of EM contours (quadrature or in-phase) depict the lateral distribution of subsurface conductivities within the survey area. Areas where the contours are widely spaced indicate areas with minimal variations in conductivity. Areas where the contours are closely spaced indicate lateral changes in conductivity. If the source of closely spaced contours is linear (e.g. underground utilities, railroad spurs, culvert, etc.), then the contours tend to parallel the object, and are closely spaced in close proximity to the object. If a buried object is localized (e.g. buried drum, isolated metal debris, etc.), then the contours tend to form circular or elliptical closures that enclose the object. The larger the object is and the closer it is to the instrument (shallow), the more contours there are in a given area. Variations that cannot be attributed to known above and/or below ground objects (metal well casings, reinforced concrete surface drain, above ground 55 gallon drums, utilities, etc.) are caused by unknown buried objects and are considered anomalous.

Buried landfill material is often characterized by circular to elliptical contour closures. These closures can vary from large circular closures that cover broad areas, to clusters of small closures that occur in zones. If the composition of the landfill is generally homogenous, with few buried objects, the contours tend to be uniform and widely spaced. If the fill material consists of both nonmetallic and metallic debris that varies significantly throughout the landfill, the contours tend to occur as numerous small closures representing both high and low values.

LIMITATIONS

There are inherent limitations associated with the EM technique that may preclude the detection of some subsurface objects. These limitations are related to the composition of the object, its size and depth of burial, and its proximity to other above or below ground features. In general, as the distance between a subsurface object and the EM instrument increases, the intensity of the associated field decreases, thereby making detection more difficult. In addition, above and below ground objects, such as buildings, debris, utilities, above ground electric lines, etc., typically produce interference that may mask effects from nearby buried features (targets).

Apart from the physical limitations of the instruments and the unwanted effects from secondary objects, the ability to detect subsurface features is also dependent upon the density of data acquisition points. If the distance between data acquisition points is significantly larger than the size of the subsurface feature the object may not be detected.

Appendix B

DAILY FIELD REPORTS

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/13/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / OSB / DJB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
6:30 AM	Mob to site from NORCAL
7:30 AM	Meet w/ Mike Godwin & Steve Quayle
	- Site walk & Safety Mtgs.
8:00 AM	Locate "Quiet area" - System check EM / MAG
	All OK
	Mag grad reading ~ -25 to -70 gammas
	- Mark out grid along Azuar
2:00 PM	Continue marking grid on Dump Rd
	- Partially done
	- Mark out utilities along Azuar
4:15 PM	Mob to NORCAL
5:30 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M 2.25 F: 8.75

David Hagin — Signature
David Hagin — Print
NORCAL Representative

Stephen Quayle — Signature
Stephen Quayle — Print
CLIENT Representative

321A BLODGETT STREET • COTATI, CA 94931 • TELEPHONE (707) 796-7170 • FAX (707) 796-7175
www.norcalgeophysical.com

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/14/08 Client/Location: CH2M Hill

Personnel: DTH / OSB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
6:30AM	Mob to site from NORCAL
7:30 PM	Meet w/ Steve Quayle
	- System checks in quiet area
	zero ✓ sensitivity ✓
	EM ok phase ✓ set-up ✓
	MAG ok. repeat along grid lines
	~25 to ~30 gammas
	- Acquire MAG & EM Data along Azuar Rd.
	- Grids 1, 2, 3 & 4
	- Download & pre-process data QA/QC
	prelim - data looks good
	- Spoke w/ Steve Farley - He wants to expand area
	along Azuar (east side of Azuar)
4:00 PM	Mob to NORCAL
5:00 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2h F: 8.5h

David Hagin Signature

David Hagin Print

NORCAL Representative

Stephen B. Quayle For CH2M Hill Signature

Stephen B. Quayle Print

CLIENT Representative

321A BLODGETT STREET • COTATI, CA 94931 • TELEPHONE (707) 796-7170 • FAX (707) 796-7175

www.norcalgeophysical.com

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/12/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / OSB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
7:00 AM	Mob to site from NORCAL
8:00 AM	Meet w / Steve Farley - discuss daily plan
8:30 AM	Meet w / Steve Quayle - Safety mtg.
	Grid
	Continue Mark out in Northwest area
9:45 AM	Street closed (Hazwx) - Mob to collect data in excluded area
	as per Steve Farley
	- Grid 5
	- Grid 6 Equipment check: EM: zero ✓, phase ✓
	Done 2 1/4 hrs. sensitivity ✓, set-up ✓
	MAG: Sensors good ✓
12:01 PM	Move to intersection
	repeat gradient rdg. of
8:00 PM	Done w/ intersection - Grid 7 complete -25 to -30 gammas/m at quiet area ✓
2:30 PM	Continue grid mark-out in NW area
4:00 PM	Mob to NORCAL
5:06 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2h F: 8h

David Hagin — Signature / Print — NORCAL Representative

Stephen B. Quayle — Signature / Print — CLIENT Representative

321A BLODGETT STREET • COTATI, CA 94931 • TELEPHONE (707) 796-7170 • FAX (707) 796-7175
www.norcalgeophysical.com

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/18/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / DJB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
7:00 AM	Mob to site from NORCAL
7:05 AM	Meet w/ Steve Quayle - safety mtg., discuss daily plan
8:30 AM	Continue grid layout along Dump Rd.
11:30 AM	System checks in Quiet Area - checks OK: see attached sheet
12:00 PM	Acquire MAG / EM in GRID 8 & 9 - west of Azuar, south end
3:30 PM	Mark out detectible utilities in GRID 8 & 9
4:30 PM	Meeting w/ Steve Quayle, Mike Hobbins & Steve Quayle
5:15 PM	Mob to NORCAL from site.
6:30 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2.25 h F: 9.25 h

David Hagin — Signature
David Hagin — Print
NORCAL Representative

Steph B. Quayle — Signature
Stephen Quayle — Print
CLIENT Representative

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www.norcalgeophysical.com

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/19/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / OSB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
7:00 AM	Mob to site from NORCAL
8:00 AM	Meet w/ Mike Godwin - Safety mtg. daily plan
8:30 AM	Review all data collected to brief Steve Farley
9:30 AM	System checks in quiet area - checks OK, see attached sheet
10:00 AM	Acquire MAG / EM data in grids 10 & 11
2:00 PM	Acquire Mag data in grids 12 & 13
	Acquire EM data in grids 14 & 15
4:30 PM	Mob to NORCAL from site.
5:30 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2h F: 8.5h

David Hagin Signature

David Hagin Print

NORCAL Representative

Signature

MICHAEL D. GODWIN Print

CLIENT Representative

321A BLODGETT STREET • COTATI, CA 94931 • TELEPHONE (707) 796-7170 • FAX (707) 796-7175

www.norcalgeophysical.com

NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/20/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / OSB Equipment: MAG / EM

Project Description: Debris Search

TIME	NOTES
7:00 AM	Mob to site from NORCAL
8:00 AM	Meet w/ Steve Quayle - Safety mtg.
8:30 AM	Equipment Tests in Quiet Area -> All Tests good (See attached)
9:00 AM	Acquire MAG / EM data along / adjacent to Dump Rd.
	Including Grids 12, 13, 14, 15, 16, 17 & 18 - Done
4:30 PM	Mob to NORCAL from site
5:30 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2h T: 8.5h

David Hagin Signature

David Hagin Print

NORCAL Representative

Signature

Stephen B. Quayle Print

CLIENT Representative

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NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/21/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH / OSB Equipment: MAG / EM / GPS

Project Description: Debris Search

TIME	NOTES
7:00 AM	Mob to site from NORCAL
8:00 AM	Meet w/ Steve Quayle - safety mtg.
8:30 AM	System checks in Quiet Area - all tests good (see attached)
9:30 AM	Acquire MAG / EM data in: Grid 19, Grid 20 & GRID 21
1:00 PM	Meet w/ Steve Quayle & Mike Godwin to determine the extent of expanded area for GRID 22 - "EXTRA GRID"
4:00 PM	Done w/ GRID 22 - approx 3 hrs. x 2 men
4:30 PM	Leave site for NORCAL
5:30 PM	Arrive @ NORCAL

FIELD DAY SUMMARY M: 2h F: 8.5

David Hagin Signature

David Hagin Print

NORCAL Representative

Stephen B. Quayle Signature

Stephen B. Quayle Print

CLIENT Representative

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NORCAL GEOPHYSICAL CONSULTANTS, INC.

DAILY FIELD REPORT

Date: 3/24/08 Client/Location: CH2M Hill / Mare Island

Personnel: DTH Equipment: GPS

Project Description: Debris Search

TIME	NOTES
8:00 AM	Mob to site from NORCAL
9:00 AM	Arrive @ site, meet w Steve Quayle for safety mtg.
9:30AM	Equipment check: GPS only today.
	GPS OK : 11 satellites PDOP = 1.58
	Acquire GPS data for grids + other features
	BM on Azuar (west side ~ 1123 N, 833 E)
	CA174 HCN12all N 1799357.79
	Chaudray + Assoc. E 6481279.302
12:30 PM	Leave site for NORCAL
1:30 PM	Arrive @ NORCAL
2:00 PM	Demob

FIELD DAY SUMMARY M: 2.5 F: 3.5

David Hagin Signature

David Hagin Print

NORCAL Representative

Stephen B. Quayle Signature

Stephen Quayle Print

CLIENT Representative

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3/13/08

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

✓ = good

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓

Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓

Additional Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ -25 to -30 gammas

David Kays
Signature

3/13/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

✓ = good

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓
Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓
Additional Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ ≈ -25 gammas

David Hays
Signature

3/14/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS ✓ = good

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓

Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓

Additional Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ ~ -25 gammas

David Hagy
Signature

3/17/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

✓ = good

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓

Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓

Additional Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ ~ -20 to -25 gammas OK.

David Hugo
Signature

3/18/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

✓ = good

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓

Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓

Additional Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ -25 to -30 gammas

David Kagan
Signature

3/19/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

V = 7000

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓
Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓
Additional Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ -25 to -30 Ω

David Rogers
Signature

3/20/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS

QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results ✓ = good
Equipment Warm-Up	✓
Positioning System Accuracy	N/A
Personnel Test	✓
Vibration Test (Cable Shake)	✓
Static Background and Static Spike	✓
Repeat Data	✓
Azimuthal Test (Magnetometer Only)	✓
Octant Test (Heading Error Test) (Magnetometer Only)	✓
Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Zero	✓
Sensitivity	✓
Phase	✓
Set-Up	✓
Additional Magnetometer QC Checks Recommended by Norcal Geophysical	**Results**
Warm-Up	✓
Regulating	✓
Signal (both sensors)	✓
Reoccupy Test Area	✓ -25 to -30 Ω

David Ragir
Signature

3/21/08
Date

QUALITY CONTROL FOR GEOPHYSICAL INSTRUMENTS ✓ = good

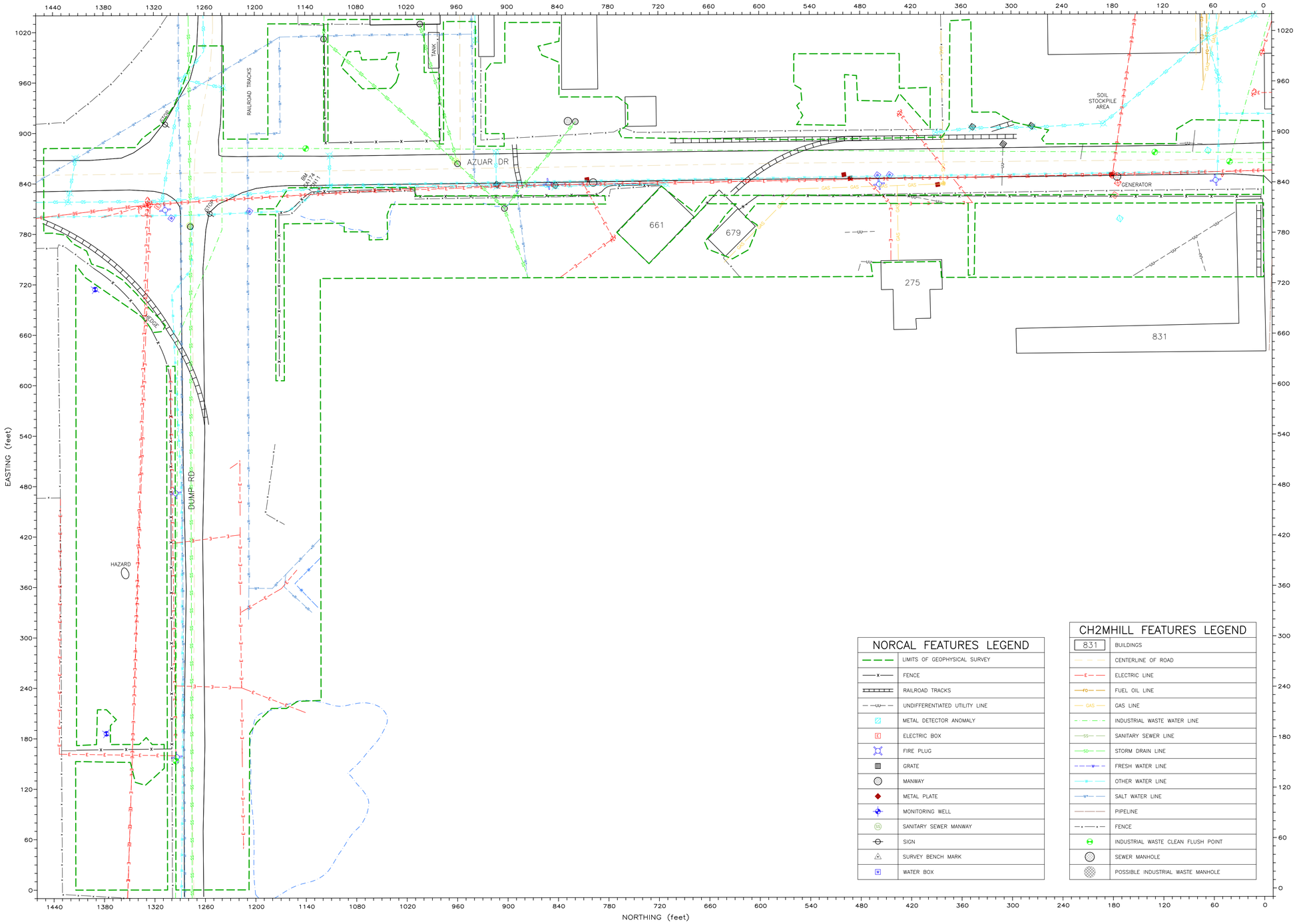
QC Requirements from Section B-4 of the Field Operating Procedure (see reverse)	Results
Equipment Warm-Up	✓
Positioning System Accuracy	✓
Personnel Test	✓
Vibration Test (Cable Shake)	N/A
Static Background and Static Spike	N/A
Repeat Data	N/A
Azimuthal Test (Magnetometer Only)	N/A
Octant Test (Heading Error Test) (Magnetometer Only)	N/A

Additional Electro Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Zero	N/A
Sensitivity	N/A
Phase	N/A
Set-Up	N/A

Additional Magnetometer QC Checks Recommended by Norcal Geophysical	Results
Warm-Up	N/A
Regulating	N/A
Signal (both sensors)	N/A
Reoccupy Test Area	N/A

David Kaye
Signature

3/24/08
Date



NORCAL FEATURES LEGEND

	LIMITS OF GEOPHYSICAL SURVEY
x	FENCE
	RAILROAD TRACKS
UU	UNDIFFERENTIATED UTILITY LINE
	METAL DETECTOR ANOMALY
E	ELECTRIC BOX
	FIRE PLUG
	GRATE
	MANWAY
	METAL PLATE
	MONITORING WELL
SS	SANITARY SEWER MANWAY
	SIGN
	SURVEY BENCH MARK
W	WATER BOX

CH2MHILL FEATURES LEGEND

831	BUILDINGS
	CENTERLINE OF ROAD
E	ELECTRIC LINE
FO	FUEL OIL LINE
GAS	GAS LINE
	INDUSTRIAL WASTE WATER LINE
SS	SANITARY SEWER LINE
SD	STORM DRAIN LINE
	FRESH WATER LINE
	OTHER WATER LINE
W	SALT WATER LINE
	PIPELINE
x	FENCE
	INDUSTRIAL WASTE CLEAN FLUSH POINT
	SEWER MANHOLE
	POSSIBLE INDUSTRIAL WASTE MANHOLE

N

SCALE
0 30 60 120
(1 inch = 60 feet)

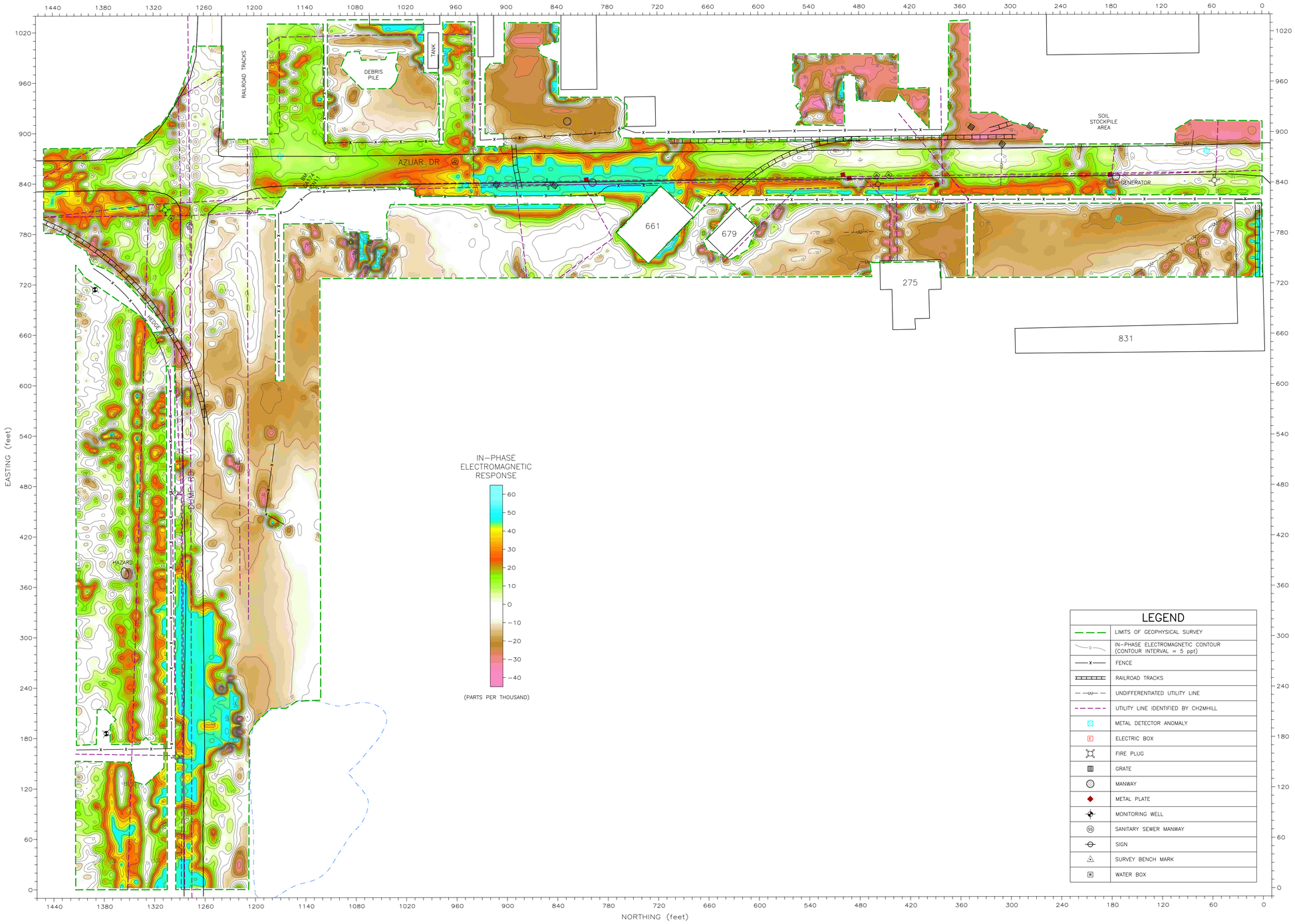
NOTE: SITE MAP CREATED FROM MAP FEATURES PROVIDED BY CH2MHILL

NORCAL

SITE MAP
GEOPHYSICAL SURVEY
MARE ISLAND

LOCATION: VALLEJO, CALIFORNIA
CLIENT: CH2MHILL
JOB #: 08-106.46
NORCAL GEOPHYSICAL CONSULTANTS INC.
DATE: MAY 2008
DRAWN BY: G.RANDALL
APPROVED BY: DTH

PLATE 1



IN-PHASE ELECTROMAGNETIC RESPONSE

60
50
40
30
20
10
0
−10
−20
−30
−40

(PARTS PER THOUSAND)

LEGEND

	LIMITS OF GEOPHYSICAL SURVEY
	IN-PHASE ELECTROMAGNETIC CONTOUR (CONTOUR INTERVAL = 5 ppt)
	FENCE
	RAILROAD TRACKS
	UNDIFFERENTIATED UTILITY LINE
	UTILITY LINE IDENTIFIED BY CH2MHILL
	METAL DETECTOR ANOMALY
E	ELECTRIC BOX
	FIRE PLUG
	GRATE
	MANWAY
	METAL PLATE
	MONITORING WELL
SS	SANITARY SEWER MANWAY
	SIGN
	SURVEY BENCH MARK
W	WATER BOX

SCALE
0 30 60 120
(1 inch = 60 feet)

NORCAL

IN-PHASE ELECTROMAGNETIC CONTOUR MAP MARE ISLAND

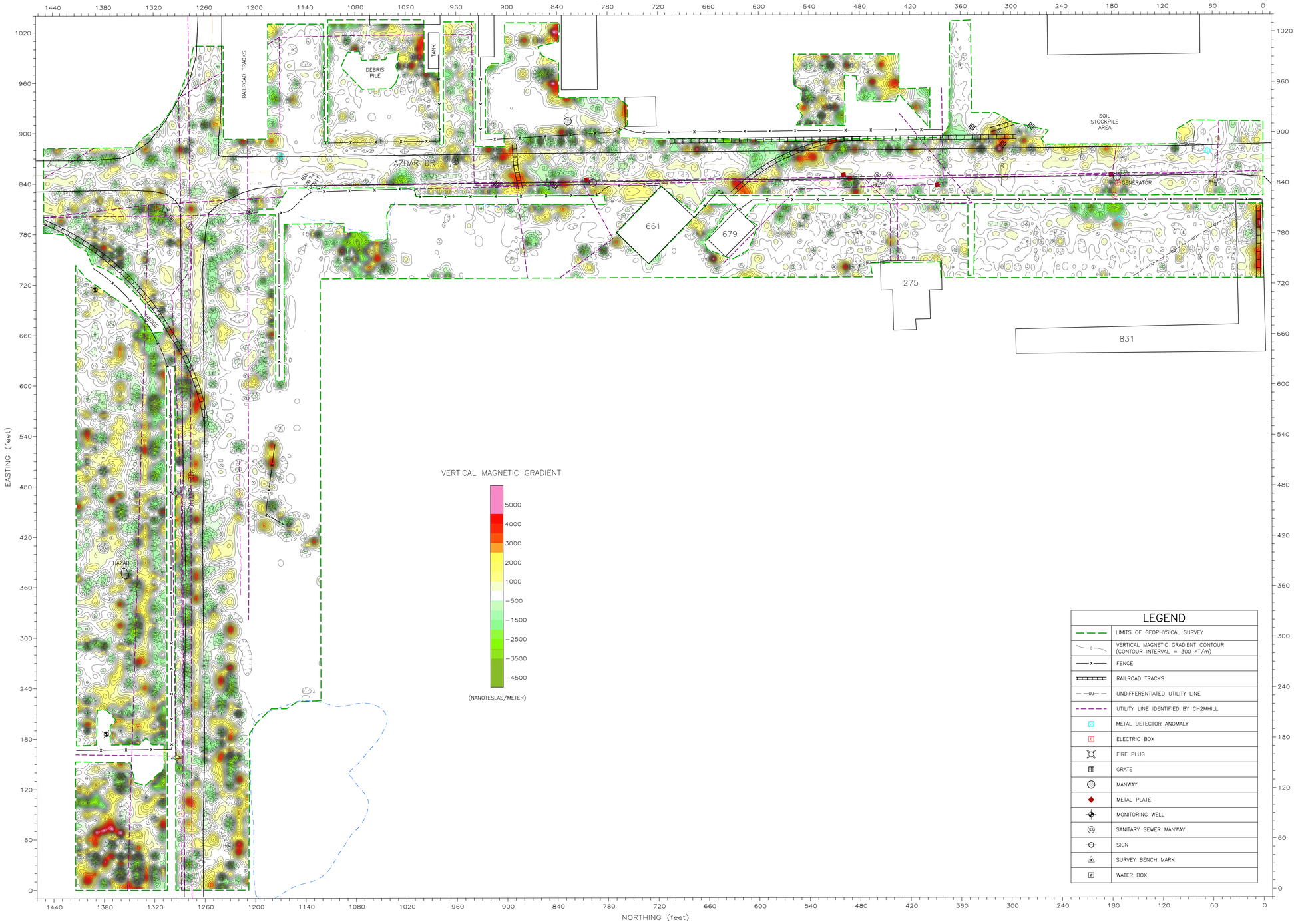
LOCATION: VALLEJO, CALIFORNIA

CLIENT: CH2MHILL

JOB #: 08-106.46 | NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: MAY 2008 | DRAWN BY: G.RANDALL | APPROVED BY: DTH

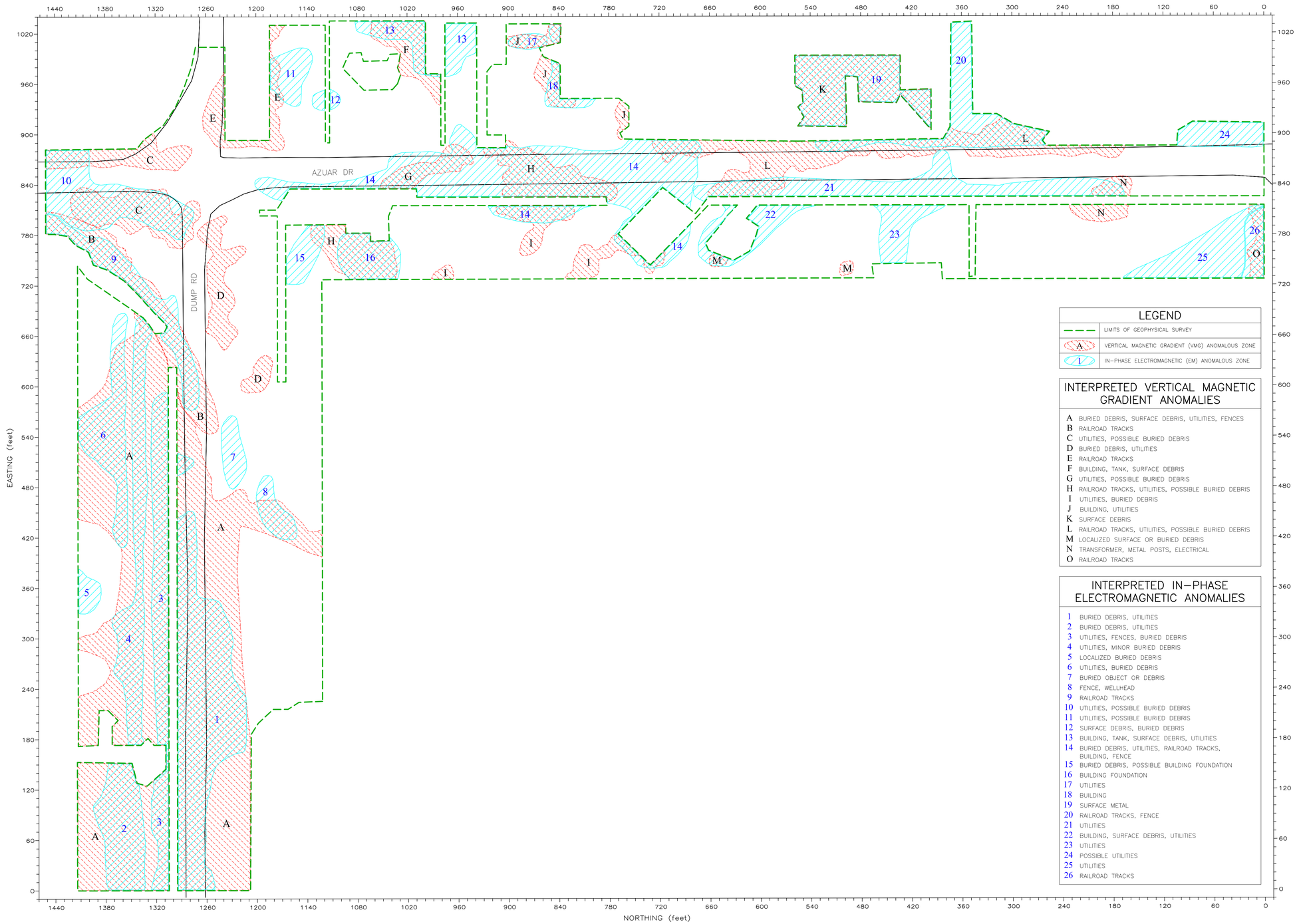
PLATE 2



VERTICAL MAGNETIC GRADIENT CONTOUR MAP MARE ISLAND

NORCAL

LOCATION: VALLEJO, CALIFORNIA		
CLIENT: CH2MHILL		PLATE 3
JOB #: 08-106.46	NORCAL GEOPHYSICAL CONSULTANTS INC.	
DATE: MAY 2008	DRAWN BY: G.RANDALL	APPROVED BY: DTH



LEGEND

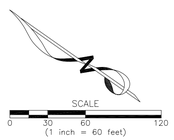
— — —	LIMITS OF GEOPHYSICAL SURVEY
A	VERTICAL MAGNETIC GRADIENT (VMG) ANOMALOUS ZONE
1	IN-PHASE ELECTROMAGNETIC (EM) ANOMALOUS ZONE

INTERPRETED VERTICAL MAGNETIC GRADIENT ANOMALIES

- A BURIED DEBRIS, SURFACE DEBRIS, UTILITIES, FENCES
- B RAILROAD TRACKS
- C UTILITIES, POSSIBLE BURIED DEBRIS
- D BURIED DEBRIS, UTILITIES
- E RAILROAD TRACKS
- F BUILDING, TANK, SURFACE DEBRIS
- G UTILITIES, POSSIBLE BURIED DEBRIS
- H RAILROAD TRACKS, UTILITIES, POSSIBLE BURIED DEBRIS
- I UTILITIES, BURIED DEBRIS
- J BUILDING, UTILITIES
- K SURFACE DEBRIS
- L RAILROAD TRACKS, UTILITIES, POSSIBLE BURIED DEBRIS
- M LOCALIZED SURFACE OR BURIED DEBRIS
- N TRANSFORMER, METAL POSTS, ELECTRICAL
- O RAILROAD TRACKS

INTERPRETED IN-PHASE ELECTROMAGNETIC ANOMALIES

1. BURIED DEBRIS, UTILITIES
2. BURIED DEBRIS, UTILITIES
3. UTILITIES, FENCES, BURIED DEBRIS
4. UTILITIES, MINOR BURIED DEBRIS
5. LOCALIZED BURIED DEBRIS
6. UTILITIES, BURIED DEBRIS
7. BURIED OBJECT OR DEBRIS
8. FENCE, WELLHEAD
9. RAILROAD TRACKS
10. UTILITIES, POSSIBLE BURIED DEBRIS
11. UTILITIES, POSSIBLE BURIED DEBRIS
12. SURFACE DEBRIS, BURIED DEBRIS
13. BUILDING, TANK, SURFACE DEBRIS, UTILITIES
14. BURIED DEBRIS, UTILITIES, RAILROAD TRACKS, BUILDING, FENCE
15. BURIED DEBRIS, POSSIBLE BUILDING FOUNDATION
16. BUILDING FOUNDATION
17. UTILITIES
18. BUILDING
19. SURFACE METAL
20. RAILROAD TRACKS, FENCE
21. UTILITIES
22. BUILDING, SURFACE DEBRIS, UTILITIES
23. UTILITIES
24. POSSIBLE UTILITIES
25. UTILITIES
26. RAILROAD TRACKS



NORCAL

ANOMALY MAP
MARE ISLAND

LOCATION: VALLEJO, CALIFORNIA
CLIENT: CH2MHILL
JOB #: 08-106.46 | NORCAL GEOPHYSICAL CONSULTANTS INC.
DATE: MAY 2008 | DRAWN BY: G.RANDALL | APPROVED BY: DTH

PLATE 4

APPENDIX H

Documentation from the 2008 Field Investigation

APPENDIX H1

Trench and Boring Logs

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	A / 3	1	1

11-4-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

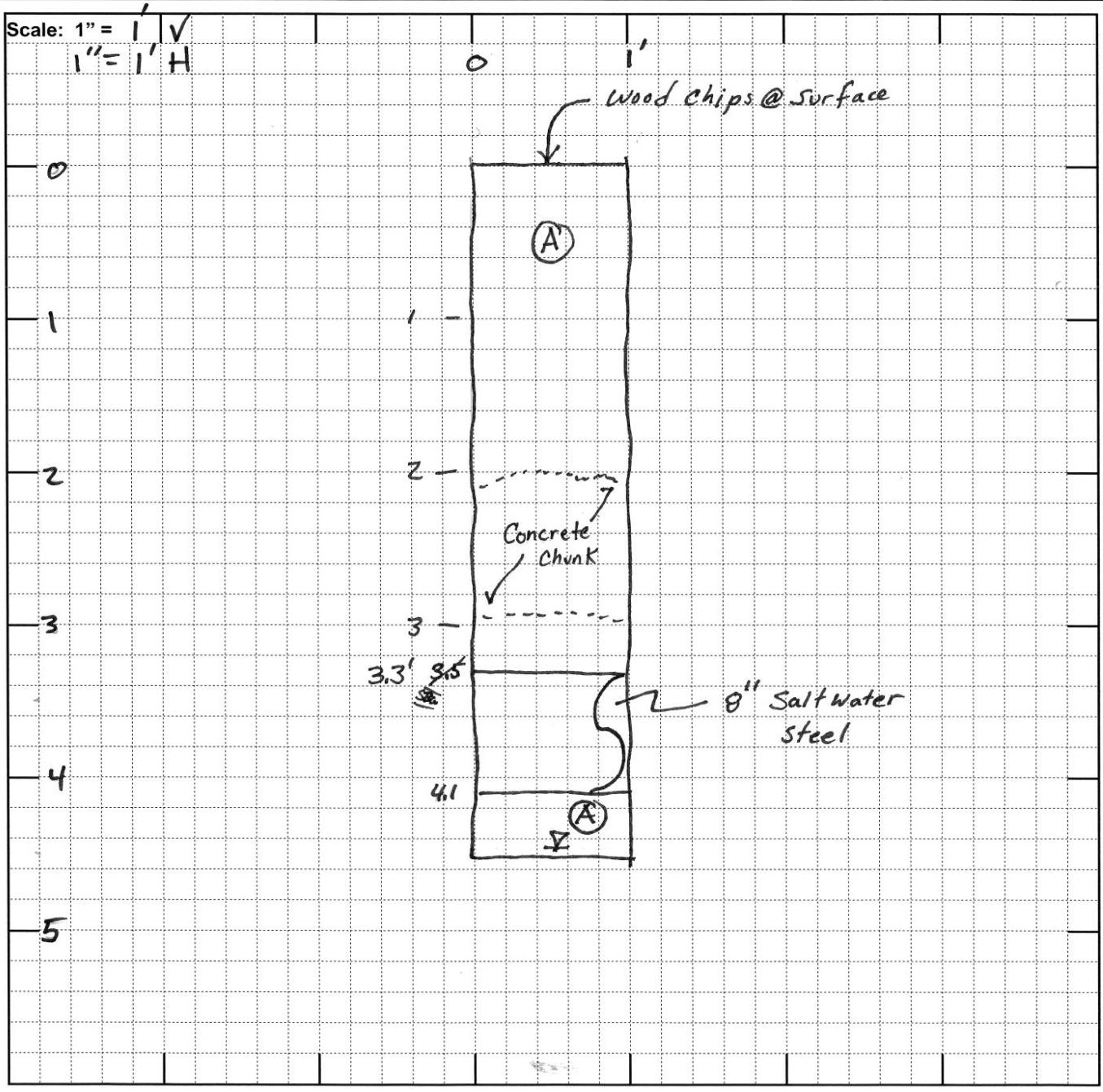
DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1340 END : 1516 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1					Silt (ML) dark gray (10YR 4/1), moist, stiff, low plasticity, 100% fines, no TPH odor, no free TPH observed.	
2				2'	CLAY (CL) v. dark greenish gray (10Y 3/1), moist, firm, med plasticity, 100% fines, Prevalent free TPH along clay fractures, TPH odor.	2' Free TPH observed
3						
4						
5						
6						
7						
7.5					Silt (ML) v. dark gray, (N3/), wet, soft, low to med plasticity, laminated w/ Peat, mica flakes, only minor occurance of free TPH along fractures, TPH odor @8.5' bgs, end of free TPH and TPH odor.	8.5' End of free TPH
8						
9						
9.9						
10				10'	Sand (SP) v. dark greenish gray (10Y 3/1), wet, loose, 95% fine Sand, 5% fines, no TPH odor, no free TPH present.	
					10' bottom of boring	

SoilBoring.xls

Trench Sidewall Record	Trench # AA /5
Contractor: Turn-Key Construction Services, Inc.	Date 10-27-08
Project No. 273939.14.01	Site
Location	Page 1 of 2
	S. Quayle
GPS Coords	
Trench View	South



Trench Sidewall Record	Trench # AA/5
Contractor: Turn-Key Construction Services, Inc.	Date
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

(A) Clayey Gravel (GC) olive brown (2.5Y 4/3) moist to wet, from 10% fine to coarse sand, 55% gravel to cobbles and debris (red yellow brick, concrete), 35% fines, no TPH odor, no free product.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	AAA / ~~2,~~ 3, 4 SBG	1	1

SOIL BORING LOG

10-28-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0.5'	hand auger				Asphalt	Hand auger to 5' bgs. - No Free Product observed.
0.5'–2'					Silt w/ gravel (ML) yellowish brown (10YR 5/6), dry to moist, no TPH odor, no free TPH observed.	
2'					CLAY (CL) V. dark greenish gray (10Y 3/1) soft, wet, med plasticity, 100% fines, no TPH odor, no free TPH observed.	
7'		3.8'/5'			@ 6.5' bgs root structures w/ reed material, mottled w/ Black (N 2.5/) surrounding reed material no TPH odor, no TPH free product observed.	
7'–10'					SILT (ML) dark greenish gray (5GY 4/1) moist, soft, low plasticity, Trace root structures and root material, no TPH odor, no TPH free product.	
10'					10' bgs bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	B/3	1	2

SOIL BORING LOG

11-4-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1200 END : 1340 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	3.5' / 5'				gravelly Silt (ML) light olive brown (2.5Y 5/3) mottled w/ yellow brown, firm to stiff, 40% fine gravel (basalt, Panoche Fm), 60% fines, No TPH odor, No free Product observed	
2						
3						
4						
4.4					weathered Asphalt fragments	
4.6						
5					Silt (ML) brownish yellow (10YR 6/1) mottled w/ yellowish brown (10YR 5/8) moist, Soft to firm, low plasticity, 90% fines 10% fine gravel (Panoche Fm), no TPH odor, NO Free TPH observed.	
6						
7	4' / 5'					
8						
9						
10						@10' Free TPH Present
10'					CLAY (CL) dark greenish gray (10Y 4/1) moist, soft, med. plasticity, 95% fines, Trace root structures and plant material, Free TPH prevalent along root structures/plant material and Clay fractures, TPH odor.	
11	3' / 5'					
12						
13						
14						

1226

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	B/3	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					14-15' root structures and free TPH decrease to only minor occurrence.	
15					15' bgs bottom of boring	Vertical extent of Free TPH Not encountered.
~~15~~ SBL						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	BBB /2,3	SHEET 1 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1420 END : 1646 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0				0.4'	Asphalt	Hand auger to 5' bgs. No TPH observed.
1					Silt (ML) V. dark greenish gray (10Y 3/1), mottled w/ black (N 2.5/) around reedy root structures / plant material (No odor / Not Free TPH). Soft, med plasticity, 95% fines, trace mica flakes, root structures w/ plant material and root structures w/ reed material. No TPH odor, no free TPH observed,	
2						
3						
4						
5	Hand auger					
6		4'/5'				
8						
9				9'		
10					Clay (CL) v. dark greenish gray (10Y 3/1), moist, Soft med plasticity, 100% fines, trace mica flakes, Root structures and fine root material, no TPH odor, No free TPH observed.	
12		3.5'/5'				
13						
14					@13.9' end of blocky fracture and end of root structures / root material No TPH odor; No TPH Free Product observed.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	BBB / 2,3	SHEET 2 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					@14.5 mottled w/ black (N 2.5/)	
15				15'	Sand (SP) gray (5Y 5/1) wet, loose, 100% fine to med sand, no TPH odor, no TPH observed, free	
16		5'/5'		16.3	wthrd Panoche Fm (Sandstone and Silt stone) - no TPH odor - no free TPH observed.	
17						
18						
19						
20				20'	20' bgs bottom of boring.	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	C / 1, 2	1	2

SOIL BORING LOG

11-4-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1100 END : 1221 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1120	0–5	3.7' / 5'			Silt w/ gravel (ML) yellowish brown (10YR 5/4), dry, firm, 80% fines, 20% fine gravel (Panoche Fm and basalt), no TPH odor, no free TPH observed	
					4.1	
1130	5–10	3.5' / 5'			Silt (ML) dark yellowish brown (10YR 3/6), dry to moist, Stiff, 95% fines, 5% fine gravel (basalt, Panoche FM), no TPH odor, No Free TPH observed.	
					8'	
					gravelly clay (CL) V. dark greyish brown (10YR 3/2) mottled w/ black, moist, firm, low plasticity, 40% fine angular gravel (basalt and sandstone) 60% fines, TPH odor, free TPH observed around gravel and along clay fracture,	
					9'	
1136	10–14	5' / 5'			CLAY (CL) v. dark greenish gray (5GY 3/1) moist, med plasticity, soft, 95% fines, Trace root structures, free TPH ~~observed~~ prevalent along fractures and along root structures / plant material TPH odor. @ 11' bgs free TPH less prevalent, continues along verticle root structures and ~~to~~ along clay fracture.	
					12.3	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	C / 1, 2	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

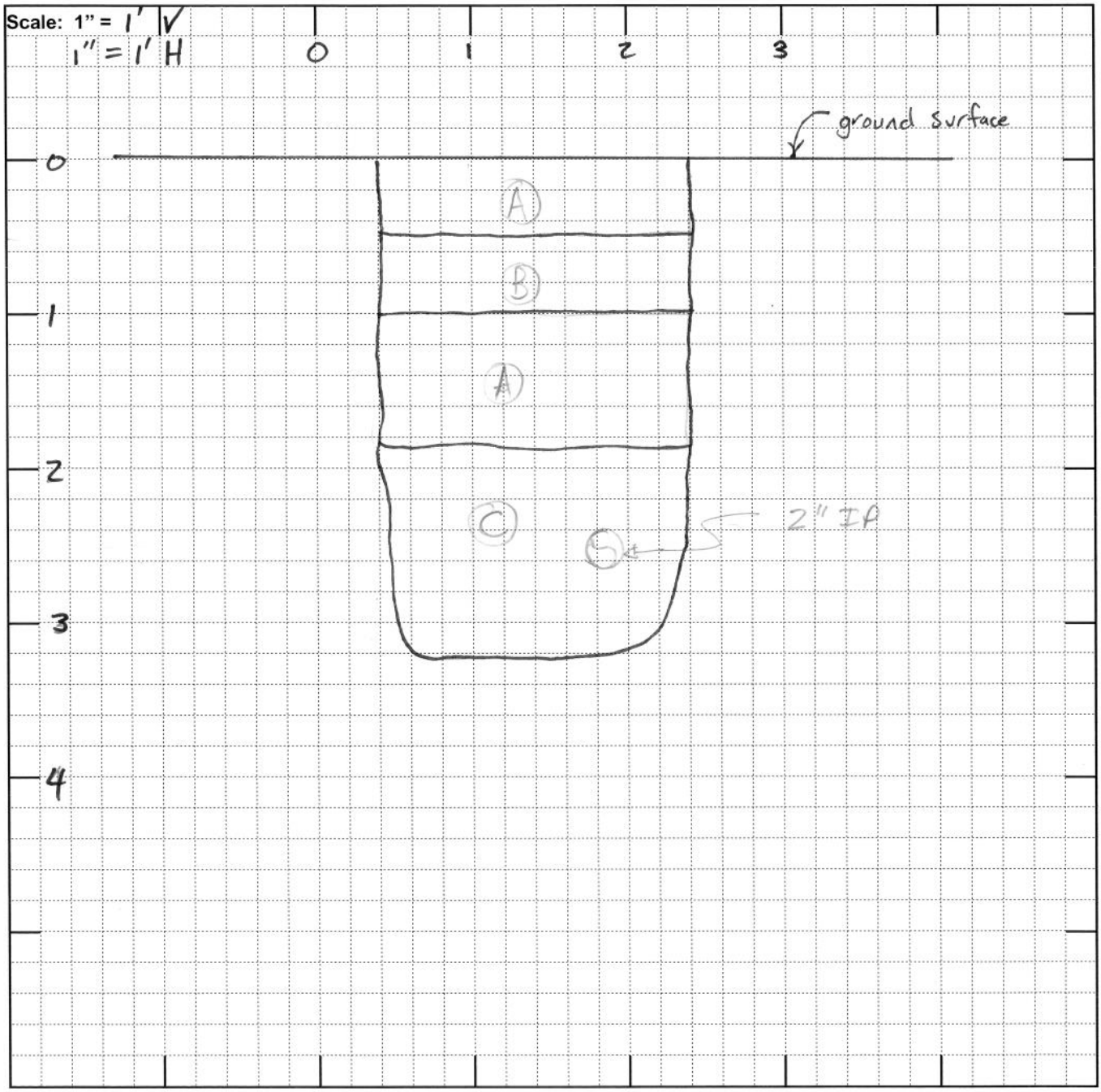
ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					@12.3 Silt (ML) V. dark greenish gray (10Y 3/1), moist, soft, low to med. plasticity, 100% fines, no TPH odor, no Free TPH observed.	Trace mica flakes
15						
16					@16.6 wet	
17		3.4' / 5'				
18						
19						
20					20' bottom of boring.	

Trench Sidewall Record	Trench # CC5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008	
Project No. 273939.14.01	Site	
Location		
GPS Coords	M. Godwin	
Trench View WEST		



Trench Sidewall Record	Trench # CC 5 Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) 0.5' AC PAVEMENT 0.35' 3/4" AC, 0.15 1/2" AC NEW PAVEMENT FROM REMOVAL OF RR TRACKS BY NORTH BAY CONSTRUCTION DATE 2006

(B) GW GRAVEL base materials brown (7.5YR 4/4) (0.4') firm, moist compacted, poorly graded med sand and clay matrix w/ basalt and clasts to 2 inches, over deeper weathered AC pavement layer

(A) AC PAVEMENT (0.8 ft) weathered old AC pavement with ang clasts to 3 inches, slight sheen, slight odor in weathered AC pavement @ 1.33 ft bgs

(C) GC clayey gravel brown (7.5YR 4/4) moist, hard to firm, clay plastic, silt stone, sandstone and basalt ang clasts, 1-2 inch thick SP coarse sand @ 2.5 ft bgs, discontinuous, not related to 2 inch pipe backfill, No permeable backfill associated with 2 inch pipe, backfill with clayey gravel fill

Top of pipe @ 2.6 ft bgs

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	CCC/2,3	SHEET 1 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : 1130 END : 1503 LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt/base rock	hand augered to 5' bgs
0.7'						No Free TPH observed.
1					Silt with gravel (ML) yellowish brown (10YR 5/6), dry to moist, no TPH odor, no free TPH observed.	
2						
3						
3'					CLAY (CH) v. dark greenish gray (10GY 3/1) mottled w/ yellow brown, moist, soft, 100% fines, sly. TPH odor, no free TPH observed,	
4						
5					Trace root structures w/ plant material, mica flakes	
6					@6' 0.2' Sand lense (SP) fine sand, olive (5Y 5/3) no TPH odor, no free product observed	
1325		4.5'/5'				
7						
7.3					Silt (ML) dark greenish gray (5GY 4/1), Soft, med plasticity, 100% fines, trace mica, high dilatancy, no TPH odor, no free TPH observed, no	
8						
8.3					Clay (CL) v. dark greenish gray (10Y 3/1) moist, soft, med plasticity, No TPH odor, no free TPH observed.	
9					@ 9.3' 0.2' Sand lense (SP) fine sand, olive (5Y 5/3) no TPH odor, No free product observed.	
9.8						
10					Wooden Block	
10'					Silty Sand (SM) v. dark greenish gray (10Y 3/1), wet, loose, 80% fine to coarse sand 20% fines, no TPH odor, no free TPH observed.	
11						
1330		4'/5'				
11.8					Clay (CL) v. dark gray (N 3/), moist, Soft, med plasticity, 95% fines, Trace mica flakes and root structures, no TPH odor, no free TPH observed,	mottled w/ black (N2.5/1) (peat?)
12						
13					@13' blocky fracture	
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	CCC /2,3	SHEET 2 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15						
16						
17	3' / 5'				17' CLAY (CH) v. dark gray (N 3/), wet, Soft, high plasticity, mica flakes, root structure, no TPH odor, No free TPH.	mottled w/ black (N 2.5/1), (laminated Peat?)
18					18.6 Silt (ML) olive (5Y 5/3), moist, Soft, low plasticity, 90% fines, 10% fine Sand, trace shells, no TPH odor, no free TPH observed.	
19					Wthrd Panoche Fm (Sand Stone Silt stone)	
20					20' 20' bgs bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	D /1,2,3	1	2

SOIL BORING LOG

10-22-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1400 END : 1550 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	hand auger				gravelly SILT (ML) brown (10YR 5/3) dry to moist, Soft, 40% fine to Coarse angular gravel, 60% fines no TPH odor, no free TPH	No Surficial Asphalt
2						
3						
4						
4.7					fine angular gravel	
5					Clay (CL) V. dark greenish gray (10Y 3/1), moist, Soft, med. plasticity, root structures, free TPH prevalent along root structures and fractures.	
6						
1505 7	3'/5'					
8						
9						
10						
11	4'/5'					
1510 12						
13					@ 13' to 13.5' only one or two root structures with FP (ie trace)	
14					@ 13.5' No free Product observed	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	D 1, 2, 3	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15						
16						
17	4'	4/5		17	Silt (ML) V. dark greenish gray (5GY 3/1) moist to wet, low plasticity, 95% fines 5% mica and shells, no free TPH, no TPH odor.	
18						
19					≈ 18.5 laminated w/ peat	
20				20	20' bottom of boring.	
22						

1515

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	DD / 3	1	1

10-24-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0820 END : 0930 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt and Road base	No Free TPH Product observed
1				1'	Silty gravel with Sand (GM) dry, loose, brown (10YR 5/3), 70% fine gravel 15% fine to coarse Sand 15% fines, Sly. TPH odor, no free TPH	
2						
3				3'	Lean clay (CL) olive gray (5Y 5/2), moist, 90% fines 10% fine Sand, trace fine gravel Sly. TPH odor, no free TPH.	
4						
5						
6						
7		2.8'/5'			SiH (ML) yellowish brown, (10YR 5/6) mottled w/ olive (5Y 5/3), moist, low plasticity, 90% fines, 10% fine Sand, No TPH odor, No Free TPH.	
8				8.3		
9					Lean CLAY (CL) dark greenish gray (5GY 4/1), moist, firm med plasticity, 95% fines, trace fine mica, trace root structures, block fracture, no TPH odor, no free TPH	
10				10'	10' bottom of boring	Backfilled w/ Neat Cement grout.

0905

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	DDD/2,3	SHEET 1 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : 0930 END : 1100 LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger →	2.8'/5'			Concrete	hand auger to 5' bgs
1'						No free TPH observed.
2					Silt w/ gravel (ML) yellowish brown (10YR 5/6), dry to moist, loose, 20% fine to coarse gravel, 5% fine sand, no TPH odor, no free product observed.	
3						
4'						
4					Silty gravel (GM) greenish gray (10GY 5/1), mottled w/ yellow brown and V. dark greenish gray, moist, loose, 75% fine to coarse gravel (Pinnacle Fm), 20% fines, trace fine to coarse gravel, no TPH odor, no free TPH observed	
5						
6						
7					wet @ 7.5' bgs	
8						
9						
10		4.5'/5'				
11						
11.2'					CLAY (CL) dark greenish gray (10Y 4/1), moist, soft, 95% fines, Trace root structures and plant material. 11.8–12 Clay, root bound, lenticular laminated Peat (black) No TPH odor, No free TPH observed.	
12						
13						
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	DDD / 2,3	2 OF 2

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.1	well graded gravel (GW) olive gray (5Y 5/2) wet, loose, 25% fine to coarse gravel, 10% fine sand, no TPH odor, no free TPH observed (Sand Fine)	<-(sand stone)
15				15'		<- observed
16		4.5'			Wthrd. Panoche Fm. alternating Sand stone Silt stone	
17		5'				
18						
19						
20				20'	20' bottom of boring	

1005

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	E / 2,3	1 OF 2

SOIL BORING LOG

10-21-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0810 END : 1000 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0					Gravelly Silt (ML) brown (10YR 4/3) dry to moist, soft, 40% fine to coarse angular gravel, 50% fines, 10% fine to coarse sand, no TPH odor	Hand auger to 4.5' bgs
2						
4						
6						
0850	2.8' / 5'					
8						
9'					Wet @ 9' bgs	
10					Well graded gravel with sand (GW) black (N 2.5/), wet, V. loose, 50% fine gravel to cobble, 20% fine to coarse sand, 30% wood fragments (@ 1/2" x 2"), Saturated w/ free TPH; Strong TPH odor.	
0855	2.9' / 5'					
12					Well graded SAND with gravel (SW) yellowish brown (10YR 5/6) wet, V. loose, < 5% fines, 40% fine to coarse gravel, 55% fine to coarse sand, Sly TPH odor, No free TPH observed.	
12.5						12.5' beginning of free TPH
12.7					Clayey Sand with gravel (SC) (10YR 3/1) V. dark greenish gray, loose, 20% fine to coarse gravel, 40% fines, 60% Sand, trace metal fragments, free TPH in cracks and surrounding gravel/sand grains,	
14						

move VP

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	E 2,3	2 OF 2

SOIL BORING LOG

10-21-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					CLAY (CL) (10Y 3/1) V. dark greenish gray, wet, soft, med plasticity, 100% fines, free TPH prevelant along fractures and rootlets, mica flakes.	
16	4' / 5'				@13.9' sly TPH odor, no root structures, no free TPH in fractures, increasing amount of mica flakes.	13.9' End free TPH
18				16.8	Silt (ML) V. dark greenish gray (5GY 3/1), wet high dilatancy, 100% fines trace mica flakes, trace shell fragments around 17', no TPH odor, no free TPH observed	
20				20	20' bottom of boring.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	EE/Z,3	SHEET 1 OF 2

10-24-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0930 END : 1035 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	Hand auger				Asphalt / Road base	Had auger to 5' bgs
1'					Silty gravel with Sand (GM) dry / loose, brown (10YR 5/3) 70% fine gravel, 15% fine to coarse sand 15% fines, Sly TPH odor, no free TPH observed	
3'					Silt (ML) light olive brown (2.5Y 5/4) mottled w/ yellowish brown (10YR 5/8), moist, low Plasticity, 90% Silt 10% fine Sand, Trace fine gravel, w/third Panoche FM, sly hydrocarbon odor,	no free TPH, @ 3.5' no TPH odor.
9.5					CLAY (CL) dark greenish gray (5GY 4/1), moist, med plasticity, 95% fines, trace mica flakes, root structures, blocky fracture, laminated peat	No TPH odor No Free TPH observed
0945	2.6'/5'				- wet @ 7'; no blocky fracture below 7'. no root structures, no laminated peat, trace shells. No free TPH observed No TPH odor	
move down Contact						
0950	5'/5'					

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	EE /23	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
				14.5	Sand (SP) trace shells	
15				14.7	Clay (CL) dark greenish gray, (5GY 4/1), moist, Soft, med plasticity, 95% fines, Trace mica flakes, Verticle root structures w/ plant material prevalent, Some laminated peat, no TPH odor, no free TPH.	
16						
17	4.2' / 5'					
18						
19						
20				20'	20' bottom of boring	Backfilled w/ Neat Cement grout.

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	EEE/2,3	1	2

27 SBA
10-24-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : 1545 END : 1720 LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	Hand Auger				Asphalt	Hand augered to 5' bgs.
0.8'						
2					Silt Sand (ML) brown (10YR 4/3), dry to moist, firm, low plasticity, 35% fine to coarse sand, 10% fine gravel, 55% fines, sly. TPH odor, no free TPH observed.	
3						
3.5'						
4						
5						
6						
7		2.3'/5'			Silt (ML) yellowish brown (10YR 5/4), moist, loose, 90% fines, 10% fine sand, no TPH odor, no free TPH	
1600						
8'						
8					Gravelly elastic Silt (MH) olive brown (2.5Y 4/3) moist, soft, low plasticity, 60% fines 30% fine to coarse gravel 10% fine to coarse sand, no TPH odor, no free TPH.	
9.2						
9.6						
9						
10						
11					Well graded Sand with gravel (SW), black (N2.5/), loose, 70% fine to coarse sand, 30% fine to coarse gravel and debris (red brick, wood fragments, no TPH odor, no free TPH observed.	sly. @ 11' First Free TPH encountered
12		3.7'/5'			Clay (CL) V. dark greenish gray, (10Y 3/1) moist, med plasticity, @ 11' Some free product along fractures.	
13						
13.5						@ 13.5' End Free TPH encountered
14					Well graded Sand with gravel (SW) – as above, No TPH odor, no Free TPH observed	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	EEE / 2,3,5 (SBA)	2	2

10-27-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

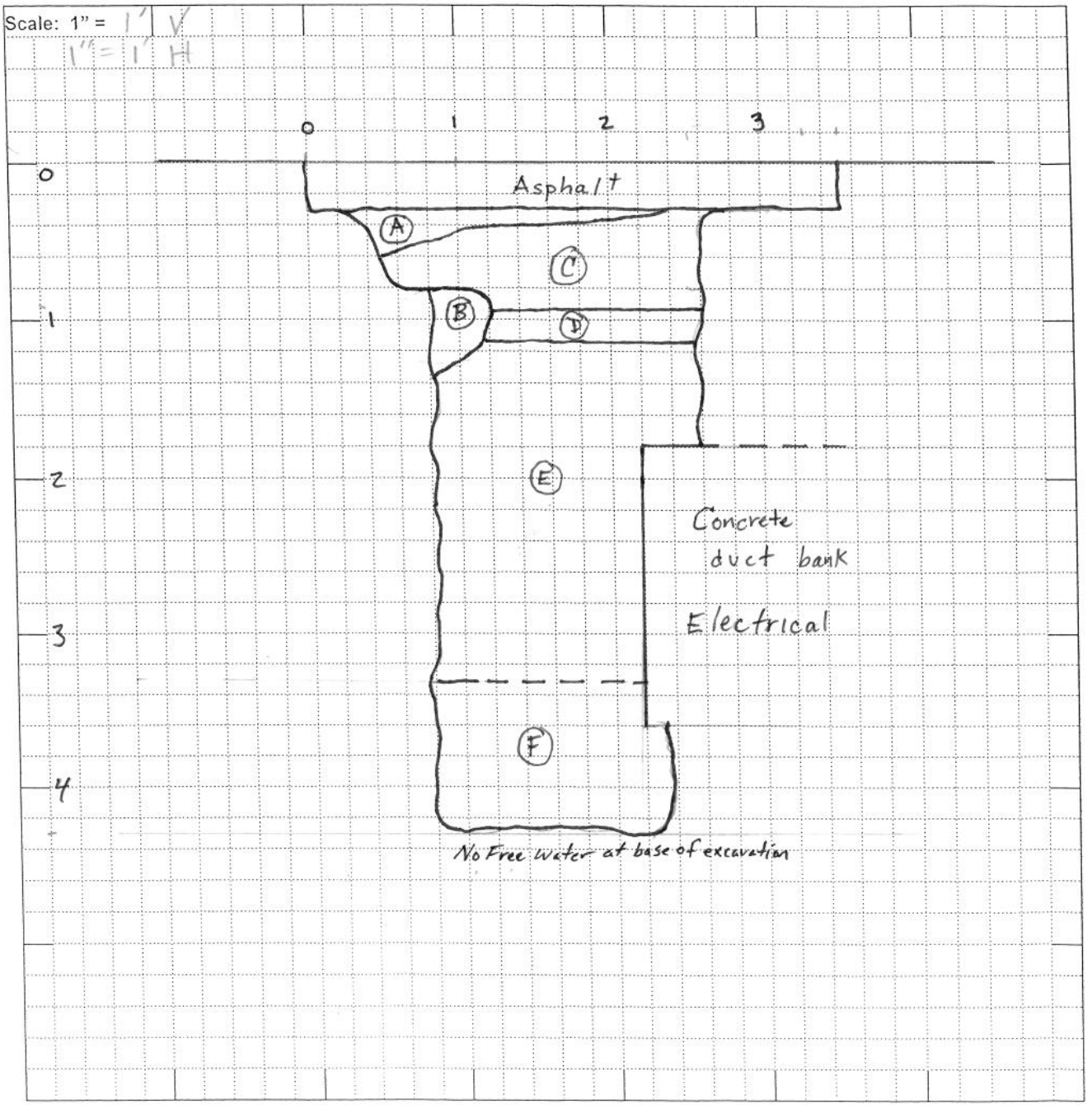
ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.1	Clay (CH) dark greenish gray (10Y 4/1), moist, soft, high plasticity, no TPH odor, no free TPH observed, some root structures.	
15						
16						
		3.7'				
17		5'				
				17.6	wthrd Panoche Fm.	
18						
19						
20				20'	20' bgs bottom of boring	

Trench Sidewall Record	Trench # EEE / 5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-29-08	
Project No. 273939.14.01	Site	
Location		
GPS Coords	S. Quayle	
Trench View North		



Trench Sidewall Record	Trench # EEE 15	Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-29-08	
Project No. 273939.14.01	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

(A) well graded gravel (GW) Road base material. Base of Contact is coarse gravel covered w/ thick shiney road oil and weathered asphalt, slt. hydrocarbon odor.

(B) Chunk of Concrete in Southern Sidewall

(C) well graded gravel w/ Sand (GW) brown (10YR 4/3) moist to wet, dense, fine to Coarse angular basalt gravel, fine to Coarse Sand, no TPH odor, no free product observed

(D) Lean Clay w/ Sand (CL) v. dark greenish gray (10Y 3/1), moist, firm, 90% fines, 10% fine to Coarse Sand, no TPH odor, no free TPH observed

(E) gravelly Silt (ML) yellow brown (10YR 5/6) mottled w/ olive (5Y 5/3), moist, stiff to stiff, low plasticity, 60% fines, 30% Coarse gravel to Cobbles (Ponoche Fm), 10% fine Sand, no TPH odor, no free TPH observed

(F) Weathered Ponoche Fm. (Silt Stone / Sandstone), No free TPH, odor, no free TPH observed.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	F /2,3	1 OF 2 1

380

SOIL BORING LOG

10-21-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

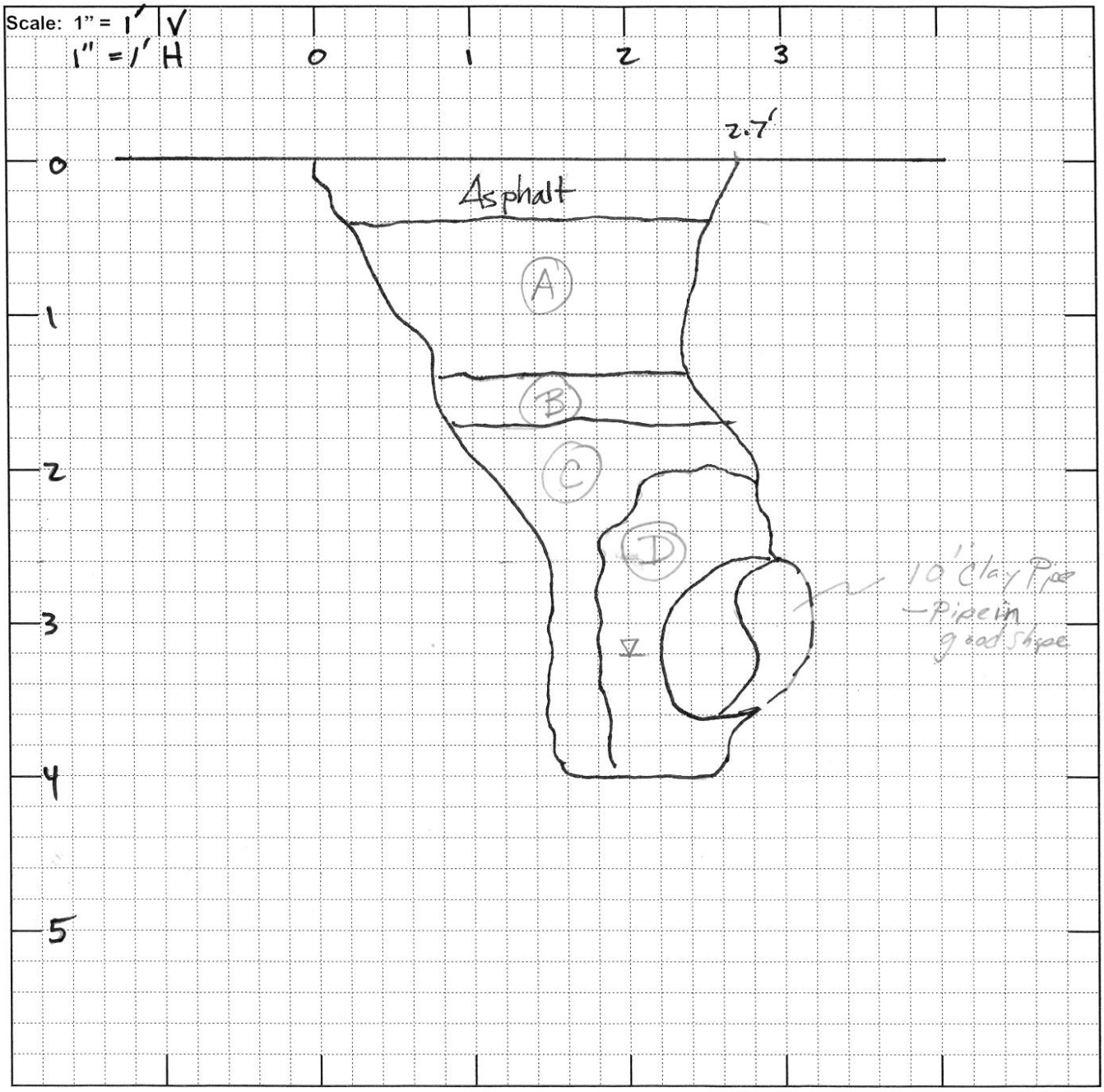
DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1000 END : 1115 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger				Silt with gravel (ML) Yellowish brown (10YR 5/4), dry, Very soft, 20% fine gravel, 70% fines, 10% fine to coarse sand, no TPH odor, no free product present.	Hand augered to 4' bgs
2				2.5'		
3					Silt (ML) olive gray (5Y 5/2) dry to moist, 100% fines, no TPH odor, no free TPH.	
4				3.5'	Silt with Sand (ML) black (N 2.5/) Soft, moist, 75% silt, 20% fine to coarse sand, 5% angular gravel, and debris (metal shards, wire, white glass), Strong TPH odor, Small amount of free product on gravel, clumps of fine root structures,	Driller noted metal debris @ 4' bgs; hand auger refusal.
5	dp w/point					
6				6.3		
7				6.5	CLAY (CL) dark greenish gray (10Y 4/1), moist, 95% fines, trace fine to coarse sand, root structures, free TPH observed along root structures & fractures.	
8					1025 Refusal @ 6.5' bgs	
9					Free TPH observed on end of Sample when removed.	
10						
11						
12						
13						
14						

SoilBoring.xls

Trench Sidewall Record	Trench # FF/5 Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-3-08
Project No. 273939.14.01	Site
Location	
GPS Coords	S. Quayle
Trench View	Northwest



Trench Sidewall Record	Trench # FF / 5 Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-3-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Clayey gravel (GC) dark greenish gray (10Y 4/1) mixed w/ olive (5Y 4/3), moist, med dense to dense, 25% clay, 65% fine to coarse gravel (basalt and red brick) 10% fine to coarse sand, no TPH odor, no free TPH observed

(B) Burned debris Cobble to sand size debris includes: (yellow brick rusted metal, melted metal, vesicular melted epoxy, metal spike) matrix is fine sand and charcoal / burned wood chips), No TPH odor, No free TPH.

(C) Silt (ML) yellow brown (10YR 5/6) moist, firm, 90% fines 10% fine sand no TPH odor, no free TPH observed

(D) Well graded gravel (GW) dark gray (N 4/), wet, loose 95% fine to coarse gravel, Trace fines. No TPH odor, no free TPH observed, ~~tan~~ water flows freely along backfill material (Permeable backfill material) groundwater

SBQ

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	FFF / 3	1	1

10-28-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0830 END : 1000 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger	1.7' / 5'			Asphalt / Base rock	Hand auger to 5' bgs
1'					Well graded Sand with gravel, (SW) brown (10YR 5/3) moist, loose, 60% Sand, 35% fine to coarse gravel, Trace fines, sly TPH odor, no free TPH observed, fine to coarse sand, angular gravel.	No free TPH observed
4'					Silt (ML) yellowish brown (10YR 5/6), moist, Soft to firm, 85% fines, 10% angular Coarse gravel (Panoche Fm) Trace fine Sand, no TPH odor, no Free TPH observed.	
9'					Well graded gravel (GW) olive gray (5Y 5/2), wet, loose, 90% fine to Coarse gravel (Sandstone) 10% fine to med Sand, no TPH odor, no Free TPH observed.	
9.4					Clayey gravel (GC) dark yellowish brown (10Y 4/4) moist, 70% rounded gravel, 20% fines 10% fine to Coarse Sand trace roots and piece of burlap, no TPH odor, no free TPH observed	
9.6					@ 9.6 color change to v. dark greenish gray (5GY 3/1) mottled w/ yellow brown, no TPH odor, no free TPH	and black (roots and Peat material) trace glass shards (white),
9.8					Clay (CL) dark greenish gray (10GY 4/1), moist, Soft, med. plasticity, no free TPH, no TPH odor.	
10.0						
12						

0900

SoilBoring.xls

10' bgs bottom of boring

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	G / 1	1 OF 1

10-21-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1125 END : 1225 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger →				Silt with gravel (ML) yellowish brown (10YR 5/4), dry, soft, 20% fine gravel, 70% fines, 10% fine to coarse sand, no TPH odor, no free TPH observed.	Hand auger to 4' bgs
3'					Silt with Sand (ML) black (N 2.5/), moist, soft, 75% silt, 20% fine to coarse sand 5% angular gravel and debris (metal shard, wire, yellow fire brick, wood fragments, strong TPH odor, no free product observed but soil is possibly stained.	
4	Push through w/ Tip					
1155	2'/5'					
8'					well graded Sand with gravel (SW) black (N 2.5/), wet, 75% fine to coarse sand, 25% gravel and debris (metal pieces, wire, red brick), Free TPH prevelant around grains.	
9.3					broken up Cobbles	
9.7					Same as above cobbles	
9.9					CLAY (CL) very dark greenish gray, wet, soft, matted layer of fine roots.	
10					10' bottom of boring	Set PVC (5' slott and 5' blank for free Product Sample).

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	GG / 1	1 OF 1

10-24-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1035 END : 1130 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt / Road base	Hand auger to 5' bgs
1				1'	Silty gravel w/ Sand, (GM), dry, loose brown (10YR 5/3), 70% fine gravel, 15% fine to Coarse Sand, 15% fines, Sly. TPH odor, no free TPH observed	
2				2.5'	Concrete	
3				3'	Silty gravel w/ sand (GM) as above	
3.5'					Silt (ML) light olive brown (2.5Y 5/4), mottled w/ yellowish brown (10YR 5/8), moist, low plasticity, 90% Silt, 10% fine Sand, trace fine gravel, w/ thin Peat Fm Sly. hydrocarbon odor, no free TPH observed.	
8.5'					CLAY (CL) V. dark greenish gray (10Y 3/1), moist, med. plasticity, 95% fines. trace root structures/ plant material blocky fracture, free TPH prevalent in blocky fractures.	
10		2.5'/5'		10'	10' bgs bottom of boring	Set temp well @ 10' bgs for free Product collection 5' screen 5' blank PVC.

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	GGG/2,3	1	2

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1015 END : 1130 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet) / INTERVAL (feet) / RECOVERY (%) / #/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
3.6'/5'		Well graded gravel w/ Sand (GW) olive (5Y 4/3) moist, loose 70% fine gravel (basalt and black asphalt chunks) 25% fine to coarse sand. Trace fines, no TPH odor, no free TPH observed	No Free TPH observed.
3.5'		Silt with Sand (ML) light olive brown (2.5Y 5/3) mottled w/ yellowish brown moist, soft, low to med plasticity, 80% fines, 15% fine to med sand, trace fine gravel (Panoche Fm) no TPH odor, no free TPH observed.	
5'/5'		Clay (CL) greenish gray (10Y 5/1) mottled w/ olive brown (2.5Y 4/4), moist, firm trace root structure/ root material, med plasticity, no TPH odor, no free TPH observed. @ 8' to 9' blocky fracture	
5'/5'		@ 10.3 to 10.3 with black roots and peat, no free TPH observed, no TPH odor.	
11.5'		Clay (CH) dark greenish gray (5G 4/1) moist, soft, high plasticity 100% fines, no TPH odor, no free TPH observed.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	GGG/2,3	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15	5'	5'		15'	Sandy Silt (ML) V. dark greenish gray (10Y 3/1), wet, soft, low plasticity, 30% fine sand, 70% fines, trace shells, no TPH odor, no free TPH observed.	
16				16.5'	Clay (CL) V. dark greenish gray (5G 3/1) wet, soft, med. plasticity, laminated peat, trace roots, no TPH odor, no TPH observed.	
15				18.4'	Sandy Silt (ML) Same as 15-16.5' no TPH odor, no free TPH observed.	
18						
17						
20				20'	20' bottom of boring	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET / OF /
273939.14.01	H /3	

11-4-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1410 END : 1550 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	5'	3.7'			Silt (ML) dark grayish brown (2.5Y 4/2) moist, firm, low to med plasticity, 95% fines, trace fine sand, no TPH odor, no free TPH observed. and	No Free TPH observed. No TPH odor.
2						root fibers
3						
4						
5						
6					@6' Soft	
7	5'	4'				
7.3'					Clay (CH) very dark gray (N 3/) wet, Soft, high plasticity, mica flakes, no TPH odor, no free TPH observed.	
9'					Silt (ML) very dark gray (N 3/) wet, soft, low plasticity, high dilatancy, trace shells and mica flakes, no TPH odor, no free TPH observed,	
10'					10' bottom of boring.	
11						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	I /3	1	2

10-22-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1600 END : 1700 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger				0.6' Asphalt	Hand auger to 5' bgs
1					Silty gravel (GM) yellowish brown (10YR 5/4) dry, loose, 25% fines, 65% fine to coarse gravel, 10% fine to coarse sand, no TPH odor, no free TPH.	
2						
3						
4					4' Lean Clay w/Sand (CL) v. dark greenish gray, moist, firm, med. plasticity, 20% fine Sand, 5% red brick fragments, 70% fines 5% fine to coarse gravel, no free TPH.	mottled w/ yellow brown (10YR 5/6)
5	DP Aquifer					
6		2' / 5'				
7						
8					8.6 Well graded gravel (GW) black (N 2.5/) moist, crushed angular fine to coarse gravel, saturated w/ free TPH,	
9					8.9	
10					10' Lean Clay w/ Sand (CL) as above Sl. TPH odor below 8.9' ; No Free TPH observed.	
11		0.5' / 5'				
12					? ? Clay (CH) V. dark greenish gray (5GY 3/1) moist SSft, Sl. TPH odor, several small occurrences of free TPH along fractures.	
13						
14						

1630

1635

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	I / 3	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

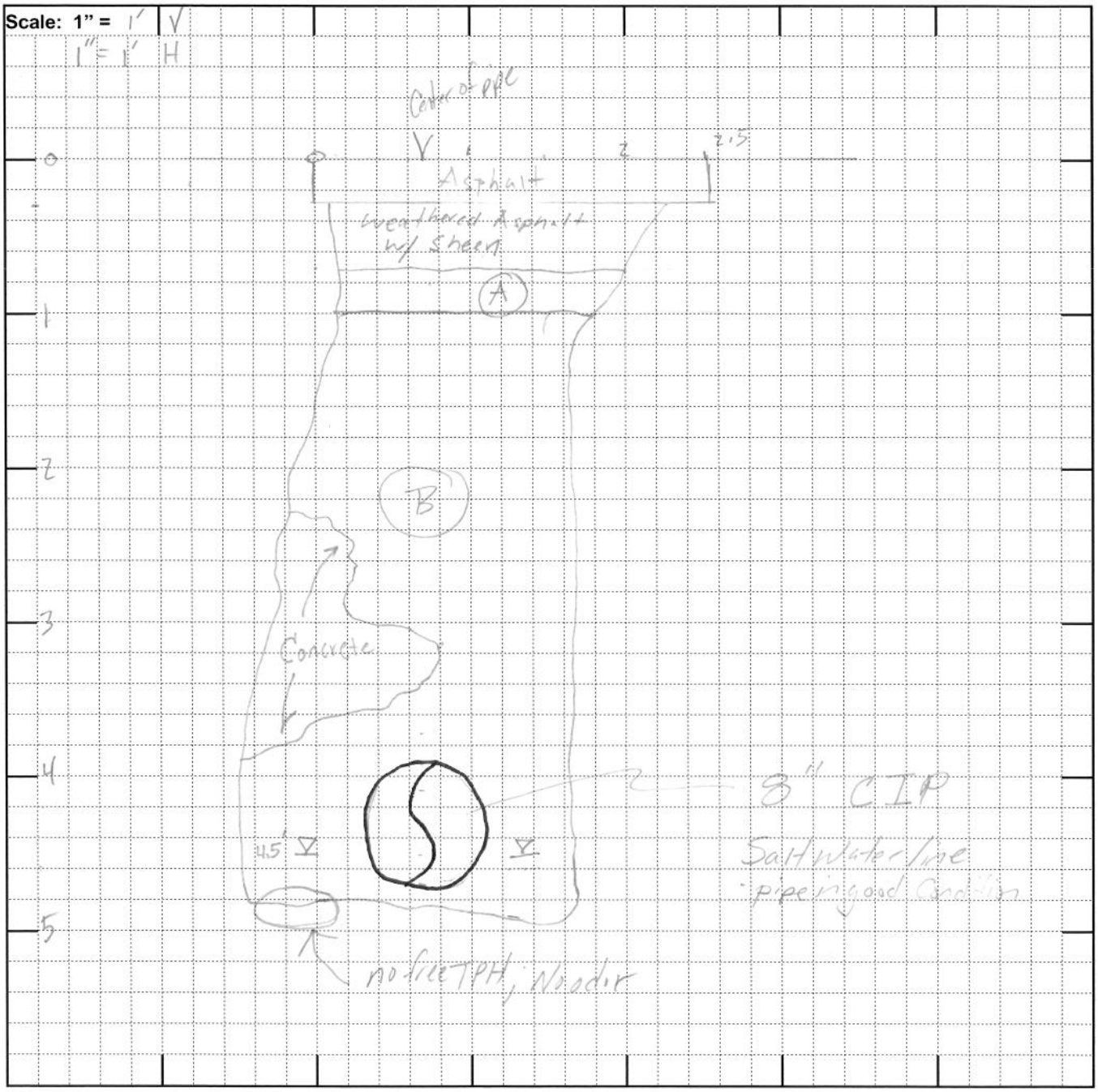
WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15					? ?	
16		1 1 / 5 1			Silt (ML) v. dark greenish gray (5GY 3/1), wet, soft, low plasticity, high dilatancy, no TPH odor, no free TPH observed	
17						
18						
19						
20				20'	20' bottom of boring	

1637

SoilBoring.xls

Trench Sidewall Record	Trench # II / 5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-3-08	
Project No. 273939.14.01	Site	
Location		
GPS Coords		
Trench View West		



Trench Sidewall Record	Trench # II/5 Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-3-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Silty Sand w/ gravel (SM) yellowish brown (10YR 5/6), moist, med. dense, 20% fines, 60% fine to Coarse Sand, 20% fine angular gravel, no TPH odor, no free TPH

(B) Clayey gravel (GC) dark greenish gray (10Y 3/1), moist, med. dense, 25% fines, 65% fine to Coarse sub angular gravel (Sand Stone, Siltstone, basalt) and debris (wood, steel, metal, wire, Concrete, asphalt), debris Covered w/ thin sheen, TPH odor (diesel?), Sheen appears to thinly cover gravel surfaces.
@ ≈ 2 bgs wood fragments (2 1-2" in length w/ Sheen, TPH odor (diesel),

@ ≈ 4.9' bgs, no sheen, no TPH odor.
(below 8" CIP; Salt water line)

-> No thick oil Free TPH observed at this location

-> No Permeable backfill.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	III/2,3	1	2

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0935 END : 1040 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0					well graded gravel w/ Sand (GW) olive (5Y 4/3) moist, loose, 70% fine gravel 25% fine to coarse Sand, 5% fines, no TPH odor, no free TPH observed.	No free TPH observed
2	4.5'	5'		2.5'		
3					Silt with Sand (ML) light olive brown (2.5Y 5/3) moist, Soft, low plasticity, 80% fines, 20% fine Sand, no TPH odor, no free TPH observed.	mottled w/ yellowish brown
4						
5				5'		
6	5'	5'			Clay (CL) dark greenish gray (10GY 4/1), moist, Soft med plasticity, 95% fines, trace root structures/root material, No TPH odor no free TPH observed.	
7						
8					@8.2 - 9' some reed material observed. Reed are black however no free TPH observed, no TPH odor.	
9						
10					below 9' blocky fracture No free TPH observed no TPH odor.	
11	4.6'	5'				
12						
13						
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	III / 2,3	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.5		
15					Sandy Silt (ML) v. dark greenish gray (10Y 3/1), wet, soft low plasticity, 30% fine Sand, 70% fines, no TPH odor, no free TPH observed.	
16	5'			16.5		
17	5'				Clay (CL) v. dark greenish gray (5G 3/1) wet, soft, med plasticity, laminated peat, trace root structures, no TPH observed, no TPH odor.	
18				18.5		
19					Sandy Silt (ML) Same as 14.5-16.5', no TPH odor, no free TPH observed.	
20				20'		
					20' bottom of boring	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	J / 1,2	1	2

SOIL BORING LOG

10-20-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model 7700

WATER LEVELS : No Measurable Water. START : 1055 END : 1300 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt/Pavement	Hand auger to 5' bgs to Confirm utility Clearance.
1.5'					1.5' gravelly SILT(ML) brown (10YR4/3), dry, angular gravel up to 1", no odor	40% gravel, 10% Sand, 50% fines
2'					CLAY(CL) dark greenish gray (10Y4/1), moist, Soft, med plasticity, 10% fine gravel, trace fine Sand, 85% fines, Sly TPH odor, No Free TPH	mottled w/ Yellowish brown (10YR5/8)
Lean					@3' wood fragments some	
4					@4.5' some black burned material, Charcoal and paper, mottled w/ Pale olive (5Y6/3) wet @ 5 bgs.	
5						
6						
1200		2'/5'				
8						
9'					Lean CLAY(CL) very dark greenish gray (10Y3/1) wet, Soft, med plasticity, 95% fine, trace shells and mica flakes, one piece of melted black glass, @9.5' bgs free TPH prevalent in Cracks and possible root structures,	
10						
1210		3.5'/5'			@12.5' root structure and Crack; free TPH prevalent.	
12					@12.5' less free TPH; only in root structures	
14					@13' root structures present, No free TPH present.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	J / 1,2	2 OF 2

SOIL BORING LOG

10-20-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14'	Poorly graded Sand (SP) greenish black (10GY 2.5/1), wet, loose, 95% fine Sand 5% or less shell and mica ~~frag~~ flakes, no free TPH, no TPH odor.	
16	5'	5'		16'	Silt (ML) very dark greenish gray (10Y 3/1), wet, 100% fines, mica flakes, laminated with root structures, no free TPH, no TPH odor.	V. dark mottled w/ brown (10YR 2/2) + Sly dilatancy
18		100%				
19				19'	Poorly graded Sand (SP) dark greenish gray (10Y 4/1) wet loose, 95% fine to med Sand, 5% fines, no free TPH	
20				19.5' 20'	Silt (ML) very dark greenish gray, soft, no free TPH, no TPH odor.	
22					20' bottom of boring	1000 No measurable water in boring Unable to Collect free TPH Sample for forensic analysis.

Free TPH observed from 9.5' bgs to 12.5' bgs.

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	JJ/2	1	2

SOIL BORING LOG

10-24-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1320 END : 1505 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay)	COMMENTS (Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.)
1	hand auger				0.5' Asphalt	Located adjacent to Trench AD-1
					0.7' Concrete	
2					Well graded gravel with Sand (GW) brown (7.5 YR 4/4), dry to moist, loose, fine to coarse sand, fine to coarse angular gravel, some angular cobbles, no TPH odor.	No free TPH observed.
3				3'		
4					Clay(CL) olive gray (5Y 4/2), mottled w/ yellowish brown (10YR 5/6), moist, med plasticity, fine no coarse sand, no TPH odor, no free TPH observed.	
5					Poor Recovery 5 – 10' bgs	
6						
7		0.1'/5'				
8						
9						
10					@ 10' CLAY (CL) olive gray (5Y 4/2) mottled w/ yellowish brown (10YR 5/6) moist, med. plasticity, some fine to coarse sand, wood fragments. (2"x2"), Sly TPH odor. no free product observed	
11						
12		0'/5'				
13						
14						

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	JJ / 2	SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					@15' metal debris (thin metal plate) covered w/ clay (CL) as above, wet. Free TPH odor, no free product observed.	
15						
16						
17	0'/5'					
18						
19					@20' metal debris, (thin metal plate covered w/ clay (CL) as above, wet. Free TPH odor. no free product observed.	
20						
21	0'/2'					
22					@22' wet clay (CL) w/ sheen, free TPH odor. No free product observed.	
					Refusal @ 22' bgs	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	JJJ/2,3	1	2

11-5-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1415 END : 1440 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0					0.2' Asphalt	
1					Well graded gravel (GW) 100% fine angular gravel (basalt).	No free TPH observed.
					1.7' Weathered Asphalt, sly TPH odor, no free TPH observed.	
2		4.5'/5'			2' Clay (CL) dark greenish gray (5G 4/1), moist, soft, med. plasticity, no TPH odor, no free TPH observed.	
3						
4						
5						
6						
7		4'/5'				
8					@7.8' trace root structures and plant material.	
9					@ 8' block fracture	
					@ 9-9.5' Some root structures and plant material including reeds, below	
10					@ 11' bgs no root structures and plant materials.	
11						
12		4.5'/5'				
13						
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	JJJ / 2,3	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.1	Sandy Silt (ML) V. dark greenish gray (5G 3/1), wet, soft, low plasticity, 40% sand, 55% fines, trace shells, no TPH odor, no free TPH observed.	
15						
16	4.5' / 5'			16.1'	Clay (CL) V. dark greenish gray (5G 3/1), wet, soft, low to med plasticity, laminated peat, no TPH odor, no free TPH observed.	
17						
18				18'	Sandy Silt (ML) V. dark greenish gray (5G 3/1) wet Same as above 14.1 to 16.1, no TPH odor, no free TPH observed.	
19						
20				20'	20' bottom of boring	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	K / 1	SHEET 1 OF 1

10-21-08 **SOIL BORING LOG**

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1400 END : 1445 LOGGER : S. Quayle

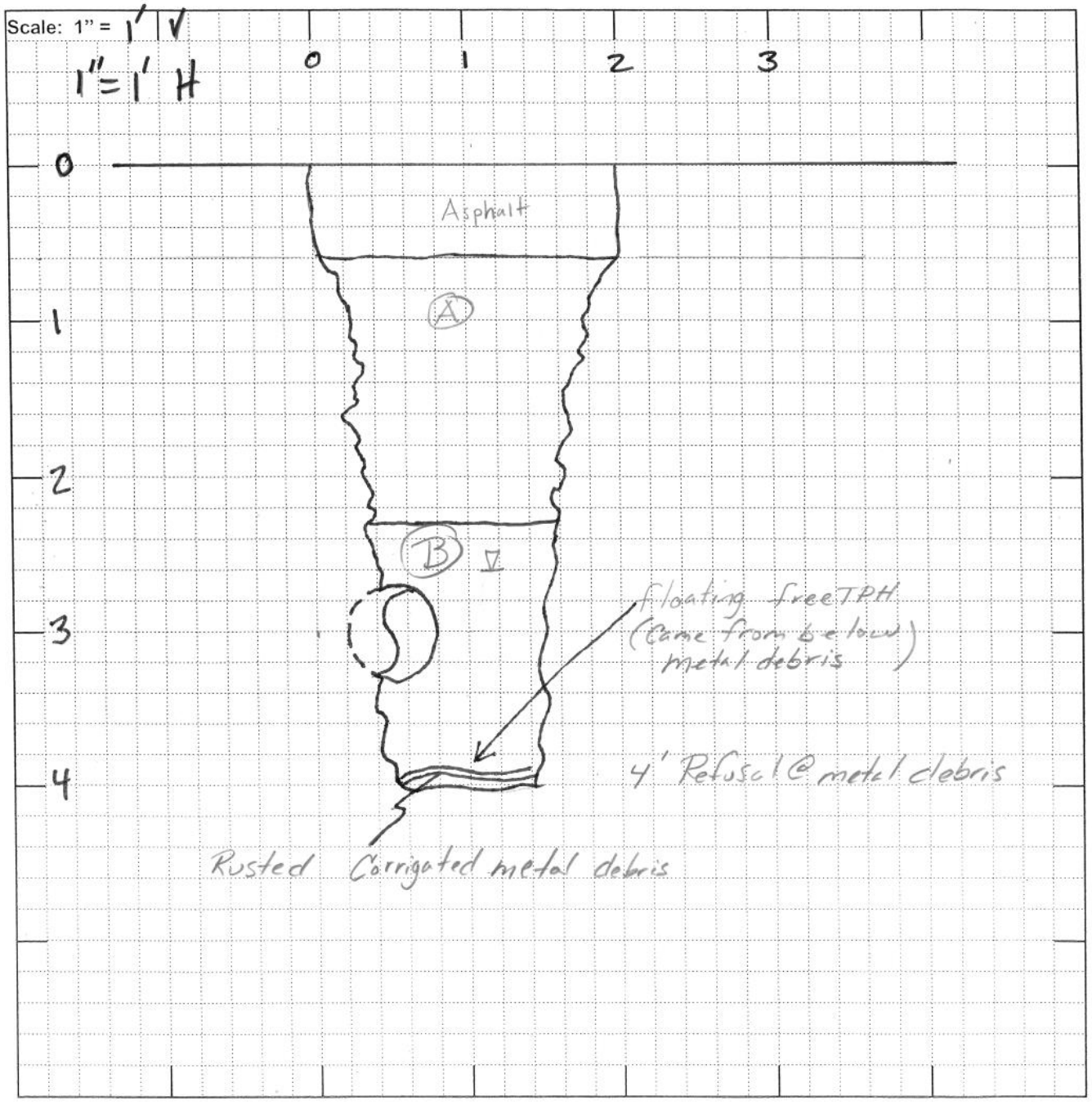
DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Handauger				Silt with gravel (ML) yellowish brown (10 YR 5/4), dry, soft, 20% fine gravel, 70% fines, 10% fine to Coarse sand, trace metal fragments, no TPH odor, no free TPH observed.	Handauger to 4' bgs
2						
3						
4	Push down w/ Tip	1.1' / 5'		4'	Silt w/ Sand (ML) black (N 2.5/), moist, soft, 75% silt, 20% fine to Coarse sand, 5% angular gravel and debris (metal Shards, wire, yellow fire brick, wood fragments, Strong TPH odor, no free Product observed, However soil is possibly Stained	
5						
6						
7						
8					— Wet @ ≈ 9' bgs	
9				8.9	9-9.4 Copper metal Fragments @ 9.8 bgs well graded sand w/gravel, (SW) olive mottled w/ red orange brown.	
10				9.8		
				10'	well graded gravel with Sand (GW) Covered w/ thick free TPH.	Set temp well @ 10' for product Sample 5' blank PVC 5' Screen
					10' bottom of boring	

1425

SoilBoring.xls

Trench Sidewall Record	Trench # KK / 5
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-08
Project No. 273939.14.01	Site
Location	
GPS Coords	S. Quayle

Trench View West



Trench Sidewall Record	Trench # KK / 5
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Well graded gravel with sand (GW) brown (7.5YR 4/3), moist, loose, 30% fine to coarse sand, 70% fine to coarse angular gravel and angular cobbles, No TPH odor, No free TPH observed.

(B) Lean clay (CL) dark greenish gray (10GY 4/1), mottled w/ yellowish brown (10YR 5/6) moist, stiff, med plasticity, 85% fines, 10% fine to coarse sand Trace fine gravel, 5% TPH odor, no free TPH observed.

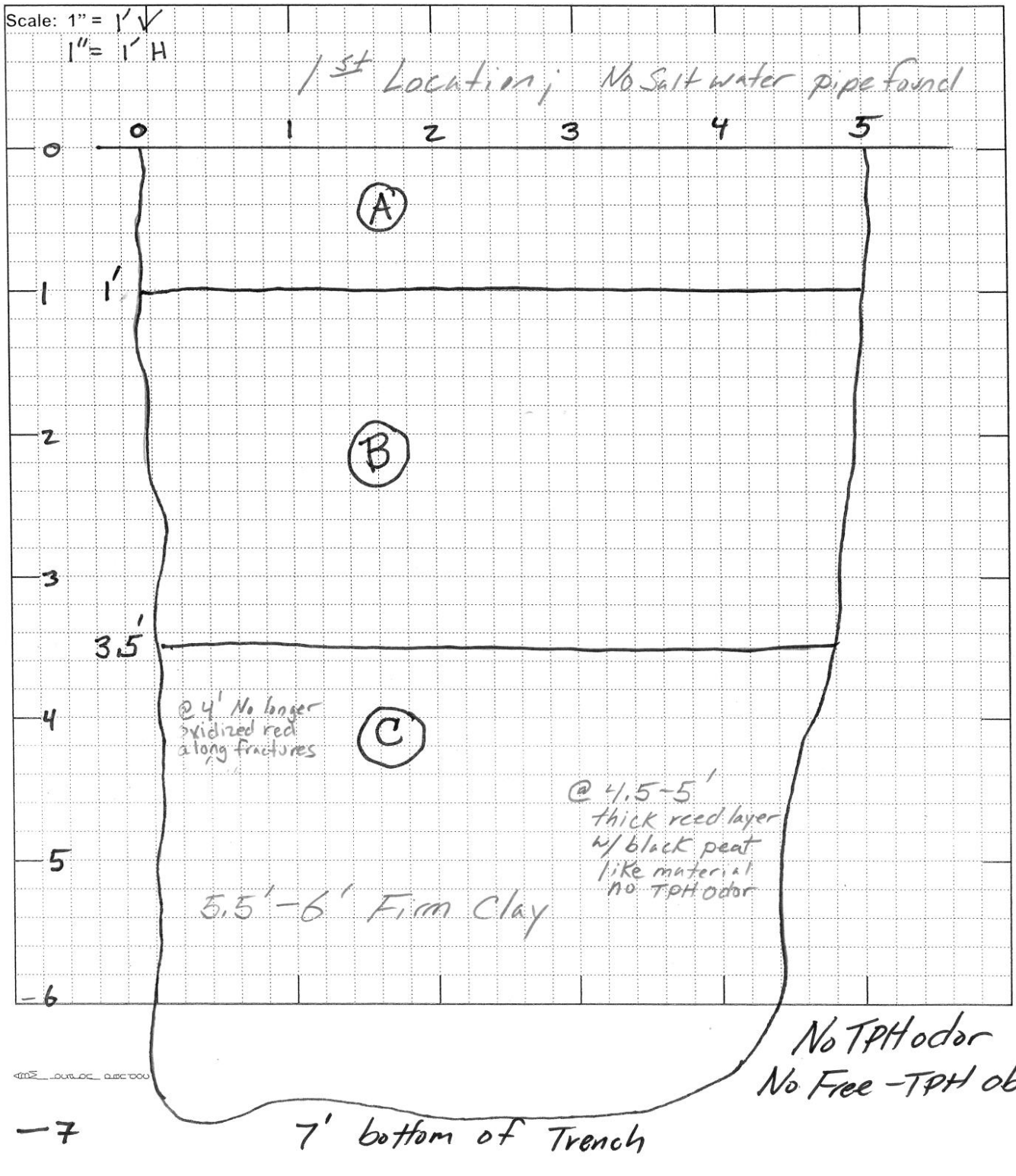
@ 4' bgs refusal on metal (rusted).

Punched through metal w/ digging bar. Water and free TPH bubbled up into Vac. boring.

Floating free TPH observed, water rose to ≈ 2.6' bgs

Viscous (Thick and black)

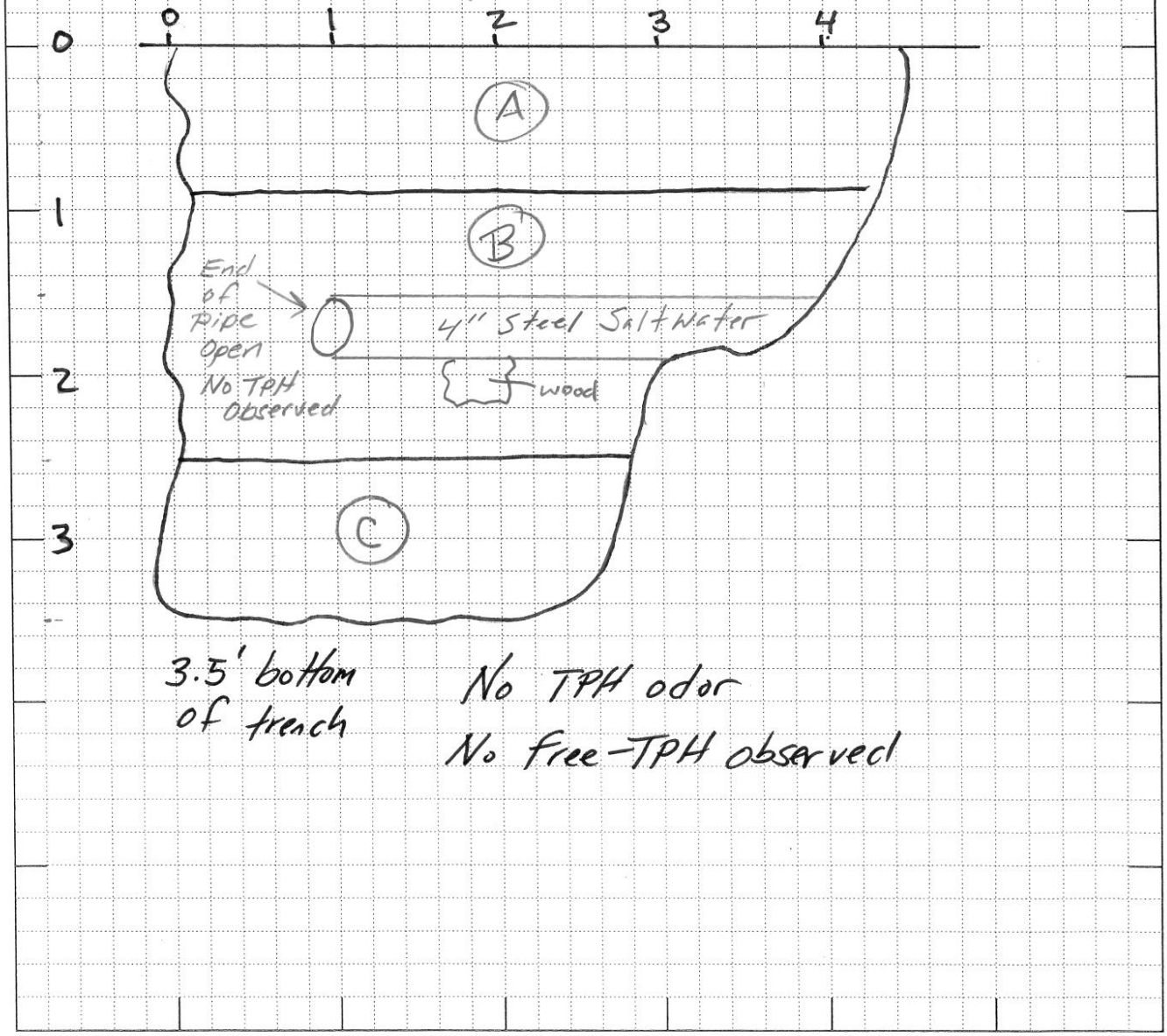
Trench Sidewall Record	Trench #	KKK / 5
Contractor: Turn-Key Construction Services, Inc.	Date	11-6-08
Project No. 273939.14.01	Site	
Location		Page 1 of 3
		S. Quayle
GPS Coords		
Trench View		Northeast



Trench Sidewall Record	Trench #	KKK /5
Contractor: Turn-Key Construction Services, Inc.	Date	
Project No. 273939.14.01	Site	Page 2 of 3
Location		
GPS Coords		
Trench View	Northeast	

Scale: 1" = 1' V
1" = 1' H

2nd Location, moved west



3.5' bottom of trench

No TPH odor
No free-TPH observed

Trench Sidewall Record	Trench # KKK /5
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-08
Project No. 273939.14.01	Site
Location	Page 3 of 3
GPS Coords	

Trench View

Scale: 1" =

(A) Lean clay with Sand (CL) v. dark grayish brown (2.5Y 3/2), moist, firm, low to med plasticity, 80% fines, 20% fine to med Sand, no TPH odor, no free TPH observed.

(B) Silt (ML) light olive brown (2.5Y 5/3) mottled w/ yellowish brown (10YR 5/6), moist, soft, low plasticity, 90% fines, 10% fine Sand, no TPH odor, no free TPH observed.

(C) Clay (CL) greenish black (10Y 2.5/1) mottled along some fractures w/ olive brown (2.5Y 4/3) Surfaces of fractures are oxidized dark reddish brown (5Y 3/4), moist, soft, med plasticity, 100% fines, no TPH odor, no free TPH observed.

description from last location 4.5 to 6.0' bgs

@ 4.5-5' bgs Thick reed layer w/ black peat material, no TPH odor, no free TPH observed.

Below 5' clay (CL) no longer mottled and oxidized. V. dark greenish gray (10Y 3/1)

@ 6' clay (CL) becomes firm

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	L/1,2	SHEET 1 OF 2

SOIL BORING LOG

10-21-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1530 END : 1710 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger				0.5' Asphalt	Located Adjacent to Former Trench DR-1
1					Well graded gravel with sand (GW) Brown (7.5YR 4/3) dry, loose, fine to Coarse Sand, fine to Coarse angular gravel, no TPH odor, No free TPH	Hand augered to 4.5' bgs
2					2' Silt (ML) olive, (5Y 4/3), moist, Soft to firm, 90% fines, 10% fine Sand, no free TPH, no TPH odor	
3						
4						
5	dp w/ tip					
6						
7		2.4'/5'				
8						
9					8.6	8.6' First Encountered free TPH. Piece of metal plate and Cobble Covered w/ Free TPH
10					8.8 Clay (CL) V. dark greenish gray (10Y 3/1), Soft, med plasticity, root structures, plant material, free TPH along root structure, plant material and fractures,	
11					11.5	
12		4'/5'			11.7 SAND (SP) (10Y 3/1) Very dark greenish gray, fine Sand, trace fine gravel, Saturated with free TPH, CLAY (CL) (N 2.5/) black to dark greenish gray (10YR 4/1) Soft, 100% fines, free TPH Prevalent along horizontal and vertical fractures, @ 12.5' End of free TPH.	@12.5 End of free TPH
13						
14						

1600

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	L /1,2	2	2

SOIL BORING LOG

10-21-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

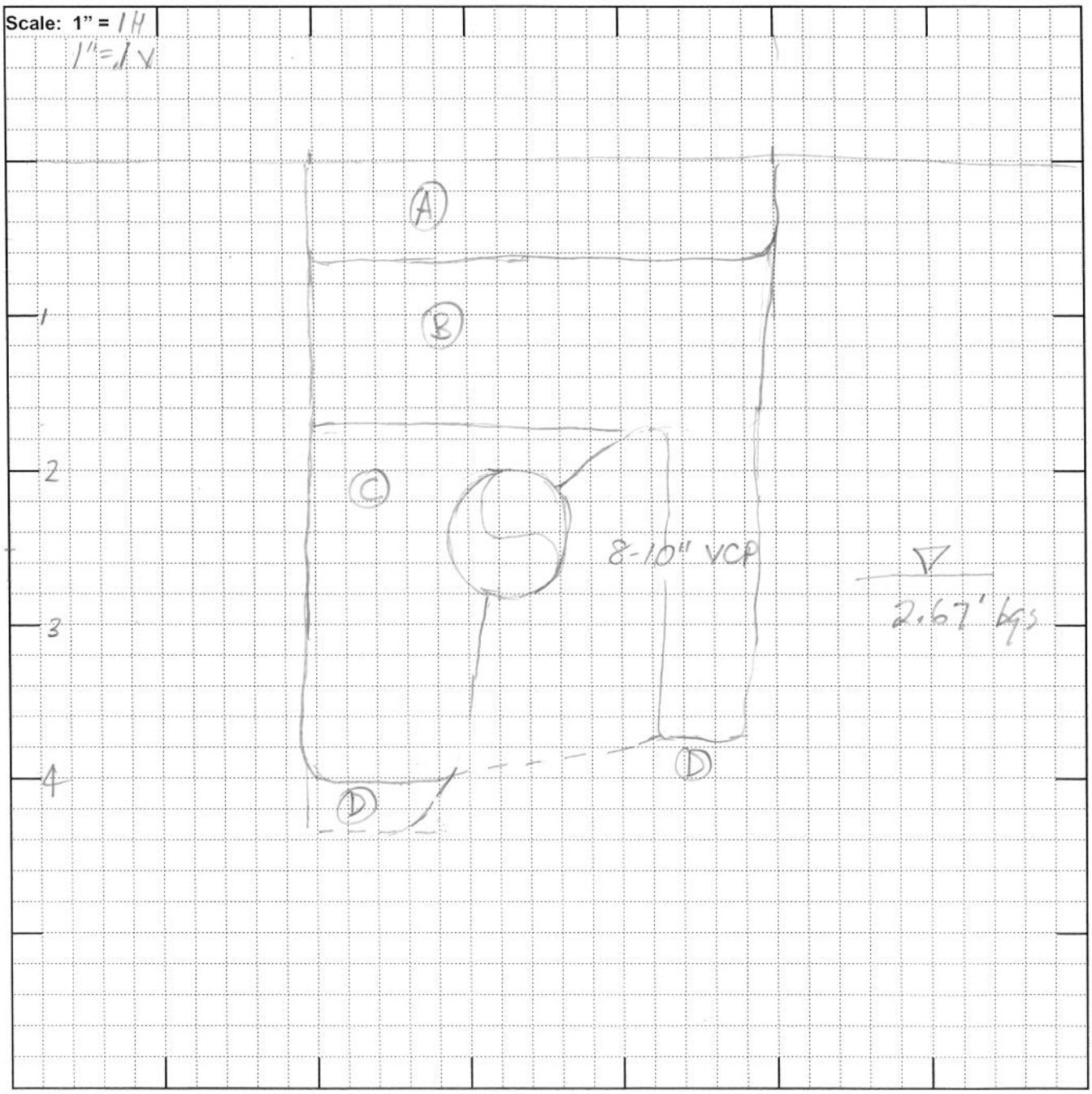
WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.5	Sand uniformly fining, some shells	Sand (SW) (5GY 2.5/1) wet, greenish black, fine to med Sand, no free TPH observed.
15				15	Clay Silt (ML) (5GY 4/1) dark greenish gray, wet, firm, high delatency, 100% fines no TPH odor, no free product	
16						
17	5'	5'			upward fining	
18					well graded Sand (SW) dark greenish gray, wet, loose, fine to coarse Sand, no free TPH	
19				19	Silt (ML) (10Y 3/1) V. dark greenish grey, ~~wet~~ moist, firm, laminated w/ Peat, mica flakes, Shell frag mats, bioturbation, no TPH odor, no free TPH	
20				20	20' bgs bottom of boring	Set PVC temp well for collection of free Product 15' slot 5' blank PVC.

1605

SoilBoring.xls

Trench Sidewall Record	Trench # LL5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/5/08	
Project No. 273939.14.01	Site DRMO, EAST OF AZUAR	
Location ~ 37' West of NW cnr Bldg 455		
		M. Godwin
GPS Coords		
Trench View SOUTH		



Trench Sidewall Record	Trench # LL5	Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/5/08	
Project No. 273939.14.01	Site DRMO, EAST OF AZUSA @ B455	
Location See pg 1		
GPS Coords		

Trench View

Scale: 1" =

(A) GRAVEL (GW) brown (10YR 4/3) wet, angular rounded clasts, 1" aggregate base material, hard, compacted sharp contact with below

(B) CLAY (CL) brown (10YR 4/3) mottled yellowish brown (10YR 5/6) moist plastic firm minor gravel clasts if Panoche ss. & s/l st, sharp contact with below. No ~~TPH~~ TPH staining, odor or free phase TPH

(C) GRAVEL (GP) dark yellowish brown (10YR 4/4) moist, hard cemented with weak concrete, gap graded sandy gravel to 1.5" clast ~~with~~ with sand

- Appears to be cement treated base material

- Water flowing into trench through cement treated base material

No staining, odor, or free phase TPH in gravel however, minor occurences of sheen on water

(D) CLAY (CL) yellowish brown (10YR 5/6), soft to firm, moist, plastic, sharp contact with above

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	LLL/2,3	1	2

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1320 END : 1537 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1					Lean Clay (CL), no TPH odor, no free TPH observed.	No Free TPH Observed.
2	5'	5'			1' well graded gravel (GW) loose, 90% fine to coarse gravel (basalt, asphalt, Panoche Fm), no TPH odor, no free TPH observed. 2'	
3					Silt w/ Sand (ML) light olive brown (2.5Y 5/3) mottled w/ yellow brown, moist, soft, low to med plasticity, 80% fine to med sand, trace fine gravel (Panoche Fm) no TPH odor, no free TPH observed.	
4					4.5	
5					Clay (CL) v. dark greenish gray (10Y 3/1), moist, soft, med plasticity, trace root structures/root material, no TPH observed, no TPH odor.	
6	5'	5'			@5.5 - 6' some reed material, no TPH odor, no free TPH observed	
7						
8					@8' begins blocky fracture no free TPH observed.	
9						
10					@10 - 10.5' root bound with reed material.	
11	5'	5'				
12						
13						
14						

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	LLL/2,3	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.5		
15					Sandy Silt (ML) V. dark greenish gray (5G 3/1), wet, soft, low plasticity, 70% fines, 30% fine Sand, Trace mica flakes, and shells, no TPH odor, no free TPH observed	
16				16.5		
17	4'/5'				Clay (CL) V. dark greenish-gray (5G 3/1) wet, soft, low to med plasticity, laminated peat, no TPH odor, no free TPH observed.	
18				18.5		
19					Silty Sand (ML) Same as above 14.5-16.5' no TPH odor, no free TPH observed.	
20				20'		
					20' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER 273939.14.01

BORING NUMBER M / 3 SHEET 1 OF 1

11-4-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1530 END : 1640 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0					Well graded Sand w/ gravel (SW) dark brown (7.5YR 3/2) mottled w/ rust, moist, loose, 70% fine to coarse Sand, 30% fine gravel, metal, roots, no TPH odor, no free TPH observed.	No Free TPH observed, No TPH odor.
1						
2	2'	2'				
3	5'					
4						
4.5					Concrete fragments angular/broken	
4.8					Silt (ML) olive brown (2.5Y 4/3) mottled w/ yellow brown, moist, soft, no TPH odor, no free TPH observed.	
5						
6						
7	3.5'	1'				
7.7	5'				CLAY (CH) dark greenish gray (10Y 4/1), moist, soft, mica flakes, high plasticity, no TPH odor, no free TPH observed	
8						
9						
9.5					Silt (ML) dark greenish gray (10YR 4/1), wet, soft, low plasticity, mica flakes, shells, no TPH odor, no free TPH observed.	
10						
10'					10' bgs bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	MM/1, 2	SHEET 1 OF 2

SOIL BORING LOG

10-24-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1115 END : 1235 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	hand auger				Asphalt / Base Rock	
1				1'	well graded gravel w/ Sand (GW) dark reddish brown (5YR 3/2), moist, loose, fine to Coarse angular gravel, fine to Coarse sand, sly. TPH odor, no free TPH observed.	
2						
3				3'	Silt (ML) greenish gray (10GY 5/1), mottled w/ very dark gray (10YR 3/1) and yellow brown (10YR 5/8), moist, low to med. plasticity, Soft, no free TPH odor, no free TPH observed,	
4						
5						
6						
7		3.5' / 5'		7'	CLAY (CL) V. dark greenish gray, (10YR 3/1) moist 100% fines, trace root structures and plant material, blocky fracture, Free TPH prevalent in block fracture and root structures. Wet @ 9'. no blocky fracture free TPH continues ~~at above~~ 9' in fractures and root structures.	
1140 8						
9						
10						
11						
1145 12		4' / 5'			Laminated Peat 12 – 12.3' bgs free TPH observed,	
13				13'	below 13' bgs No free TPH Observed, no TPH odor.	SILT (MH) dark greenish gray (10Y 4/1) wet, soft, med plasticity no free TPH observed.
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	MM1,2	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.1	Sand (SP) trace shells.	
				14.5	CLAY (CH) black (N 2.5/) moist, soft, high plasticity, no TPH odor, no TPH observed free	
16						
					@ 17' with shells % increasing w/ depth to almost entirely shells at 18.7' bgs	
18				18.7	Weathered Panoche Fm. olive mottled w/ yellow brown no TPH odor no free TPH observed	
20				20'	20' bottom of boring.	Set temp well for collection of free product 15' screen 5' blank PVC.

1150

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	MMM /2,3	1	2

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1400 END : 1620 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	3.2'/5'				Silt w/ gravel (ML) olive (5Y 5/3) and yellowish brown (10YR 5/6) soft, moist, 75% fines 25% fine to coarse gravel (Panoche Fm) no TPH odor, No free TPH present.	No free TPH observed low plasticity
2						
3						
4	1.3'/5'				well graded gravel w/ Sand (GW) V. dark gray (2.5Y 3/1) medium dense, 60% gravel (basalt, asphalt, Panoche Fm) 35% fines, coarse Sand, Trace fines, no TPH odor, no free TPH observed.	
5						
6					Clay (CL) V. dark greenish grey (10Y 3/1), moist, soft, fine root structures / root material, no TPH odor, no free TPH observed.	
7						
8						
9						
10	5'/5'				@ 10-13.5' blocky fracture no free TPH	
11					@ 10.5-11' Some reed material. No free TPH observed	
12					@ 11.8-12.1' Some reed material, No free TPH observed.	
13						
14						

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	MMA /2,3	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15				15'	Sandy silt (ML) v. dark greenish gray (5G 3/1) wet, soft, low plasticity, 70% fines 30% fine sand, trace mica flakes, no TPH odor, no free TPH observed,	trace shells
16	4.5'					
17	/ 5			17.5		
18					Clay (CL) v. dark greenish gray (5G 3/1), wet, soft, low to med plasticity, laminated pent, no TPH odor, no free TPH observed	
19						
20				20'	20' bottom of boring.	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	N / 1	1	1

SOIL BORING LOG

10-20-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1415 END : 1615 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger				Gravelly SILT (ML) brown (10YR5/3) dry to moist, loose, subrounded and angular gravel up to 2" no odor, 40% gravel, 10% fine to coarse Sand, 50% fines.	Handauger to 5' bgs No Free TPH observed.
1.5					Poorly graded SAND (SP) grayish brown (2.5Y 5/2), moist, loose, 95% Sand (fine), 5% fines, no tpH odor.	
2.5					CLAY (CL) very dark greenish gray (5GY 3/1) moist, 95% fines, 5% fine Sand, no TPH odor	
2.7					SILT with gravel (ML) black (N 2.5/1), moist, 20% fine to coarse gravel, 10% fine Sand 70% fines, Some areas have almost 50% wood chips/fragments replacing the fines, trace to some nails, copper pieces, white glass, Soft, Sly. TPH odor, no free tPH	
10'					Same as above, No wood fragments Sly TPH odor, no free TPH	1600 Set PVC temp well 5' blank and 5' screen Will Leave temp well overnight. will attempt to collect free TPH Sample for forensic analysis tomorrow.
					10' bottom of boring	

1530

1 11/3'

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	NN / 1,2,3	SHEET 1 OF 2

SOIL BORING LOG

10-27-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : 1000 END : 1120 LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	hand auger				1' Asphalt	
2					Well graded gravel with Sand (GW) dark reddish brown, (5YR 3/2), moist, loose, fine to coarse Sand, no TPH odor, no free TPH observed	
2.5'					Silt (ML) olive (5Y 5/4) mottled w/ yellowish brown, (10YR 5/8) and dark greenish gray (5GY 4/1), moist, soft, low to med plasticity, no free TPH observed.	
4					CLAY (CL) greenish gray (10Y 5/1), moist, firm, blocky fracture, med plasticity, TPH odor, no free TPH.	
5						
6						
1015 7	2'/5'					
8					@ 9' bgs beginning of free TPH observed. Prevalent along blocky fracture.	
9						
10						
11	4.4'/5'				@ 11.4-11.6 root structures; Free TPH Prevalent along root structures @ 11.6 end of black fracture. @12.5'-13.5' only slight trace of free TPH.	
12						
13						
13.5'						
14					silty Sand (SM) greenish gray (10YR 5/1) wet, 70% fine Sand, 30% fines, no TPH odor, no free TPH.	some shells, limited Peat
14'						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	NN /1,2,3	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER : S. Qvayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					Sand (SP) greenish gray (5GY 5/1), wet, loose, 90% fine sand 10% fines, no TPH odor, no free TPH	
15				15		
					Silt (ML) dark greenish gray (5GY 4/1), moist, soft, low plasticity, 90% fines, 10% fine sand, no TPH odor, no free TPH	
16				16		
					w/thin Pancake Fm. no TPH odor, no TPH free product.	
17	4.9' / 5'					
18						
19						
20				20		
					20' bottom of boring	Set temp well to collect free TPH 15' screen 5' blank PVC.

1025

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	NNN /4	SHEET 1 OF 1

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1145 END : 1345 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	4.5'	4.5/5			Lean clay w/ Sand (CL) olive brown (2.5Y 4/3) mottled w/ yellow brown (10YR 5/6), moist, firm, low plasticity, 75% fines, 20% fine to coarse Sand, 5% fine gravel (Panoche FM) no TPH odor, no free TPH observed.	No Free TPH Product observed.
2						
2.5'						
3					Broken chunks of Sand Stone olive (5Y 5/3) and yellowish brown weathered Panoche FM, no TPH odor, no free TPH observed.	
3.3'						
4					Clay (CH) black (N 2.5/) moist Soft, high plasticity, No TPH odor, no TPH observed free	
4.5'						
5	4'	4/5'			Clay (CL) very dark gray (N 3/) mottled w/ Peat black (N 2.5/), moist, soft, low to med plasticity, some laminated peat and roots, no TPH odor no free TPH observed. @6' reed material black, however, no TPH odor, no free product observed. @7' to 10' blocky fracture no TPH odor, no free product observed.	
6						
7						
8						
9						
10						
10'					10' bgs bottom of boring.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	01	1	1

SOIL BORING LOG

10-22-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0745 END : 0830 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger →				Silt (ML) yellowish brown (10YR 5/6) moist, soft, low plasticity, 95% fines 5% fine gravel and fine to coarse sand, no TPH odor, no free TPH.	Hand auger to 5' bgs on 10/21.
1						
2						
3						
4						
5						Poor recovery from 5 to 10' bgs
6						
7						
0805		6.6'/5'				
8						
9					wet @ 9.4 ; No free TPH	
9.5					Clayey gravel (GC) black (N2.5/),	
10					wet, loose, 25% fines, 75% fine gravel, trace (<1") small flat metal debris, Subrounded gravel, gravel Saturated w/ free product, free TPH present in fractures of Clay material,	Set temp well for collection of free TPH 5' Screen 5' blank PVC.
10'					10' bottom of boring	

SoilBoring.xls

SB01

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	00/1	1	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0920 END : 1030 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger	3.7'/5'			Sandy Silt w/gravel (ML) brown (10YR 5/3), dry to moist, Soft, 20% fine gravel, 25% fine Sand, 55% fines, no TPH odor, no free TPH observed.	Hand auger to 5' bgs
2.5					Silt (ML) olive gray (5Y 5/2), moist, Soft 90% fines, 10% fine Sand no TPH odor, no free TPH observed:	mottled w/ yellowish brown (10YR 5/6)
8					Clay (CL) dark greenish gray (10Y 4/1), moist, Soft, med Plasticity, root structures, 8-8.5 root bound; prevalent free TPH in fractures and along roots. Present but less frequent below 8.5'	
9.7					Silt (ML) (5GY 4/1), wet, Soft, low plasticity, mica flakes, high dilatancy, no free TPH observed, no TPH odor	
10'					10' bottom of boring	Set temp well 5' Screen, 5' blank, -unable to collect free product Sample

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	00/1	2	2

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0830 END : 0845 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
10					Clay (CL) dark greenish gray (10Y 4/1), moist, soft, med. plasticity, Trace root stresses/ root materials, no TPH odor, no free TPH observed.	
11	5'	5'				
12					@ 11.7–12' reeds observed, (black color) no TPH odor, no free TPH observed.	
13						
14					@ 14–15' laminated peat (black) No TPH odor, no free TPH observed.	
15	2'	2'				
16				16'	Weathered Panoche FM (Sandstone/ Silt stone) No TPH odor.	
17				17'	Refusal @ 17' bgs	Temp well PVC set to 17' bgs for collection of free Product 15' Screen 5' blank.
2						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	000/2,3	SHEET 1 OF 2

11-5-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1128 END : ~~1421~~ 1412 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1–5	3' / 5'				Sandy Silt (ML) light olive brown (2.5Y 5/4), moist, 40% fine Sand, 55% silt, trace fine gravel (Panoche Fm), no TPH odor, no free TPH observed.	No Free TPH Observed
5.8'						
6–10	4.2' / 5'				Clay (CL) v. dark greenish gray (5G 3/1) moist, Soft, med plasticity, trace root structures/plant material, no TPH odor, no free TPH observed. @ 6.5-7' root bound w/ roots and reed material no TPH odor, NO TPH observed below 7' trace root structures continue.	
10–13	4.3' / 5'					
13.2					Sandy Silt (ML) v. dark greenish gray (10GY 3/1), wet, Silt, low plasticity, 40% Sand, 50% fines, trace shells, no TPH odor, no free TPH observed.	
14						

CH2MHILL

PROJECT NUMBER	BORING NUMBER
273939.14.01	000/2,3 SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

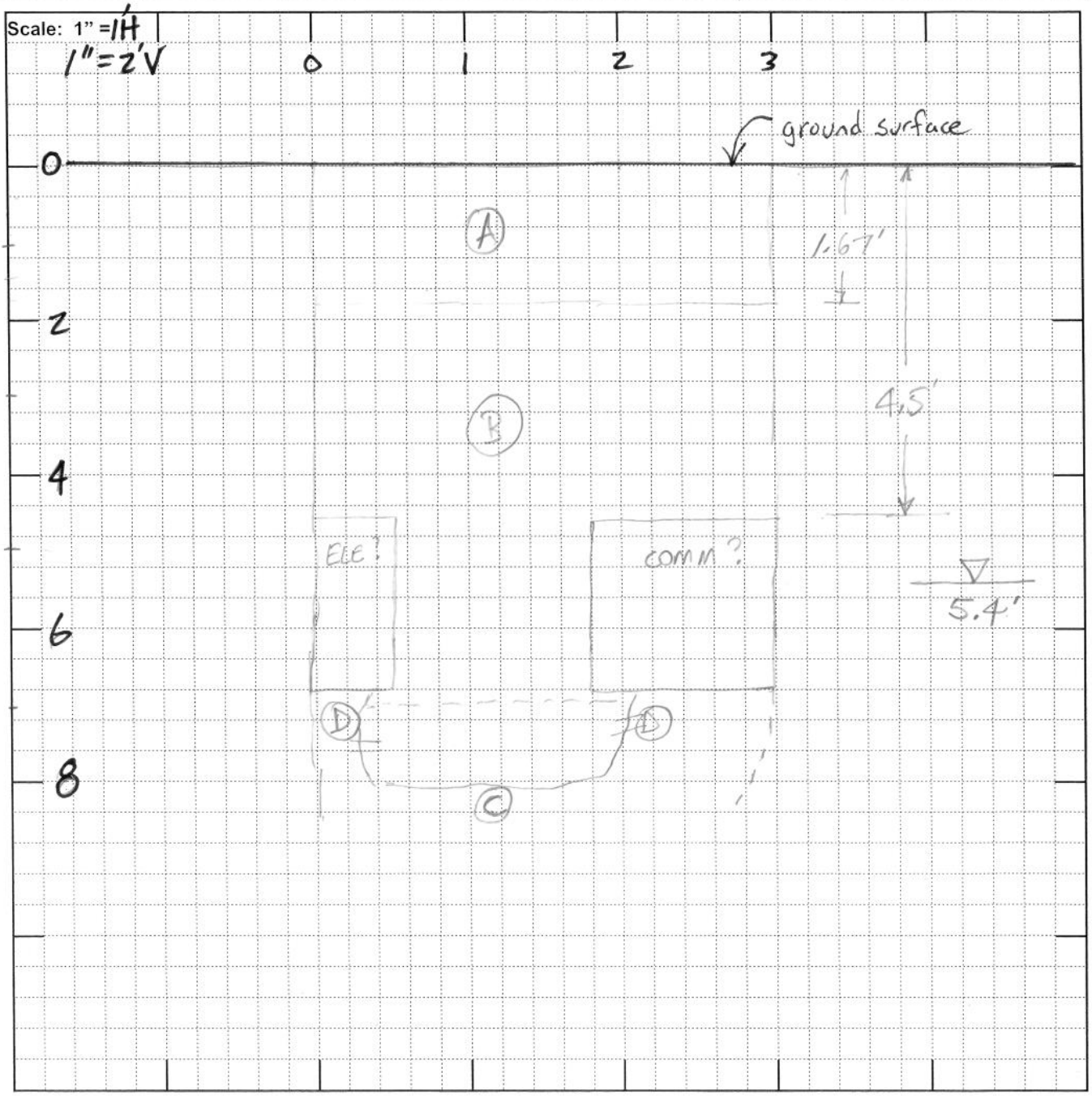
ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.2	Clay (CL) V. dark greenish gray (5G 3/1) moist, soft, med plasticity, Some vertical root structures and plant material, no TPH odor, no TPH observed	
15						
16					@16' laminated peat, no root structures,	
17	4'/5'			17.4		
				17.7	Shells w/ Sand, wet	
18					Clay (CL) V. dark greenish gray (5G 3/1) moist, soft, med plasticity, laminated Peat, NO TPH, NO Free TPH observed, and vertical root structures with plant materials,	
19						
20				20'	20' bottom of boring	

Trench Sidewall Record	Trench # P/5 Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/5/08
Project No. 273939.14.01	Site ~~BR~~ CTA. NORTH of DUMPRD
Location TRENCH ~12 ft WEST OF ABANDONED BURIED ELECTRICAL & COMMUNICATION VAULTS, center of south leg of CTA	
	M. Godwin
GPS Coords	
Trench View EAST	



Trench Sidewall Record	Trench # P/5 Pg 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/5/08
Project No. 273939.14.01	Site DRMO-CTA
Location TRENCH 12FT WEST OF ABANDONED, DAMAGED ELECTRICAL & COMMUNICATIONS VAULTS, CENTER OF SOUTH LEG OF CTA	
GPS Coords	

Trench View

Scale: 1" =

(A) GRAVEL (GW) olive brown (2.5Y 4/3) wet, dense, to loose, mod. clasts to 1" ind., recycled base material or concrete.

(B) GRAVELLY CLAY (GC) yellowish brown (10YR 5/4) firm moist, small gravel constits and clasts of Panoche Fm. s.s. & slst plastic clay matrix mottled white, yellow, red, no TPH in clay

(C) GRAVEL (GP) gray to yellowish brown large angular clast (≤ 6 inches) Panoche fm. begins under ± concrete utility corridors, depth of gravel bed material not found, no gravelly or permeable material on top of utility corridors

(D) TPH, thick viscous free phase TPH oozing into vac boring from below concrete utility corridor predominantly seeping out from northerly utility corridor

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	PP /1,2	SHEET 1 OF 2

10-23-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0820 END : 0945 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger →				Asphalt	Hand auger to 5' bgs
0.5					Sandy Silt with gravel (ML) brown, (10YR 5/3) moist, soft, 20% fine gravel, 25% fine Sand, 55% fines, no TPH odor, No free TPH observed	
2					Gravelly Silt (ML) dark greenish gray (10GY 4/1) mottled w/ yellow brown moist Soft, med plasticity, 40% fine to coarse gravel, 60% fines, no TPH odor, no free TPH.	
5						
0850		2.5'/5'			Wet @ ≈ 8'	
9.4					CLAY (CL) dark greenish gray (10Y 4/1), moist, Soft, med plasticity, wood fragments thin root fibers free TPH Prevelant along fractures, root Structures and surrounding wood fragments, 11–12' blocky fracture, free TPH observed along blocky fracture and root structures	@ 9.4 1st observation of free product
0857		4.3'/5'				
13.3					@ 12.5' No Free TPH observed	@ 12.5' End of free TPH observed
14					well graded — Sand (SP) olive, (5Y 5/3) moist, dense, 95% Sand 5% fines, no free TPH no TPH odor.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	PP /1,2	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

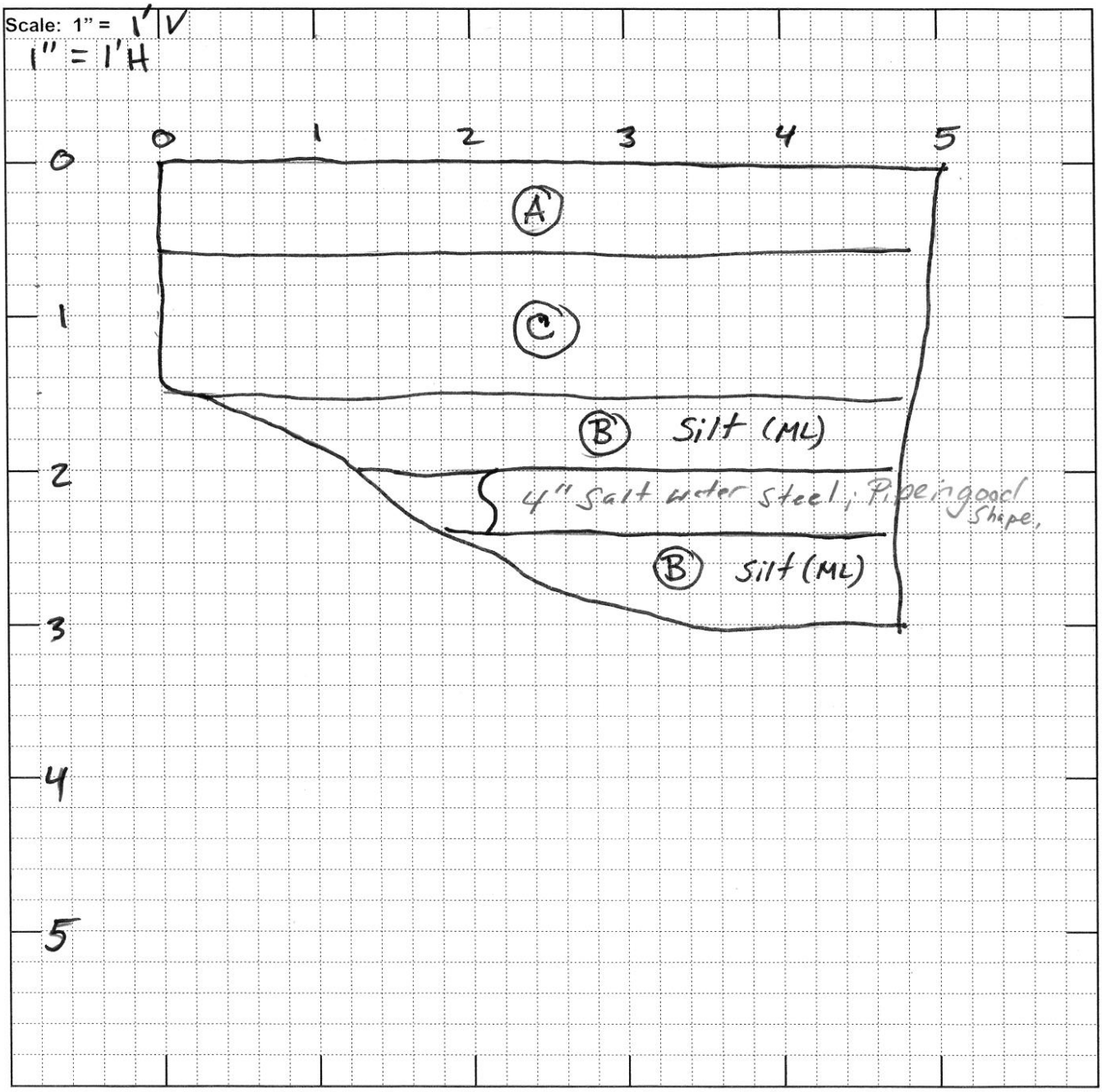
DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					Sand (SP) Pale olive (5Y 6/3) mottled w/ brownish yellow (10YR 6/8), moist, firm to dense, 95% fine Sand 5% fines, no free TPH, no TPH odor. wthrd. Panoche FM.	
15						
16						
17 (0905)						
18						
19					Silt (ML) yellowish brown (10YR 5/8) mottled w/ Pale olive (5Y 6/3), moist, 90% fines, 10% fine Sand, no free TPH, no TPH odor. wthrd. Panoche Fm.	
20					20' bottom of boring.	Set PVC to 20' bgs 15' screen; 5' blnk

SoilBoring.xls

Trench Sidewall Record	Trench # PPP/5
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-08
Project No. 273939.14.01	Site
Location	Page 1 of 2
	S. Quayle
GPS Coords	
Trench View	Northeast



Trench Sidewall Record	Trench # PPP/5
Contractor: Turn-Key Construction Services, Inc.	Date 11-6-08
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

(A) Lean Clay with Sand (CL) v. dark grayish brown (2.5Y 3/2), moist, firm, low to med. plasticity, 80% fines, 20% fine to med. Sand, No TPH odor, no free TPH observed.

(B) SILT (ML) light olive brown (2.5Y 5/3) mottled w/ yellowish brown (10YR 5/6), moist, soft, low plasticity, 90% fines, 10% fine Sand, no TPH odor, no free TPH observed

(C) Well graded gravel w/ Sand (GW) dark grayish brown (2.5Y 4/2) no TPH odor, no free TPH observed.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	QQ/2,3	SHEET 1 OF 2

10-24-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1520 END : 1710 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt/base rock	
0.1'					Well graded gravel with Sand (GW) dark reddish brown (5YR 3/2) moist, loose, fine to coarse Sand, fine to coarse gravel, no free TPH	
3'					Silt (ML) v. dark greenish gray (5GY 3/1), motted w/ yellowish brown (10YR 5/6), soft med plasticity, 90% fines, 10% fine Sand, no free TPH, no TPH odor	
8'					CLAY (CL) dark greenish gray (10Y 4/1), moist, low to med plasticity, 100% fines, root structures with root materials, blocky fracture, Free TPH prevalent along blocky fracture and root structures.	
					@ 12' bgs Free TPH in fractures and rootlets decreases from Prevalent to Trace/Some occurance.	

3' 5'

5' 5'

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	QQ /2,3	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.5'	Silt (ML) / Sand	
15					wthrd Panoche FM	
16		5' / 5'			olive / yellow brown	
17					no TPH, No free TPH	
18					observed.	
19 / 20				20'	20' bottom of boring	
20 SBQ						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	QQQ/2,3	SHEET 1 OF 2

11-5-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1045 END : 1259 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1					Sandy Silt (ML) light olive brown (2.5Y 5/4) moist, 40% fine sand 55% silt, trace fine gravel (Panoche Fm), no TPH odor, no free TPH observed,	
2	4' / 5'					
3						
4						
4.8'						
5					Clay (CL) dark greenish gray (10YR 4/1) moist, Soft, med. plasticity, no free TPH, no TPH odor,	
6	4.5' / 5'				@6.5' root structures and plant material	
7					@7.3' thin mm scale layer of dried free product or tar. Sly TPH odor. Present along root structures.	Trace Free TPH
8					- below 7.3' No TPH odor, No TPH observed.	
9						
10						
11	5' / 5'					
12						
13						
13'					Sandy Silt (ML) V. dark greenish gray (10GY 3/1) moist, soft, low plasticity, 40% Sand 50% fines, no TPH odor. fine no TPH observed.	
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	QQQ / 2,3	SHEET 2 OF 2

11-5-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1045 END : 1259 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.2'	Clay (CL) dark greenish gray (10GY 4/1) moist, soft, med. plasticity, vertical root structure and plant material; no TPH odor, no TPH observed,	
15						
16	5'				@16.5 to 16.8' laminated peat,	
17	/ 5'					
18						
19						
20				20'	20' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	R /1,2	1	2

SOIL BORING LOG

10-22-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0955 END : 1050 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet) / INTERVAL (feet) / RECOVERY (%) / #/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
Hand auger		Well graded gravel with sand (GW) brown (7.5YR 4/4) dry to moist, fine to coarse gravel, med to coarse sand, loose, No TPH odor, No Free TPH.	Hand auger to 5' bgs
		3' — silt (ML) olive (5Y 5/3) mottled w/ yellowish brown (10YR 5/6), Soft, low plasticity, 90% fines 10% fine Sands Trace mica flakes. no TPH odor, No Free TPH.	
1.5' / 5' (1000)			
		9.8 — wet@9.8' No Free TPH above 9.8'	
1.4' / 5' (1005)		9.9 — Clayey gravel (GC) black (N2.5/), wet, loose, 60% fine gravel, 30% fines, 10% fine sand, No metal debris observed, Free TPH present in fractures of clay material, gravel fraction saturated w/ free TPH.	
		free TPH extends into clay fractures below 9.9' to a depth of 10' bgs. At 10' bgs end of free TPH.	
		CLAY (CL) v. dark greenish gray (10Y 3/1), moist, Soft mottled w/ black (N 2.5/)	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER
273939.14.01	R /1,2 SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					100% fines, mica flakes, no TPH odor, no free TPH.	
				14.8		
15					Silt (ML) dark greenish gray (5GY 4/1), wet, soft 100% fines, mica flakes, laminated w/ peat, no TPH odor, No free-TPH.	
16						
17	5'	1.3'				
18						
19						
20				20'	20' bottom of boring	Set temp PVC 15' screen and 5' blank for collection of free product.

1015

SoilBoring.xls

SBA

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	RR/1	1	2

SOIL BORING LOG

10-23-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1330 END : 1505 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0.5'					Asphalt	Located adjacent to former Trench T-5
1'					Ag. base	Hand auger to 5' bgs
1					Clay (CL) olive (5Y 5/3), dry to moist, firm, med plasticity, Trace fine Sand, fine gravel and shells, no tph odor, no free tph observed	
2	hand auger					
3'						
3					Silt w/ Sand (ML) dark greenish gray, moist, 20% fine to coarse sand 5% fine gravel, no free TPH, no TPH odor. Soft, med. plasticity,	
4						
5						
6						
7		2'/5'				
8					Trace Coarse gravel @ 8'	
					Trace Wood fragments @ 8.5'	
9						
9.3						
10					Clay (CL) dark greenish gray (5GY 4/1), soft, med plasticity, blocky fracture, root bound, wood fragments, free TPH prevalent around wood fragments, along blocky fracture and along root structures.	Set temp Well 5' screen and 5' blank - unable to collect free Product sample.

1410

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	RR/1	2 OF 2

SOIL BORING LOG

11-12-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0750 END : 0830 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
					Continued from RR/1 Logon 10-23-08	
10					Clay (CL) dark greenish gray (5GY 4/1), soft, med plasticity, blocky fracture, root structures and plant material, free TPH prevalent along blocky fracture and root structures	Free TPH Continues
11						
12	5'	4/5	1/1			
13						
13.4						
14					Silt (ML) greenish gray (10GY 5/1), moist, firm, free TPH prevalent along fractures,	mottled w/ yellow brown (10YR 5/6),
14.5						-14.5' end of free Product observed.
15						
16					Weathered Panoche Fm yellowish brown (10YR 5/8), (Silt Stone, Sand stone) No TPH odor No free TPH observed	
17	5'	5/5'				
18						
19						
20					20' bottom of boring	Set temp well for free product Collection 15' Screen 5' blank

D816

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	RRR/2,3	SHEET 1 OF 2

11-5-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1455 END : 1640 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	2.4'/5'				well graded gravel w/ Sand (GW) olive (5Y 5/3) dry, loose, no TPH odor no free TPH observed.	No Free TPH product observed
1.0					1.0' well graded gravel w/ Sand (GW) brown (10YR 4/3), no TPH odor, no free TPH observed.	
2						
3						
3.8					Sand (SW) no TPH odor, no free TPH.	
4						
4.2					Clay (CL) dark greenish gray (10GY 4/1), moist, firm, low plasticity, no TPH odor, no free TPH observed.	
5						
6						
7	4.3'/5'				@7.8' begins blocky fracture and some root Structures w/ plant material.	
8						
9					@8.3' Some reed material to 8.4'	
10						
11					@11' absent of root Structures below	
12	5'/5'				@11.8-12' Sand lense (SP)	
13					@13.5-13.7' root bound below 13.7 trace vertical root Structures	
14						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	RRR/2,3	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14						
15						
16					@16.4 one piece of shiney black material w/ blocky fracture Possibly Coal (NO TPH odor, no free TPH observed)	
17	3.6'/5'					
18						
19						
19.5					Sandy Silt (ML) V. dark greenish gray (10GY 3/1), wet, soft, low plasticity, 40% Sand, 55% fines, Trace shells and mica, no TPH odor, no free TPH observed	
20					20' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	S /3	1	1

SOIL BORING LOG

10-20-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

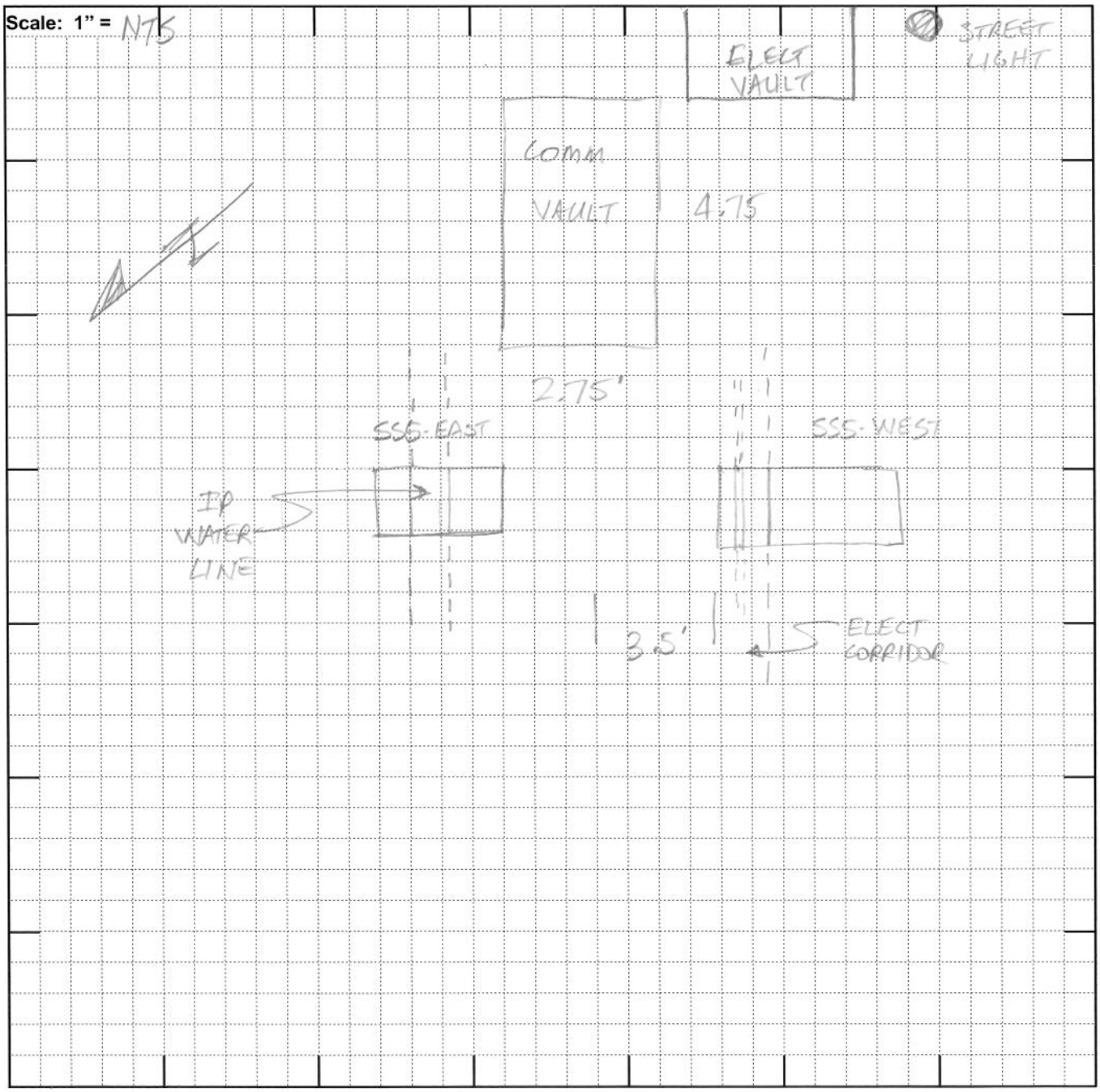
WATER LEVELS : START : 1625 END : 1745 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger →				Gravelly SILT (ML) brown (10YR 5/3), dry, Soft, fine to coarse sand, fine to coarse gravel, 40% gravel, 50% fines, 10% Sand, no TPH odor, no free product.	Hand auger to 4' bgs
2						
4				≈ 4	well graded Sand (SW) dark reddish brown (5YR 3/2) mottled w/ yellowish red (5YR 4/6), Moist. fine to coarse Sand fine gravel, 10% gravel, 60% Sand, 30% debris (glass, wood, copper ties, asbestos cloth), Sly. TPH odor wet @ 6.3, 2"X2" glass shard	
6	4'/6'				@6.5' ≈ ½" of Pale green (7/2) fine Sand size grains @6.9' ½" bleb of free product	
1700				7	CLAY (CL) dark greenish gray (10YR 4/1), wet, Soft low to med. plasticity, with root structures trace mica flakes, thin (mm scale) laminations of silt, no TPH odor, no free Product observed.	mottled w/ black
8						
10				10	10' bottom of boring	

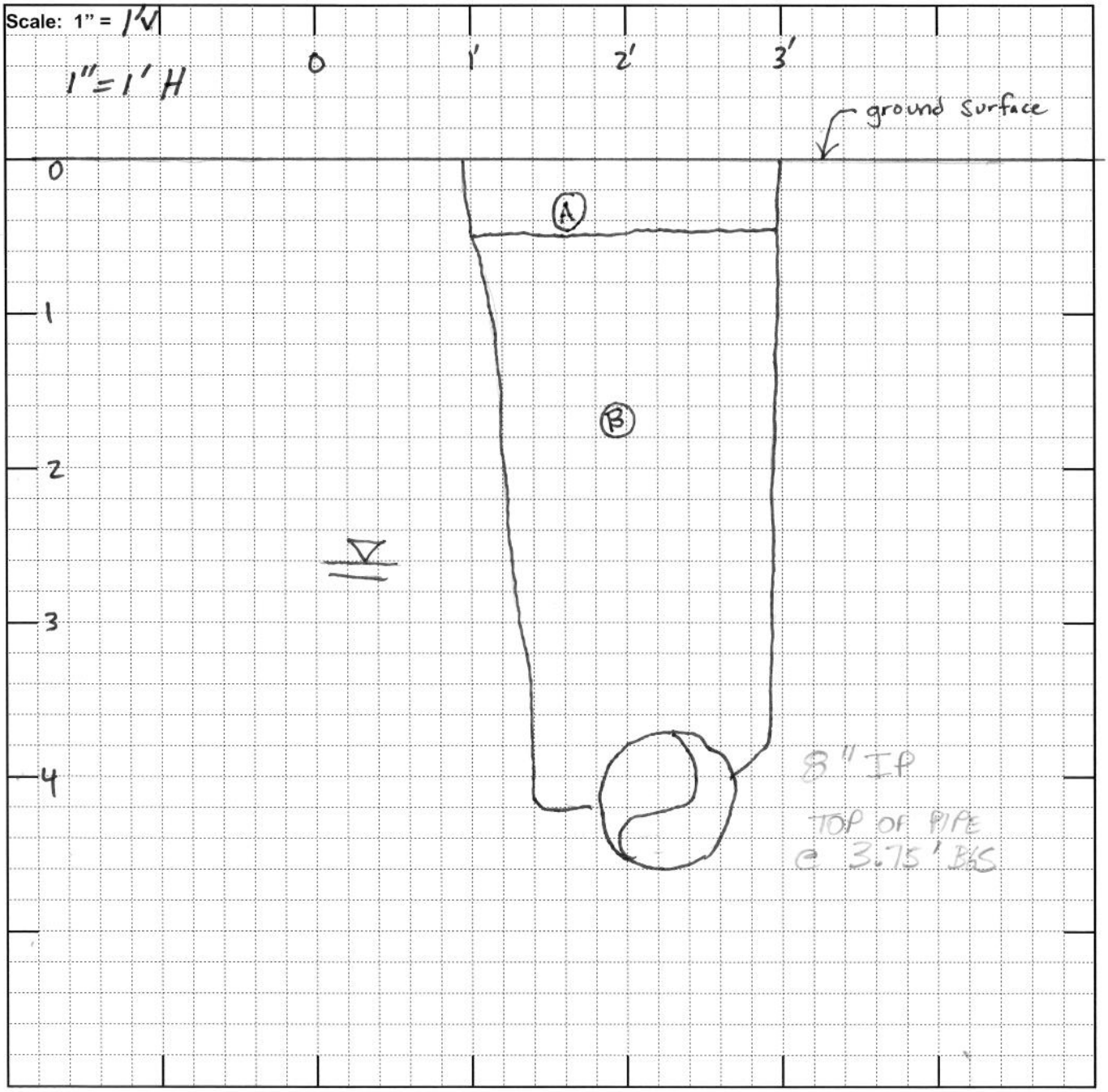
SoilBoring.xls

Trench Sidewall Record	Trench # SSS-EAST/WEST	Page 1 of 5
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008	
Project No. 273939.14.01	Site	
Location		
GPS Coords	M Godwin	

Trench View



Trench Sidewall Record	Trench # SS 5-EAST Page 2 of 5
Contractor: Turn-Key Construction Services, Inc.	Date OCT 28 2008
Project No. 273939.14.01	Site DEMO TPH INVS, AZUAR
Location	
GPS Coords	M. Godwin
Trench View	South



Trench Sidewall Record	Trench # SS5-EAST Page 3 of 5
Contractor: Turn-Key Construction Services, Inc.	Date OCT 28 2008
Project No. 273939.14.01	Site
Location	
GPS Coords	

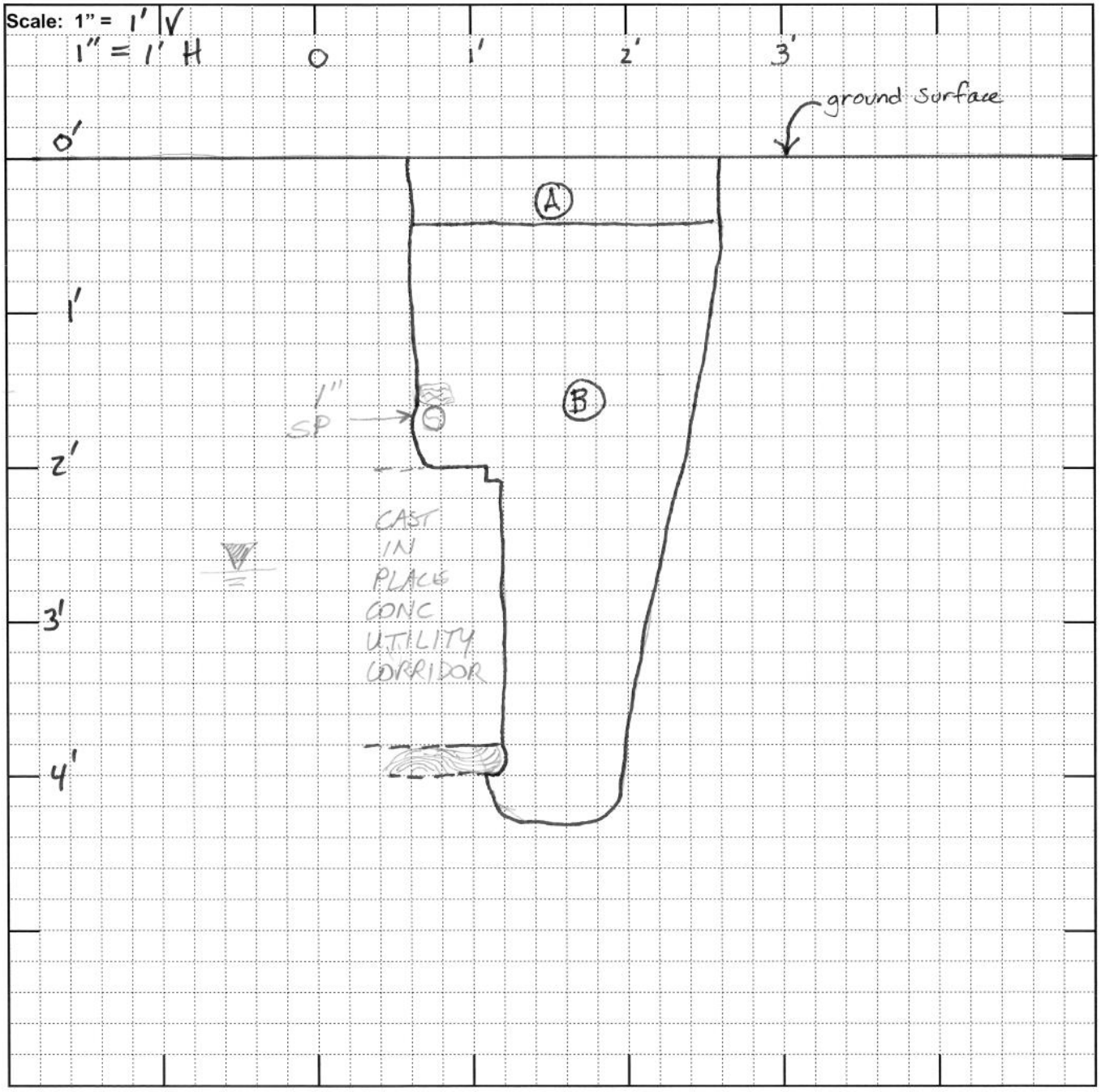
Trench View

Scale: 1" =

(A) 0.5' 3/4 AC PAVEMENT

(B) GC, CLAYEY GRAVEL, MOIST, HARD, 5Y 5/3 (OLIVE) fines plastic, gravel consists of claystone, siltstone, sandstone to 4" dia angular to subangular pipe backfill with recycled gravel materials of AC pavement concrete + pit run aggregate materials No oil/TPH in section or base of vac boring at pipe, Minor sheen on water surface. water stabilized @ 2.67' bgs.

Trench Sidewall Record	Trench # SS5-WEST	Page 4 of 5
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008	
Project No. 273939.14.01	Site	
Location		
GPS Coords	M. Godwin	
Trench View SOUTH		



Trench Sidewall Record	Trench # SS5-WEST Page 5 of 5
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) 0.4' AC PAVEMENT, 0.25' OVER WEATHERED AC PAVEMENT

(B) GC - CLAYEY GRAVEL, light olive brown (2.5Y 5/4) MOIST, firm, gravel clasts angular to 5", consists of basalt, sandstone, chert, likely backfill mixed with basalt railroad ballast, wood form @ base of concrete utility corridor, no permeable backfill around utility corridor, no TPH in fill, sheen on water -

⇒ 1.5' bgs, sheen coated ~~on~~ GC, not flowing, strong TPH (diesel) odor

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	SSS/4	1	1

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1125 END : 1230 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1	3.5'/5'				Lean clay with Sand (CL) olive brown (2.5Y 4/3) mottled w/ yellowish brown (10YR 5/6), firm, low plasticity, 75% fines, 20% fine to coarse sand, 5% fine gravel (Panoche Fm) no TPH odor, no free TPH observed. moist	No metal debris observed
2				2.1		
3					Broken chunks of Sand stone olive (5Y 5/3) and yellowish brown (10YR 5/8), weathered Panoche Fm. no TPH odor, no free TPH observed.	
4				4.6'		
5	4'/5'				Clay (CL) V. dark greenish gray (10Y 3/1), moist, soft, med plasticity, trace root structures, block fractures, 4.6 - 5.0 free TPH prevelent along blocky fracture. Below 5' No TPH odor, no free TPH observed.	
6						
7						
8						
9					@ 9.7' wood fragment, no TPH odor no free TPH observed.	
10				10'	10' bottom of boring.	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	T/2	1	2

10-22-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1100 END : 1500 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt	Hand auger to 5' bgs
0.8'					Well graded gravel with Sand (GW) yellowish brown, moist, fine to coarse Sand, fine to coarse gravel, angular gravel, loose, no TPH odor, no free TPH.	
3'					Well graded Sand with gravel (SW) moist, loose fine to coarse Sand, fine to coarse gravel, angular shaped gravel, almost 50% debris (wood fragment, metal plate fragments, rusted metal, broken glass, metal pipe, rock w/ vessicles, debris listed in order of abundance) no TPH odor, No free TPH observed. @ 6.5' wet. – chunk of yellow fire brick.	V. dark grayish brown (10YR 3/2) mottled w/ rust Start of debris (wood, metal) wet @ 6.5'
7	4'/5'				Clay (CL) dark greenish gray (5GY 4/1) moist, soft, med plasticity, mica flakes, root structures, no TPH odor, No free TPH observed.	
1155						
10	4.5'/5'					
1159						
13.5						

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	T /2	2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					Silty Sand (SM) greenish black (10Y 2.5/1), moist, fine sand, 20% fines, 80% fine sand, no TPH odor, mica flakes, no free TPH.	
15						
				15.5		
16		4.9'			Silt (SM) dark greenish gray (5GY 4/1) moist, 100% fines, trace mica flakes no free TPH, no TPH odor.	
17		5'				
1200					17.5 - 18 ~~wet~~ Some Shells	
18					18.5 - 19' Some vertical root structures	
19						
20				20'	20' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	TT/2,3	SHEET 1 OF 2

10-27-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity — LOCATION :

ELEVATION : — DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : — START : 1350 — END : 1450 — LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				0.8' Asphalt	Hand auger to 5' bgs.
1–2					Well graded gravel w/ Sand (GW) dark brown (10YR4/3) dry, loose gravel w/ Coarse Sand, no TPH odor, no free TPH observed	No Free TPH observed
3–4						
5					? ? ?	
6					Sandy Silt (ML) dark greenish gray (10GY4/1) moist Soft, low to med plasticity, 60% fines, 30% fine to med Sand 10% fine to Coarse gravel (Pinole Fm), no TPH odor, no free Product observed.	mottled w/ yellow brown.
7		2.9'/5'				
8						
9					9'	
10					Clay (CL) V. dark greenish gray (10Y 3/1), moist, firm, 95% fines, trace mica and root structures, no TPH odor, no free TPH	
11		3.7'/5'			@ 9.0 – 9.2 wood, brick (red & fire) shells in clay.	
12					@ 10' Soft, no free TPH, no TPH odor	
13					@ 12' black fractures, No free TPH, no TPH odor.	
14					@ 13.6' laminated w/ peat, No free TPH, no TPH odor. 14'	

1405

1410

CH2MHILL

PROJECT NUMBER	BORING NUMBER
273939.14.01	TT/2,3 SHEET 2 OF 2

SOIL BORING LOG

10-27-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					wthrd Panoche Fm (sand stone), no TPH odor, no free TPH observed.	
15						
16						
17						
18						
19						
20				20'	20' bottom of boring	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	TTT/2,3	SHEET 1 OF 2

11-15-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1340 END : 1450 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1					Silt (ML) yellowish brown (10YR 5/6) moist, firm low to med plasticity, trace fine sand, no TPH odor, no free TPH observed.	no Hand w/ greenish gray (5G 4/2)
2						No Free TPH Observed
3						
3.7						
4					Clay (CL) dark greenish gray (5GY 4/1), moist, soft to Firm, some root structures with plant material, no TPH odor, no TPH observed,	
5						
6						
6.8						
7					Clay (CL) dark greenish gray (5G 4/1) moist, soft, med plasticity, no TPH odor, no free TPH observed	
8						
9						
10						
11						
12						
13						
13.2						
14					Sandy silt (ML) v. dark greenish gray (10GY 3/1), wet, soft, low plasticity, 45% sand, 50% fines, trace shells, no TPH odor, no free TPH observed.	
14'						

CH2MHILL

PROJECT NUMBER	BORING NUMBER
273939.14.01	TTT/2,3 SHEET 2 OF 2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					Clay (CL) dark greenish gray (5G 4/1), soft, moist, med plasticity, trace root structures and plant material, no TPH odor, no free TPH observed.	
15					@ 14.6' – 16.5' laminated peat and root bound	
16					@ 17' No laminated peat, only trace verticle root structures	
17						
18						
19						
20				20'	20' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET
273939.14.01	4 / 4	1 OF 1

SOIL BORING LOG

11-12-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1040 END : 1200 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1–4	5'	3.2'			Silt (ML) light olive brown (2.5Y 5/4) mottled w/ yellowish brown (10YR 5/6) firm, low plasticity, 95% fines, trace fine sand, No TPH odor, no free TPH observed.	– No Free TPH – No metal debris
3.9'						
5–6	5'	4'			Lean clay w/ Sand (CL) Olive (5Y 4/3) mottled w/ yellowish brown (10YR 5/8), moist, Soft, low plasticity, 75% fines, 20% fine to med Sand, trace fine gravel, no TPH odor, No free TPH observed.	
6.5'						
7–9		1'			Clay (CL) V. dark greenish gray (10Y 3/1), moist, Soft, med plasticity, 95% fines, Trace root structures/road materials, no TPH odor, no free TPH observed.	blocky fracture
10'						
					10' bottom of boring	

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	uu/3	SHEET 1 OF 1

10-23-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1415 END : 1540 LOGGER : S. Quayle

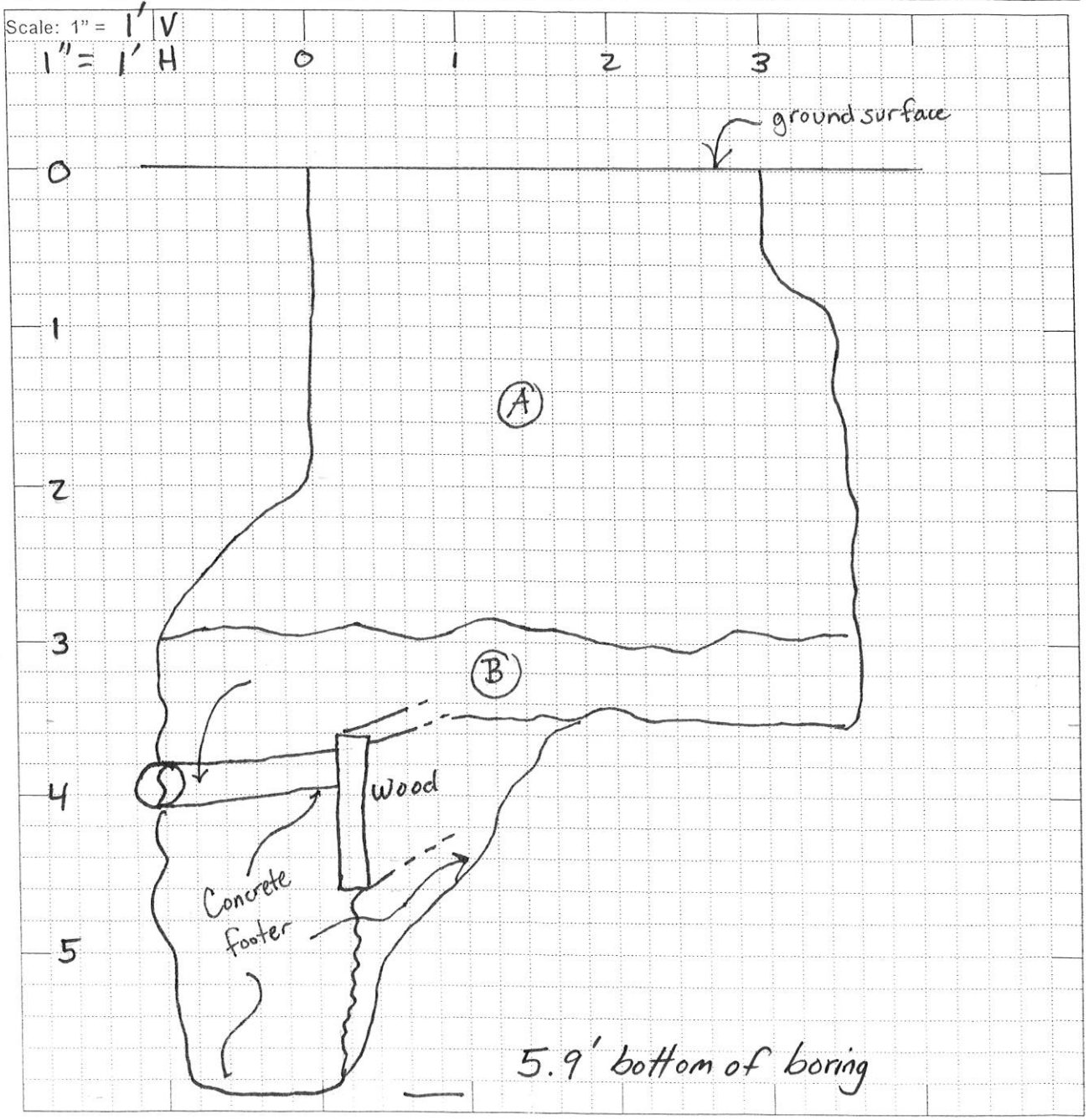
DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0					Asphalt	hand auger to 5'bgs
0.5'					Silt (ML) yellowish brown (10YR 5/4) firm, trace fine gravel and sand, no free TPH, no TPH odor	
3'					Silt (ML) dark greenish gray (5GY 4/1) mottled w/ yellowish brown (10YR 5/6), ~90% fines, 10% fine sand, no free TPH, no TPH odor.	
8.3					wood fragments saturated w/ free TPH	Lean CLAY (CL) dark greenish gray (5GY 4/1), mottled w/ yellowish brown (10YR 5/6), some fine sand, no TPH odor, no free TPH, wood fragments observed
8.5					Lean CLAY (CL)	
9.1					wood fragment; TPH odor, no free TPH	
9.3					Lean CLAY (CL)	
9.6					Red brick; free TPH in Sand Catcher below red brick	Lean Clay (CL) v. dark greenish gray (10Y 3/1) moist, soft, med plasticity, trace fine sand, partially root bound, blocky fracture, free TPH prevalent around roots, wood fragments and along block fracture
10'					10' bgs bottom of boring	

hand auger

3'/5'

SoilBoring.xls

Trench Sidewall Record	Trench #	UUU /5
Contractor: Turn-Key Construction Services, Inc.	Date	10-30-08
Project No. 273939.14.01	Site	
Location		Page 1 of 2
		S. Quayle
GPS Coords		
Trench View	East	



Trench Sidewall Record	Trench #	UUU/5
Contractor: Turn-Key Construction Services, Inc.	Date	10-30-08
Project No. 273939.14.01	Site	
Location		Page 2 of 2
GPS Coords		

Trench View

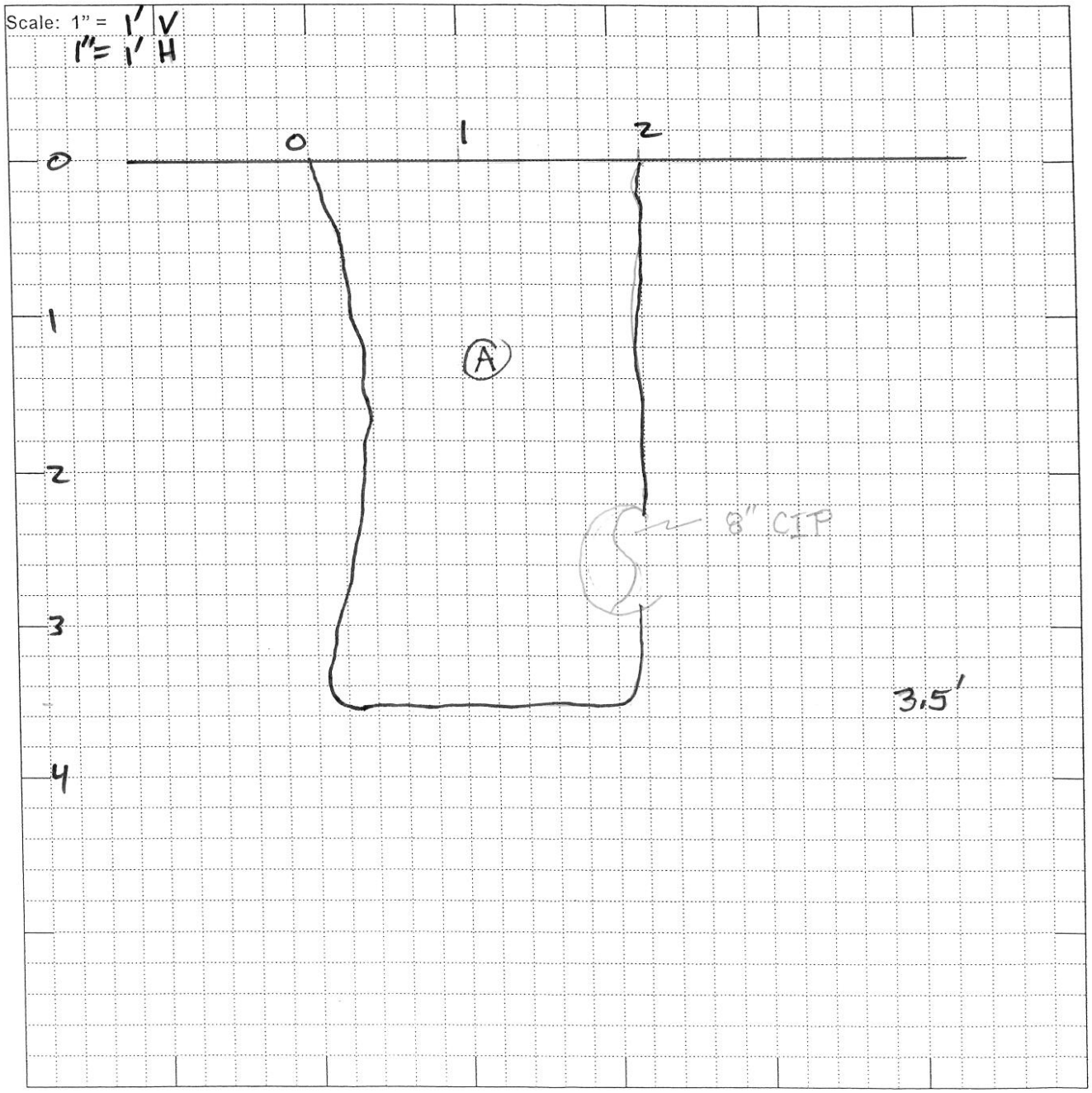
Scale: 1" =

(A) Clayey gravel (GC) olive
no TPH odor, no free TPH observed.

(B) Clay (CL) gray
no TPH odor, no free TPH observed.
@ 5.9' bgs Small bleb of free TPH observed in clay fracture.

(dime to quarter size)

Trench Sidewall Record	Trench # V / 5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-30-08	
Project No. 273939.14.01	Site	
Location		
GPS Coords	S. Quayle	
Trench View North		



Trench Sidewall Record	Trench # V /5 Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-30-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Silty Gravel (GM) light olive brown (2.5Y 5/4) mottled w/ yellowish brown (10YR 5/6) moist, firm, 60% gravel, 30% fines, 10% fine sand, fine to Cobble sized gravel (Parachute Fm and Basalt) fine formed Sand, no debris, no TPH odor, no free TPH observed in side walls or on pipe or vault.

- Dry hole
- No visible free TPH in side wall.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	VV /1,2	1	2

11-4-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 0900 END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1				1	Poorly graded SAND(SP) dark grayish brown (2.5Y 4/2) moist, loose, fine sand, no TPH odor, no free TPH observed.	
2		1.6'/5'		1.5	Silt (ML) yellowish brown (10YR 5/6), moist, soft, low plasticity, 90% fines, 10% fine sand, no TPH odor, no free TPH	
3					Lean CLAY (CL) v. dark greenish gray (10Y 3/1) moist, firm, 90% fines, 10% fine gravel and burned wood fragments (charcoal), sl. TPH odor, no free TPH observed.	
4						
5						5-10' driller noted v. soft.
6					Poor Recovery	
7		1.6'/5'				
8					Gravelly Lean Clay (CL) v. dark greenish gray (10Y 3/1) wet, 40% fine gravel, root structures, and wood fragments, 60% fines, TPH odor, Free TPH Prevalent around	gravel and along wood fragments and root structures.
9						
10					Lean Clay (CL) dark greenish gray (10Y 4/1), moist, soft, med plasticity, 90% fines, 10% root structures and plant material, free TPH odor, Free TPH prevalent along Clay fractures and along root structures.	
11						
12		4'/5'				
13						
14				13.9		

0929

0940

SoilBoring.xls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	VV /1,2	2	2

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : END : LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14					Weathered Panoche Fm (Sand Stone and Silt Stone) Sly odor; No Free TPH observed.	
15					@ 15' bgs no TPH odor.	
16		5'				
17		5'				
18						
19						
20					20' bottom of boring.	

CH2MHILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
273939.14.01	VVV/4	1	1

11-12-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION:

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

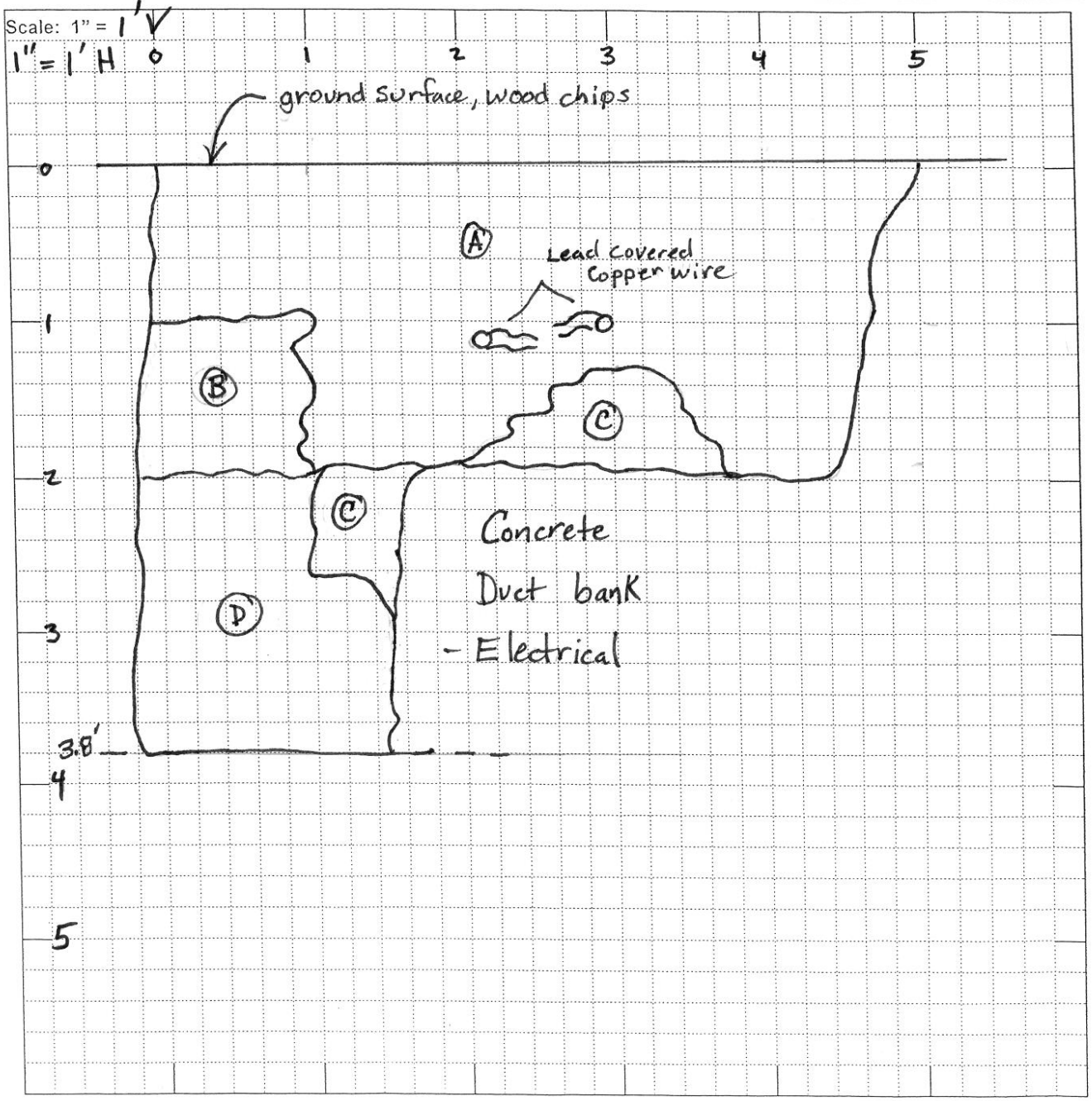
DRILLING METHOD AND EQUIPMENT: Direct-Push Geoprobe Model

WATER LEVELS : START : 1300 END : 1430 LOGGER : S. Quayle

DEPTH BELOW SURFACE (feet)	INTERVAL (feet)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 6 - 6 - 6 in (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
1					Lean clay (CL) olive brown (2.5Y 4/3) mottled w/ yellowish brown (10YR 5/6), firm, low to med plasticity, 85% fines 10% fine to coarse sand, trace fine gravel (basalt and Franciscan), no TPH odor, No free TPH observed.	
2	3.5' / 5'			2.5'		/siltstone
3					Broken chunks of sandstone olive (5Y 5/3) and yellowish brown (10YR 5/8) weathered Franciscan, no TPH odor, no free TPH observed	
4				4.4'		
5					Clay (CL) greenish black (10Y 2.5/1), mottled/ brown (7.5YR 4/3) moist, stiff low plasticity, no TPH odor, no free TPH observed.	
6	4.5' / 5'					
7				7'		
8					clay (CL) v. dark greenish gray (10Y 3/1), moist, firm, low Plasticity, trace root structures/ root material, laminated peat, blocky fracture, Free TPH Prevalent along blocky fractures and root structures/ material, Strong TPH odor	
9						
10					10' bottom of boring	

SoilBoring.xls

Trench Sidewall Record	Trench # X / 5
Contractor: Turn-Key Construction Services, Inc.	Date 10-30-08
Project No. 273939.14.01	Site
Location	Page 1 of 2
	S. Quayle
GPS Coords	
Trench View North	



Trench Sidewall Record	Trench # X /5
Contractor: Turn-Key Construction Services, Inc.	Date 10-30-08
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

(A) Clayey gravel w/ Sand (GC) brown (7.5YR 4/2) moist, dense to V. dense, gravel size fine to Cobble (Pinache Fm and basalt) fine to Coarse Sand, with debris (red brick, yellow brick, metal pipe, springs, plastic pipe fittings, metal pipe, Concrete, bolts, metal strap, glass, scrap metal, melted metal w/ vessicles) 70% gravel and debris, 20% fines, 10% Sand, no TPH odor, no free TPH observed.

(B) Sand (SP) yellowish brown (10YR 5/4) moist, loose, fine to med Sand, no TPH odor, no free TPH observed.

(C) Concrete overpour.

(D) Well graded gravel w/ Sand (GW) dark brown (7.5YR 3/2) moist, dense, gravel size fine to cobble (Pinache Fm and Basalt) fine to Coarse Sand, with debris (wire, brick, metal strap, metal w/ vessicles and rust, and Concrete) 60% gravel and debris, 30% Sand, 10% fines, no TPH odor, no free TPH observed.

- Hole dry
- No visible free TPH in sidewall or on debris.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	YY / 3	SHEET 1 OF 1

SOIL BORING LOG

10-28-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

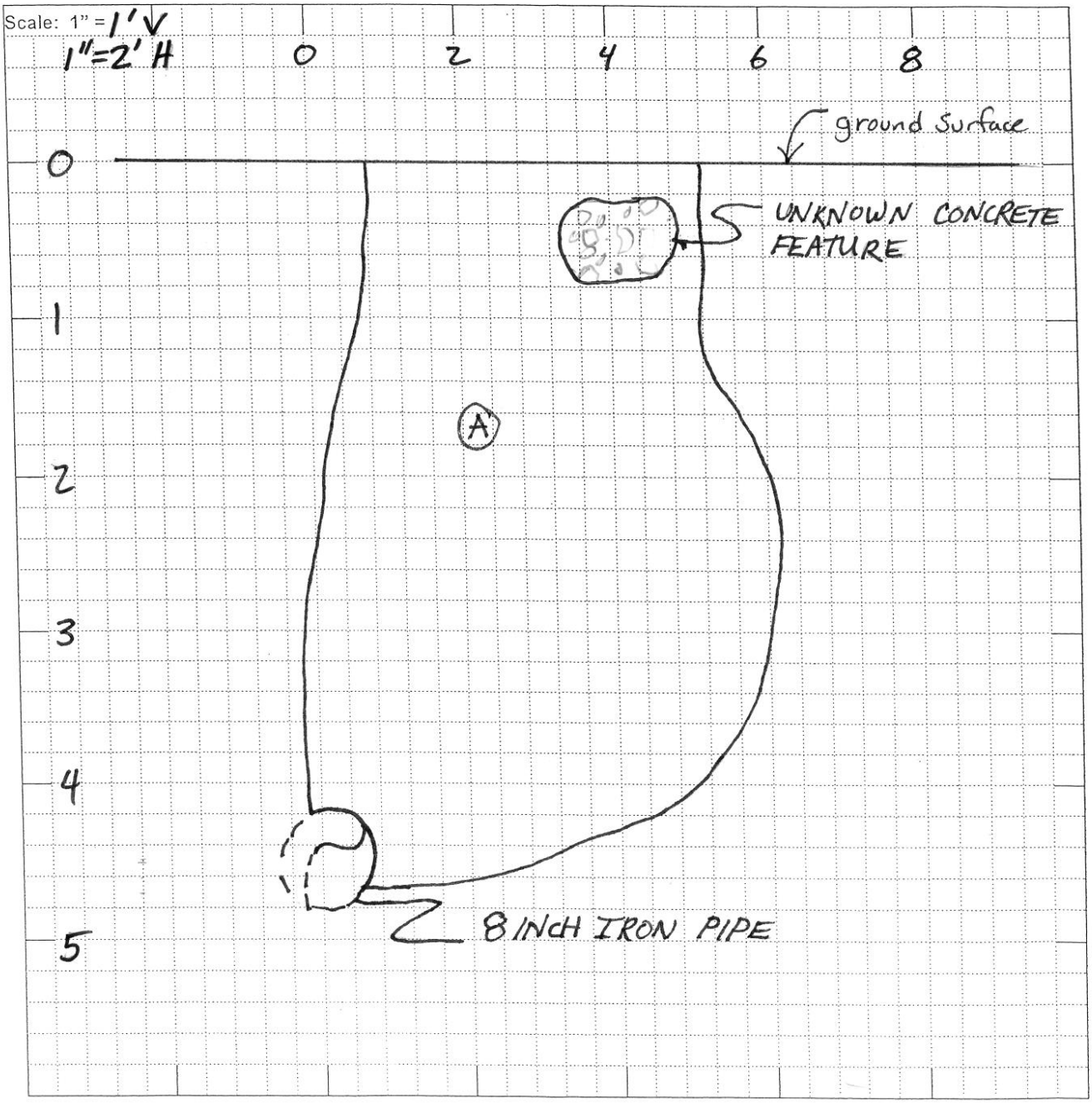
WATER LEVELS : START : 1045 END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	Hand auger				Concrete	Hand auger to 5' bgs No free TPH observed
1'					Silt w/ gravel (ML) yellowish brown (10YR5/6), dry to moist, no TPH odor, no free TPH observed	
4.5'					CLAY (CL) V. dark greenish gray (5G 3/1) mottled w/ yellow brown and black moist, 85% fines, 10% fine to Coarse Sand, Trace fine gravel (Panoche Fm), Soft, med plasticity, no TPH odor no free TPH.	
8.1	2.1' / 5'				fine, rounded Well graded Sand w/ gravel (SW) black (N/2.5/) wet, loose 25% gravel, 70% fine to Coarse Sand, Trace fines, and Coarse sand size red brick fragments, 1 piece of thin folded metal, no TPH odor no free TPH observed	
8.7					~~Silty gravel (GM)~~ greenish gray (10GY5/1), mottled w/ yellow brown and V. dark greenish gray, 85% fines, 15% fine to Coarse gravel Angular Panoche Fm and brick fragments, no TPH odor, No free TPH observed.	Silt w/ gravel (ML)
9.2					CLAY (CL) v. dark greenish gray (5GY 3/1), Moist soft, med plasticity, no TPH odor, No free TPH Observed	
10'					10' bgs bottom of boring	

1120

SoilBoring.xls

Trench Sidewall Record	Trench # 25
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2008
Project No. 273939.14.01	Site
Location	Page 1 of 2
	M. Godwin
GPS Coords	
Trench View SOUTH	



Trench Sidewall Record	Trench # Z5
Contractor: Turn-Key Construction Services, Inc.	Date 10/28/2003
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

(A) CLAYEY GRAVEL - (GC) dark brown (10YR 3/3) moist, loose to soft, fines plastic, with organic debris - sawdust, roots -, Gravel clasts to 12 inches clasts include 2 inch pipe, wire, fire bricks, red clay bricks, oxidized sheet metal, steel dimensional bar and round stock, fasteners, 8 inch diameter water pipe, top of pipe @ 4.25 ft bgs. hole dry, no TPH odors, no visible TPH in side walls

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	ZZ / 1,2,5	SHEET 1 OF 2

10-27-08

SOIL BORING LOG

PROJECT: Follow-on TPH Investigation DRMO and Vicinity — LOCATION :

ELEVATION : — DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : — START : 1130 — END : 1230 — LOGGER : S. Quayle

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
0	hand auger				Asphalt	Hand auger to 5' bgs
1'					Sandy Silt (ML) brown (10YR 4/2) dry to moist, firm, low plasticity, 35% fine to med sand, 10% fine gravel, 55% fines, no TPH odor, no free TPH.	No free TPH observed.
4'					well graded gravel (GW) dark brown (10YR 3/3), moist, loose, 90% fine to coarse gravel, 10% fine ~~to~~ coarse sand, slt TPH odor, wood fragments (trace) no free TPH observed.	
1145	2.4'/5'					
8'					SILT (ML) v. dark greenish gray (10Y 3/1), moist, low plasticity, 100% fines, trace root structures, no TPH odor, no free TPH observed.	
	4'/5'					
12.2					Wet, Brick fragments, sand, gravel, trace wood fragments, No free TPH, No TPH odor	
12.6					CLAY (CL) Very dark gray (N 3/), moist, med plasticity, 100% fines, trace to some root structures, no free TPH, no TPH odor.	trace mica flakes.

CH2MHILL

PROJECT NUMBER	BORING NUMBER	
273939.14.01	ZZ / 1,2,5	SHEET 2 OF 2

SOIL BORING LOG

10-27-08

PROJECT: Follow-on TPH Investigation DRMO and Vicinity LOCATION :

ELEVATION : DRILLING CONTRACTOR: WDC Exploration and Wells., Richmond, CA

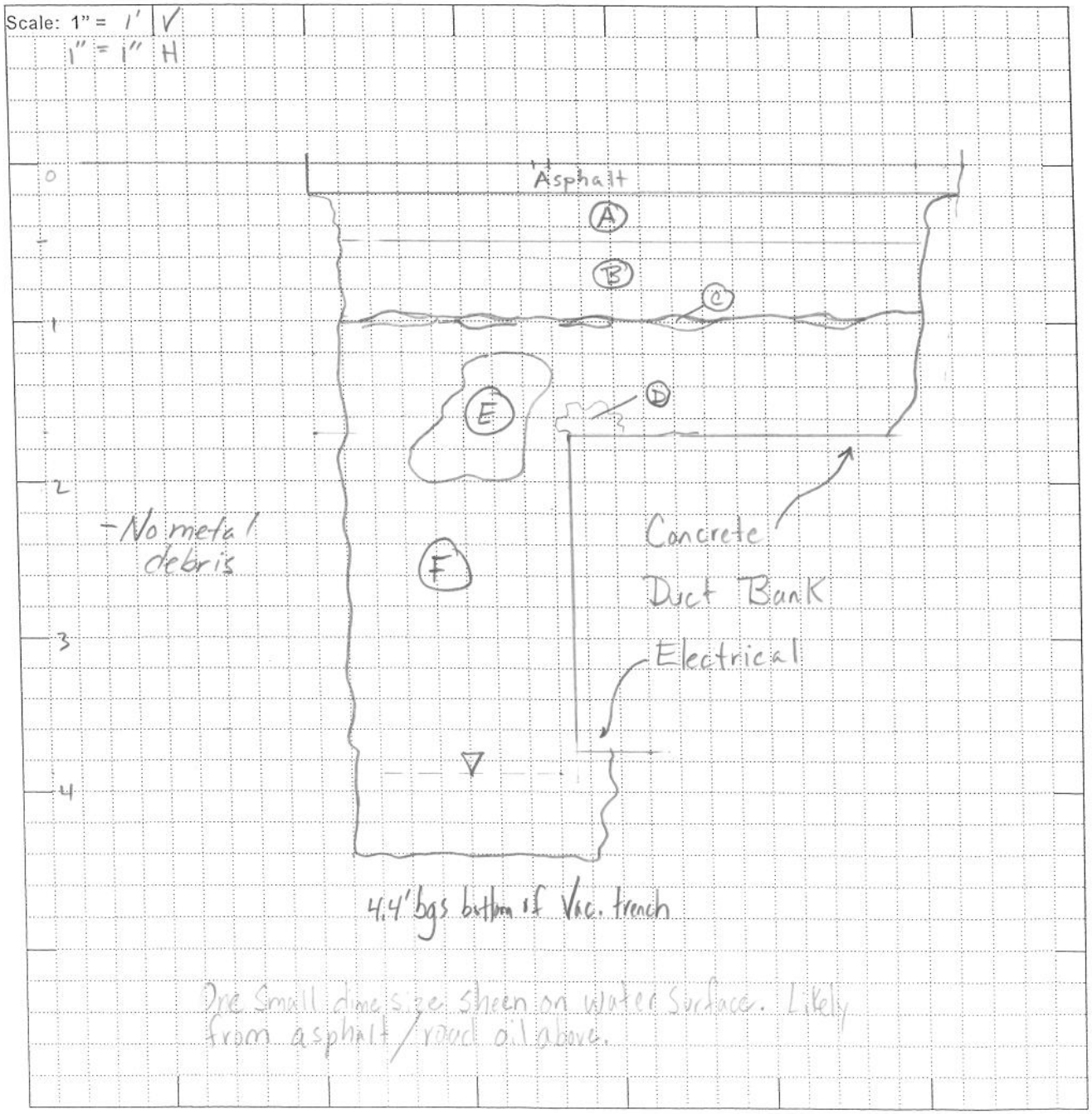
DRILLING METHOD AND EQUIPMENT USED :

WATER LEVELS : START : END : LOGGER :

DEPTH BELOW SURFACE (Meters)	INTERVAL (Meters)	RECOVERY (%)	#/TYPE (SS=Split Spoon, ST=Shelby Tube)	STANDARD PENETRATION TEST RESULTS 15-15-15 cm (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY, OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, % gravel/sand/silt-clay	COMMENTS: Drilling and Soil Logging Comments/Notes, Drilling Observations and Samples.
14				14.4	sand (SW) no free TPH; no TPH odor.	
				14.6	CLAY (CH) as above	
15				15'	wthrd. Panoche Fm.	
16						
17						
18						
19						
20				20'	20' bgs bottom of boring	Set temp well 15' screen 5' blank for collection of free TPH.

SoilBoring.xls

Trench Sidewall Record	Trench # ZZ / 5	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-29-08	
Project No. 273939.14.01	Site	
Location		
	S. Quayle	
GPS Coords		
Trench View North		



Dre Small dime size sheen on water surface. Likely from asphalt/road oil above.

Trench Sidewall Record	Trench # ZZ 15	Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 10-29-08	
Project No. 273939.14.01	Site	
Location		
GPS Coords		

Trench View

Scale: 1" =

(A) Gravel (GW) base material brown (7.5YR 4/2), moist, firm, fine to med Sand and clay matrix, basalt fine to coarse gravel over 1" weathered asphalt, no TPH odor, no free product observed

(B) well graded gravel w/ Sand (GW) brown (10YR 4/3), moist, dense, fine angular basalt gravel, fine to coarse Sand, no TPH odor, no free Product observed.

(C) Sporatic layer of gravel Covered w/ road oil. no TPH odor thin layer (mm) of shiney hard road oil over gravel surface,

(D) Concrete

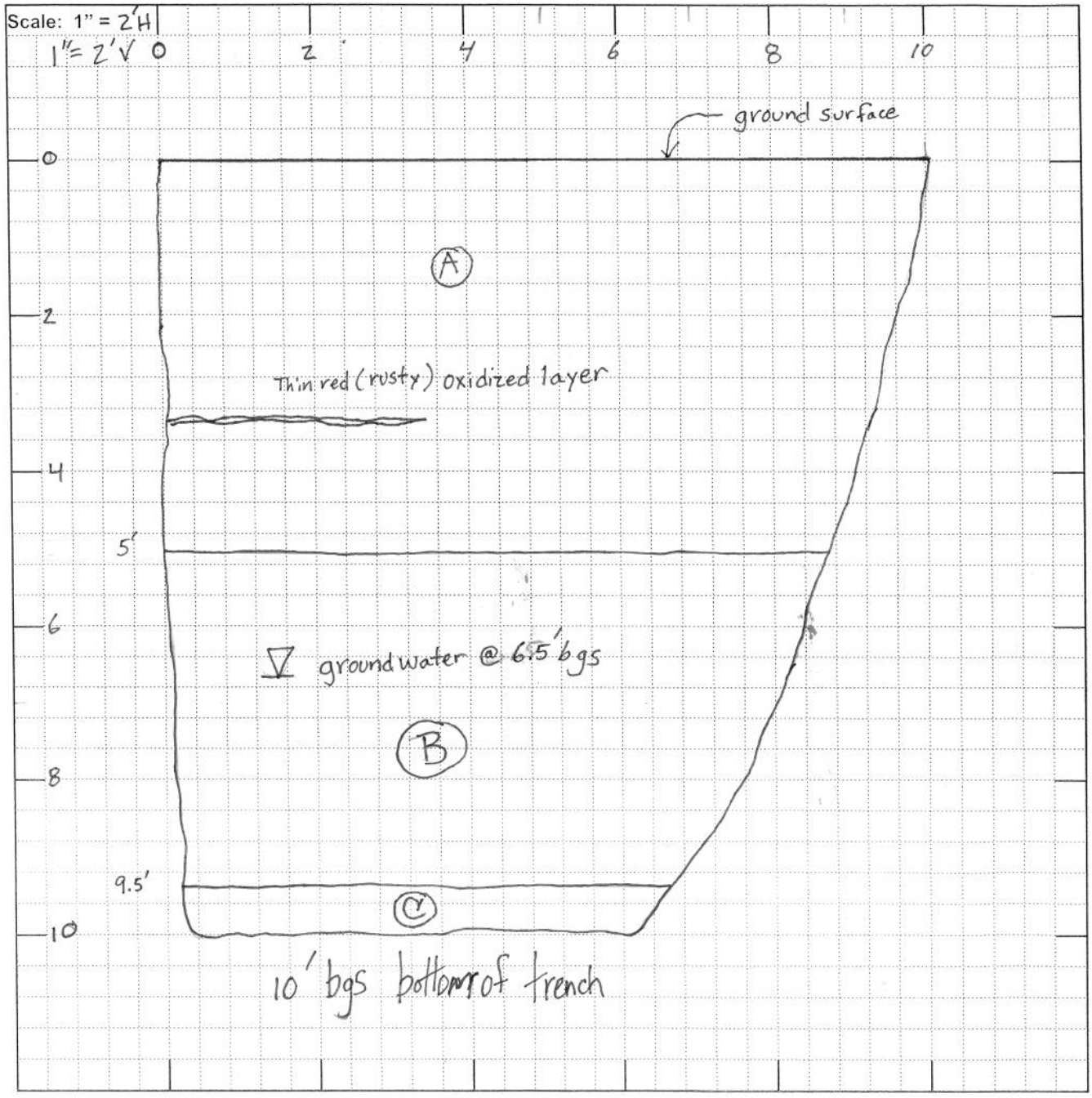
(E) Clay (CL) V. dark greenish gray (5GY 3/1) moist, firm, med plasticity, no TPH odor, no free TPH.

(F) Silty Gravel (GM) yellowish brown (10YR 5/4) moist, loose to dense angular gravel (basalt, Silt stone, Sand stone Clasts, fine to Cobble Size), no TPH odor, no free TPH observed

Top of duct bank 45" from grade Surface

(electrical)

Trench Sidewall Record	Trench # Trench A	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11-10-08	
Project No. 273939.14.01	Site	
Location 100' North of Location A / 3		
GPS Coords		
Trench View North		



Trench Sidewall Record	Trench # Trench A
Contractor: Turn-Key Construction Services, Inc.	Date 11-10-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Silt (ML) dark gray (2.5Y 4/1), moist, stiff, 100% fines, trace mica flakes, no TPH odor, no free TPH observed

@ 2' bgs color change, mottled w/ dark yellowish brown (10YR 4/4), trace fine root structures, no free TPH, no free TPH observed.

@ 3.5' bgs thin oxidized (rusted layer) mms thick, Stations 0 — 3. no TPH odor, no free TPH observed.

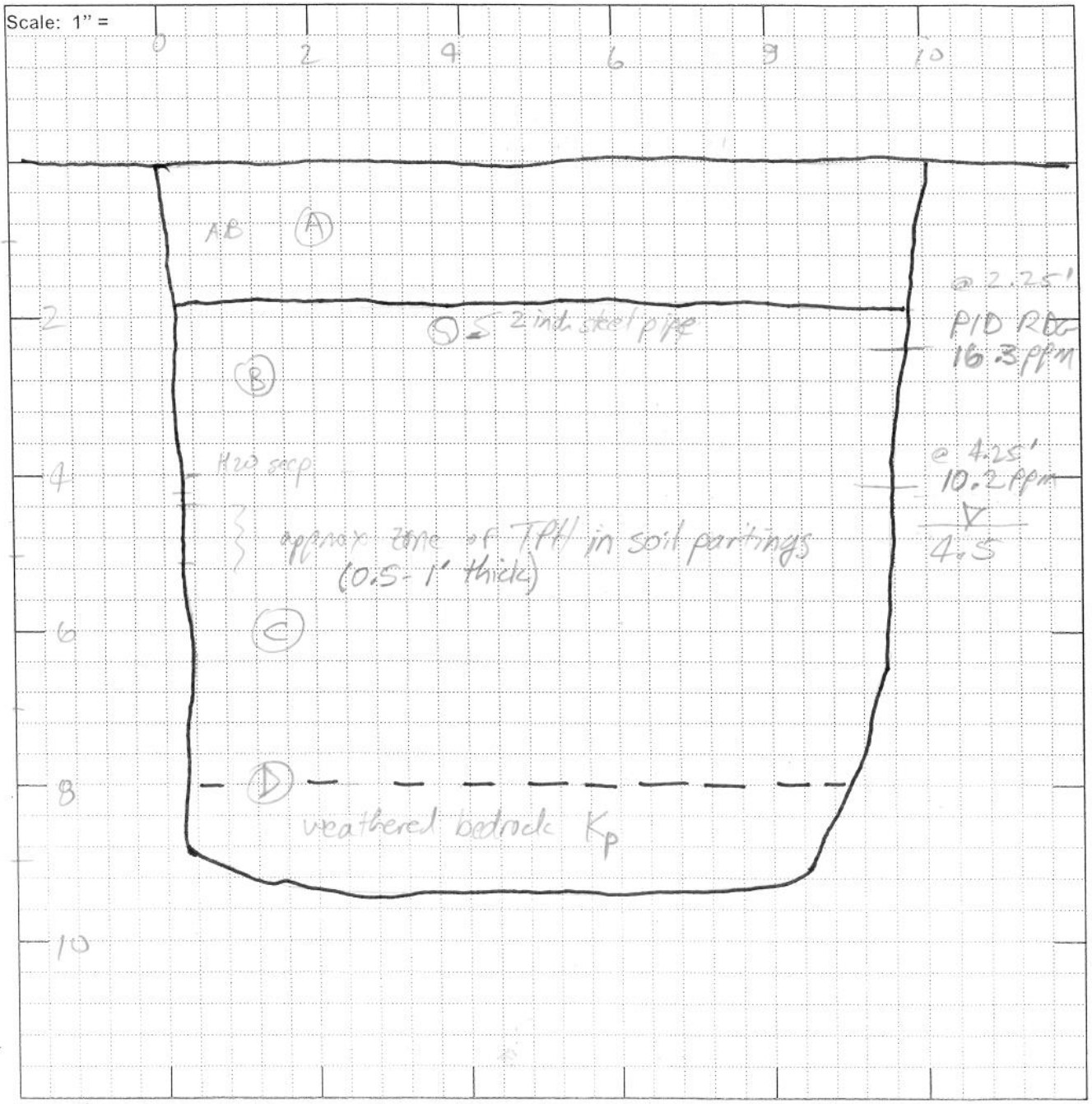
5' (B) CLAY (CL) V. dark greenish gray (10Y 3/1) mottled w/ dark yellowish brown (10YR 4/4), moist, soft, med plasticity, 95% fines, Trace mica flakes, root structures w/ plant and reed material, no TPH odor, no free TPH observed.

@ 6.5' bgs first encountered ground water.

@ 7' bgs color change mottled w/ black.

9.5' (C) Silty Sand (SM) V. dark gray (N 3/) wet loose, 70% fine Sand, 25% fines, Trace Shells and mica flakes, no TPH odor, no free TPH observed.

Trench Sidewall Record	Trench # Trench DDD-1	Page 1 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/12/2009	
Project No. 273939.14.01	Site	
Location TRENCH 20 ft EAST, EAST EDGE PAVEMENT AT NW 100 West SOUTHWEST CORNER B637		
		M. Godwin
GPS Coords		
Trench View Northwest		



Trench Sidewall Record	Trench # Trench DDD-1 Page 2 of 2
Contractor: Turn-Key Construction Services, Inc.	Date 11/12/03
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) GRAVEL (GW) very dark grayish brown (10YR 3/2) firm, moist, silty to clayey groundmass, angular igneous clasts to 3 inches, imported as base fill under former pavement, approx 1.75 ft thick

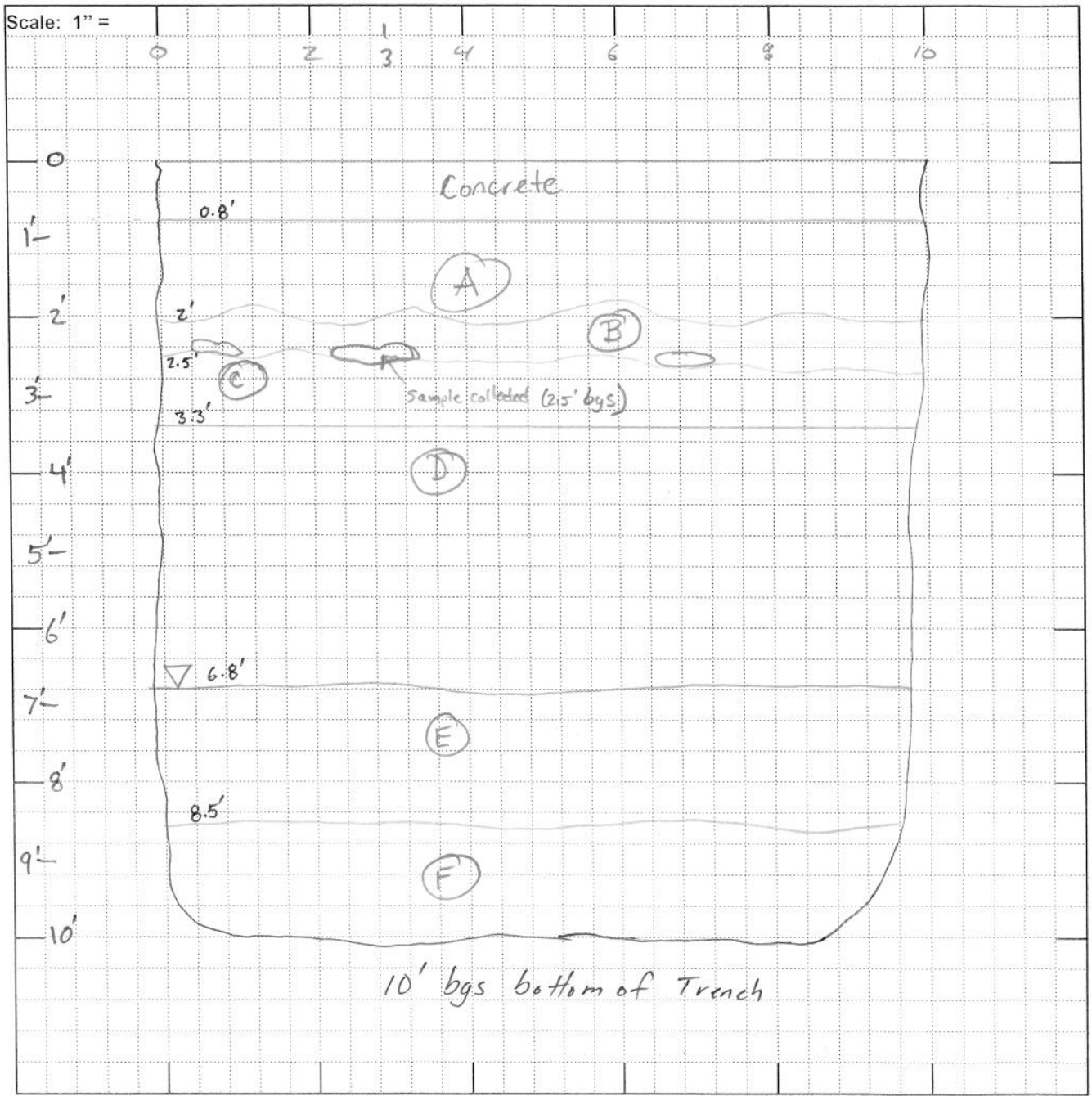
(B) SILT (ML) dark greenish gray (5GY 3/1), firm to loose, mottled black (5Y 2.5/1) clay to silt, artificial fill, impacted weathered Panoche fm siltstone + claystone, mild light end of TPH odors, beginning 2.5-3 ft bgs sooner TPH odors @ 4 ft bgs

Water + TPH seeping from clastic silty fill @ 4.25-4.5 ft bgs, oily / thick (weathered) diesel odor, 10.2 ppm VOC pid reading, dark brown not viscous TPH in soil partings, soil not saturated with TPH

(C) SILTY CLAY (CL) olive brown (2.5Y 4/3) mottled very dark gray (10YR 3/1) and dusky red (2.5YR 3/4), plastic, soft, moist, trace siltstone clasts to 1/4 inch, no odor, no TPH or sheen

(D) CLAY (CL) light olive brown (2.5Y 5/4) to olive gray (5Y 4/2) moist, plastic, soft, clasts weathered Panoche fm siltstone, top of weathered bedrock layer, includes fractured siltstone with limonite staining on fracture surface, no odor, no staining, no product, no sheen

Trench Sidewall Record	Trench # Trench DDD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-13-08
Project No. 273939.14.01	Site page 1 of 2
Location	
	S. Quayle
GPS Coords	
Trench View Southwest	



Trench Sidewall Record	Trench # Trench DDD-2
Contractor: Turn-Key Construction Services, Inc.	Date 11-13-08
Project No. 273939.14.01	Site Page 2 of 2
Location	
	S. Quayle
GPS Coords	

Trench View

Scale: 1" =

(A) Gravelly SILT (ML) olive brown (2.5Y 4/3) moist, soft, low plasticity, 60% fines, 30% fine to coarse angular gravel (Panoche Fm) Slight TPH odor, no free TPH observed.

(B) Gravelly Lean clay (CL) v. dark greenish gray (10Y 3/1), moist, soft, low plasticity, 50% fines, 40% fine to coarse angular gravel (basalt), 10% fine to coarse sand, Strong TPH odor, light free product sheen on gravel and sand grains, Some areas are more gravelly than others, For example: Sample 2.5' taken from Gravely Sand lense,

(C) Clay (CL) dark greenish gray (10Y 4/1) mottled w/ black (N 2.5/), moist, soft, med plasticity, no TPH odor, no free TPH observed

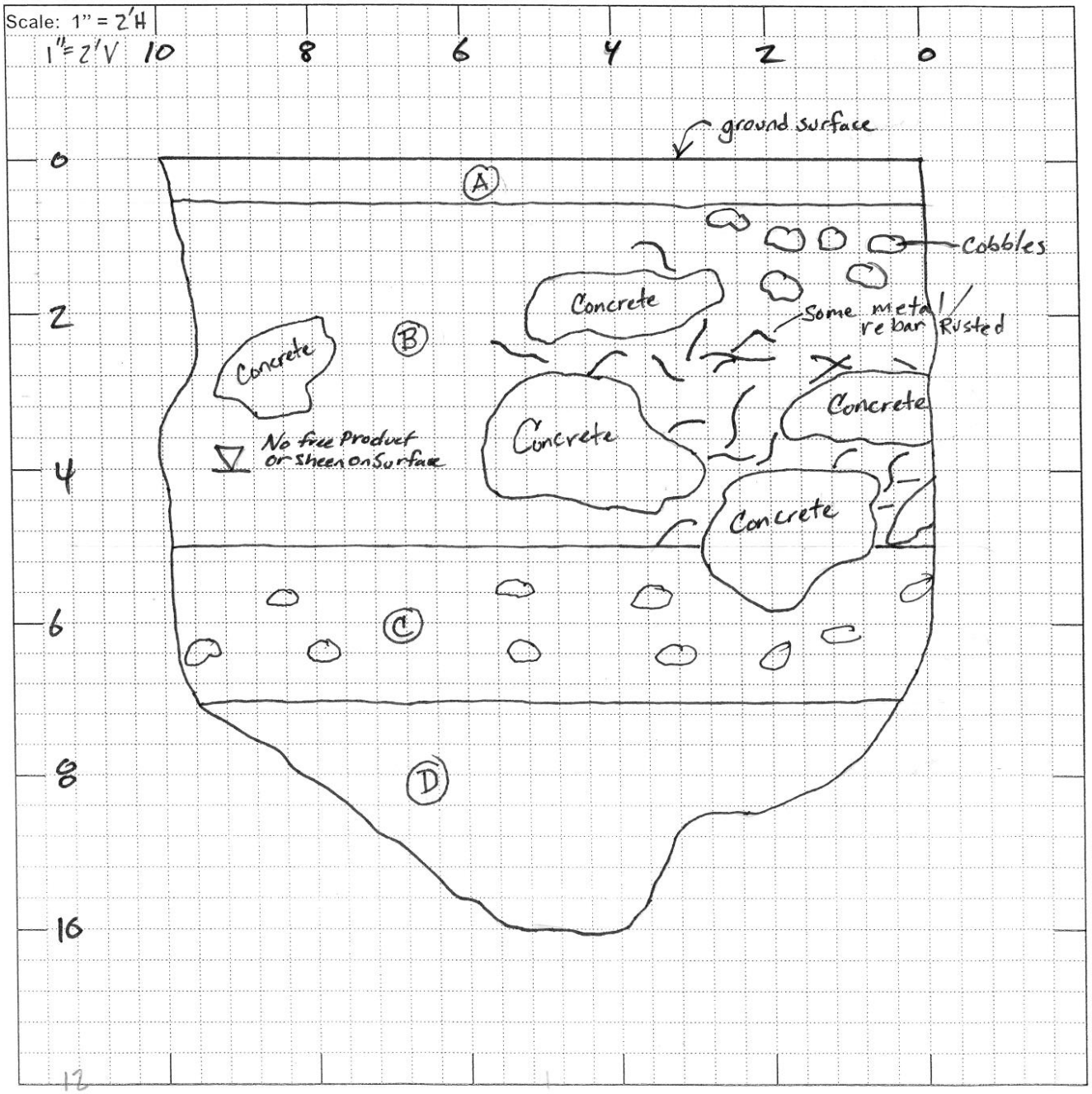
(D) Clay (CL) black (N 2.5/) moist, firm, low to med plasticity, trace mica flakes, no TPH odor, no free TPH observed

@ 6.8' first encounted gw / Sly. Sheen on Surface of water

(E) Sandy Silt (ML)

(F) Wthrd Panoche Fm. (Silt stone / Sand stone)

Trench Sidewall Record	Trench # Trench EE
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location 50' feet east of Location EE / 2,3	
	Page 1 of 3
GPS Coords	
Trench View South	



Trench Sidewall Record	Trench # Trench EE
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location	
	Page 2 of 3
GPS Coords	

Trench View

Scale: 1" =

<- observed

(A) Clayey Gravel (GC) dark grayish brown (2.5Y 4/2), moist loose, 60% fine to coarse gravel, 30% fines, 10% fine Sand, No TPH odor, No free TPH observed.

(B) Silt (ML) light olive brown (2.5Y 5/4) mottled w/ yellowish brown (10YR 5/8), moist, low plasticity, 90% fines, 10% fine Sand, No TPH odor, No free TPH observed.

@ 1.5' bgs Station 4' Construction debris mixed in w/ Silt brick, concrete, dried tar, wood fragments, trace rebar. No Free TPH, No TPH odor.

@ 2.5' Station 0-5' Some metal rebar debris (rusted), Some cobbles stained w/ rust from rebar.

@ 4' Station 0-5' Continues as seen at 2.5', First encountered groundwater 4' bgs

@ 5' (C) Well graded gravel w/ sand (GW) olive (5Y 5/4) mottled w/ light olive brown (2.5Y 5/4) wet, loose, 85% fine to Coarse gravel and Cobbles, 10% fine to Coarse Sand, 'gravel' composed of basalt, concrete fragments and Concrete, No TPH odor, No free TPH observed.

@ 7' trace yellowish fine brick 1' x 0.5' (Rectangle)

Trench Sidewall Record	Trench # Trench EE
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location	
	Page 3 of 3
GPS Coords	

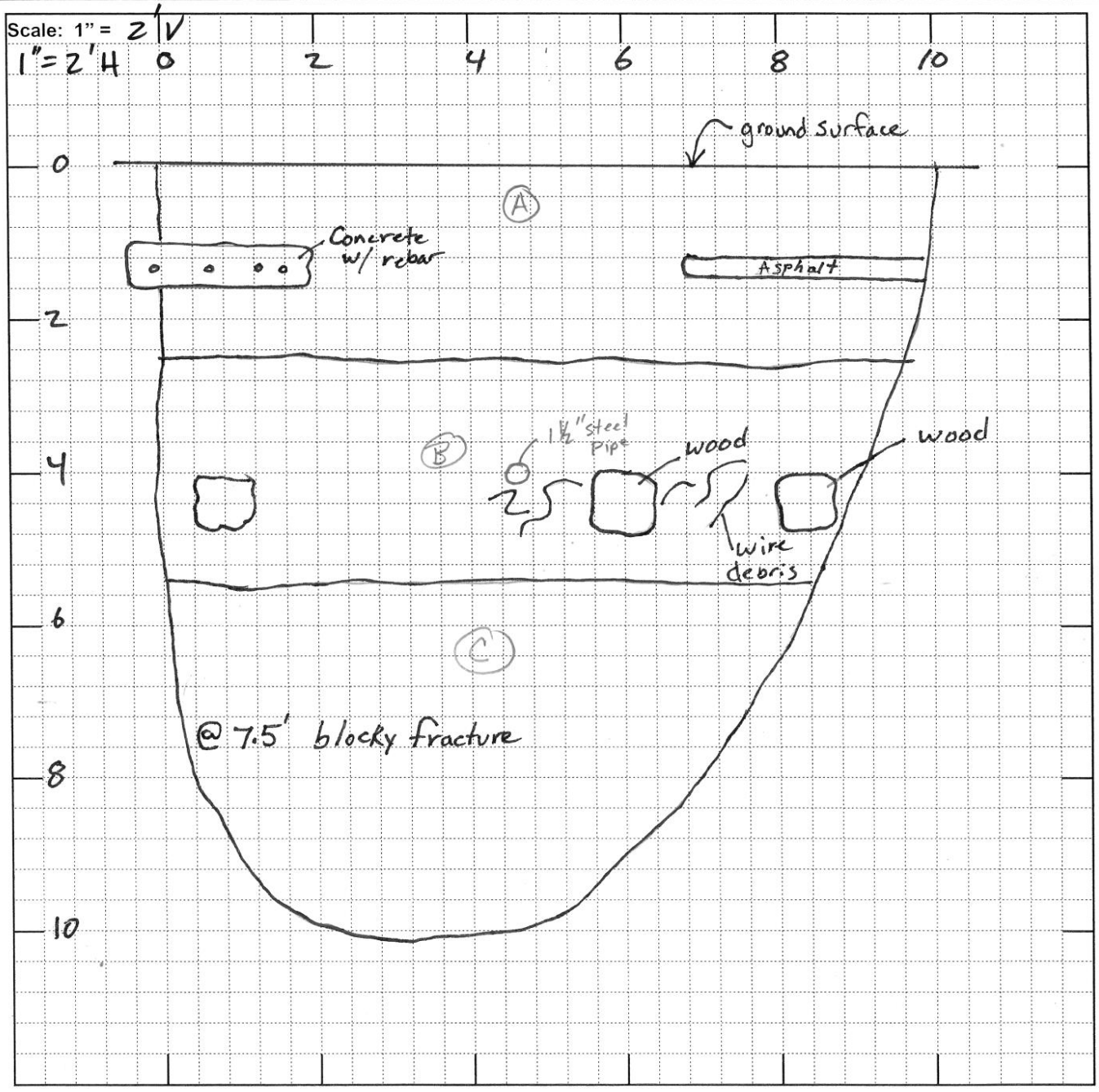
Trench View

Scale: 1" =

@ 7' bgs CLay (CL) dark greenish gray (10GY 4/1) moist, low plasticity, 95% fines, Trace root structures w/ Plant material, blocky fracture, laminated peat (black in color); No TPH odor, No free TPH observed.

@ 9' Clay becomes firm to stiff. Blocky fracture continues, No TPH odor, No Free TPH observed.

Trench Sidewall Record	Trench #	Trench GGG
Contractor: Turn-Key Construction Services, Inc.	Date	11-13-08
Project No. 273939.14.01	Site	
Location		Page 1 of 2
		S. Quayle
GPS Coords		
Trench View	South East	



Trench Sidewall Record	Trench #	Trench GGG
Contractor: Turn-Key Construction Services, Inc.	Date	11-13-08
Project No. 273939.14.01	Site	
Location		Page 2 of 2
GPS Coords		

Trench View

Scale: 1" =

(A) well graded gravel with sand (GW) no TPH odor, no free TPH observed

(B) Silt w/ Sand (ML) no TPH odor, no free TPH observed.

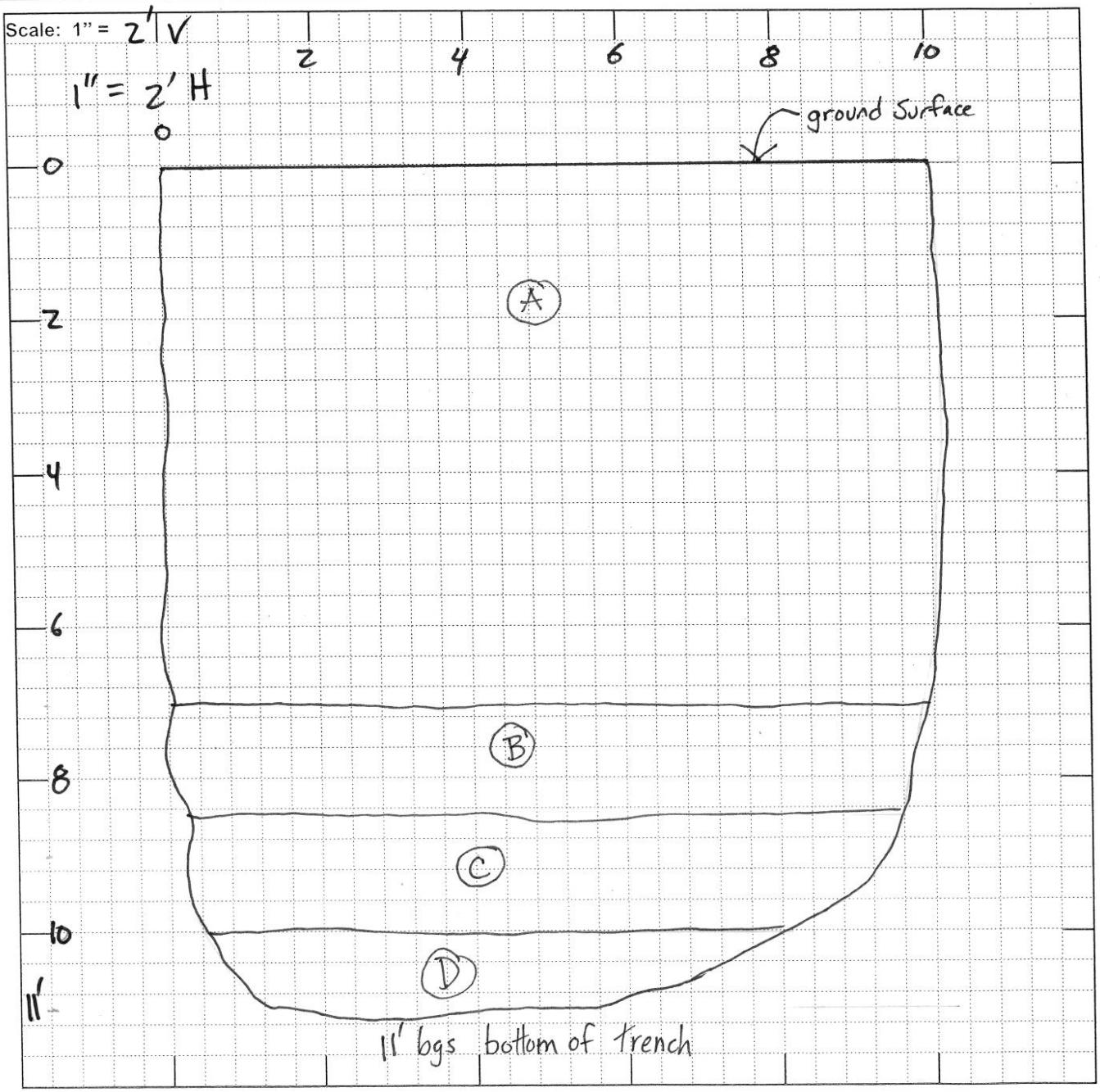
(C) Clay (CL) greenish gray (10Y 5/1), mottled w/ olive brown (2.5Y 4/4), moist, firm, trace root structure/root material, med plasticity, no TPH odor. No free TPH

@ 7.5' blocky fracture.

@ 10' with black reeds at Base, No free TPH observed, No TPH odor

Trench Sidewall Record	Trench # Trench H
Contractor: Turn-Key Construction Services, Inc.	Date 11-10-08
Project No. 273939.14.01	Site
Location 2' north of Location H/3	
GPS Coords	

Trench View North



Trench Sidewall Record	Trench # Trench H
Contractor: Turn-Key Construction Services, Inc.	Date 11-10-08
Project No. 273939.14.01	Site
Location	
GPS Coords	

Trench View

Scale: 1" =

(A) Silt (ML) dark greenish brown (2.5Y 4/2), mottled w/ dark yellowish brown (10YR 4/4), moist, firm, low plasticity, 100% fines, Trace root fibers, no TPH odor, no free TPH observed.

@ 3.5' bgs wood fragments 1" to 1' in length. Fragments are pieces of redwood. No wood fragments below 4' bgs

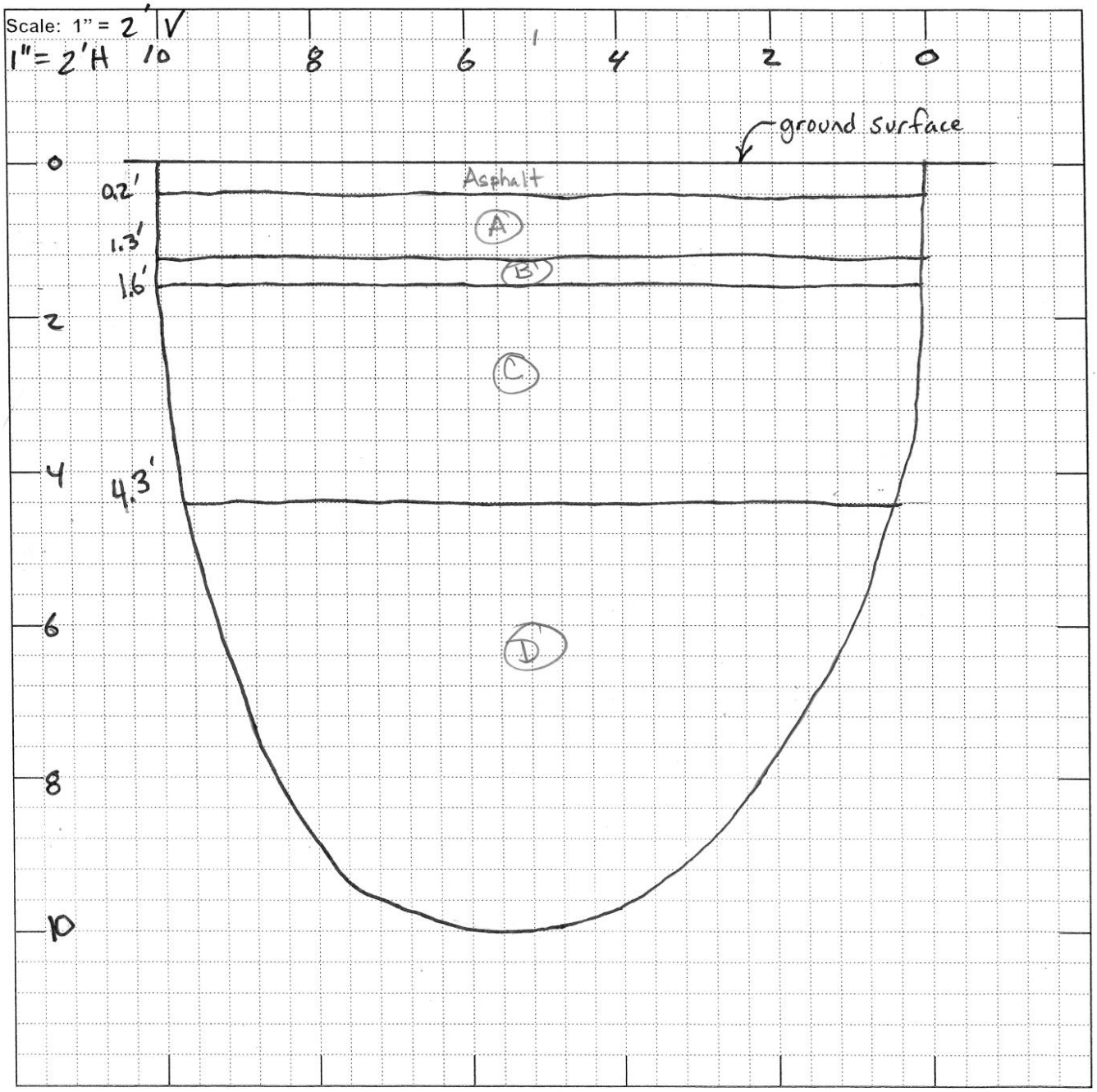
@ 7' (B) CLAY (CH) V. dark gray (N 3/) mottled w/ olive (5Y 4/3) root structures, wet, Soft, high plasticity, Trace mica flakes and root structures,

@ 8.5' (C) Silty Sand (SM) V. dark greenish gray (5GY 3/1) wet Soft, 70% fine sand, 25% fines, trace mica flakes and shells, no TPH odor, no free TPH observed.

@ 10' (D) Clay (CL) black (N 2.5/), moist Soft, med plasticity, trace mica flakes, no TPH odor, no free TPH observed.

11' bottom of boring.

Trench Sidewall Record	Trench # Trench JJJ
Contractor: Turn-Key Construction Services, Inc.	Date 11-13-08
Project No. 273939.14.01	Site
Location	Page 1 of 2
	S. Quayle
GPS Coords	
Trench View	West



Trench Sidewall Record	Trench # Trench JJJ
Contractor: Turn-Key Construction Services, Inc.	Date 11-13-08
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

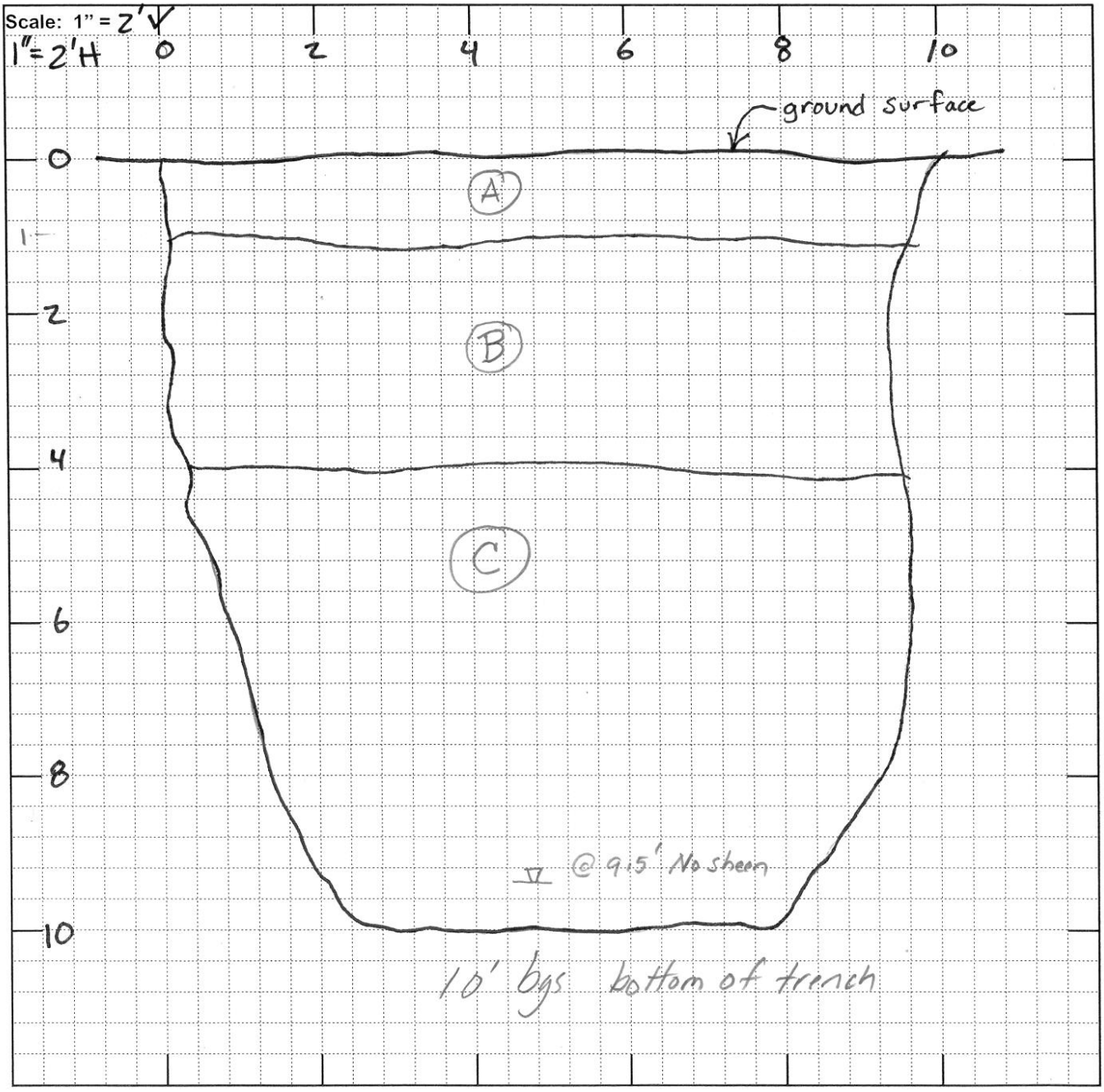
(A) well graded gravel w/ Sand (GW) brown (10YR 4/3), moist, loose, 70% fine to coarse angular gravel (basalt) 20% fine to coarse Sand, 5% fines, no TPH odor, No free TPH observed.

(B) weathered asphalt, fine gravel with pockets of thick black tar material, Pockets of thick black tar material visible in side wall @ 1.6' bgs. Sly TPH odor. This tar is associated with paving and not with free phase hydrocarbons.

(C) Silt (ML) olive (5Y 4/3) mottled w/ yellowish brown (10YR 5/8), moist, stiff, low plasticity, 90% fines, 10% fine Sand, no TPH odor, no free TPH observed.

(D) Clay (CL) v. dark greenish gray (10Y 3/1), moist, Soft to firm, med. plasticity, 100% fines, no TPH odor, no free TPH observed
@ 5' bgs wet, blocky fracture, No Free TPH
@ 6' bgs No blocky fracture, Some root structures and reed material, no free TPH
@ 7' bgs, blocky fracture, Some root structures and reed material, no free TPH
@ 10' bgs w/ reed material, blocky fracture Continues, no free TPH

Trench Sidewall Record	Trench #	Trench RRR
Contractor: Turn-Key Construction Services, Inc.	Date	11-13-08
Project No. 273939.14.01	Site	
Location		Page 1 of 2
		S. Quayle
GPS Coords		
Trench View		Northeast



Trench Sidewall Record	Trench # Trench RRR
Contractor: Turn-Key Construction Services, Inc.	Date
Project No. 273939.14.01	Site
Location	Page 2 of 2
GPS Coords	

Trench View

Scale: 1" =

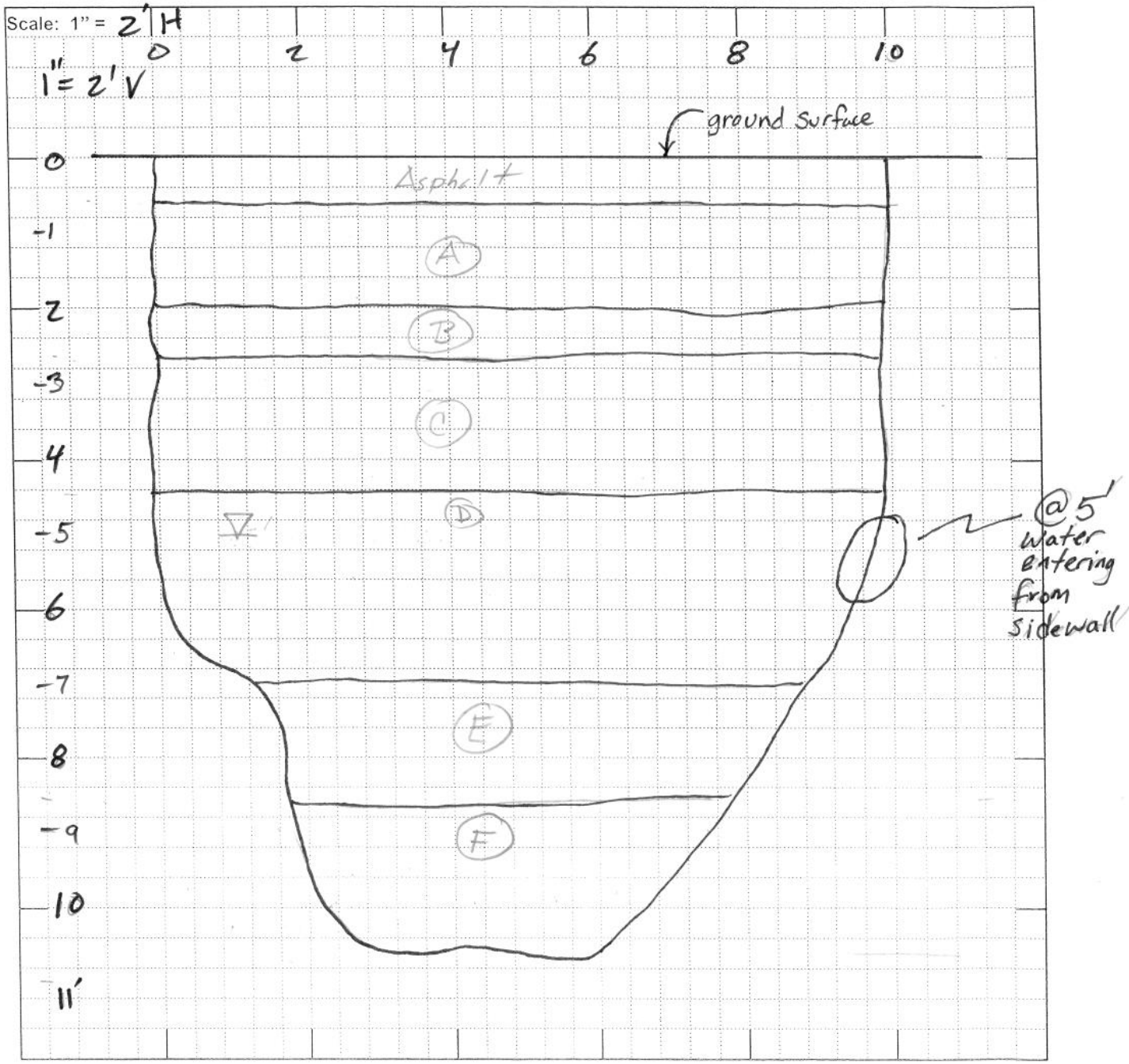
(A) well graded gravel w/ Sand (GW) olive (5Y 5/3), dry, loose, no TPH odor, no free TPH observed.

@ 1' (B) Well graded gravel w/ Sand (GW) brown (10YR 4/3) no TPH odor, no free TPH observed.

@ 4' (C) Clay (CL) dark greenish gray (10GY 4/1), moist, firm, low plasticity, no TPH odor, no free TPH observed.

@ 9' blocky fracture
wet @ 9.5' bgs, No Sheen
@ 10' root and reed structures

Trench Sidewall Record	Trench # Trench UU
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location	
	Page 1 of 3
GPS Coords	
Trench View North	

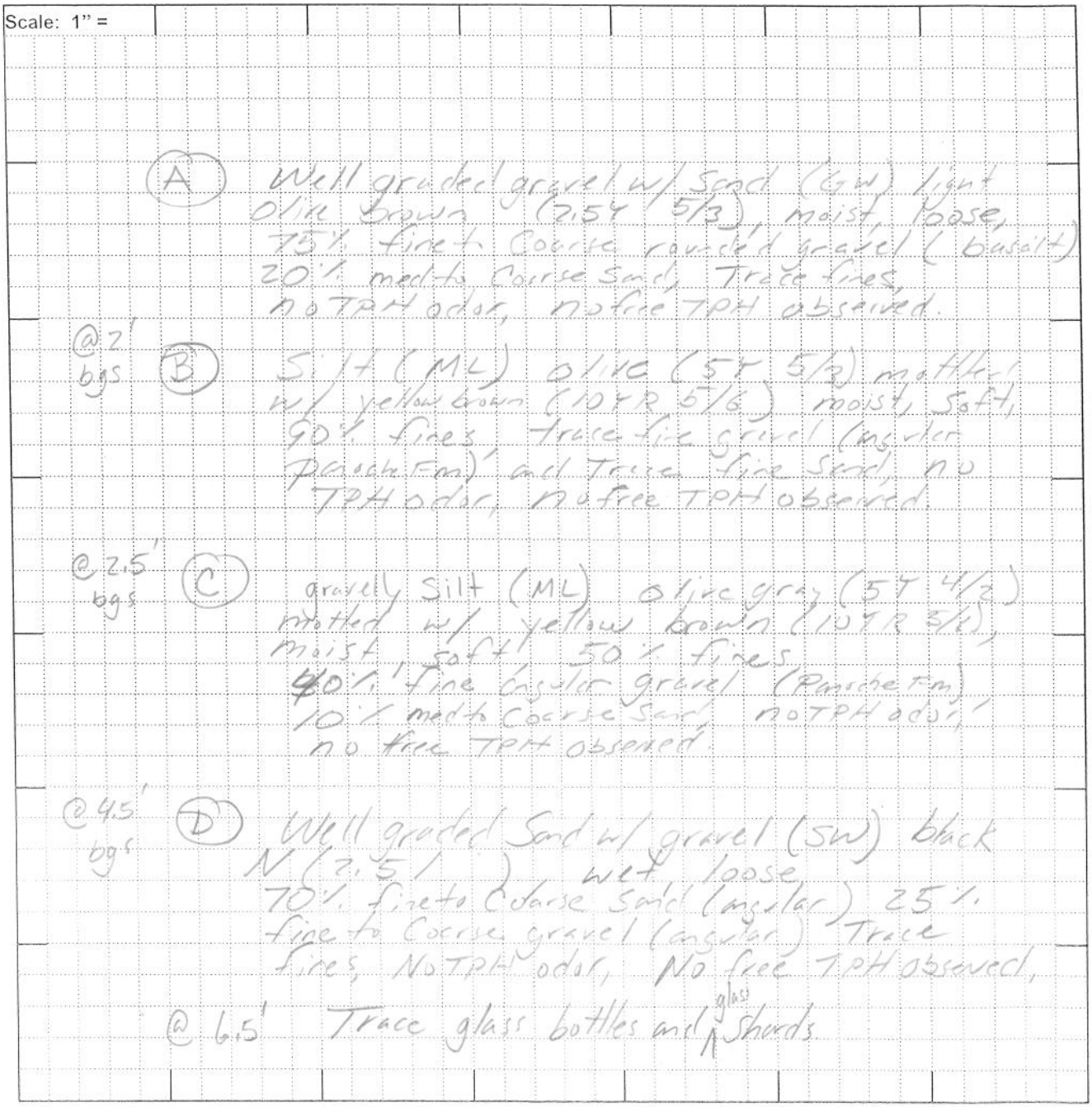


Trench Sidewall Record	Trench # Trench MW
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location	

GPS Coords

Trench View

Scale: 1" =



Trench Sidewall Record	Trench # Trench UU
Contractor: Turn-Key Construction Services, Inc.	Date 11-11-08
Project No. 273939.14.01	Site
Location	

Page 3 of 3

GPS Coords

Trench View

Scale: 1" =

@7' bgs (E) Clay (CL) V. dark greenish gray (10Y 3/1) mottled w/ black (N 2.5/) peat material, wet, soft, low to med plasticity, 95+% fines, trace fine sand, brick, glass. No TPH odor, no free TPH observed.

@ 8' bgs - Several small (quarter size) clods of sheen begin to form. - No odor; No thick viscous free TPH, only sheen. Sligo

(F) Clay (CL) V. dark greenish gray (10Y 3/1), mottled w/ brown (7.5YR 4/3) moist low to med plasticity. 95+% fines, Trace mica flakes and fine sand no TPH odor, No free TPH observed.

- Clay as above

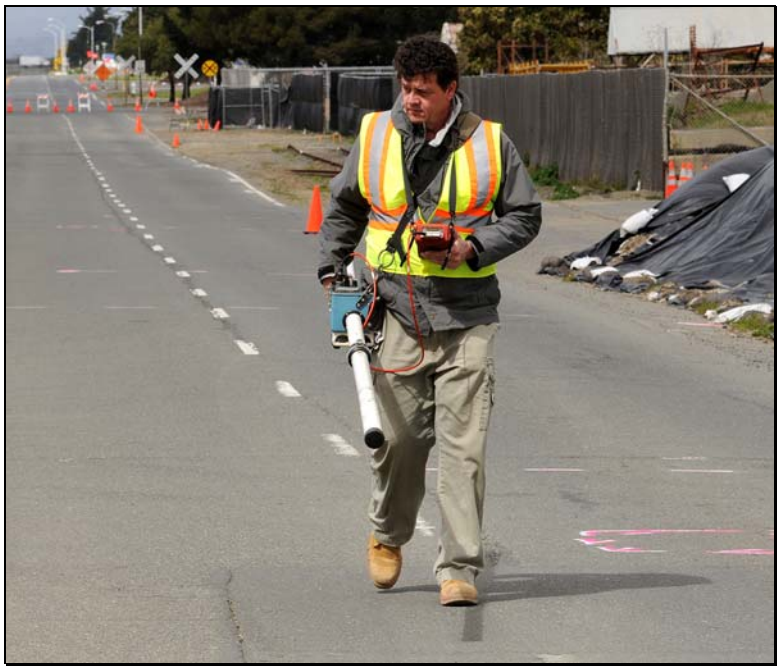
@ 10.5' bgs, No TPH odor, No free TPH observed

10.5' bottom of boring.

APPENDIX H2

Photographs

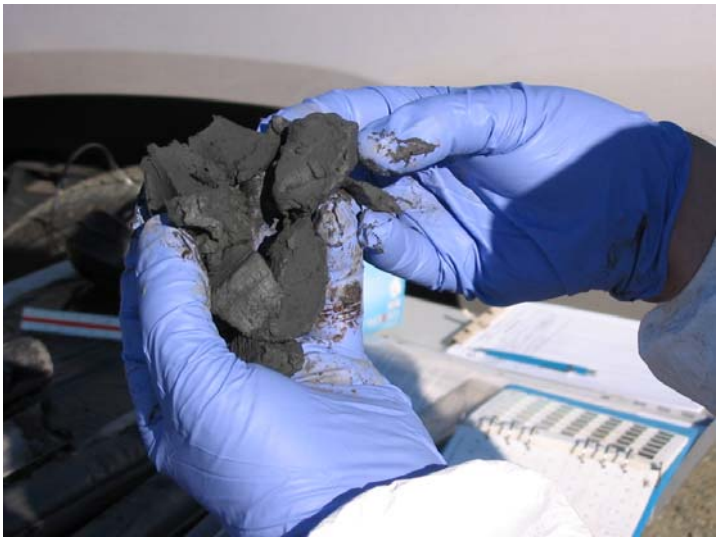
MARCH 10-14, 2008



Geophysical survey using a Geonics EM-31 to measure changes in the ground conductivity using an electromagnetic inductive technique

OCTOBER 20-24, 2008

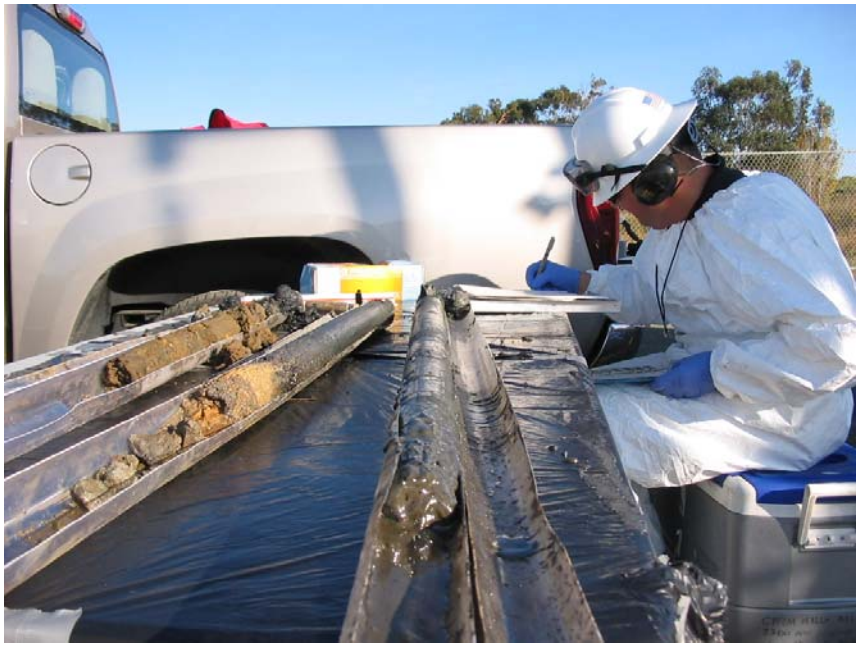
Location E, 13.5′ bgs – free product observed in clay fractures



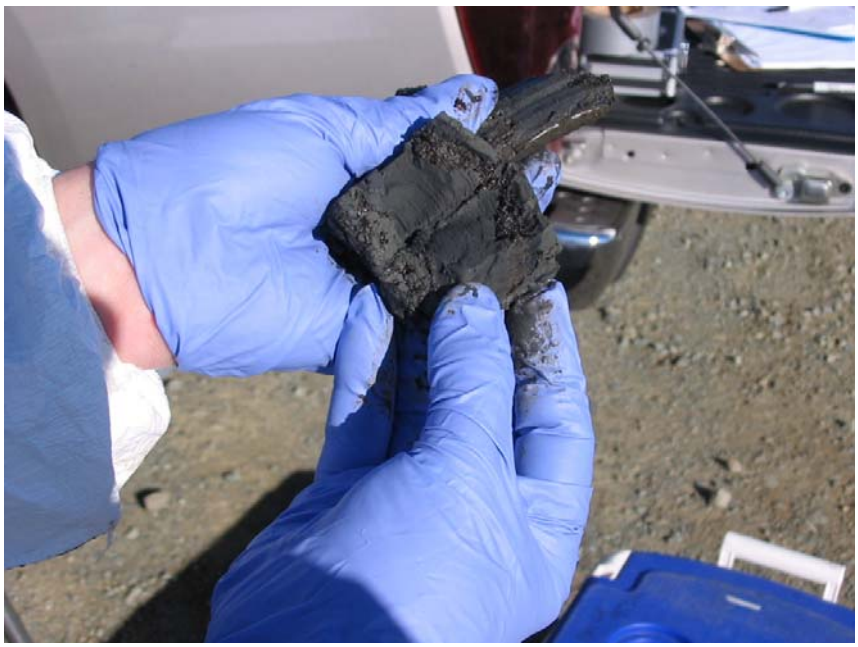
Location E, 13.9′ bgs – free product absent from clay fractures

Location BB – free product being sampled from maintenance hole (Data collection category [DCC] 1)

Initiating soil boring at location F (DCCs 2 and 3)

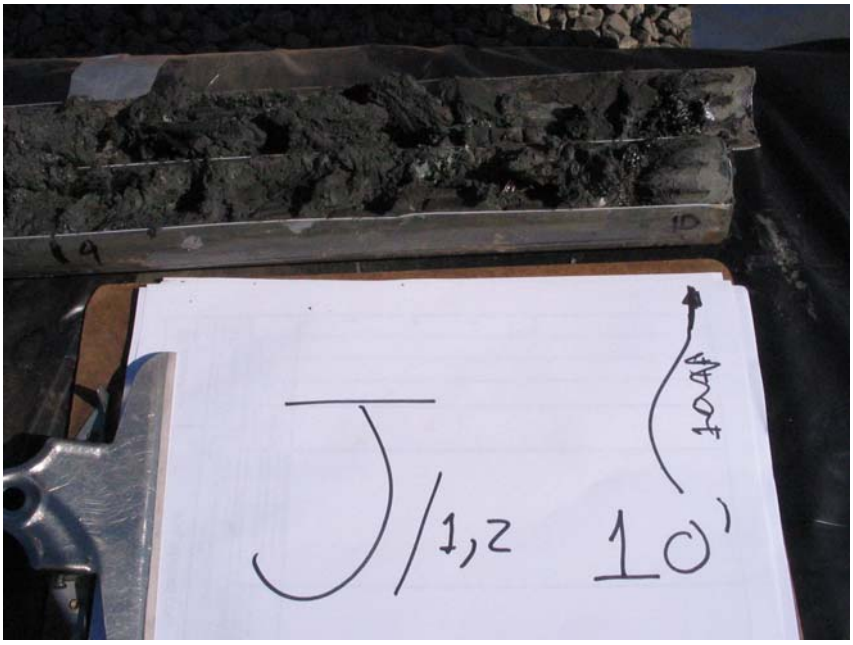


Logging soil core



Location E, 13.5′ bgs – free product observed in clay fractures (DCCs 2 and 3)

Location E , 13.9′ bgs – free product absent from clay fractures (DCCs 2 and 3)



Soil core collected from borehole at location J (DCCs 1 and 2); core section from 4 to 10 feet bgs, showing free product just above 10 feet bgs

Azuar Drive road closure, looking south along the road; in background, Geoprobe rig setting up at location DD (DCC 3)

Soil core from borehole at location J (DCCs 1 and 2); free product observed in sand and gravel at approximately 9.8 feet bgs

Soil core from borehole at location E (DCCs 2 and 3); free product observed in clayey sand with gravel between approximately 12.5 and 12.7 feet bgs

Sample vials filled with free product collected at location L (DCCs 1 and 2)

Soil core from location T (DCC 2); well-graded sand with gravel and debris present from approximately 3 to 7 feet bgs

Soil collected from core at location GG (DCC 1); free product present in blocky fractures of clay, 9.5 feet bgs

OCTOBER 27-31, 2008

Location NN – At 9.5 feet bgs, free product along blocky fracture of clay (DCCs 1, 2 and 3)

Location ZZ – At 14 feet bgs, clay with roots, no free product observed (DCCs 1 and 2)

Location SS West (vacuum boring) -- Close-up of electrical duct bank on left; visible sheen on water on right (DCC 5)

Location ZZ (vacuum boring) – Ditch Witch equipment advancing a vacuum boring (DCC 5)

Location EEE -- Compaction of backfill material (DCC 5)

Location V -- Brick storm drain vault and 8-inch cast-iron storm drain pipe; no free product observed (DCC 5)

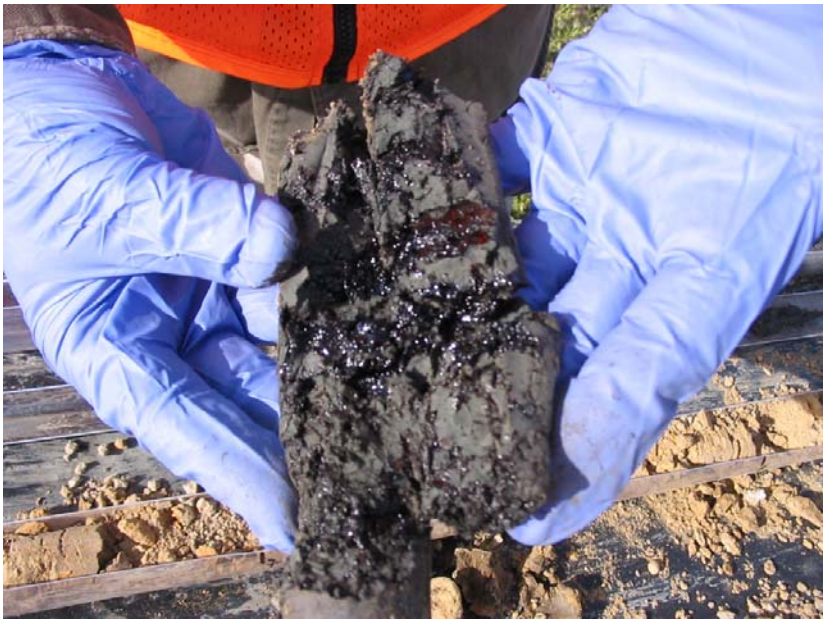
NOVEMBER 3-7, 2008

Location II – Material from just above pipe; sheen observed around gravel in clayey gravel (DCC 5)

Location FF – No free product observed (DCC 5)

Location VV, at 13 feet bgs – Clayey gravel with root structures; free product observed around gravel (DCCs 1 and 2)

Location C – Clay with free product along clay fractures and around gravel (DCCs 1 and 2)



Location B, at 13 feet bgs – Clay with free product in fractures and root structures (DCC 3)

Location QQQ – Thin (mm scale) layer of free product in clay at 7.3 feet bgs (DCC 5)

NOVEMBER 10-14, 2008

Location P (vacuum boring) – Free product observed seeping from communication duct bank in the right side of photo (DCC 5)

Trench A – Photo shows location of trench (looking south towards Dump Road) (DCC 5)

Trench EE – Photo shows location of trench (looking southeast, Building 489 in background on left) (DCC 5)

Trench EE – Photo shows trench being backfilled (looking west, Azuar Drive in background) (DCC 5)

Trench UU – Photo shows location of trench (looking east, Building 535 in background) (DCC 5)

Trench DDD-1 – Photo shows brown free product and water seeping into trench at 4.5 bgs (DCC 5)

Trench DDD-2 – Trowel pointing at layer of gravel with odor and sheen of free product in the north sidewall at approximately 3 feet bgs (DCC 5)

Trenches DDD-1 and DDD-2 – Photo shows trench DDD-1 in foreground and trench DDD-2 in background (looking east, Building 637 in background) (DCC 5)

APPENDIX H3

Analytical Results

Semivolatile Organics

Curtis & Tompkins, Ltd.

Semivolatile Organics by GC/MS

Lab #:	207887	Location:	Followon TPH Investigation DRMO site
Client:	CH2M Hill Constructors Inc.	Prep:	EPA 3550B
Project#:	STANDARD	Analysis:	EPA 8270C
Field ID:	FTPH-FP-TR-DDD2-S2.5	Batch#:	145356
Lab ID:	207887-001	Sampled:	11/13/08
Matrix:	Soil	Received:	11/14/08
Units:	ug/Kg	Prepared:	11/25/08
Basis:	dry	Analyzed:	11/25/08
Diln Fac:	10.00		

Moisture: 17%

Analyte	Result	RL	MDL
Phenol	ND	4,000	1,100
bis(2-Chloroethyl)ether	ND	4,000	470
2-Chlorophenol	ND	4,000	980
2-Methylphenol	ND	4,000	1,200
bis(2-Chloroisopropyl) ether	ND	4,000	540
4-Methylphenol	ND	4,000	1,100
N-Nitroso-di-n-propylamine	ND	4,000	600
Hexachloroethane	ND	4,000	160
Nitrobenzene	ND	4,000	590
Isophorone	ND	4,000	110
2,4-Dimethylphenol	ND	4,000	310
Benzoic acid	ND	20,000	6,300
2,4-Dichlorophenol	ND	4,000	220
4-Chloroaniline	ND	4,000	630
Hexachlorobutadiene	ND	4,000	160
2-Methylnaphthalene	ND	800	100
1-Methylnaphthalene	1,000	800	100
Hexachlorocyclopentadiene	ND	20,000	780
2,4,6-Trichlorophenol	ND	4,000	210
2,4,5-Trichlorophenol	ND	4,000	300
2-Chloronaphthalene	ND	4,000	110
2-Nitroaniline	ND	8,000	830
Dimethylphthalate	ND	4,000	93
2,4-Dinitrophenol	ND	20,000	1,800
4-Nitrophenol	ND	8,000	1,100
Dibenzofuran	ND	4,000	820
Diethylphthalate	ND	4,000	110
N-Nitrosodiphenylamine	2,000 J	4,000	97
Hexachlorobenzene	ND	4,000	100
Pentachlorophenol	ND	8,000	1,800
Carbazole	ND	4,000	830
Di-n-butylphthalate	ND	4,000	130
Butylbenzylphthalate	ND	4,000	110
3,3'-Dichlorobenzidine	ND	8,000	690
bis(2-Ethylhexyl)phthalate	ND	4,000	410
Di-n-octylphthalate	ND	4,000	110

Surrogate	%REC	Limits
2-Fluorophenol	DO	25-135
Phenol-d5	DO	25-135
2,4,6-Tribromophenol	DO	25-144
Nitrobenzene-d5	DO	25-135
2-Fluorobiphenyl	DO	34-135
Terphenyl-d14	DO	32-136

J= Estimated value
DO= Diluted Out
ND= Not Detected
RL= Reporting Limit
MDL= Method Detection Limit

TPH - Gasoline

Curtis & Tompkins, Ltd.

Gasoline by GC/FID (5035 Prep)

Lab #:	207887	Location:	Followon TPH Investigation DRMO site
Client:	CH2M Hill Constructors Inc.	Prep:	EPA 5035
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	FTPH-FP-TR-DDD2-S2.5	Batch#:	145037
Matrix:	Soil	Sampled:	11/13/08
Units:	mg/Kg	Received:	11/14/08
Diln Fac:	1.000	Analyzed:	11/18/08

Type:	SAMPLE	Basis:	dry
Lab ID:	207887-001	Moisture:	17%

Analyte	Result	RL	MDL
Gasoline C7-C12	0.88 Y	0.21	0.014

Surrogate	%REC	Limits
Trifluorotoluene (FID)	89	64-148
Bromofluorobenzene (FID)	97	64-148

Type:	BLANK	Basis:	as received
Lab ID:	QC471157		

Analyte	Result	RL	MDL
Gasoline C7-C12	0.027 J	0.20	0.014

Surrogate	%REC	Limits
Trifluorotoluene (FID)	99	64-148
Bromofluorobenzene (FID)	97	64-148

J= Estimated value
Y= Sample exhibits chromatographic pattern which does not resemble standard
RL= Reporting Limit
MDL= Method Detection Limit

TPH – Diesel & Motor Oil

Curtis & Tompkins, Ltd.

Total Extractable Hydrocarbons

Lab #:	207887	Location:	Followon TPH Investigation DRMO site
Client:	CH2M Hill Constructors Inc.	Prep:	EPA 3550B
Project#:	STANDARD	Analysis:	EPA 8015B
Field ID:	FTPH-FP-TR-DDD2-S2.5	Sampled:	11/13/08
Matrix:	Soil	Received:	11/14/08
Units:	mg/Kg	Prepared:	11/24/08
Batch#:	145346		

Type:	SAMPLE	Moisture:	17%
Lab ID:	207887-001	Diln Fac:	20.00
Basis:	dry	Analyzed:	11/26/08

Analyte	Result	RL	MDL
Diesel C10-C24	4,800	24	5.0
Motor Oil C24-C36	1,900	120	16

Surrogate	%REC	Limits
Hexacosane	DO	25-162

Type:	BLANK	Diln Fac:	1.000
Lab ID:	QC472458	Analyzed:	11/25/08
Basis:	as received		

Analyte	Result	RL	MDL
Diesel C10-C24	ND	1.0	0.21
Motor Oil C24-C36	ND	5.0	0.65

Surrogate	%REC	Limits
Hexacosane	126	25-162

DO= Diluted Out
ND= Not Detected
RL= Reporting Limit
MDL= Method Detection Limit

Purgeable Organics by GC/MS

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	207887	Location:	Followon TPH Investigation DRMO site
Client:	CH2M Hill Constructors Inc.	Prep:	EPA 5035
Project#:	STANDARD	Analysis:	EPA 8260B
Field ID:	FTPH-FP-TR-DDD2-S2.5	Basis:	dry
Lab ID:	207887-001	Sampled:	11/13/08
Matrix:	Soil	Received:	11/14/08
Units:	ug/Kg		

Moisture: 17%

Analyte	Result	RL	MDL	Diln Fac	Batch#	Analyzed
Freon 12	ND	9.6	0.96	0.7987	145036	11/18/08
Chloromethane	ND	9.6	0.96	0.7987	145036	11/18/08
Vinyl Chloride	ND	1,000	10	83.33	145319	11/25/08
Bromomethane	ND	1,000	20	83.33	145319	11/25/08
Chloroethane	ND	1,000	27	83.33	145319	11/25/08
Acetone	200 J	1,000	100	83.33	145319	11/25/08
Freon 113	ND	500	40	83.33	145319	11/25/08
1,1-Dichloroethene	ND	500	10	83.33	145319	11/25/08
Methylene Chloride	180 J	1,000	100	83.33	145319	11/25/08
Carbon Disulfide	ND	500	10	83.33	145319	11/25/08
MTBE	ND	500	10	83.33	145319	11/25/08
trans-1,2-Dichloroethene	ND	500	10	83.33	145319	11/25/08
1,1-Dichloroethane	ND	500	10	83.33	145319	11/25/08
2-Butanone	ND	1,000	200	83.33	145319	11/25/08
cis-1,2-Dichloroethene	ND	500	10	83.33	145319	11/25/08
Chloroform	ND	500	10	83.33	145319	11/25/08
1,1,1-Trichloroethane	ND	500	10	83.33	145319	11/25/08
Carbon Tetrachloride	ND	500	10	83.33	145319	11/25/08
1,2-Dichloroethane	ND	500	10	83.33	145319	11/25/08
Benzene	ND	500	10	83.33	145319	11/25/08
Trichloroethene	ND	500	10	83.33	145319	11/25/08
1,2-Dichloropropane	ND	500	10	83.33	145319	11/25/08
Bromodichloromethane	ND	500	10	83.33	145319	11/25/08
4-Methyl-2-Pentanone	ND	1,000	200	83.33	145319	11/25/08
Toluene	11 J	500	10	83.33	145319	11/25/08
1,1,2-Trichloroethane	ND	500	10	83.33	145319	11/25/08
Tetrachloroethene	ND	500	10	83.33	145319	11/25/08
Dibromochloromethane	ND	500	10	83.33	145319	11/25/08
1,2-Dibromoethane	ND	500	10	83.33	145319	11/25/08
Chlorobenzene	ND	500	10	83.33	145319	11/25/08
1,1,1,2-Tetrachloroethane	ND	500	10	83.33	145319	11/25/08
Ethylbenzene	ND	500	10	83.33	145319	11/25/08
m,p-Xylenes	14 J	500	10	83.33	145319	11/25/08
o-Xylene	ND	500	10	83.33	145319	11/25/08

J= Estimated value
ND= Not Detected
RL= Reporting Limit
MDL= Method Detection Limit

Curtis & Tompkins, Ltd.

Purgeable Organics by GC/MS

Lab #:	207887	Location:	Followon TPH Investigation DRMO site
Client:	CH2M Hill Constructors Inc.	Prep:	EPA 5035
Project#:	STANDARD	Analysis:	EPA 8260B
Field ID:	FTPH-FP-TR-DDD2-S2.5	Basis:	dry
Lab ID:	207887-001	Sampled:	11/13/08
Matrix:	Soil	Received:	11/14/08
Units:	ug/Kg		

Analyte	Result	RL	MDL	Diln Fac	Batch#	Analyzed
Styrene	ND	500	10	83.33	145319	11/25/08
Bromoform	ND	500	20	83.33	145319	11/25/08
Isopropylbenzene	32 J	500	10	83.33	145319	11/25/08
1,1,2,2-Tetrachloroethane	ND	500	10	83.33	145319	11/25/08
1,2,3-Trichloropropane	ND	500	14	83.33	145319	11/25/08
Propylbenzene	25 J	500	10	83.33	145319	11/25/08
Bromobenzene	ND	500	10	83.33	145319	11/25/08
1,3,5-Trimethylbenzene	ND	500	10	83.33	145319	11/25/08
2-Chlorotoluene	ND	500	10	83.33	145319	11/25/08
tert-Butylbenzene	12 J	500	10	83.33	145319	11/25/08
1,2,4-Trimethylbenzene	19 J	500	10	83.33	145319	11/25/08
sec-Butylbenzene	230 J	500	10	83.33	145319	11/25/08
1,3-Dichlorobenzene	ND	500	10	83.33	145319	11/25/08
1,4-Dichlorobenzene	ND	500	10	83.33	145319	11/25/08
n-Butylbenzene	330 J	500	10	83.33	145319	11/25/08
1,2-Dichlorobenzene	ND	500	10	83.33	145319	11/25/08
1,2-Dibromo-3-Chloropropane	ND	500	40	83.33	145319	11/25/08
1,2,4-Trichlorobenzene	ND	500	10	83.33	145319	11/25/08

Surrogate	%REC	Limits	Diln Fac	Batch#	Analyzed
Dibromofluoromethane	89	65-135	83.33	145319	11/25/08
1,2-Dichloroethane-d4	90	52-149	83.33	145319	11/25/08
Bromofluorobenzene	97	65-135	83.33	145319	11/25/08
Trifluorotoluene (MeOH)	124	55-147	83.33	145319	11/25/08

J= Estimated value
ND= Not Detected
RL= Reporting Limit
MDL= Method Detection Limit

APPENDIX I

Analytical Data Validation Reports for the 2007-2008 Follow-on Investigation

Data Validation Reports - 2007

MINS03

FTPH-FP-DR1-6.5
FTPH-FP-FSA-1-3

TPH Diesel & Motor Oil

Data Validation Report – TPH Diesel & Motor Oil

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS03

Parameters: TPH-Diesel & Motor Oil

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-DR-DR1-6.5	MINS03-001	11/08/07	Product
FTPH-FP-FSA-1-3	MINS03-002	11/14/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analysis carried out within 40 days of extraction for the soil sample.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Diesel & Motor Oil and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Diesel and TPH-Motor Oil were detected in the method blank. Sample results were all greater than 10 times the level found in the method blank. No data were qualified on this basis.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-FP-DR-DR1-6.5. The %R and relative percent difference (RPD) values were inapplicable for matrix interference evaluation due to the high levels of diesel and motor oil in this sample.

c. Surrogate Spikes

Surrogate compounds, 2-fluorobiphenyl and *o*-terphenyl, were added to all laboratory QC and field samples. The %R values for both surrogates in sample FTPH-FP-FSA-1-3 were greater than the upper laboratory control limits due to the high levels of TPH-Diesel and Motor Oil in this sample. Data were not qualified on this basis.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Diesel & Motor Oil analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Diesel & Motor Oil data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Diesel & Motor Oil data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

TPH - Gasoline

Data Validation Report – TPH Gasoline

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS03

Parameters: TPH-Gasoline

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-DR-DR1-6.5	MINS03-001	11/08/07	Product
FTPH-FP-FSA-1-3	MINS03-002	11/14/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Analyses were carried out within 14 days of collection for all soil samples.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Gasoline and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. No target analytes were detected in the method blank.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-FP-DR-DR1-6.5. The %R and relative percent difference (RPD) values were within the laboratory control limits

c. Surrogate Spikes

Surrogate compounds, 4-bromofluorobenzene and trifluorotoluene, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Gasoline analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Gasoline data are found of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Gasoline data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

Volatiles

Data Validation Report - VOA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS03

Parameters: Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-DR-DR1-6.5	MINS03-001	11/08/07	Product
FTPH-FP-FSA-1-3	MINS03-002	11/14/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

VOA analyses were carried out within 14 days of collection for soil samples. Samples in this SDG were identified by the laboratory as petroleum products. The holding time established for soil was applied to the evaluation of the holding time effects. No data were qualified on this basis.

II. GC/MS Instrument Performance Check

The instrument performance check, bromofluorobenzene (BFB), for volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. The percent difference (%D) between the initial calibration $\overline{RRF}$ and the continuing calibration RRF for all compounds is within ±25%, except for the following:

Continuing Calibration ID	Analyte	%D	Affected Sample	Flag	A or P
Instrument: 5973Y Date: 11/19/07, 09:42	Dichlorodifluoromethane	27.8%	FTPH-FP-DR-DR1-6.5	UJ	P
Instrument: 5973Y Date: 11/20/07, 13:14	2-Hexanone	28.11%	FTPH-FP-FSA-1-3	UJ	P

Note: Positive %D value indicates a potential low bias of the associated data.

V. Blanks

One method blank per analytical batch was prepared and analyzed. Acetone was detected in the method blank associated with sample FTPH-FP-DR-DR1-6.5 at 320 µg/kg, but not detected in the other method blank. However, acetone is a common laboratory contaminant, both samples analyzed within the adjacent time frame were considered affected and data qualified as follows:

Method Blank ID	Analyte	Blank Concentration (µg/kg)	Affected Samples	Flag (µg/kg)
B111907MVOSY1	Acetone	320 J	FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	9000 U 6000 U

VI. System Monitoring Compounds (SMC)

Four SMC (dibromofluoromethane, 1,2-dichloroetheane-d4, 4-bromofluorobenzene, and toluene-d8) were added to all laboratory QC and field samples. The SMC recovery in the samples and all associated laboratory QC analyses was within the control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD was performed on samples under separate SDGs for this project.

VIII. Laboratory Control Sample (LCS)

LCS and LCS Duplicate analyses were performed as required. The %R and relative percent difference values were within the laboratory control limits.

IX. Internal Standards

Three internal standards, bromochloromethane, chlorobenzene-d5, and 1,4-difluorobenzene were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard.

X. Field Duplicates

Field duplicates were not submitted with this SDG for VOC analyses.

XI. Compound Quantitation and Reported CRQLs

Compound quantitation was calculated according to the correct equation. Correct quantitation ion and RRF were used to quantitate compounds. The internal standard, quantitation ion, and RRF were used consistently throughout the analysis. Sample results and CRQLs are adjusted to reflect the dry-weight and dilution factors.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with the qualifications summarized in Table I and Table II.

XIV. Data Qualifier

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The associated numerical value is an estimate.

Table I. VOA Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS03	FTPH-FP-DR-DR1-6.5	Dichlorodifluoromethane	UJ	P	Low recovery of calibration verification %D.
MINS02	FTPH-FP-FSA-1-3	2-Hexanone	UJ	P	Low recovery of calibration verification %D.

Table II. VOA Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/kg)	Modified Final Concentration (µg/kg)
FTPH-FP-DR-DR1-6.5	Acetone	5400 J	9000 U
FTPH-FP-FSA-1-3		2600 J	6000 U

Semivolatiles

Data Validation Report - SV

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS03

Parameters: Semi-Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-DR-DR1-6.5	MINS03-001	11/08/07	Product
FTPH-FP-FSA-1-3	MINS03-002	11/14/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction should be performed within 14 days of collection and analyses carried out within 40 days of extraction for soil samples. Samples in this SDG were identified by the laboratory as petroleum products. The holding time established for soil was applied to the evaluation of the holding time effects. No data were qualified on this basis.

II. GC/MS Instrument Performance Check

The instrument performance check, Decafluorotriphenylphosphine (DFTPP), for semi-volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05.

The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

VI. Surrogate Spikes

Six surrogate compounds were added to all laboratory QC and field samples. The recovery of one surrogate spike, terphenyl-d14, exceeded the upper control limits in samples FTPH-FP-DR-DR1-6.5 and FTPH-FP-FSA-1-3. The recovery for the other five surrogate spikes was within the control limits. Data were not qualified on this basis.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-FP-DR-DR1-6.5. The %R and relative percent difference (RPD) values were within the control limits for all target compounds, except for the following:

Sample ID	Analyte	MS %R	MSD %R	%R Control Limit	RPD	RPD Criteria	Data Qualification
FTPH-FP-DR-DR1-6.5	Hexachloroethane	71%	177%	35-110%	85%		NA
	2-Methylnaphthalene	9%	27%	45-105%	8%		NA
	Hexachlorocyclopentadiene	0%	0%	12-100%	NC		R
	4,6-Dinitro-2-methylphenol	30%	32%	30-135%	7%		UJ
	Phenanthrene	25%	16%	50-110%	3%		NA
	Fluoranthene	18%	20%	55-115%	1%	30	NA
	Butylbenzylphthalate	140%	151%	50-125%	8%		NA
	bis(2-Ethylhexyl)phthalate	122%	129%	45-125%	5%		NA
	Di-n-octylphthalate	198%	227%	40-130%	14%		NA
	Indeno(1,2,3-cd)pyrene	41%	33%	40-120%	13%		NA
	Benzo(g.h.i)perylene	47%	36%	40-125%	16%		NA

Notes: NC – Not calculated. NA – No action.

VIII. Laboratory Control Sample (LCS)

The LCS analysis was performed with the analytical batch. All %R values were within the control limits.

IX. Internal Standards

Six internal standards, as specified in the methodology, were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard.

The area counts of Chrysene-d12 and Perylene-d12 in samples FTPH-FP-DR-DR1-6.5 and FTPH-FP-FSA-1-3 were below the lower control limit. Affected sample results are qualified as follows:

Sample ID	Internal Standard	IS Area Count	Control Limit	Affected Analyte	Flag
FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	Chrysene-d12	120616 139313	159171 - 636684	Pyrene Butylbenzyl phthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene Chrysene bis(2-Ethylhexyl)phthalate	J/UJ
FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	Perylene-d12	34004 31970	109252 - 437008	Di-n-octyl phthalate Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	J/UJ

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.

X. Field Duplicate

Field duplicates were not submitted with this SDG for SV analyses.

XI. Compound Quantitation and Reported CRQLs

The CRQLs were supported with adequate initial calibration concentrations. Sample results and CRQLs were adjusted to reflect the dry-weight factor.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with qualifications summarized in Table I and Table II.

XIV. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. Semi-Volatiles Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS03	FTPH-FP-DR-DR1-6.5	Hexachlorocyclopentadiene	R	A	The MS/MSD was not recovered (%R = 0%).
MINS03	FTPH-FP-DR-DR1-6.5	4,6-Dinitro-2-methylphenol	UJ	A	The MS/MSD recovery was below the lower control limits.
MINS03	FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	Pyrene Butylbenzyl phthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene Chrysene bis(2-Ethylhexyl)phthalate Di-n-octyl phthalate Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	J/UJ	A	Associated internal standard area counts were below the lower control limits.

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.

Table II. Semi-Volatiles Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged in relation to the detections in blanks.			

Pesticides and PCBs

Data Validation Report – Pesticides and PCBs

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS03

Parameters: Pesticides and PCBs

Method: USEPA SW846 Methods 8081 & 8082

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-DR-DR1-6.5	MINS03-001	11/08/07	Product
FTPH-FP-FSA-1-3	MINS03-002	11/14/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Methods 8081 and 8082.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analyses carried out within 40 days of extraction for all samples.

II. GC/ECD Instrument Performance Check

The Resolution Check Mixture (RCM), containing correct compounds and surrogates, was analyzed at the beginning of every initial calibration on each GC column and instrument used. The resolution of peaks met the criteria of 60%.

The Performance Evaluation Mixture (PEM), containing the correct compounds and surrogates, was analyzed immediately after the RCM and every other 12-hour analytical period. Response peaks met the criteria of 90% of resolution. The absolute retention time of every single component pesticides and surrogate was within the retention time window determined from the initial calibration using the Individual Standard Mixtures.

The percent difference (%D) between the calculated amount and nominal amount for each single component pesticide and surrogate in both PEM analyses on each column was within the ±25% criteria.

The percent breakdown for both 4,4'-DDT and Endrin in each PEM was less than 20% for both GC columns. The combined percent breakdown for both 4,4'-DDT and Endrin in each REM was less than 30% for both GC columns

III. Initial Calibration

Individual Standard Mixtures A and B was analyzed at low, midpoint, and high levels on each GC column and instrument used at adequate concentrations as specified in the methodology. The response peaks were well separated; and met the resolution criterion of 90%. The absolute retention time of every single component pesticides and surrogate was within the retention time window determined from the initial calibration using the Individual Standard mixtures.

The Percent Relative Standard Deviation (%RSD) of the calibration factors for each single component compounds was within the 20% criteria and the surrogate %RSD within the 30% acceptance criteria.

The multi-component target compound was each analyzed separately at single concentration in the initial calibration except Aroclor 1016 and Aroclor 1260. The elution times for major peaks are distinctively distanced between the two Aroclors and therefore acceptable.

The retention times were determined for three peaks for each compound. No exceedance of this retention time window of ±0.07-minutes was identified in any analysis under this SDG. Calibration factor was determined for each peak selected from the multi-component analytes.

IV. Calibration Verification

Each 12-hour analysis sequence was bracketed with an instrument blank and the PEM at the beginning and a second instrument blank and the midpoint Individual Standard Mixtures A and B at the end.

Response peaks met the criteria of 90% of resolution. The absolute retention time for each single component pesticide and surrogate in the Individual Standard Mixtures A and B was within the retention time window.

The percent difference (%D) between the calculated amount and true amount for each single component pesticide and surrogate in the midpoint Individual Standard Mixtures A and B was within the ±25% criteria, except for the following:

Continuing Calibration ID	Analyte	%D	Affected Sample	Flag	A or P
Instrument: 6890Q Date: 12/03/07 Column: CLP1 & CLP2	4,4'-DDT	-33.7% -27.4%	FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	UJ	P

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

An instrument blank was analyzed at least every 12 hours and immediately prior to the analysis of PEM or the Individual Standard Mixtures. No target compound was detected.

VI. Surrogate Spikes

Two surrogate spikes, Tetrachloro-m-xylene (TCX) and Decachlorobiphenyl (DCB), were added to all laboratory QC and field samples.

The recovery of DCB in samples FTPH-FP-DR-DR1-6.5 and FTPH-FP-FSA-1-3 exceeded the upper control limit. No target analytes were detected at or above the CRDLs in this sample; no data qualifying actions were taken on this basis.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were not performed on project samples in this SDG.

VIII. Laboratory Control Sample (LCS)

LCS analysis is not required for soil samples per the methodology.

IX. Field Duplicate

Field duplicates were not submitted with this SDG for pesticides and PCBs analyses.

X. Pesticides Cleanup Check

GPC and Florisil cleanup were performed on extracts of samples as required by the methodology. The recovery and blank met the criteria.

XI. Overall Assessment of Data

Data were found of know quality and acceptable with the qualification summarized in Tables I and II.

XII. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. Pesticides and PCBs Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS03	FTPH-FP-DR-DR1-6.5 FTPH-FP-FSA-1-3	4,4'-DDT	UJ	P	The %D value for the continuing calibration exceeded 25% (low bias).

Table II. Pesticides and PCBs Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged due to detections in the blanks.			

MINS04

FTPH-FP-AD-4

TPH Diesel & Motor Oil

Data Validation Report – TPH Diesel & Motor Oil

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS04

Parameters: TPH-Diesel & Motor Oil

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-AD-4	MINS04-001	11/26/07	Product
FTPH-IDW-SO-02	MINS04-002	11/27/07	Soil
FTPH-IDW-SO-03	MINS04-003	11/27/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analysis carried out within 40 days of extraction for the soil sample.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Diesel & Motor Oil and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Motor Oil was detected in one of the method blanks. Sample results were all greater than 10 times the level found in the method blank. No data were qualified on this basis.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on samples FTPH-FP-AD-4 and FTPH-IDW-SO-02. The %R and relative percent difference (RPD) values were inapplicable for matrix interference evaluation due to the high levels of diesel and motor oil in this sample.

c. Surrogate Spikes

Surrogate compounds, 2-fluorobiphenyl and *o*-terphenyl, were added to all laboratory QC and field samples. The %R values for *o*-terphenyl in samples FTPH-IDW-SO-02 and FTPH-IDW-SO-03 were greater than the upper laboratory control limits due to the high levels of TPH-Diesel and Motor Oil in this sample. Data were not qualified on this basis.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Diesel & Motor Oil analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Diesel & Motor Oil data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Diesel & Motor Oil data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

TPH - Gasoline

Data Validation Report – TPH Gasoline

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS04

Parameters: TPH-Gasoline

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-AD-4	MINS04-001	11/26/07	Product
FTPH-IDW-SO-02	MINS04-002	11/27/07	Soil
FTPH-IDW-SO-03	MINS04-003	11/27/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Analyses were carried out within 14 days of collection for all soil samples.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Gasoline and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. No target analytes were detected in the method blank.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on samples FTPH-FP-AD-4 and FTPH-IDW-SO-03. The %R and relative percent difference (RPD) values were within the laboratory control limits

c. Surrogate Spikes

Surrogate compounds, 4-bromofluorobenzene and trifluorotoluene, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Gasoline analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Gasoline data are found of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Gasoline data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

Volatiles

Data Validation Report - VOA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS04

Parameters: Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-AD-4	MINS04-001	11/26/07	Product
FTPH-IDW-SO-02	MINS04-002	11/27/07	Soil
FTPH-IDW-SO-03	MINS04-003	11/27/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

VOA analyses should be performed within 14 days of collection for soil samples. Sample FTPH-FP-AD-4 was a free petroleum product. This sample, along with the two soil samples in this SDG, were analyzed within the 14-day holding time.

II. GC/MS Instrument Performance Check

The instrument performance check, bromofluorobenzene (BFB), for volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%, except for the following:

Continuing Calibration ID	Analyte	%D	Affected Sample	Flag	A or P
Instrument: 5973B Date: 12/05/07, 10:47	Trichlorofluoromethane Carbon Tetrachloride Tetrachloroethene	-29.8% -34.9% -38.5%	None	No action	-

Note: A negative %D value indicates a potential high bias of the associated data. "None" – No associated samples were affected.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected in method blanks.

VI. System Monitoring Compounds (SMC)

Four system monitoring compounds (dibromofluoromethane, 1,2-dichloroetheane-d4, 4-bromofluorobenzene, and toluene-d8) were added to all laboratory QC and field samples. The SMC recovery in all analyses was within the control limits, except that the %R values for toluene-d8 and 4-bromofluorobenzene in both soil samples FTPH-IDW-SO-02 and FTPH-IDW-SO-03 exceeded the upper control limit. The samples were then re-analyzed and the surrogate spike %R values remained at the similar levels, indicating that the elevated surrogate recovery was a result of matrix effects rather than analytical deficiency. However, based on the internal standard recovery, VOC results for samples FTPH-IDW-SO-02 and FTPH-IDW-SO-03 were to be reported from the re-analysis (12/05/07) without data qualifying. The results reported from the initial analyses (12/03/07) were to be qualified (R) and rejected, in favor of the re-analysis results.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD was performed on samples under separate SDGs for this project.

VIII. Laboratory Control Sample (LCS)

LCS and LCS Duplicate analyses were performed. The %R and relative percent difference (RPD) values were within the laboratory control limits.

IX. Internal Standards

Three internal standards, bromochloromethane, chlorobenzene-d5, and 1,4-difluorobenzene were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard, except for the following:

Sample ID	Internal Standard	IS Area Count	Control Limit	Affected Analyte	Flag
FTPH-IDW-SO-02RE FTPH-IDW-SO-03RE	1,4-Dichlorobenzene-d4	93302 88973	133825 – 535300	*trans*-1,2-Dichloroethene 4-Bromofluorobenzene 1,1,2,2-Tetrachloroethane *n*-Propylbenzene 2-Chlorotoluene 4-Chlorotoluene 1,3,5-Trimethylbenzene *sec*-Butylbenzene 1,3-Dichlorobenzene 4-Isopropyltoluene 1,4-Dichlorobenzene 1,2-Dichlorobenzene *n*-Butylbenzene 1,2-Dibromo-3-chloropropane 1,2,4-Trichlorobenzene Hexachlorobutadiene Naphthalene 1,2,3-Trichlorobenzene	J/UJ

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.
RE – Reanalysis

X. Field Duplicates

Field duplicates were not submitted with this SDG for VOC analyses.

XI. Compound Quantitation and Reported CRQLs

Compound quantitation was calculated according to the correct equation. Correct quantitation ion and RRF were used to quantitate compounds. The internal standard, quantitation ion, and RRF were used consistently throughout the analysis. Sample results and CRQLs are adjusted to reflect the dry-weight and dilution factors.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with the qualifications summarized in Table I and Table II.

XIV. Data Qualifier

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. VOA Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS04	FTPH-IDW-SO-02 FTPH-IDW-SO-03 (Analyzed on 12/03/08)	All VOCs	R	A	In favor of the initial analysis results.
MINS04	FTPH-IDW-SO-02RE FTPH-IDW-SO-03RE (Analyzed on 12/05/08)	*trans*-1,2-Dichloroethene 4-Bromofluorobenzene 1,1,2,2-Tetrachloroethane *n*-Propylbenzene 2-Chlorotoluene 4-Chlorotoluene 1,3,5-Trimethylbenzene *sec*-Butylbenzene 1,3-Dichlorobenzene 4-Isopropyltoluene 1,4-Dichlorobenzene 1,2-Dichlorobenzene *n*-Butylbenzene 1,2-Dibromo-3-chloropropane 1,2,4-Trichlorobenzene Hexachlorobutadiene Naphthalene **1,2,3-Trichlorobenzene**	J/UJ	A	The internal standard area count was below the lower control limit.

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.
RE – Reanalysis

Table II. VOA Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/kg)	Modified Final Concentration (µg/kg)
No data wer qualified in relation to detections in blanks.			

Semivolatiles

Data Validation Report - SV

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS04

Parameters: Semi-Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-AD-4	MINS04-001	11/26/07	Product

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction should be performed within 14 days of collection and analyses carried out within 40 days of extraction for soil samples. The sample in this SDG was as a free petroleum product. The holding time established for soil was applied to the evaluation of the holding time effects. The sample was extracted and analyzed within the advisory holding time.

II. GC/MS Instrument Performance Check

The instrument performance check, Decafluorotriphenylphosphine (DFTPP), for semi-volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05.

The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

VI. Surrogate Spikes

Six surrogate compounds were added to all laboratory QC and field samples. The recovery of one surrogate spike, terphenyl-d14, exceeded the upper control limits in samples FTPH-FP-DR-DR1-6.5 and FTPH-FP-FSA-1-3. The recovery for the other five surrogate spikes was within the control limits. Data were not qualified on this basis.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were not performed on a project sample in this SDG.

VIII. Laboratory Control Sample (LCS)

The LCS analysis was performed with the analytical batch. All %R values were within the control limits.

IX. Internal Standards

Six internal standards, as specified in the methodology, were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard.

The area counts of Chrysene-d12 and Perylene-d12 in samples FTPH-FP-AD-4 were below the lower control limit. Affected sample results are qualified as follows:

Sample ID	Internal Standard	IS Area Count	Control Limit	Affected Analyte	Flag
FTPH-FP-AD-4	Chrysene-d12	258975	285027 - 1140108	Pyrene Butylbenzyl phthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene Chrysene bis(2-Ethylhexyl)phthalate	J/UJ
FTPH-FP-AD-4	Perylene-d12	202725	223279 - 893116	Di-n-octyl phthalate Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	J/UJ

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.

X. Field Duplicate

Field duplicates were not submitted with this SDG for SV analyses.

XI. Compound Quantitation and Reported CRQLs

The CRQLs were supported with adequate initial calibration concentrations. Sample results and CRQLs were adjusted to reflect the dry-weight factor.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with qualifications summarized in Table I and Table II.

XIV. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. Semi-Volatiles Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS04	FTPH-FP-AD-4	Pyrene Butylbenzyl phthalate 3,3'-Dichlorobenzidine Benzo(a)anthracene Chrysene bis(2-Ethylhexyl)phthalate Di-n-octyl phthalate Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene Benzo(g,h,i)perylene	J/UJ	A	Associated internal standard area counts were below the lower control limits.

Notes: J/UJ – Detects are qualified (J) and non-detects are qualified (UJ) as estimated.

Table II. Semi-Volatiles Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged in relation to the detections in blanks.			

Pesticides and PCBS

Data Validation Report – Pesticides and PCBs

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS04

Parameters: Pesticides and PCBs

Method: CLP SOW OLM04.3 (Soil)
USEPA SW846 Methods 8081/8082 (Product)

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-AD-4	MINS04-001	11/26/07	Product
FTPH-IDW-SO-02	MINS04-002	11/27/07	Soil
FTPH-IDW-SO-03	MINS04-003	11/27/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3 for soil samples and USEPA SW846 Methods 8081 and 8082 for free petroleum products.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analyses carried out within 40 days of extraction for all samples.

II. GC/ECD Instrument Performance Check

The Resolution Check Mixture (RCM), containing correct compounds and surrogates, was analyzed at the beginning of every initial calibration on each GC column and instrument used. The resolution of peaks met the criteria of 60%.

The Performance Evaluation Mixture (PEM), containing the correct compounds and surrogates, was analyzed immediately after the RCM and every other 12-hour analytical period. Response peaks met the criteria of 90% of resolution. The absolute retention time of every single component pesticides and surrogate was within the retention time window determined from the initial calibration using the Individual Standard Mixtures.

The percent difference (%D) between the calculated amount and nominal amount for each single component pesticide and surrogate in both PEM analyses on each column was within the ±25% criteria.

The percent breakdown for both 4,4'-DDT and Endrin in each PEM was less than 20% for both GC columns. The combined percent breakdown for both 4,4'-DDT and Endrin in each REM was less than 30% for both GC columns

III. Initial Calibration

Individual Standard Mixtures A and B was analyzed at low, midpoint, and high levels on each GC column and instrument used at adequate concentrations as specified in the methodology. The response peaks were well separated; and met the resolution criterion of 90%. The absolute retention time of every single component pesticides and surrogate was within the retention time window determined from the initial calibration using the Individual Standard mixtures.

The Percent Relative Standard Deviation (%RSD) of the calibration factors for each single component compounds was within the 20% criteria and the surrogate %RSD within the 30% acceptance criteria, except for the following:

Initial Calibration ID	Analyte	%RSD	Affected Sample	Flag	A or P
Instrument: 6890Q Date: 11/27/07 Column: DB-XLB	4,4'-DDT	22.42%	FTPH-IDW-SO-02 FTPH-IDW-SO-03	UJ	P

The multi-component target compound was each analyzed separately at single concentration in the initial calibration except Aroclor 1016 and Aroclor 1260. The elution times for major peaks are distinctively distanced between the two Aroclors and therefore acceptable.

The retention times were determined for three peaks for each compound. No exceedance of this retention time window of ±0.07-minutes was identified in any analysis under this SDG. Calibration factor was determined for each peak selected from the multi-component analytes.

IV. Calibration Verification

Each 12-hour analysis sequence was bracketed with an instrument blank and the PEM at the beginning and a second instrument blank and the midpoint Individual Standard Mixtures A and B at the end.

Response peaks met the criteria of 90% of resolution. The absolute retention time for each single component pesticide and surrogate in the Individual Standard Mixtures A and B was within the retention time window.

The percent difference (%D) between the calculated amount and true amount for each single component pesticide and surrogate in the midpoint Individual Standard Mixtures A and B was within the ±25% criteria.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

An instrument blank was analyzed at least every 12 hours and immediately prior to the analysis of PEM or the Individual Standard Mixtures. No target compound was detected.

VI. Surrogate Spikes

Two surrogate spikes, Tetrachloro-m-xylene (TCX) and Decachlorobiphenyl (DCB), were added to all laboratory QC and field samples.

The recovery of TCX and DCB in all samples and QC analyses was within the laboratory control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-IDW-SO-02. The %R values for endrin and 4,4'-DDT exceeded the upper control limits. These compounds were not detected in this sample; data were not qualified on this basis.

VIII. Laboratory Control Sample (LCS)

LCS analysis is not required for soil samples per the methodology.

IX. Field Duplicate

Field duplicates were not submitted with this SDG for pesticides and PCBs analyses.

X. Pesticides Cleanup Check

GPC and Florisil cleanup were performed on extracts of samples as required by the methodology. The recovery and blank met the criteria.

XI. Overall Assessment of Data

The dual column RPD value for alpha-chlordane in sample FTPH-IDW-SO-02 was greater than the control criterion of 25%. The alpha-chlordane result for sample FTPH-IDW-SO-02 was qualified (J) as estimated.

Data were found of know quality and acceptable with the qualification summarized in Tables I and II.

XII. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. Pesticides and PCBs Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS04	FTPH-IDW-SO-02 FTPH-IDW-SO-03	4,4'-DDT	UJ	P	The %RSD value for the initial calibration exceeded 20%.
MINS04	FTPH-IDW-SO-02	alpha-Chlordane	J	A	The dual column RPD value exceeded 25%.

Table II. Pesticides and PCBs Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged due to detections in the blanks.			

MINS05

FTPH-TS-AD2-S13.5

TPH Diesel & Motor Oil

Data Validation Report – TPH Diesel & Motor Oil

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: TPH-Diesel & Motor Oil

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analysis carried out within 40 days of extraction for the soil sample.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Diesel & Motor Oil and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Motor Oil was detected in one of the method blanks. Sample results were all greater than 10 times the level found in the method blank. No data were qualified on this basis.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD2-S13.5. The %R and relative percent difference (RPD) values were within the laboratory control limits.

c. Surrogate Spikes

Surrogate compounds, 2-fluorobiphenyl and *o*-terphenyl, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Diesel & Motor Oil analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Diesel & Motor Oil data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Diesel & Motor Oil data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

TPH - Gasoline

Data Validation Report – TPH Gasoline

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: TPH-Gasoline

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

The sample was analyzed within the 14-day holding time.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Gasoline and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. No target analytes were detected in the method blank.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD2-S13.5. The %R and relative percent difference (RPD) values were within the laboratory control limits

c. Surrogate Spikes

Surrogate compounds, 4-bromofluorobenzene and trifluorotoluene, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Gasoline analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Gasoline data are found of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Gasoline data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

Volatiles

Data Validation Report - VOA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

VOA analyses should be performed within 14 days of collection for soil samples. The sample in this SDG was analyzed within the holding time.

II. GC/MS Instrument Performance Check

The instrument performance check, bromofluorobenzene (BFB), for volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected in method blanks.

VI. System Monitoring Compounds (SMC)

Four system monitoring compounds (dibromofluoromethane, 1,2-dichloroetheane-d4, 4-bromofluorobenzene, and toluene-d8) were added to all laboratory QC and field samples. The SMC recovery in all analyses was within the control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD was performed on samples under separate SDGs for this project.

VIII. Laboratory Control Sample (LCS)

LCS analyses were performed. The %R values were within the laboratory control limits.

IX. Internal Standards

Three internal standards, bromochloromethane, chlorobenzene-d5, and 1,4-difluorobenzene were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard.

X. Field Duplicates

Field duplicates were not submitted with this SDG for VOC analyses.

XI. Compound Quantitation and Reported CRQLs

Compound quantitation was calculated according to the correct equation. Correct quantitation ion and RRF were used to quantitate compounds. The internal standard, quantitation ion, and RRF were used consistently throughout the analysis. Sample results and CRQLs are adjusted to reflect the dry-weight and dilution factors.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with the qualifications summarized in Table I and Table II.

Table I. VOA Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to data in this SDG.					

Table II. VOA Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/kg)	Modified Final Concentration (µg/kg)
No data were qualified in relation to detections in blanks.			

SVOCs (PAH Only)

Data Validation Report - PNA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: PNA

Method: USEPA SW846 Method 8270-SIM

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Method 8270-SIM.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Soil samples should be extracted within 14 days of collection and the extracts analyzed within 40 days of extraction. Samples were extracted and analyzed within the holding times.

II. GC/MS Instrument Performance Check

The instrument performance check, Decafluorotriphenylphosphine (DFTPP), for semi-volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05.

The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

VI. Surrogate Spikes

Three surrogate compounds, as specified in the methodology, were added to all laboratory QC and field samples. The recovery in samples and QC analyses was within the control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD2-S13.5. The percent recovery (%R) and relative percent difference (RPD) values were within the control limits, except the RPD value for pyrene (37%). The pyrene result for sample FTPH-TS-AD2-S13.5 was qualified (J) as estimated.

VIII. Laboratory Control Sample (LCS)

LCS analysis was perfored for the analytical batch. All %R values were within the control limits.

IX. Internal Standards

Six internal standards, as specified in the methodology, were used.

The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The internal standard area counts for all analyses were within –50% to +100% of those of the associated calibration standard.

X. Compound Quantitation and Reported CRQLs

The CRQLs were supported with adequate initial calibration concentrations. Sample results and CRQLs were adjusted to reflect the dry-weight factor.

XI. System Performance

No specific system degradation was observed.

XII. Overall Assessment of Data

Data are of known quality and acceptable with qualifications summarized in Table I and Table II.

XIII. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.

Table I. Semi-Volatiles Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS05	FTPH-TS-AD2-S13.5	Pyrene	J	P	The MS/MSD RPD value exceeded the control limits.

Table II. Semi-Volatiles Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged in relation to the detections in blanks.			

Metals

Data Validation Report – TAL Metals

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: TAL Metals

Method: CLP SOW ILM04.1

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW ILM04.1.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Inorganic Data Review (USEPA 2004) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample analysis was carried out within 180 days (28 days for mercury) of collection for all soil samples.

II. Calibration

a. Initial Calibration

A blank and one calibration standard were used in establishing analytical curve for ICP. The average of two replicate exposures was reported for all standards, QC, and sample analysis. All analysis was reported within the documented linear range of the ICP calibration curve.

A blank and more than four calibration standards were employed to establish the analytical curve for cold vapor (CV) mercury analysis. The linearity of the CV calibration curve met the criteria of correlation coefficient ≥ 0.995.

CRQL check standard analyses were performed as required by the methodology for ICP metals and mercury. The results met the acceptance criteria of 70 – 130% (50 –150% for Sb, Pb, and Tl) of the true value for all ICP target analytes and mercury.

b. Initial and Continuing Calibration Verification (ICV and CCV)

The ICV was analyzed immediately after the initial calibration for ICP Metals and CV mercury analysis. The ICV results met the criteria of 90 – 110% of the true value for ICP Metals and 80 – 120% of the true value for Mercury.

The CCV (at the mid-point concentration of the calibration curve) was analyzed at a frequency of 10% (less than 2 hours of run time), at the beginning of analysis run, and after the last sample analysis.

The CCV results met the criteria of 90 – 110% of the true value for ICP Metals and 80 – 120% of the true value for Mercury.

III. Blanks

Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed as required by the methodology for ICP Metals and Mercury. No target analytes were detected at or above the CRQLs. Selected metals were detected in ICBs and/or CCBs between the MDLs and CRQLs. Sample results were either greater than 10 times the respective CCB detections, or already

qualified due to the detections in the preparation blank (see discussion below). No sample results were qualified on this basis.

A preparation blank (PB) was prepared and analyzed for each analytical batch. No target analytes were detected at or above the CRQL; selected metals were detected in the PB at levels between the MDLs and CRQLs. Sample results less than 10 times the PB detections are considered affected. The affected results are qualified as follows:

Prep. Blank ID	Analyte	Blank Concentration (mg/kg)	Affected Samples	Flag
B121707ICPS06	Sb Cd Ag Tl	-0.38 B -0.34 B -0.48 B -0.70 B	FTPH-TS-AD2-S13.5	UJ

Note: B – The value is between the MDL and CRQL.

Negative detections in ICBs, CCBs, and the PB were evaluated against the associated sample results. No significant effects of the negative detections in the blanks were identified except those addressed above.

IV. ICP Interference Check Sample (ICS)

ICS solutions A and AB were analyzed as required by the methodology. The percent recovery (%R) of analytes in solution AB met the acceptance criteria of ±20%.

V. Laboratory Control Sample (LCS)

LCS analyses were performed as required by the methodology. The %R values in the LCS met the acceptance criteria of 80 – 120% for all target analytes.

VI. Duplicate Sample

Duplicate analyses were performed on sample FTPH-TS-AD2-S13.5. RPD values or concentration difference met the control criterion (35% for RPD, 2 x CRQL for difference), except qualified as follows:

Sample ID	Analyte	RPD (%)	Control Criteria (%)	Affected Sample	Data Qualification
FTPH-TS-AD2-S13.5	Ca	55.0%	35%	FTPH-TS-AD2-S13.5	J

VII. Spike Sample Analysis

Matrix spike analyses were performed on sample FTPH-TS-AD2-S13.5. The %R values met the control limits, except for the following:

Spiked Sample ID	Analyte	%R (%)	Control Limit (%)	Affected Sample	Data Qualification
FTPH-TS-AD2-S13.5	Sb	12.6%	80 - 120%	FTPH-TS-AD2-S13.5	UJ
	Cd	60.0%			UJ
	Ca	132.9%			J
	Cr	62.5%			J
	V	79.2%			J

VIII. ICP Serial Dilution

Serial dilution analyses were performed on sample FTPH-TS-AD2-S13.5. The %D values were within the control criterion of 10% for sample concentrations >50xMDL, except for the following:

Dilution Analysis Sample ID	Analyte	%D (%)	Control Criteria (%)	Affected Sample	Data Qualification
FTPH-TS-AD2-S13.5	Ca	17.9%	10%	FTPH-TS-AD2-S13.5	J
	Fe	17.2%			
	Ni	13.2%			
	V	15.5%			
	Zn	11.9%			

IX. Field Duplicate

Field duplicates were not submitted with this SDG for metals analyses.

X. Overall Assessment

Data are found of know quality and acceptable with the qualification summarized in Table I and Table II at the end of this report.

XI. Data Qualifier

Qualifier	Definition
U	The analyte was analyzed for, but was not detected at or above the reported CRQL.
J	The associated numerical value is an estimate.

Table I. Metals Data Qualification Summary

SDG	Sample ID	Analyte	Flag	A or P	Reason
MINS05	FTPH-IDW-SO-03	Antimony Cadmium Silver Thallium	UJ	A	Negative detection of the analyte was found in the preparation blank.
MINS05	FTPH-IDW-SO-03	Calcium	J	A	Duplicate analysis RPD value exceeded the control criterion.
MINS05	FTPH-IDW-SO-03	Antimony Cadmium Calcium Chromium Vanadium	UJ UJ J J J	A	Spike sample analysis %R value exceeded the control limit.
MINS05	FTPH-IDW-SO-03	Calcium Iron Nickel Vanadium Zinc	J	A	Serial dilution result (%D) exceeded the control criterion (10%).

Table II. Metals Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/kg)	Modified Final Concentration (mg/kg)
No data were qualified in relation to the blank detections except stated in Table I.			

Note: B – The value is between the MDL and CRQL.

Cyanide

Data Validation Report - Cyanide

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS05

Parameters: Cyanide

Method: CLP SOW ILM04.1

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD2-S13.5	MINS05-001	12/03/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW ILM04.1.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Inorganic Data Review (USEPA 2004) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Holding time criterion was not provided in the National Functional Guidelines (EPA, 2004) for cyanide analysis in soil samples (the CLP SOW ILM04.1 specifies a 14-day holding time for water samples). Sample analysis was carried out within 14 days of collection for all soil samples.

II. Calibration

a. Initial Calibration

A blank and more than three (seven) calibration standards (one calibration standard at the CRQL) were employed to establish the analytical curve for cyanide analysis. The least square linear regression correlation coefficient (r) is >0.995 as required by the methodology.

A distilled standard (at midpoint concentration) was analyzed and the result met the acceptance criteria of ±15% of the un-distilled standard.

b. Initial and Continuing Calibration Verification (ICV and CCV)

An ICV was distilled and analyzed after the initial calibration. The ICV result met the acceptance criteria of 85 – 115% of the true value.

The CCV (at the mid-point concentration of the calibration curve) was analyzed at a frequency of 10%, at the beginning of analysis run, and after the last sample analysis. The CCV results met the criteria of 85 - 115% of the true value.

III. Blanks

A method blank was prepared for each analytical batch. Cyanide was detected at 0.35 mg/kg, between the MDL and CRQL, in the method blank. Cyanide results for the associated samples were qualified as follow:

Prep. Blank ID	Analyte	Concentration in Blank (mg/kg)	Affected Sample	Original Result (mg/kg)	Adjusted Result (mg/kg)
B121707CNS01	Cyanide	0.095 J	FTPH-TS-AD2-S13.5	0.14 J	2.0 U

An initial calibration blank (ICB) was analyzed immediately after ICV; and continuing calibration blanks (CCBs) were analyzed immediately after CCVs. Cyanide was detected in the ICB and CCBs at levels between the MDL and CRQL. Data were qualified based on the method blank; no further data qualifiers were assigned.

IV. Laboratory Control Sample (LCS)

LCS analysis was performed as required by the methodology. The percent recovery (%R) value met the acceptance criteria of 80 – 120%.

V. Duplicate Sample

Duplicate analysis was performed on sample FTPH-TS-AD2-S13.5. The concentration difference value met the control criterion (±2xCRQL).

VI. Spike Sample Analysis

Matrix spike analysis was performed on sample FTPH-TS-AD2-S13.5. The %R value was within the acceptance criteria of 75 – 125%.

VII. Field Duplicate

Field duplicates were not submitted with this SDG for cyanide analyses.

X. Overall Assessment

Data are found of know quality and acceptable for use.

Table I. Cyanide Data Qualification Summary

SDG	Sample ID	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to cyanide data under this SDG.					

Table II. Cyanide Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
FTPH-TS-AD2-S13.5	Cyanide	0.14 J	2.0 U

MINS06

FTPH-TS-AD6-S6.5
FTPH-TS-AD7-S7

TPH Diesel & Motor Oil

Data Validation Report – TPH Diesel & Motor Oil

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: TPH-Diesel & Motor Oil

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analysis carried out within 40 days of extraction for the soil sample.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Diesel & Motor Oil and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Motor Oil was detected in one of the method blanks. Sample results were all greater than 10 times the level found in the method blank. No data were qualified on this basis.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD6-S6.5. The %R and relative percent difference (RPD) values were within the laboratory control limits.

c. Surrogate Spikes

Surrogate compounds, 2-fluorobiphenyl and *o*-terphenyl, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Diesel & Motor Oil analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Diesel & Motor Oil data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Diesel & Motor Oil data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

TPH - Gasoline

Data Validation Report – TPH Gasoline

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: TPH-Gasoline

Method: California DHS Modified USEPA Method 8015

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per California DHS Modified USEPA Method 8015

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

The sample was analyzed within the 14-day holding time.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Gasoline and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. No target analytes were detected in the method blank.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD6-S6.5. The %R and relative percent difference (RPD) values were within the laboratory control limits

c. Surrogate Spikes

Surrogate compounds, 4-bromofluorobenzene and trifluorotoluene, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Gasoline analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Gasoline data are found of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Gasoline data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

Volatiles

Data Validation Report - VOA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: Volatiles

Method: CLP SOW OLM04.3

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW OLM04.3.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

VOA analyses should be performed within 14 days of collection for soil samples. The sample in this SDG was analyzed within the holding time.

II. GC/MS Instrument Performance Check

The instrument performance check, bromofluorobenzene (BFB), for volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected in method blanks.

VI. System Monitoring Compounds (SMC)

Four system monitoring compounds (dibromofluoromethane, 1,2-dichloroetheane-d4, 4-bromofluorobenzene, and toluene-d8) were added to all laboratory QC and field samples. The SMC recovery in all analyses was within the control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD was performed on samples under separate SDGs for this project.

VIII. Laboratory Control Sample (LCS)

LCS analyses were performed. The %R values were within the laboratory control limits.

IX. Internal Standards

Three internal standards, bromochloromethane, chlorobenzene-d5, and 1,4-difluorobenzene were used. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard.

X. Field Duplicates

Field duplicates were not submitted with this SDG for VOC analyses.

XI. Compound Quantitation and Reported CRQLs

Compound quantitation was calculated according to the correct equation. Correct quantitation ion and RRF were used to quantitate compounds. The internal standard, quantitation ion, and RRF were used consistently throughout the analysis. Sample results and CRQLs are adjusted to reflect the dry-weight and dilution factors.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with the qualifications summarized in Table I and Table II.

Table I. VOA Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to data in this SDG.					

Table II. VOA Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/kg)	Modified Final Concentration (µg/kg)
No data were qualified in relation to detections in blanks.			

SVOCs (PAH Only)

Data Validation Report - PNA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: PNA

Method: USEPA SW846 Method 8270-SIM

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Method 8270-SIM.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Soil samples should be extracted within 14 days of collection and the extracts analyzed within 40 days of extraction. Samples were extracted and analyzed within the holding times.

II. GC/MS Instrument Performance Check

The instrument performance check, Decafluorotriphenylphosphine (DFTPP), for semi-volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05.

The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

VI. Surrogate Spikes

Three surrogate compounds, as specified in the methodology, were added to all laboratory QC and field samples. The recovery for two of the three surrogate spikes was below the lower control limits in samples FTPH-TS-AD6-S6.5 and FTPH-TS-AD7-S7 during the initial analyses (extracted 12/11/07, analyzed

12/14/07). These samples were re-extracted (12/18/07) and re0analyzed (12/20/07). The recovery for all surrogates in samples and QC analyses was within the control limits. PNA results for samples FTPH-TS-AD6-S6.5 and FTPH-TS-AD7-S7 were to be reported from the re-analyses. Results from the initial analyses were to be rejected and qualified (R).

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-TS-AD7-S7. The percent recovery (%R) and relative percent difference (RPD) values were within the control limits, except the %R value for dibenzo(a,h)anthracene (38%) in the MSD. The %R value in the MS and the RPD value was within the control limits. No data were qualified on this basis.

VIII. Laboratory Control Sample (LCS)

LCS analysis was perfored for the analytical batch. All %R values were within the control limits.

IX. Internal Standards

Six internal standards, as specified in the methodology, were used.

The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The internal standard area counts for all analyses were within –50% to +100% of those of the associated calibration standard.

X. Compound Quantitation and Reported CRQLs

The CRQLs were supported with adequate initial calibration concentrations. Sample results and CRQLs were adjusted to reflect the dry-weight factor.

XI. System Performance

No specific system degradation was observed.

XII. Overall Assessment of Data

Data are of known quality and acceptable with qualifications summarized in Table I and Table II.

XIII. Data Qualifier

Qualifier	Definition
R	The reported result is rejected and should not be used to any extend.

Table I. Semi-Volatiles Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
MINS06	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7 (Initial analysis on 12/14/07)	All PNA	R	P	In favor of the results reported from the re-analysis on 12/20/07.

Table II. Semi-Volatiles Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged in relation to the detections in blanks.			

Metals

Data Validation Report – TAL Metals

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: TAL Metals

Method: CLP SOW ILM04.1

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW ILM04.1.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Inorganic Data Review (USEPA 2004) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample analysis was carried out within 180 days (28 days for mercury) of collection for all soil samples.

II. Calibration

a. Initial Calibration

A blank and one calibration standard were used in establishing analytical curve for ICP. The average of two replicate exposures was reported for all standards, QC, and sample analysis. All analysis was reported within the documented linear range of the ICP calibration curve.

A blank and more than four calibration standards were employed to establish the analytical curve for cold vapor (CV) mercury analysis. The linearity of the CV calibration curve met the criteria of correlation coefficient ≥ 0.995.

CRQL check standard analyses were performed as required by the methodology for ICP metals and mercury. The results met the acceptance criteria of 70 – 130% (50 –150% for Sb, Pb, and Tl) of the true value for all ICP target analytes and mercury.

b. Initial and Continuing Calibration Verification (ICV and CCV)

The ICV was analyzed immediately after the initial calibration for ICP Metals and CV mercury analysis. The ICV results met the criteria of 90 – 110% of the true value for ICP Metals and 80 – 120% of the true value for Mercury.

The CCV (at the mid-point concentration of the calibration curve) was analyzed at a frequency of 10% (less than 2 hours of run time), at the beginning of analysis run, and after the last sample analysis.

The CCV results met the criteria of 90 – 110% of the true value for ICP Metals and 80 – 120% of the true value for Mercury.

III. Blanks

Initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) were analyzed as required by the methodology for ICP Metals and Mercury. No target analytes were detected at or above the CRQLs. Selected metals were detected in ICBs and/or CCBs between the MDLs and CRQLs. Sample results were either greater than 10 times the respective CCB detections, or already

qualified due to the detections in the preparation blank (see discussion below). No sample results were qualified on this basis.

A preparation blank (PB) was prepared and analyzed for each analytical batch. No target analytes were detected at or above the CRQL; selected metals were detected in the PB at levels between the MDLs and CRQLs. Sample results less than 10 times the PB detections are considered affected. The affected results are qualified as follows:

Prep. Blank ID	Analyte	Blank Concentration (mg/kg)	Affected Samples	Flag
B121707ICPS06	Sb Cd Ag Tl	-0.38 B -0.34 B -0.48 B -0.70 B	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	UJ

Note: B – The value is between the MDL and CRQL.

Negative detections in ICBs, CCBs, and the PB were evaluated against the associated sample results. No significant effects of the negative detections in the blanks were identified except those addressed above.

IV. ICP Interference Check Sample (ICS)

ICS solutions A and AB were analyzed as required by the methodology. The percent recovery (%R) of analytes in solution AB met the acceptance criteria of ±20%.

V. Laboratory Control Sample (LCS)

LCS and LCS duplicate analyses were performed as required by the methodology. The %R and relative percent difference (RPD) values were within the control limits for all target analytes.

VI. Duplicate Sample

Duplicate analyses were performed on sample FTPH-TS-AD2-S13.5. RPD values or concentration difference met the control criterion (35% for RPD, 2 x CRQL for difference), except qualified as follows:

Sample ID	Analyte	RPD (%)	Control Criteria (%)	Affected Sample	Data Qualification
FTPH-TS-AD2-S13.5	Mn	78.2%	35%	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	J

VII. Spike Sample Analysis

Matrix spike analyses were performed on sample FTPH-TS-AD2-S13.5. The %R values met the control limits, except for the following:

Spiked Sample ID	Analyte	%R (%)	Control Limit (%)	Affected Sample	Data Qualification
FTPH-TS-AD6-S6.5	Sb Cd Cr Ni V	11.5% 66.0% 41.2% 69.1% 76.5%	80 - 120%	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	UJ UJ J J J

VIII. ICP Serial Dilution

Serial dilution analyses were performed on sample FTPH-TS-AD2-S13.5. The %D values were within the control criterion of 10% for sample concentrations >50xMDL, except for the following:

Dilution Analysis Sample ID	Analyte	%D (%)	Control Criteria (%)	Affected Sample	Data Qualification
FTPH-TS-AD6-S6.5	Na	24.1%	10%	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	J

IX. Field Duplicate

Field duplicates were not submitted with this SDG for metals analyses.

X. Overall Assessment

Data are found of know quality and acceptable with the qualification summarized in Table I and Table II at the end of this report.

XI. Data Qualifier

Qualifier	Definition
UJ	The analyte is not detected at or above the MDL, and the MDL is considered as an estimate.
J	The associated numerical value is an estimate.

Table I. Metals Data Qualification Summary

SDG	Sample ID	Analyte	Flag	A or P	Reason
MINS06	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	Antimony Cadmium Silver Thallium	UJ	A	Negative detection of the analyte was found in the preparation blank.
MINS06	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	Manganese	J	A	Duplicate analysis RPD value exceeded the control criterion.
MINS06	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	Antimony Cadmium Chromium Nickel Vanadium	UJ UJ J J J	A	Spike sample analysis %R value exceeded the control limit.
MINS06	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	Sodium	J	A	Serial dilution result (%D) exceeded the control criterion (10%).

Table II. Metals Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/kg)	Modified Final Concentration (mg/kg)
No data were qualified in relation to the blank detections except stated in Table I.			

Note: B – The value is between the MDL and CRQL.

Cyanide

Data Validation Report - Cyanide

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): MINS06

Parameters: Cyanide

Method: CLP SOW ILM04.1

Laboratory: Laucks Testing Laboratories, Seattle, WA

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-TS-AD6-S6.5	MINS06-001	12/10/07	Soil
FTPH-TS-AD7-S7	MINS06-002	12/10/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA CLP SOW ILM04.1.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Inorganic Data Review (USEPA 2004) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Holding time criterion was not provided in the National Functional Guidelines (EPA, 2004) for cyanide analysis in soil samples (the CLP SOW ILM04.1 specifies a 14-day holding time for water samples). Sample analysis was carried out within 14 days of collection for all soil samples.

II. Calibration

a. Initial Calibration

A blank and more than three (seven) calibration standards (one calibration standard at the CRQL) were employed to establish the analytical curve for cyanide analysis. The least square linear regression correlation coefficient (r) is >0.995 as required by the methodology.

A distilled standard (at midpoint concentration) was analyzed and the result met the acceptance criteria of ±15% of the un-distilled standard.

b. Initial and Continuing Calibration Verification (ICV and CCV)

An ICV was distilled and analyzed after the initial calibration. The ICV result met the acceptance criteria of 85 – 115% of the true value.

The CCV (at the mid-point concentration of the calibration curve) was analyzed at a frequency of 10%, at the beginning of analysis run, and after the last sample analysis. The CCV results met the criteria of 85 - 115% of the true value.

III. Blanks

A method blank was prepared for each analytical batch. Cyanide was detected at 0.35 mg/kg, between the MDL and CRQL, in the method blank. Cyanide results for the associated samples were qualified as follow:

Prep. Blank ID	Analyte	Concentration in Blank (mg/kg)	Affected Sample	Original Result (mg/kg)	Adjusted Result (mg/kg)
B121707CNS01	Cyanide	0.095 J	FTPH-TS-AD6-S6.5 FTPH-TS-AD7-S7	0.16 J 0.30 J	2.0 U 2.0 U

An initial calibration blank (ICB) was analyzed immediately after ICV; and continuing calibration blanks (CCBs) were analyzed immediately after CCVs. Cyanide was detected in the ICB and CCBs at levels between the MDL and CRQL. Data were qualified based on the method blank; no further data qualifiers were assigned.

IV. Laboratory Control Sample (LCS)

LCS analysis was performed as required by the methodology. The percent recovery (%R) values (75.9% and 74.4%, respectively) were below the lower control limits (85 – 115%). Sample results were qualified as non-detects based on the method blank results; no further data qualifiers were assigned on this basis.

V. Duplicate Sample

Duplicate analysis was not performed on a project sample in this SDG.

VI. Spike Sample Analysis

Matrix spike analysis was not performed on a project sample in this SDG.

VII. Field Duplicate

Field duplicates were not submitted with this SDG for cyanide analyses.

X. Overall Assessment

Data are found of know quality and acceptable for use.

Table I. Cyanide Data Qualification Summary

SDG	Sample ID	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to cyanide data under this SDG.					

Table II. Cyanide Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
FTPH-TS-AD6-S6.5	Cyanide	0.16 J	2.0 U
FTPH-TS-AD7-S7		0.30 J	2.0 U

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207887

FTPH-FP-TR-DDD2-S2.5

TPH-Diesel & Motor Oil

Data Validation Report – TPH Diesel & Motor Oil

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): 207877

Parameters: TPH-Diesel & Motor Oil

Method: USEPA SW846 Method 8015

Laboratory: Curtis & Tompkins, Ltd., Berkeley, California

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-TR-DDD2-S2.5	207887-001	11/13/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analysis carried out within 40 days of extraction for the soil sample.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Diesel & Motor Oil and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Diesel and TPH-Motor Oil were detected in the method blank. Sample results were all greater than 10 times the level found in the method blank. No data were qualified on this basis.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on sample FTPH-FP-TR-DDD2-S2.5. The %R value for TPH-Diesel in the MS exceeded the upper control limit due to the elevated TPH-Diesel and TPH-Motor Oil concentrations in this sample. The %R value in the MSD and the relative percent difference (RPD) values were within the laboratory control limits. No data qualifying action was taken.

c. Surrogate Spikes

Surrogate compounds, 2-fluorobiphenyl and *o*-terphenyl, were added to all laboratory QC and field samples. The %R values for both surrogates in sample FTPH-FP-TR-DDD2-S2.5 could not be quantitated due to the high levels of TPH-Diesel and Motor Oil in this sample. Data were not qualified on this basis.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Diesel & Motor Oil analyses.

V. Compound Quantitation and Reporting Limits

Compound quntitation algorithm was verified to be correct. All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Diesel & Motor Oil data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Diesel & Motor Oil data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

TPH - Gasoline

Data Validation Report – TPH Gasoline

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): 207877

Parameters: TPH-Gasoline

Method: USEPA SW846 Method 8015

Laboratory: Curtis & Tompkins, Ltd., Berkeley, California

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-TR-DDD2-S2.5	207887-001	11/13/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Method 8015.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Analyses were carried out within 14 days of collection for all soil samples.

II. Calibration

At least five standards at different levels were applied to establish the initial calibration prior to the analyses of samples. The relative standard deviation (%RSD) value was ≤20% where the average response factor was chosen for analyte quantitation. The correlation coefficient (r) for least square linear regression or the coefficient of determination (r^2) for quadratic fit is ≥0.990 if either approach was chosen for analyte quantitation.

Continuing calibration verification (CCV) analyses were performed daily before sample analysis, after every 10 samples, and at the end of the analysis sequence. The CCV concentrations were within ±15% of the true values for TPH-Gasoline and surrogate compounds as required by the methodology.

III. Blanks

A method blank was prepared and analyzed per analytical batch. TPH-Gasoline was detected in the method blank at a level below the reporting limit. The TPH-Gasoline concentration in the associated sample was greater than 10 tmes that of the method blank. No data qualifying action was required.

IV. Accuracy and Precision Data

a. Laboratory Control Sample (LCS)

One LCS was prepared and analyzed with each analytical batch. The percent recovery (%R) value was within the laboratory control limits.

b. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were performed on a batch QC sample. The %R and relative percent difference (RPD) values were within the laboratory control limits

c. Surrogate Spikes

Surrogate compounds, 4-bromofluorobenzene and trifluorotoluene, were added to all laboratory QC and field samples. The %R values were within the laboratory control limits.

d. Field Duplicates

Field duplicates were not submitted with this SDG for TPH-Gasoline analyses.

V. Compound Quantitation and Reporting Limits

All reported sample result and surrogate values were quantitated within the calibration range.

VI. Overall Assessment

TPH-Gasoline data are of known quality and acceptable for use.

Table I. TPH-Diesel Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned to TPH-Gasoline data under this SDG.					

Table II. TPH-Diesel Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (mg/Kg)	Modified Final Concentration (mg/Kg)
No target compounds were detected in the blanks under this SDG.			

Volatiles

Data Validation Report - VOA

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): 207887

Parameters: Volatiles

Method: USEPA SW846 Methods 5035/8260B

Laboratory: Curtis & Tompkins, Ltd., Berkeley, California

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-TR-DDD2-S2.5	207887-001	11/13/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Methods 5035/8260B.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

VOA analyses were carried out within 14 days of collection for the soil sample.

II. GC/MS Instrument Performance Check

The instrument performance check, bromofluorobenzene (BFB), for volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected at or above method detection limits (MDLs), except as qualified below:

Method Blank ID	Analyte	Concentration in Blank (µg/kg)	Affected Samples	Original Result (µg/kg)	Adjusted Result (µg/kg)
QC472337	Methylene Chloride	6.3 J	FTPH-FP-TR-DDD2-S2.5	180 J	1000 U

VI. System Monitoring Compounds (SMC)

Four SMC were added to the sample and all laboratory QC analyses. The SMC recovery in the sample and associated QC analyses was within the control limits.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD was not performed on the project sample in this SDG.

VIII. Laboratory Control Sample (LCS)

LCS and LCS Duplicate analyses were performed as required. The %R and relative percent difference values were within the laboratory control limits.

IX. Internal Standards

Four internal standards were added to the sample and all associated laboratory QC analyses as required by the methodology. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard.

X. Field Duplicates

Field duplicates were not submitted with this SDG for VOC analyses.

XI. CRQLs

Sample results and CRQLs are adjusted to reflect the dry-weight and dilution factors. VOCs (except Freon 12 and chloromethane) for sample FTPH-FP-TR-DDD2-S2.5 were reported from the mid-level analysis (methanol preserved). The RLs were raised accordingly.

XII. System Performance

No specific system degradation was observed.

XIII. Overall Assessment of Data

Data are of known quality and acceptable with the qualifications summarized in Table I and Table II.

XIV. Data Qualifier

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The associated numerical value is an estimate.

Table I. VOA Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
No data qualifiers were assigned in this section.					

Table II. VOA Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/kg)	Modified Final Concentration (µg/kg)
FTPH-FP-TR-DDD2-S2.5	Methylene Chloride	180 J	1000 U

Semivolatiles

Data Validation Report - SVOCs

Project/Site Name: Mare Island DRMO TPH Investigation

Sample Delivery Group (SDG): 207877

Parameters: SVOCs

Method: USEPA SW846 Method 8270C

Laboratory: Curtis & Tompkins, Ltd., Berkeley, California

Samples:

Sample ID	Lab Sample ID	Collection Date	Matrix
FTPH-FP-TR-DDD2-S2.5	207887-001	11/13/07	Soil

Introduction

This data review report covers the sample delivery group and associated samples listed on the cover sheet. The analyses were performed per USEPA SW846 Method 8270C.

The validation followed the procedures specified in the USEPA CLP National Functional Guidelines for Organic Data Review (USEPA 1999) with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits). Instrument calibration, frequency of QC analyses, and analytical sequence requirements were evaluated against the analytical methodology.

Findings identified in this validation are discussed in the section pertinent to each of the evaluated QC parameters. Qualified data, if any, are summarized in Table I and Table II at the end of this report. Data qualifiers are classified as P (protocol) to indicate whether the data qualification is due to a laboratory deviation from specified protocols, or as A (advisory) if the qualification is of a technical advisory nature per sample matrix or method limitation.

I. Holding Times

Sample extraction was carried out within 14 days of collection and analyses carried out within 40 days of extraction for all soil samples.

II. GC/MS Instrument Performance Check

The instrument performance check, Decafluorotriphenylphosphine (DFTPP), for semi-volatile analysis was performed at the beginning of each 12-hour period. The ion abundance was reported correctly and met the method criteria.

III. Initial Calibration

Correct concentrations of standards were used for initial calibration. The Relative Response Factors (RRF) for all target compounds and system monitoring compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05. No individual Relative Standard Deviation (%RSD) exceeded 30% for all compounds.

IV. Continuing Calibration

Continuing calibrations were analyzed at the beginning of each 12-hour analysis period following the analysis of the instrument performance check and prior to the analysis of method blank and samples.

The continuing calibration RRF for all compounds met the compound-specific minimum RRF criteria. No individual RRF is <0.05.

The percent difference (%D) between the initial calibration RRF and the continuing calibration RRF for all compounds is within ±25%, except that the %D value for 2,4-dinitrophenol (-28%) indicated a low bias of the associated data. 2,4-Dinitrophenol was not detected in sample FTPH-FP-TR-DDD2-S2.5; the result was qualified (UJ) as estimated.

V. Blanks

One method blank per analytical batch was prepared and analyzed. No target compound was detected.

VI. Surrogate Spikes

Three surrogate compounds, as specified in the methodology, were added to all laboratory QC and field samples. The recovery of all these surrogate spikes in

sample FTPH-IDW-SO-01 could not be quantitated due to the required dilution (10x) to overcome the severe matrix interference associated with this sample. No data were qualified on this basis.

VII. Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD analyses were not performed on the project sample in this SDG.

VIII. Internal Standards

Six internal standards were added to the sample and all associated QC analyses as required by the methodology. The internal standard retention time was within ± 30 seconds from that of the associated 12-hour calibration standard. The area counts were within –50 to +100% of the associated calibration standard.

IX. Field Duplicate

Field duplicates were not submitted with this SDG for SV analyses.

X. Compound Quantitation and Reported CRQLs

The CRQLs were supported with adequate initial calibration concentrations. Sample results and CRQLs were adjusted to reflect the dry-weight factor.

XI. System Performance

No specific system degradation was observed.

XII. Overall Assessment of Data

Data are of known quality and acceptable with qualifications summarized in Table I and Table II.

XIII. Data Qualifier

Qualifier	Definition
J	The associated numerical value is an estimate.
UJ	The analyte was not detected at or above the MDL, and the MDL is an estimate.

Table I. Semi-Volatiles Data Qualification Summary

SDG	Sample	Analyte	Flag	A or P	Reason
207877	FTPH-FP-TR-DDD2-S2.5	2,4-Dinitrophenol	UJ	P	The continuing calibration %D value displayed a potential low bias of the associated data.

Table II. Semi-Volatiles Blanks Data Qualification Summary

Sample	Analyte	Reported Concentration (µg/Kg)	Modified Final Concentration (µg/Kg)
No data were flagged in relation to the detections in blanks.			

APPENDIX J

Chemical Forensic Evaluation Report for the 2007-2008 Follow-on Investigation

Forensic Chemistry Evaluation of Bunker Fuel at DRMO Area Former Mare Island Naval Shipyard Vallejo, California

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Forensic Chemistry Evaluation of Bunker Fuel at DRMO Area
Former Mare Island Naval Shipyard
Vallejo, California

Introduction

The U.S. Navy has been investigating the lateral and vertical extent and potential migration pathways of separate-phase petroleum product in the subsurface at the Defense Reutilization Marketing Office (DRMO) site and vicinity at the former Mare Island Naval Shipyard. The investigation area includes Dump Road west of Azuar Drive and Azuar Drive south of Dump Road to Building 637.

Zemo & Associates LLC was asked by the U.S. Navy to perform a forensics evaluation to assess whether multiple populations of bunker fuel exist in the vicinity of the DRMO. More specifically, the forensics chemistry evaluation was performed to assess whether the bunker fuel associated with the DRMO oil sump box west of Azuar Drive could be the source of the bunker fuel present in trenches at the Lennar Mare Island (LMI) property east of Azuar Drive, and if the bunker fuel at the Navy property south of Dump Road could be the source of the bunker fuel in trenches at the properties north of Dump Road. These areas are designated in this study as “Navy side Azuar Drive”, “LMI side Azuar Drive”, “Navy side Dump Road” and “North side Dump Road”. Distinguishing among weathered bunker fuels is generally a challenging forensic task because the chemical composition of bunker fuel is very broad due to its residual nature and loosely-constrained performance specifications as a fuel. However, in this case the bunker fuel on the Navy side of the respective areas can be chemically characterized, and the samples from other locations can be compared to the respective Navy-side populations.

It is assumed that the bunker fuel on the Navy side of each area exhibits variability in chemistry due to the many years of periodic disposal that likely occurred, because multiple bunker fuels may have been disposed of or released at multiple locations continuously or intermittently over time. This forensic evaluation relies on the assumption that the samples from the Navy side of each area capture the range of variability in chemistry of the potential Navy “source” of each

area. This assumption is reasonable. If a sample from the LMI side Azuar Drive or the North side Dump Road falls outside of the range of variability expressed within the respective Navy-side samples, it is concluded that the bunker fuel in the sample is not related to those on the respective Navy side.

There are three primary forensic tools used to compare and source weathered heavy oils such as bunker fuels: (1) evaluation of the high-molecular-weight "biomarkers" such as terpanes and steranes; (2) evaluation of "source ratios" of pairs of certain alkylated polycyclic aromatic hydrocarbons (PAHs); (3) bulk stable isotopes of carbon and hydrogen. All are useful because these constituents are highly resistant to environmental weathering, and are inherited from the crude oil from which the bunker fuel was refined. The use of these tools is supported by many references in the peer-reviewed forensic literature.

When interpreting forensic chemistry data for the purpose of sourcing a product, it is important to remember that similarities between samples indicates that they may be the same product, but it is not conclusive unless all of the forensic parameters "match"; if samples are different for any one parameter, then it is probable that they are not the same product (Wang and Christensen 2006). In other words, a "match" may not be a unique solution, but a "no match" is conclusive. An example of this was shown in a paper by Mazeas and Budzinski (2002) where oil residues appeared to have similar source ratios based on the alkyl PAH data but were different oils based on the carbon isotopes, and some had similar carbon isotopes but different alkyl PAH source ratios.

Lastly, it is important to note that the finding of potential similarity of bunker fuel at two locations based on forensic chemistry does not in itself mean that the product migrated from one location to the other. The product could have migrated between the locations via a contiguous preferential pathway, or it could have been disposed of directly at the separate locations. The forensic chemistry findings are only part of the evidence required to draw conclusions regarding migration. Physical evidence, such as the finding of a contiguous preferential pathway containing bunker fuel, is also necessary to draw final conclusions regarding migration from one point to another.

Sample Collection and Analysis

Nineteen (19) samples of free product were collected by CH2M Hill (contractor for the Navy) from the locations shown on Figure 1, which included five samples from Navy side Dump Road, three samples from North side Dump Road, three samples from Navy side Azuar Drive, three samples from LMI side Azuar Drive, and five samples from utilities within the study area. One sample of product-impacted soil was collected from LMI side Azuar Drive at TR-DDD2, where product was encountered but was not expected; this sample was collected at the extreme southern portion of the study area adjacent to Building 637. Sufficient product was not present at proposed forensic sample locations SB-J, SB-N and SB-Q (North-side Dump Road), SB-OO (LMI side Azuar Drive) and SB-ZZ (Navy side Azuar Drive); therefore no samples were collected at these locations. The twenty samples were submitted to Zymax Forensics, a specialty analytical laboratory, for forensic chemistry analyses. Twenty samples were analyzed for "GC-MS Full Scan" which includes the biomarkers (by ASTM Method D5739) and for bulk stable isotopes of carbon and hydrogen by isotope ratio mass spectrometry (IRMS). Due to unforeseen equipment constraints at Zymax, the bulk stable hydrogen isotope analysis was outsourced and performed by ISOTECH, a specialty isotope laboratory. Due to limited product volume in the field sample, only 13 of the 20 samples were also analyzed for "Extended PAHs" (modified EPA Method 8270 SIM). Note that the product samples were submitted to the laboratory with "FTPH-FP-" as the sample identification prefix; the samples are identified in this report as "SB-" (soil boring) and "UT-" (utility) for brevity.

ASTM D5739 Results and Evaluation

The ASTM D5739 analysis provided a total ion chromatogram that can be used for fuel typing based on the chromatogram pattern. The results of this study indicate that the product present at all locations is a heavy fuel oil such as bunker fuel, except for TR-DDD2. The product at TR-DDD2 appears to be a lighter fuel oil (such as fuel oil 4 or 5, or a lighter bunker fuel formulation) with significantly more diesel-range material present than any of the other samples. The product at SB-L has indications of a double-hump, suggesting a mixture of fuel oils or a different

bunker fuel formulation. The product at all locations except for SB-G and SB-R are highly weathered as evidenced by the fact that the n-alkanes are missing. The product at SB-G and SB-R is less weathered as evidenced by the fact that the n-alkanes nC_{11}-nC_{35} are present. Unless the environmental conditions that influence weathering are significantly different than at the other sampling locations (soil type, depth to groundwater, depth of sample and thickness of product), the presence of and relative amounts of the n-alkanes suggests that the fuel at SB-G and SB-R was released to the environment more recently than at all of the other locations (e.g., Kaplan 2003; Stout et al 2002). For all of the samples, the vast majority of the mass is higher-boiling than C_{15}, indicating that the products should be of very low solubility in groundwater. The water soluble fraction of bunker fuel is limited primarily to the aromatics with 14 carbons or fewer. Published research has shown that fresh bunker fuel has relatively low solubility (Shiu et al 1990), and that highly weathered bunker fuel is virtually insoluble (Zemo & Foote 2003).

The ASTM D5739 analysis provided high resolution gas chromatography mass spectrometry ion chromatograms for eight groups of hydrocarbons: alkylcyclohexanes (m/z 83), n-alkanes (m/z 85), isoprenoids (m/z 113), bicyclanes (m/z 123), terpanes (m/z 191), steranes (m/z 217), monoaromatic steranes (m/z 253), and triaromatic steranes (m/z 231). Except for the n-alkanes, these hydrocarbon groups have large and complex molecular structures and are very resistant to environmental weathering. These resistant molecules are referred to as "biomarkers" in the forensic chemistry literature and they are widely used to compare and source weathered crude oils, diesels and heavier petroleum products (such as heavy fuel oils) (e.g., Wang et al 2006; Wang and Christensen 2006; Stout et al 2002; and references therein). The chemistry and nomenclature of these biomarkers is discussed in detail in the referenced papers and will not be discussed in this report. The ASTM D5739 chromatograms for each group of hydrocarbons were compared across all of the samples with respect to the relative peak heights and patterns. Though the final data from this analysis are not quantitative, qualitative interpretations can be made by measuring peak heights and calculating ratios thereof within individual samples. Two duplicate analytical runs were performed on sample SB-V V on December 16, 2008. These were analyzed on a different instrument than the instrument used for the original analysis of SB-V V in November 2008. The two December 2008 duplicates are identified on the table and figures herein as "SB-V V Dups"; however they may reflect minor variability from SB-V V due to the use of a different instrument. ASTM D5739 also provides

histograms of relative abundance for the aromatic hydrocarbons and the sulfur containing heterocyclic compounds. These histograms were visually compared to one another.

Ratios of the following biomarkers were used to "source" products in this study: the isoprenoids norpristane (i-18), pristane (i-19) and phytane (i-20) (m/z 113); the terpanes C_{27}18α21β-trisnorhopane (Ts), C_{27}17α21β-trisnorhopane (Tm), C_{29}αβ-30-norhopane, and C_{30}αβ-hopanes (m/z 191); and the C_{27}αα-steranes and C_{29}αα-steranes (m/z 217). The ratios were determined from measured peak heights and are summarized on Table 1. Ratios of the key biomarkers are presented as double-ratio cross plots on Figures 2 through 5. Double-ratio cross plots are frequently used to show similarities of sample populations in forensic studies, and are relatively robust interpretations because two parameters are shown instead of one. The isoprenoid biomarker results (Figure 2) indicate that the 20 samples appear to cluster as two main populations: product from the Dump Road area versus product from the Azuar Drive area. These two main populations are indicated on most of the other biomarker cross plots, but are not as distinct. The isoprenoid biomarker results have been relied upon throughout this evaluation to distinguish the Dump Road area samples from the Azuar Drive area samples. Figures 2 through 5 show that within the Dump Road area samples, variability is observed on both the Navy side and the North side. Samples SB-G and SB-L, both on the Navy side, are dissimilar from the rest on the Navy side based on more than one ratio. SB-L is also different from all other samples based on peaks 1-5 of the sterane biomarkers (m/z 217) (not plotted, but see Zymax chromatogram). Sample D on the North side appears to be different from the rest based on one ratio. Utility vault sample UT-BB typically clusters with samples SB-G and/or SB-L. Figures 2 through 5 show that within the Azuar Drive area samples, variability is observed on both the Navy side and the LMI side. The LMI-side sample SB-RR may show a difference from other Azuar Drive samples (Figures 3 and 4), but the apparent difference is small. On Figure 2, the other four utility samples generally cluster with the Azuar Drive area samples; however, their chemistry is similar to both populations on the other cross plots.

Regarding the potential relationship of the product on the Navy side to the product on the other side of each respective area, the biomarker data indicate that the samples from the LMI side Azuar Drive or North side Dump Road generally fall within the range of variability exhibited on the respective Navy side, except for SB-D and TR-DDD2 (Figure 2) and possibly SB-RR

(Figures 3 and 4). This indicates that the bunker fuel at SB-D and TR-DDD2 is not related to the bunker fuel on the respective Navy side, that SB-RR is inconclusive, and that the remaining samples on the LMI side Azuar Drive and North side Dump Road cannot be distinguished from the respective Navy side based on these biomarkers.

Extended PAH Results and Evaluation

The Extended PAH analysis (modified EPA 8270 SIM) provided quantitative data on the parent and alkylated constituents of each homologous series (e.g., naphthalene (C_0) and the C_1 to C_4 naphthalenes), for a total of 49 analytes. These analytes included the PAH and the sulfur-containing benzothiophenes and dibenzothiophenes. Due to insufficient product volume in 7 of the field samples, the total sample population for this analysis is only 13. This is 7 fewer samples than for the biomarker and isotope data sets and therefore the PAH data set may capture less of the variability in the sample populations. Therefore, conclusions based on these PAH results may be less reliable than those based on the biomarkers and isotopes. Table 1 presents the data and Figure 6 presents a cross-plot of the "source ratios" C_2-dibenzothiophene/C_2-phenanthrene versus C_3-dibenzothiophene/C_3-phenanthrene; these ratios are very resistant to weathering and are routinely used to "source" oils and heavy petroleum products (e.g., Douglas et al 1996, Boehm 2006). This evaluation indicates that most of the product samples have similar source ratios, and that UT-BB and possibly UT-W are dissimilar. Table 1 present the data and Figure 7 presents a cross plot of the parent PAH proportion fluoranthene/(fluoranthene + pyrene) versus benzo(a)anthracene/(benzo(a)anthracene + chrysene) (Yunker et al 2002). This evaluation indicates that the products have similar ratios, except possibly for sample SB-PP.

Regarding the potential relationship of the product on the Navy side to the product on the other side of each respective area, the PAH source ratios indicate that the samples from the LMI side Azuar Drive and North side Dump Road generally fall within the range of variability exhibited on the respective Navy side, except possibly for sample SB-PP (Figure 7). This indicates that the bunker fuel at SB-PP may not be related to the product on the Navy side, and that the remaining samples on the LMI side Azuar Drive and North side Dump Road cannot be distinguished from the respective Navy side based on PAH source ratios.

Stable Isotope Results and Evaluation

The 20 samples were analyzed for bulk stable isotopes of carbon (13C/12C; reported as δ13C) and hydrogen (2H[deuterium]/1H; reported as δ2H) in per mil (0/00) using IRMS. Results are shown on Table 1. The numerical values reported are the difference in the ratio relative to the heavier isotope as compared to the respective standard. The analytical precision for the bulk δ13C value is 0.2 per mil and for the bulk δ2H value is 2 per mil. Bulk stable isotopes have been used for decades to "source" oils and petroleum products. The chemistry and background of stable isotopes and their application to sourcing petroleum products is discussed in detail in Philp (2002) and references therein, and will not be discussed in this report. Bulk stable isotopes were used in this study instead of compound-specific isotope analysis (CSIA) because (1) they are much less expensive to analyze, (2) the products are highly weathered, therefore constituents other than the n-alkanes would have to be analyzed for CSIA, and (3) it was likely that the bulk data would be adequate for the purposes of the study.

Carbon and hydrogen stable isotopes can change or "fractionate" due to microbial biodegradation; the result is preferential enrichment of the heavier isotope which results in the isotopic character becoming "less negative" relative to the standard. It has been well established that carbon and hydrogen isotope ratios for larger molecular weight hydrocarbons (molecules with more than 18 carbons) are not significantly changed by biodegration (e.g., Pond et al 2002, Mansuy et al 1997). Therefore, the isotopic character of the weathered bunker fuels evaluated in this study is expected to be stable.

The carbon isotope results for this study are shown as a bar chart on Figure 8. For carbon isotope results, differences greater than 0.5 per mil can indicate different sources. This figure shows that the maximum δ13C value for the product on the Navy side of the two areas is -23.9. The figure also shows that there is variability within the two Navy-side populations, indicating that different bunker fuels may be present in each of these areas. Most of the samples within the study area have δ13C values of -24 to -22.5; Figure 8 shows that samples SB-D, SB-WWW, TR-DDD2 and UT-BB are clearly dissimilar from the other samples. Figure 9 is a cross plot of carbon and hydrogen stable isotopes, which provides a more detailed evaluation because two values are compared. Pond et al (2002) encouraged the use of hydrogen isotopes in addition to

carbon isotopes in source attribution studies because crude oils have a much wider variation in the δ2H values than for the δ13C values.

The isotopic ranges for the Navy side Dump Road samples and for the Navy side Azuar Drive samples are highlighted by boxes on Figure 9. Figure 9 shows that the North side Dump Road samples SB-D and SB-WWW do not plot near the Navy box and therefore are not related to the Navy side Dump Road product. The LMI Side Azuar Drive samples plot near the Navy box except for SB-PP and TR-DDD2. This indicates that SB-PP and TR-DDD2 are not related to the Navy side Azuar Drive product. The δ2H result for SB-PP was confirmed with two analytical runs. Utility sample UT-BB is dissimilar from the other utilities.

Discussion and Conclusions

Samples of product were collected from the Dump Road area [both from the Navy side (n=5) and the North side (n=3)] and from the Azuar Drive area [both from the Navy side (n=3) and the LMI side (n=4, includes TR-DDD2)], as well as from selected utilities (n=5). The product type present at all locations except for one is a heavy fuel oil such as bunker fuel. One location (TR-DDD2) appears to be a lighter fuel oil (e.g., fuel oil 4 or 5, or a lighter bunker fuel formulation). Based primarily on the isoprenoid biomarkers, it appears that the Dump Road area bunker fuels and the Azuar Drive area bunker fuels are different from one another. Within each of these two areas, there is variability in the bunker fuel on the Navy sides and variability in the bunker fuel on the LMI side Azuar Drive and North side Dump Road. This is consistent with the conceptual model that different bunker fuels were likely disposed of over many years at multiple locations within the study area. In evaluating whether the bunker fuel on the LMI side Azuar Drive or North side Dump Road is similar to that found on the Navy side of the respective area, it is assumed that the samples from the Navy side capture the range of variability in chemistry of the potential Navy “source”.

The forensic chemistry parameters of the products on the LMI side Azuar Drive or North side Dump Road area fall within the range of variability exhibited on the respective Navy side except for SB-D and SB-WWW (Dump Road area), and SB-PP and TR-DDD2, and possibly SB-RR (Azuar Drive area). The carbon and hydrogen isotope data for SB-D, SB-WWW, and SB-PP are conclusive evidence that these product samples are not related to the product on the

respective Navy side. The biomarker data (Ts/Tm; m/z 191) for SB-RR suggests that it may be different from the product on the respective Navy side, but it is inconclusive because the apparent difference is relatively small. The biomarkers, total ion chromatogram, and isotope results all are conclusive evidence that the product at TR-DDD2 is unrelated to the product on the Navy side.

The remaining locations (SB-C from North side Dump Road and SB-V V from LMI side Azuar Drive), are not distinguishable from the bunker fuel on the respective Navy side based on the forensic chemistry results from this study. The utility vault sample UT-BB has similar chemistry to the Dump Road area samples, whereas the other four utility vault samples appear similar to the Azuar Drive area samples based on the isoprenoid biomarkers but are inconclusive based on other parameters.

Note that the finding of potential similarity of bunker fuel at two locations based on forensic chemistry does not in itself mean that the product migrated from one location to the other. The product could have migrated between the locations via a contiguous preferential pathway, or it could have been disposed of directly at the separate locations. Physical evidence, such as the finding of a contiguous preferred pathway containing bunker fuel, is also necessary to draw final conclusions regarding migration from one point to another.

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Table 1
Forensic Chemistry Results
DRMO Area Bunker Fuel Evaluation

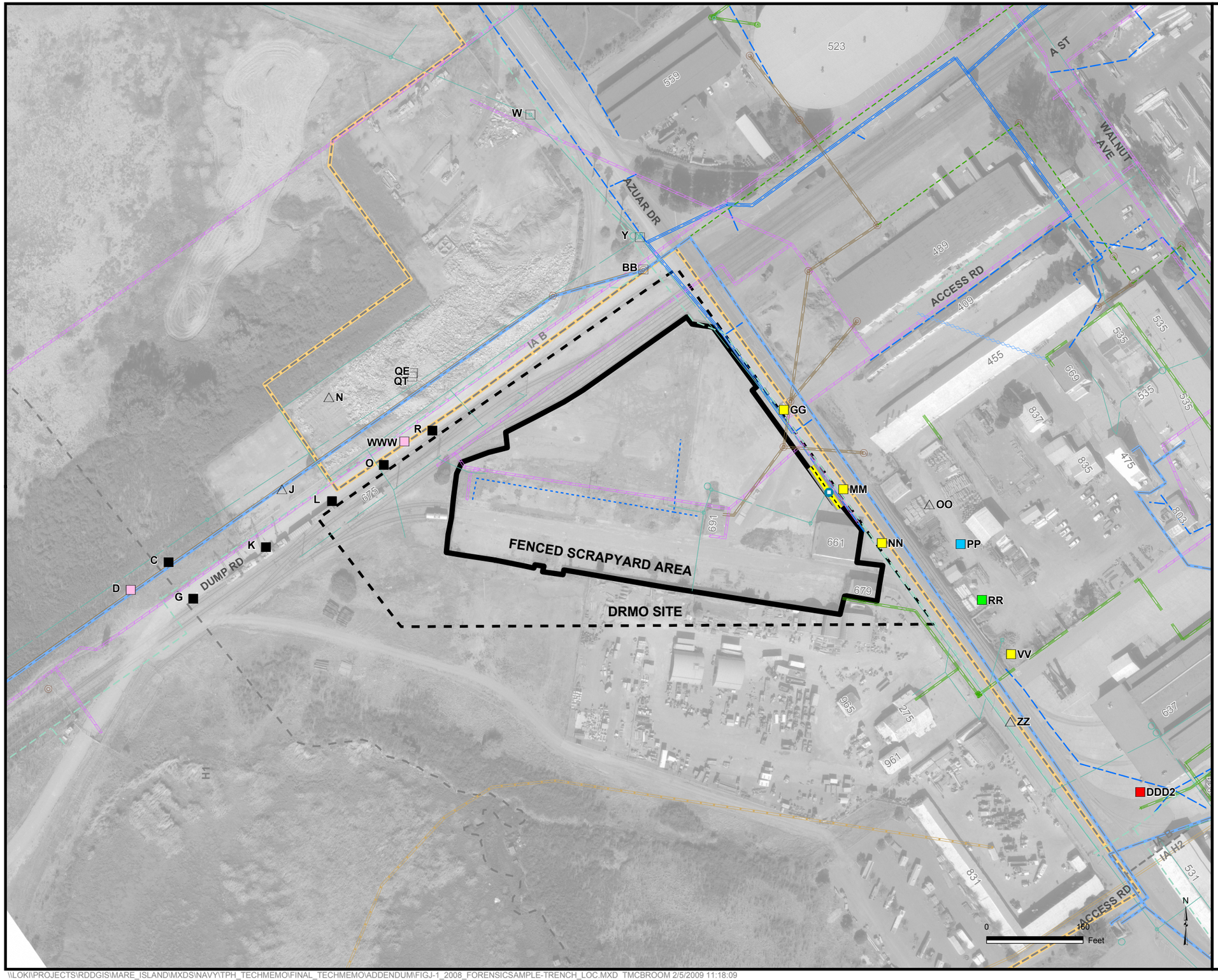
	Biomarker Ratios					PAH Source Ratios				Isotopes	
	I-18/Ph	Pr/Ph	Ts/Tm	C29/C30 Hopanes	C27/C29 Steranes	C2D/C2P	C3D/C3P	Fl/(Fl+Py)	BaA/(BaA+Cr)	δ 13C	δ 2H
Navy side Dump Rd											
SB-G	0.88	1.80	0.78	0.64	1.58	na	na	na	na	-23.9	-128
SB-K	0.73	1.60	0.59	0.59	1.85	na	na	na	na	-23.1	-128
SB-L	0.88	1.47	0.78	0.80	2.16	0.32	0.33	0.26	0.29	-23.6	-132
SB-O	0.71	1.45	0.53	0.60	1.73	0.44	0.42	0.18	0.25	-22.7	-132
SB-R	0.72	1.41	0.5	0.57	1.79	na	na	na	na	-22.8	-128
North side Dump Rd											
SB-D	0.61	1.82	0.58	0.58	1.63	na	na	na	na	-25.0	-129
SB-C	0.68	1.58	0.59	0.63	1.91	0.40	0.39	0.25	0.29	-23.7	-134
SB-WWW	0.82	1.58	0.54	0.59	1.83	0.31	0.31	0.26	0.26	-24.6	-127
Navy side Azuar Dr											
SB-GG	0.08	1.49	0.53	0.55	1.56	0.32	0.30	0.19	0.26	-23.4	-131
SB-MM	0.20	1.50	0.62	0.61	1.49	na	na	na	na	-23.8	-132
SB-NN	0.13	0.77	0.51	0.59	1.73	0.36	0.34	0.31	0.24	-23.0	-138
LMI side Azuar Dr											
SB-PP	0.07	1.35	0.63	0.58	1.67	0.34	0.34	0.45	0.24	-23.7	-148
SB-RR	0.05	1.54	0.45	0.55	1.52	0.39	0.40	0.33	0.19	-24.0	-140
SB-V V	0.05	1.53	0.53	0.57	1.62	0.51	0.40	0.34	0.22	-23.3	-139
TR-DDD2	0.82	1.86	0.61	0.65	1.49	0.36	0.33	nc	nc	-24.9	-136

Table 1
Forensic Chemistry Results
DRMO Area Bunker Fuel Evaluation

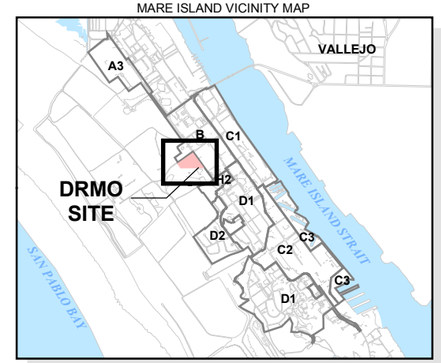
	Biomarker Ratios					PAH Source Ratios				Isotopes	
	I-18/Ph	Pr/Ph	Ts/Tm	C29/C30 Hopanes	C27/C29 Steranes	C2D/C2P	C3D/C3P	Fl/(Fl+Py)	BaA/(BaA+Cr)	δ 13C	δ 2H
Utilities											
UT-Y	0.04	1.35	0.53	0.56	1.65	na	na	na	na	-24.0	-133
UT-W	0.04	1.31	0.49	0.57	1.86	0.30	0.51	0.30	0.32	-23.4	-133
UT-BB	0.76	1.67	0.76	0.60	1.71	0.55	0.56	0.31	0.33	-24.5	-127
UT-QE	0.00	1.18	0.58	0.61	1.66	na	na	na	na	-23.2	-132
UT-QT	0.05	1.44	0.58	0.63	1.79	0.34	0.35	0.23	0.33	-22.5	-134
SB-V V Dup1	0.05	1.64	0.59	0.60	1.50						
SB-V V Dup2	0.03	1.59	0.57	0.56	1.75						

Notes:
1. Samples analyzed for biomarkers using ASTM D5739 and for extended PAHs using modified EPA 8270 SIM in November 2008.
2. na = not analyzed due to insufficient sample volume.
3. nc = not calculated because one analyte was not detected.
4. Values for biomarker ratios are based on measured peak heights.
   - i-18, Pr, Ph = norpristane, pristane, phytane (m/z 113)
   - Ts/Tm = C27 18α,21β-trisnorhopane/C27 17α,21β-trisnorhopane (m/z 191); C29/C30 hopanes = C29 αβ-30-norhopane/C30 αβ-hopane (m/z 191)
   - C27/C29 steranes = C27αα-steranes/C29αα-steranes (m/z 217)
   - C2D/C2P = C2dibenzothiophene/C2phenanthrene; C3D/C3P = C3dibenzothiophene/C3phenanthrene
   - Fl = fluoranthene, Py = pyrene, BaA = benzo(a)anthracene, Cr = chrysene
   - δ13C = 13carbon/12carbon, per mil (0/00), relative to PDB standard
   - δ2H = 2 hydrogen/1 hydrogen, per mil (0/00), relative to SMOW standard
5. SB-V V Dup 1 and 2 were analyzed on a different instrument in December 2008; samples analyzed only for ASTM D5739.

FIGURES



MARE ISLAND VICINITY MAP



LEGEND

- △ INSUFFICIENT SAMPLE VOLUME AVAILABLE
- UTILITY VAULT FORENSIC SAMPLE
- FORENSIC TRENCH SAMPLE - DIFFERENT PRODUCT CHEMISTRY FROM ALL OTHER SAMPLES
- NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- INCONCLUSIVE NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- NOT NAVY-SIDE DUMP ROAD PRODUCT CHEMISTRY
- NOT NAVY-SIDE AZUAR DRIVE PRODUCT CHEMISTRY
- FORMER OIL SUMP BOX
- SEWER CLEANOUT
- SEWER MANHOLE
- FORMER PERFORATED PIPE
- UNDERGROUND ELECTRICAL UTILITY
- INDUSTRIAL WASTEWATER PIPELINE (IR14)
- BACKBONE SEWER PIPELINE
- SEWER SERVICE LINE
- GAS PIPELINE
- OTHER WATER PIPELINE
- ABANDONED DREDGE PIPELINE
- EXISTING DREDGE PIPELINE
- EXISTING FRESHWATER PIPELINE
- ABANDONED OR DEAD FRESHWATER PIPELINE
- SALTWATER PIPELINE
- STORMWATER BACKBONE
- STORMWATER SERVICE LINE
- INVESTIGATION AREA
- EASTERN EARLY TRANSFER PARCEL BOUNDARY
- FENCED SCRAPYARD AREA (FSA)
- DEFENSE REUTILIZATION AND MARKETING OFFICE (DRMO) SITE

FIGURE 1
2008 CHEMICAL FORENSIC SAMPLE LOCATIONS AND SUMMARY FINDINGS

TPH TECHNICAL MEMORANDUM
DRMO SITE AND VICINITY
MARE ISLAND, CALIFORNIA

CH2MHILL

\\LOKI\PROJECTS\RDDGIS\MARE_ISLAND\MXDS\NAVY\TPH_TECHMEMO\FINAL_TECHMEMO\ADDENDUM\FIGJ-1_2008_FORENSICSAMPLE-TRENCH_LOC.MXD TMCBROOM 2/5/2009 11:18:09

Figure 2: Isoprenoid Biomarkers - i-18/Ph v Pr/Ph

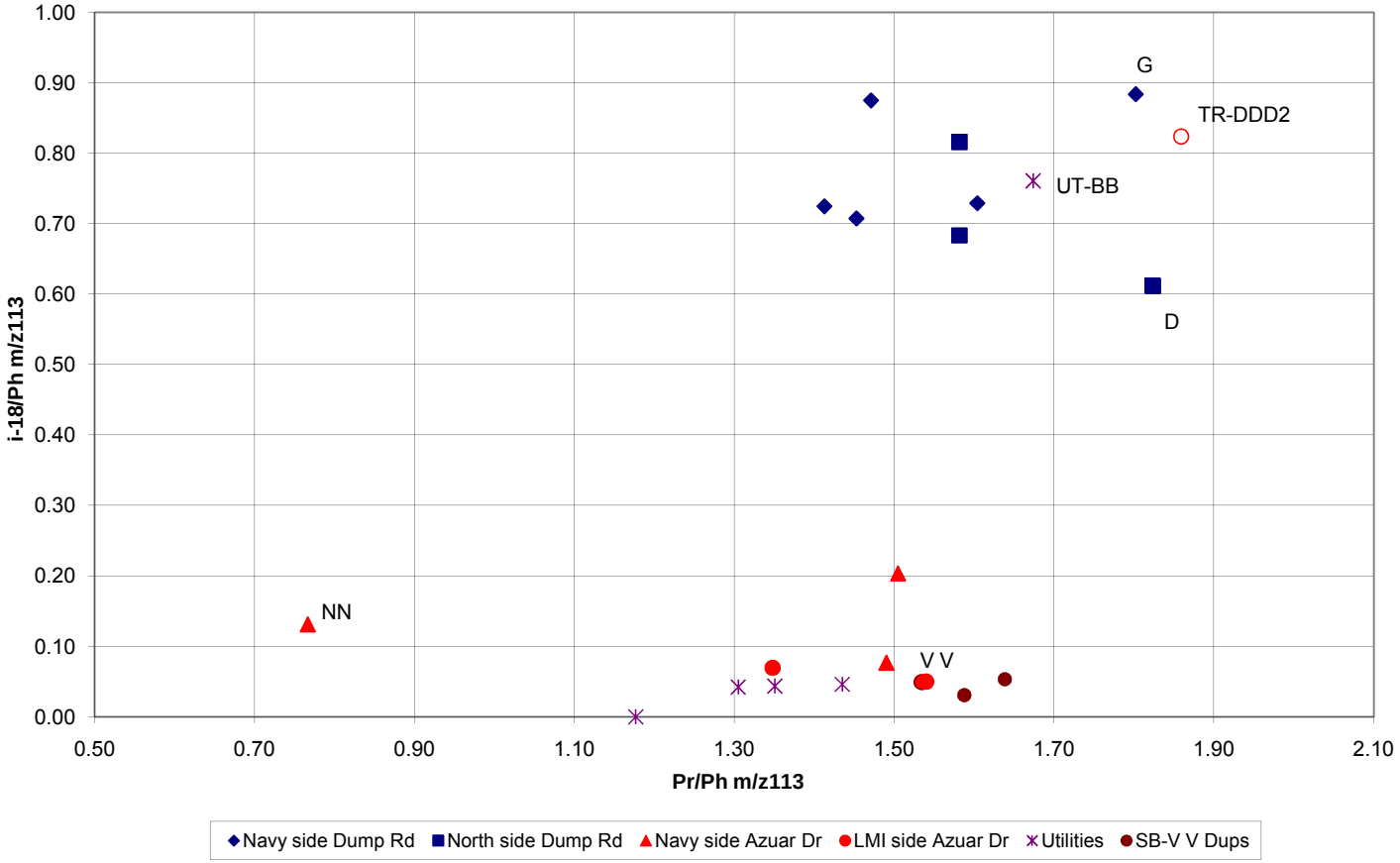


Figure 3: Terpanes Biomarkers - Ts/Tm v C29/C30Hopanes

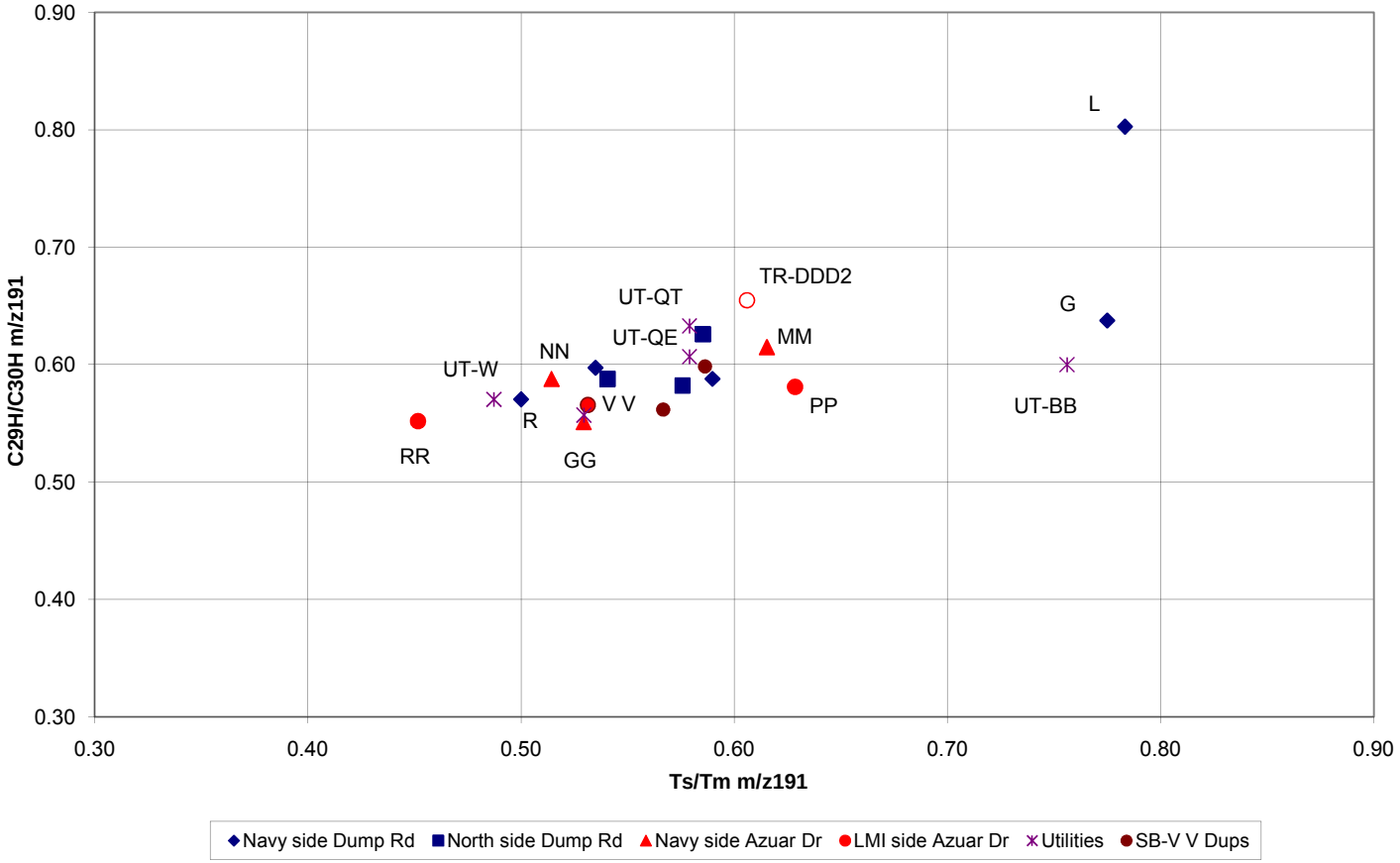


Figure 4: Terpanes and Steranes Biomarkers - Ts/Tm v C27/C29Steranes

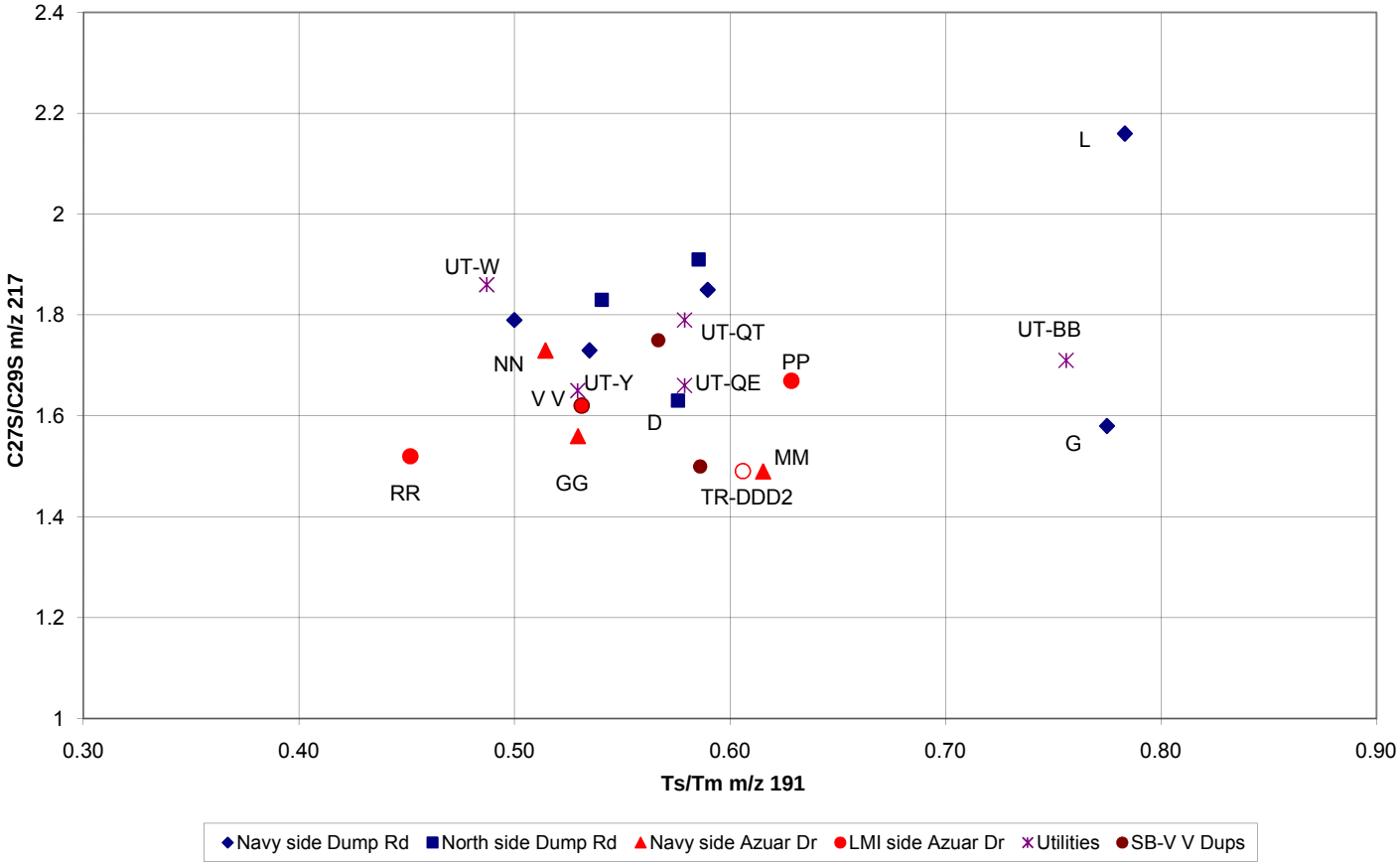


Figure 5: Terpanes and Steranes Biomarkers - C29/C30Hopanes v C27/C29Steranes

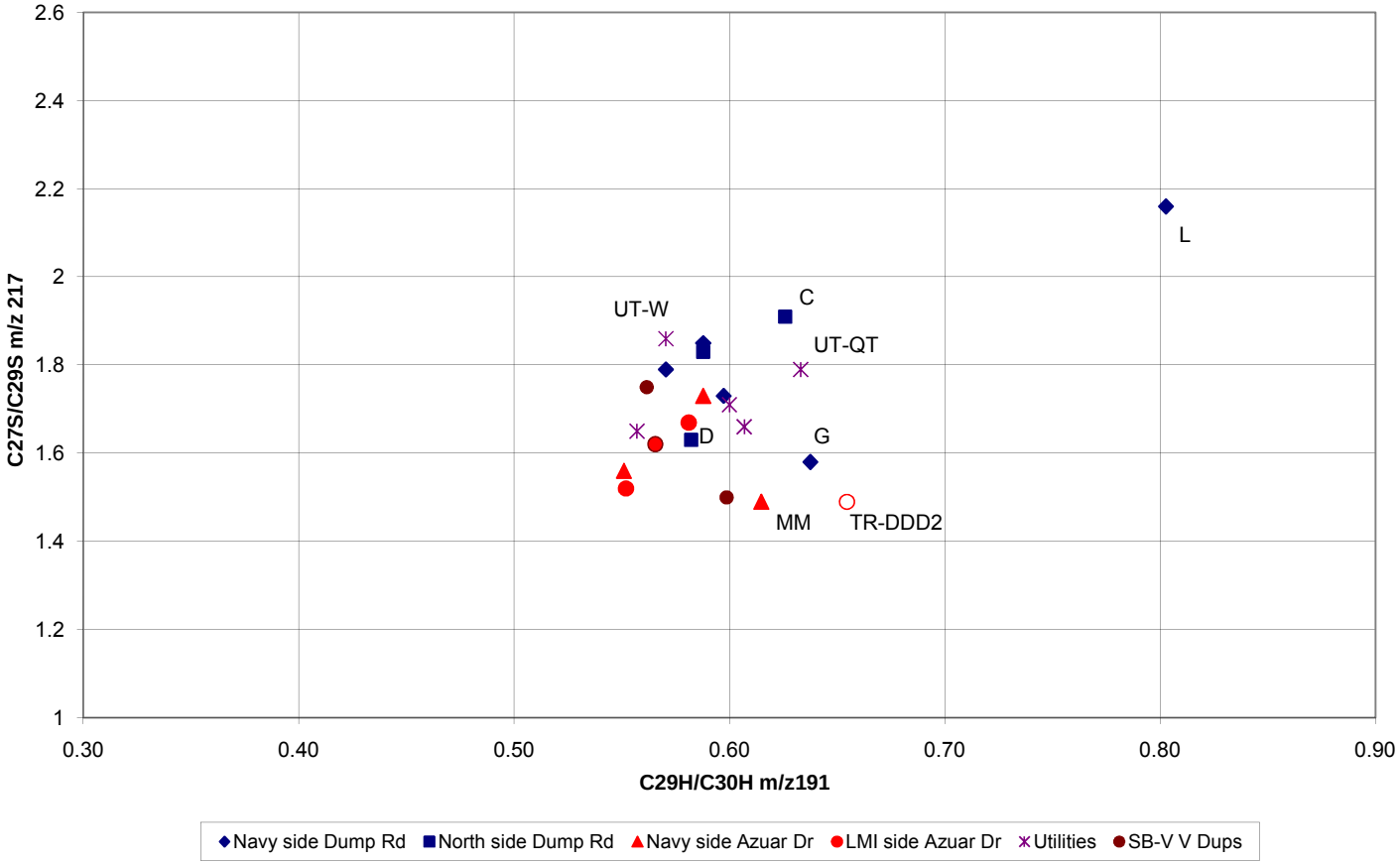


Figure 6: Alkyl PAH Source Ratios - Dibenzothiophenes and Phenanthrenes

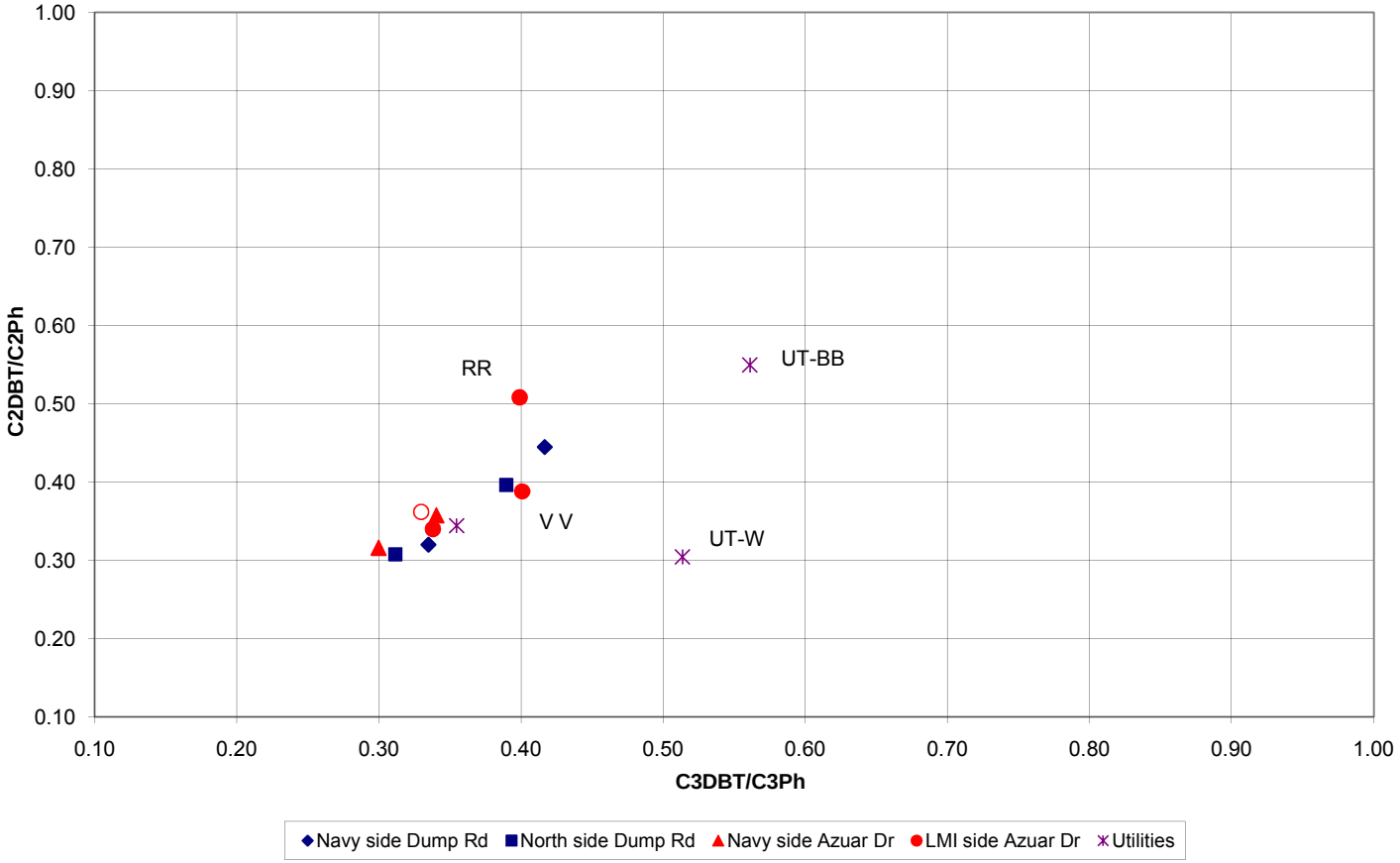


Figure 7: Parent PAH Source Ratios

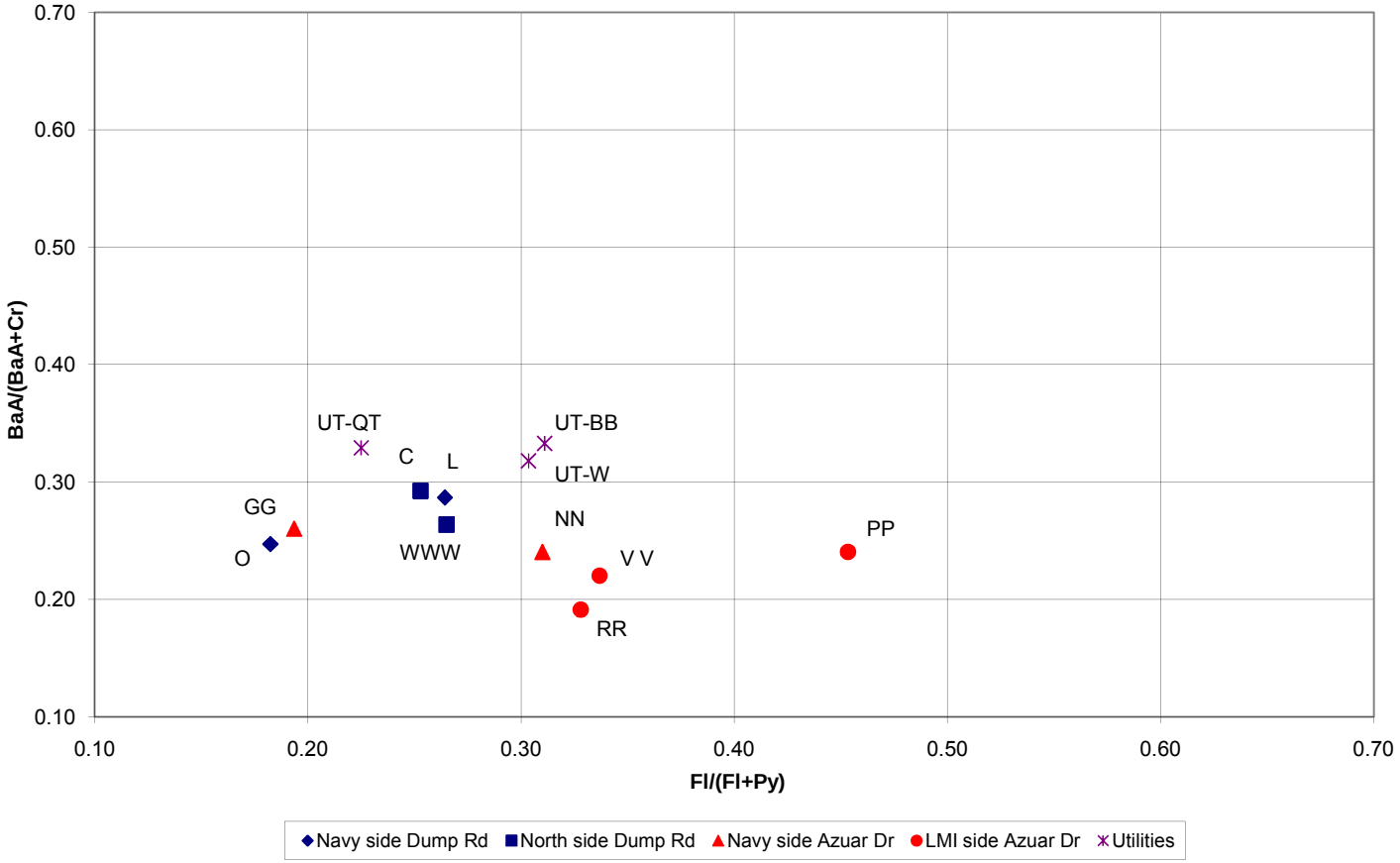


Figure 8: Carbon Isotope Ratios

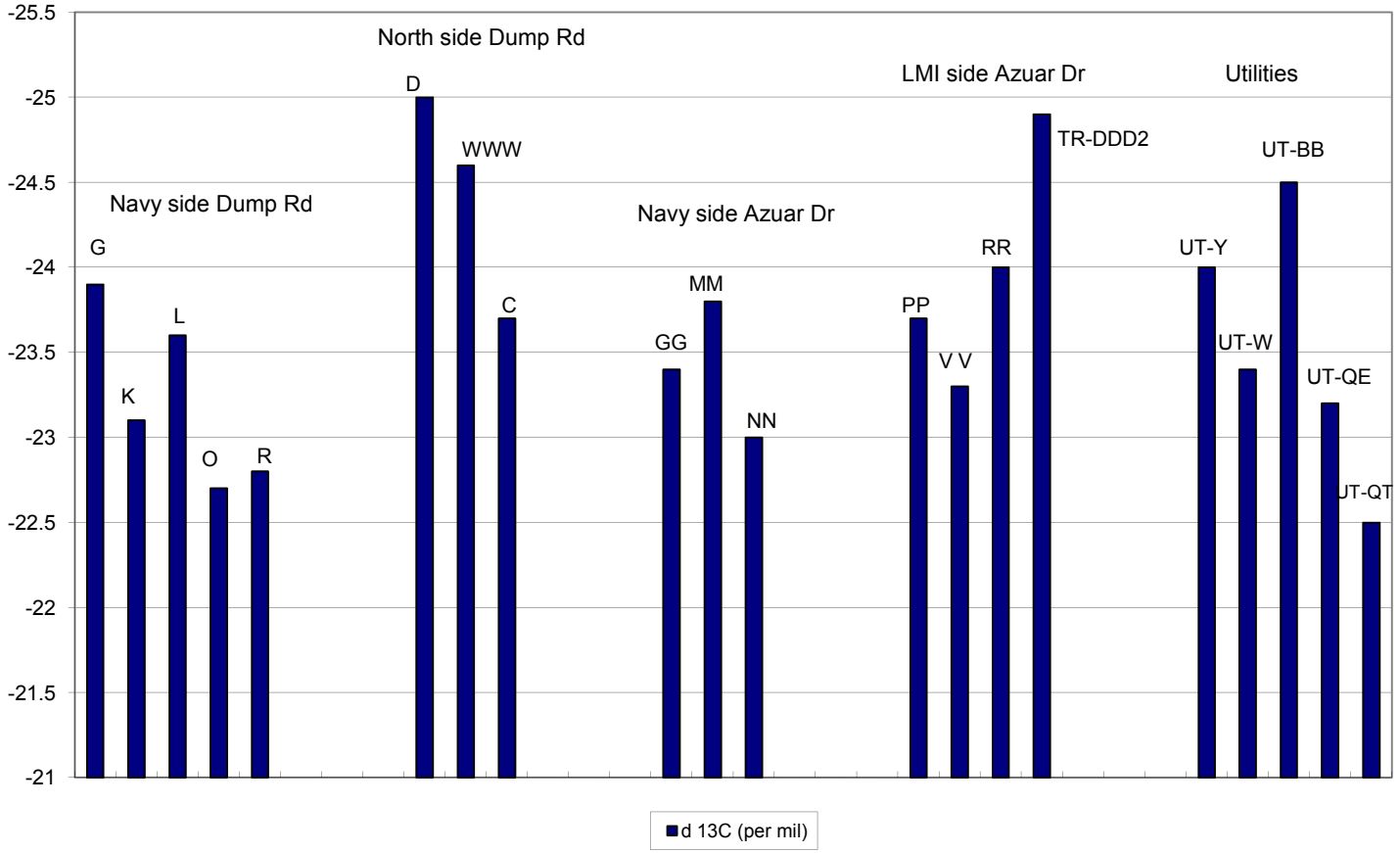
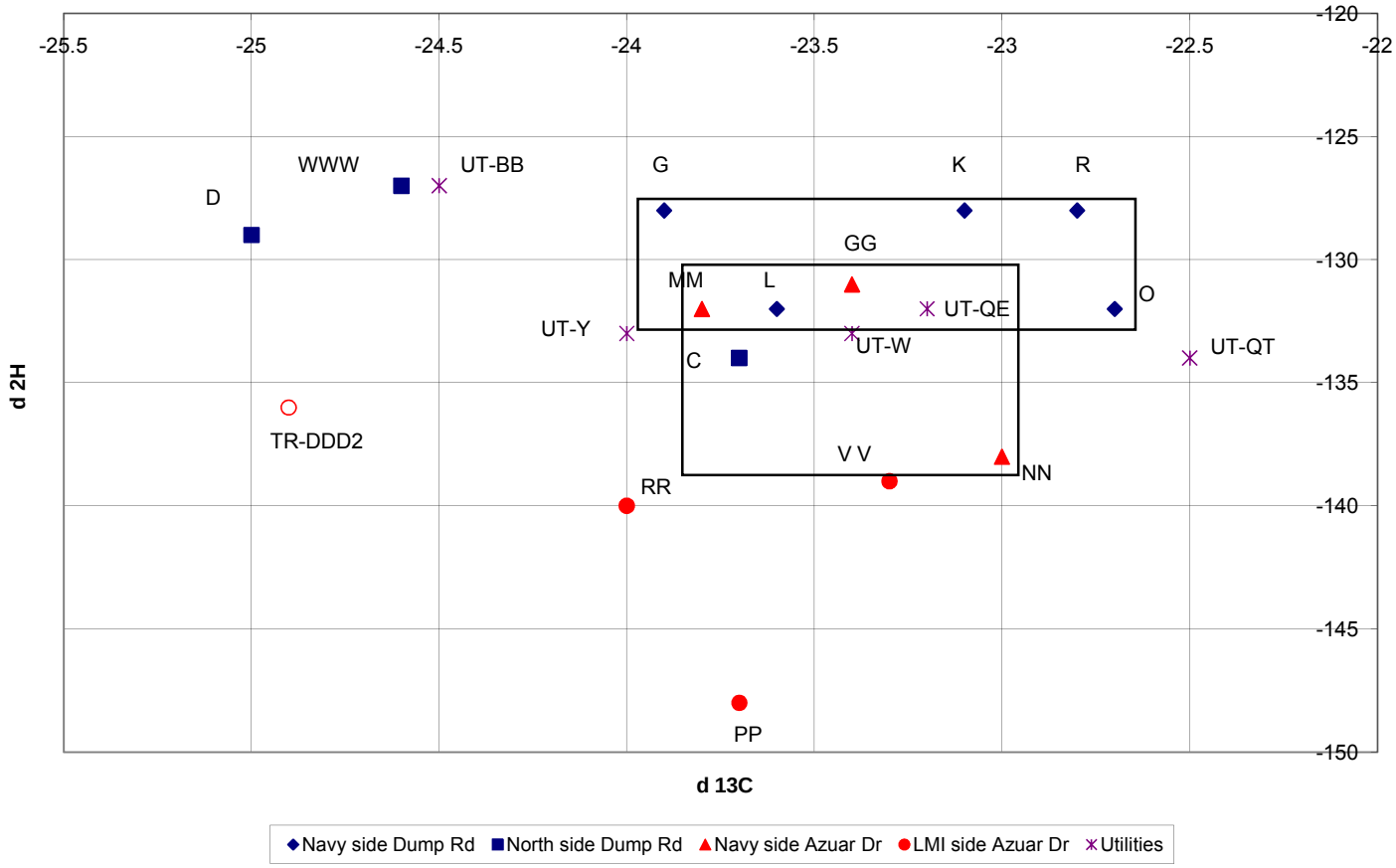


Figure 9: Carbon and Hydrogen Isotopes



APPENDIX

Zymax Forensics and Isotech Laboratory Reports

ZymaX

71 Zaca Lane San Luis Obispo CA 93401 tel 805.544.4696 fax 805.544.8226

CHAIN of CUSTODY

report to: ARTEMIS ANTIPAS
company: CH2M HILL, INC
address: 1100 112th AVE NE, STE 400 BELLVUE, WA, 98004-4505

phone: 425-453-3005 x505 fax: 425-468-3100
project: FOLLOW ON TPH INVSTGTN, DEMO
project #: 273939-14.01
sampler: STEPHEN QUAYLE/DAVE BALL

ANALYSIS REQUESTED

Turnaround Time: ASAP ☐ 48 hr ☐ 12 hr ☐ 72 hr ☐ 24 hr ☐ std ☒

ZymaX use only	SAMPLE DESCRIPTION	Date Sampled	Time	Matrix	Preserve	FORENSIC BY ASTM D5739	PAH 8270-SIM	C-ISOMERS 1 RUN	# of containers	Remarks
41343-1	FTPH-FP-SB-N	10/21/08	1415	PROD	U	X	X	X	2	FORENSIC ANALYSIS
2	FTPH-FP-SB-D	10/23/08	1140	PROD	U	X	X	X	2	
3	FTPH-FP-UT-Y	10/23/08	1215	PROD	U	X	X	X	2	
4	FTPH-FP-UT-W	10/23/08	1230	PROD	U	X	X	X	2	
5	FTPH-FP-SB-G	10/21/08	1500	PROD	U	X	X	X	2	
6	FTPH-FP-SB-K	10/22/08	0905	PROD	U	X	X	X	2	
7	FTPH-FP-SB-L	10/22/08	0935	PROD	U	X	X	X	2	
8	FTPH-FP-SB-WNW	10/22/08	0845	PROD	U	X	X	X	2	FROM ENGEO BORING
9	FTPH-FP-SB-O	10/23/08	1055	PROD	U	X	X	X	2	
10	FTPH-FP-SB-R	10/22/08	1200	PROD	U	X	X	X	1	
11	FTPH-FP-UT-BB	10/22/08	1215	PROD	U	X	X	X	2	

Comments
FED EX AIRBILL
7980 4656 3010

Sample integrity upon receipt:
- Samples received intact ☐
- Samples received cold ☐
- Custody seals ☐
- Correct container types ☐

Bill 3rd Party:
PO# _____
Quote yes no

Relinquished by:
Signature: Steph B. Quayle
Print: Stephen B. Quayle
Company: CH2M Hill
Date: 10-23-08 Time: 1730

Relinquished by:
Signature _____
Print _____
Company _____
Date _____ Time _____

Received by:
Signature _____
Print _____
Company _____
Date _____ Time _____

Received by ZymaX envirotechnology inc:
Signature: Tina Henson
Print: Tina Henson
Company: Zymax
Date: 10/24/08 Time: 0830

email: zymax@ZymaXusa.com

Isotech Data

Job 10643

Project 41343

Isotech Lab No.	Sample Name	δ^2H ‰
149743	41343-2	-129
149744	43134-3	-133
149745	41343-4	-133
149746	41343-5	-128
149747	41343-6	-128
149748	41343-7	-132
149749	41343-8	-127
149750	41343-9	-132
149751	41343-10	-128
149752	41343-11	-127

REPORT OF ANALYTICAL RESULTS

ZymaX FORENSICS

Client:	Artgmis Antipas CH2M HILL 1100 112th Ave. NE STE 400 Bellvue, WA 98004-4505	Lab Number: Received: Matrix:	41343 10/24/2008 Fractions
Project: Project Number: Collected by:	Follow up on TPH Investigation 273939-14.01 Stephen Quayle/ Doye Ball	Sample Description: See Below Analyzed: Method:	 11/7/2008 CF-IRMS

$\delta^{13}C$

LAB NUMBER	SAMPLE DESCRIPTION	$\delta^{13}C$ ‰
41343-2	FTPH-FP-SB-D	-25.0
41343-3	FTPH-FP-UT-Y	-24.0
41343-4	FTPH-FP-UT-W	-23.4
41343-5	FTPH-FP-SB-G	-23.9
41343-6	FTPH-FP-SB-K	-23.1
41343-7	FTPH-FP-SB-L	-23.6
41343-8	FTPH-FP-SB-WWW	-24.6
41343-9	FTPH-FP-SB-O	-22.7
41343-10	FTPH-FP-SB-R	-22.8
41343-11	FTPH-FP-UT-BB	-24.5
Analytical Precision (1-sigma)		0.2

Submitted by,
ZymaX FORENSICS

River He, PhD
Isotope Lab Manager

41343c.xls
RH D12.03 04

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-4
Collected:	10/23/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, D
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-UT-W
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	23.3
C1 Dibenzothiophenes	2.5	128.7
C2 Dibenzothiophenes	2.5	187.3
C3 Dibenzothiophenes	2.5	174.5
C4 Dibenzothiophenes	2.5	143.6
Fluoranthene	2.5	41.7
Pyrene	2.5	95.7
C1 Pyrenes/Fluoranthenes	2.5	408.3
C2 Pyrenes/Fluoranthenes	2.5	311.2
C3 Pyrenes/Fluoranthenes	2.5	127.6
Benz(a)anthracene	2.5	20.2
Chrysene	2.5	43.3
C1 Chrysenes	2.5	229.0
C2 Chrysenes	2.5	147.3
C3 Chrysenes	2.5	65.7
C4 Chrysenes	2.5	22.4
Benzo(b)fluroanthene	2.5	8.3
Benzo(k)fluoranthene	2.5	4.4
Benzo(e)pyrene	2.5	15.4
Benzo(a)pyrene	2.5	10.5
Perylene	2.5	14.1
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	4.2

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41343-4pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas CH2M HILL 1100 112th Ave. NE STE 400 Bellvue, WA 98004-4505	Lab Number: Collected: Received: Matrix:	41343-4 10/23/08 10/24/08 Product
Project: Project Number: Collected by:	Follow up on TPH Investigation, D 273939-14.01 Stephen Quayle/ Doye Ball	Sample Description: FTPH-FP-UT-W Analyzed: Method:	 10/29/08 8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	23.2
C2 Benzothiophenes	2.5	53.2
C3 Benzothiophenes	2.5	104.7
C4 Benzothiophenes	2.5	147.4
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	121.3
2-Methylnaphthalene	2.5	59.5
C2 Naphthalenes	2.5	575.4
C3 Naphthalenes	2.5	819.3
C4 Naphthalenes	2.5	855.3
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	11.9
Acenaphthene	2.5	20.6
Fluorene	2.5	64.2
C1 Fluorenes	2.5	91.6
C2 Fluorenes	2.5	50.1
C3 Fluorenes	2.5	101.7
Anthracene	2.5	35.8
Phenanthrene	2.5	103.6
C1 Phenanthrenes/Anthracenes	2.5	313.9
C2 Phenanthrenes/Anthracenes	2.5	615.7
C3 Phenanthrenes/Anthracenes	2.5	339.8
C4 Phenanthrenes/Anthracenes	2.5	200.9

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41343-4pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-7
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation- DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-SB-L
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	91.4
C2 Benzothiophenes	2.5	148.8
C3 Benzothiophenes	2.5	209.4
C4 Benzothiophenes	2.5	234.4
Naphthalene	2.5	35.2
1-Methylnaphthalene	2.5	813.2
2-Methylnaphthalene	2.5	849.0
C2 Naphthalenes	2.5	2628.0
C3 Naphthalenes	2.5	2318.4
C4 Naphthalenes	2.5	1766.5
Biphenyl	2.5	14.3
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	ND
Acenaphthene	2.5	42.3
Fluorene	2.5	132.0
C1 Fluorenes	2.5	192.1
C2 Fluorenes	2.5	84.9
C3 Fluorenes	2.5	159.4
Anthracene	2.5	52.0
Phenanthrene	2.5	313.0
C1 Phenanthrenes/Anthracenes	2.5	755.9
C2 Phenanthrenes/Anthracenes	2.5	943.8
C3 Phenanthrenes/Anthracenes	2.5	625.9
C4 Phenanthrenes/Anthracenes	2.5	234.4

*PQL - Practical Quantitation Limit

**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41343-7pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-7
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation- DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

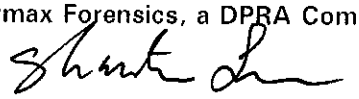
Sample Description:	FTPH-FP-SB-L
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	65.1
C1 Dibenzothiophenes	2.5	252.5
C2 Dibenzothiophenes	2.5	301.9
C3 Dibenzothiophenes	2.5	209.5
C4 Dibenzothiophenes	2.5	186.0
Fluoranthene	2.5	37.9
Pyrene	2.5	105.5
C1 Pyrenes/Fluoranthenes	2.5	438.8
C2 Pyrenes/Fluoranthenes	2.5	372.3
C3 Pyrenes/Fluoranthenes	2.5	152.3
Benz(a)anthracene	2.5	20.1
Chrysene	2.5	50.0
C1 Chrysenes	2.5	235.2
C2 Chrysenes	2.5	184.2
C3 Chrysenes	2.5	67.5
C4 Chrysenes	2.5	15.5
Benzo(b)fluroanthene	2.5	10.5
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	20.8
Benzo(a)pyrene	2.5	12.8
Perylene	2.5	10.9
Indeno(1,2,3-c,d)pyrene	2.5	2.5
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	4.3

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company



Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41343-7pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-8
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, D
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-SB-WWW
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	18.6
C2 Benzothiophenes	2.5	50.8
C3 Benzothiophenes	2.5	95.1
C4 Benzothiophenes	2.5	117.8
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	128.7
2-Methylnaphthalene	2.5	17.2
C2 Naphthalenes	2.5	504.6
C3 Naphthalenes	2.5	778.7
C4 Naphthalenes	2.5	752.6
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	5.8
Acenaphthene	2.5	15.9
Fluorene	2.5	48.0
C1 Fluorenes	2.5	86.7
C2 Fluorenes	2.5	46.3
C3 Fluorenes	2.5	83.4
Anthracene	2.5	32.7
Phenanthrene	2.5	141.1
C1 Phenanthrenes/Anthracenes	2.5	413.4
C2 Phenanthrenes/Anthracenes	2.5	575.4
C3 Phenanthrenes/Anthracenes	2.5	457.9
C4 Phenanthrenes/Anthracenes	2.5	149.4

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41343-8pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas CH2M HILL 1100 112th Ave. NE STE 400 Bellvue, WA 98004-4505

Lab Number:	41343-8
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, D
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

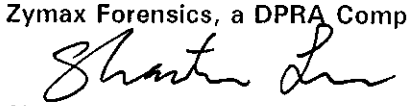
Sample Description:	FTPH-FP-SB-WWW
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	28.2
C1 Dibenzothiophenes	2.5	127.0
C2 Dibenzothiophenes	2.5	177.2
C3 Dibenzothiophenes	2.5	142.6
C4 Dibenzothiophenes	2.5	111.9
Fluoranthene	2.5	20.8
Pyrene	2.5	57.7
C1 Pyrenes/Fluoranthenes	2.5	343.7
C2 Pyrenes/Fluoranthenes	2.5	257.0
C3 Pyrenes/Fluoranthenes	2.5	109.9
Benz(a)anthracene	2.5	12.4
Chrysene	2.5	34.6
C1 Chrysenes	2.5	176.6
C2 Chrysenes	2.5	135.7
C3 Chrysenes	2.5	48.0
C4 Chrysenes	2.5	10.0
Benzo(b)fluroanthene	2.5	5.6
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	15.0
Benzo(a)pyrene	2.5	7.2
Perylene	2.5	8.4
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	ND

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company



Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41343-8pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-9
Collected:	10/23/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-SB-O
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	22.0
C2 Benzothiophenes	2.5	37.3
C3 Benzothiophenes	2.5	94.1
C4 Benzothiophenes	2.5	142.3
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	41.5
2-Methylnaphthalene	2.5	ND
C2 Naphthalenes	2.5	281.7
C3 Naphthalenes	2.5	651.1
C4 Naphthalenes	2.5	839.2
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	ND
Acenaphthene	2.5	13.5
Fluorene	2.5	31.1
C1 Fluorenes	2.5	59.0
C2 Fluorenes	2.5	43.3
C3 Fluorenes	2.5	106.4
Anthracene	2.5	20.6
Phenanthrene	2.5	50.2
C1 Phenanthrenes/Anthracenes	2.5	199.4
C2 Phenanthrenes/Anthracenes	2.5	407.8
C3 Phenanthrenes/Anthracenes	2.5	400.3
C4 Phenanthrenes/Anthracenes	2.5	191.7

*PQL - Practical Quantitation Limit

**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41343-9pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-9
Collected:	10/23/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

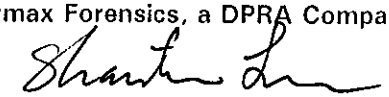
Sample Description:	FTPH-FP-SB-O
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	17.4
C1 Dibenzothiophenes	2.5	92.5
C2 Dibenzothiophenes	2.5	181.3
C3 Dibenzothiophenes	2.5	166.8
C4 Dibenzothiophenes	2.5	163.5
Fluoranthene	2.5	24.0
Pyrene	2.5	107.6
C1 Pyrenes/Fluoranthenes	2.5	411.1
C2 Pyrenes/Fluoranthenes	2.5	364.1
C3 Pyrenes/Fluoranthenes	2.5	168.7
Benz(a)anthracene	2.5	13.3
Chrysene	2.5	40.5
C1 Chrysenes	2.5	214.6
C2 Chrysenes	2.5	142.3
C3 Chrysenes	2.5	60.0
C4 Chrysenes	2.5	20.7
Benzo(b)fluroanthene	2.5	11.4
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	22.2
Benzo(a)pyrene	2.5	13.3
Perylene	2.5	16.9
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	3.5

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company



Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41343-9pna.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas CH2M HILL 1100 112th Ave. NE STE 400 Bellvue, WA 98004-4505

Lab Number:	41343-11
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-UT-BB
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	33.8
C2 Benzothiophenes	2.5	67.0
C3 Benzothiophenes	2.5	146.1
C4 Benzothiophenes	2.5	239.8
Naphthalene	2.5	3.8
1-Methylnaphthalene	2.5	70.6
2-Methylnaphthalene	2.5	19.4
C2 Naphthalenes	2.5	523.8
C3 Naphthalenes	2.5	1018.5
C4 Naphthalenes	2.5	1403.7
Biphenyl	2.5	7.0
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	9.8
Acenaphthene	2.5	27.6
Fluorene	2.5	58.8
C1 Fluorenes	2.5	84.0
C2 Fluorenes	2.5	56.2
C3 Fluorenes	2.5	123.0
Anthracene	2.5	30.5
Phenanthrene	2.5	65.4
C1 Phenanthrenes/Anthracenes	2.5	230.2
C2 Phenanthrenes/Anthracenes	2.5	512.8
C3 Phenanthrenes/Anthracenes	2.5	399.8
C4 Phenanthrenes/Anthracenes	2.5	211.6

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41343-11PNA.xls
STL/th

ZymaX FORENSICS

Client:	Artgmis Antipas
	CH2M HILL
	1100 112th Ave. NE STE 400
	Bellvue, WA 98004-4505

Lab Number:	41343-11
Collected:	10/22/08
Received:	10/24/08
Matrix:	Product

Project:	Follow up on TPH Investigation, DRMO
Project Number:	273939-14.01
Collected by:	Stephen Quayle/ Doye Ball

Sample Description:	FTPH-FP-UT-BB
Analyzed:	10/29/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	29.9
C1 Dibenzothiophenes	2.5	164.4
C2 Dibenzothiophenes	2.5	281.9
C3 Dibenzothiophenes	2.5	224.3
C4 Dibenzothiophenes	2.5	186.4
Fluoranthene	2.5	61.4
Pyrene	2.5	136.0
C1 Pyrenes/Fluoranthenes	2.5	348.0
C2 Pyrenes/Fluoranthenes	2.5	341.5
C3 Pyrenes/Fluoranthenes	2.5	134.5
Benz(a)anthracene	2.5	32.4
Chrysene	2.5	64.9
C1 Chrysenes	2.5	226.7
C2 Chrysenes	2.5	117.8
C3 Chrysenes	2.5	55.5
C4 Chrysenes	2.5	14.4
Benzo(b)fluroanthene	2.5	46.0
Benzo(k)fluoranthene	2.5	17.9
Benzo(e)pyrene	2.5	29.0
Benzo(a)pyrene	2.5	28.9
Perylene	2.5	21.5
Indeno(1,2,3-c,d)pyrene	2.5	6.2
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	7.0

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

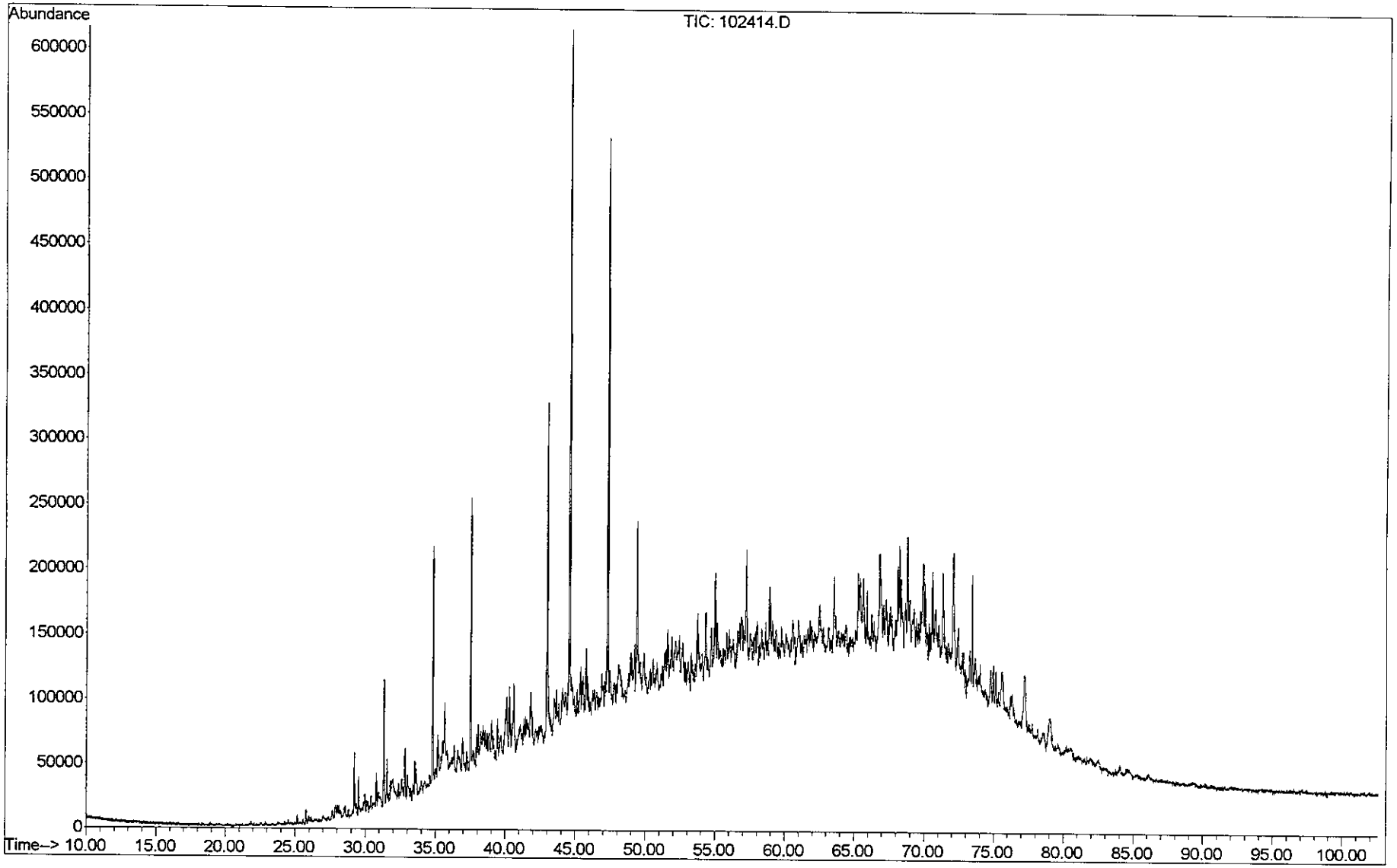
Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

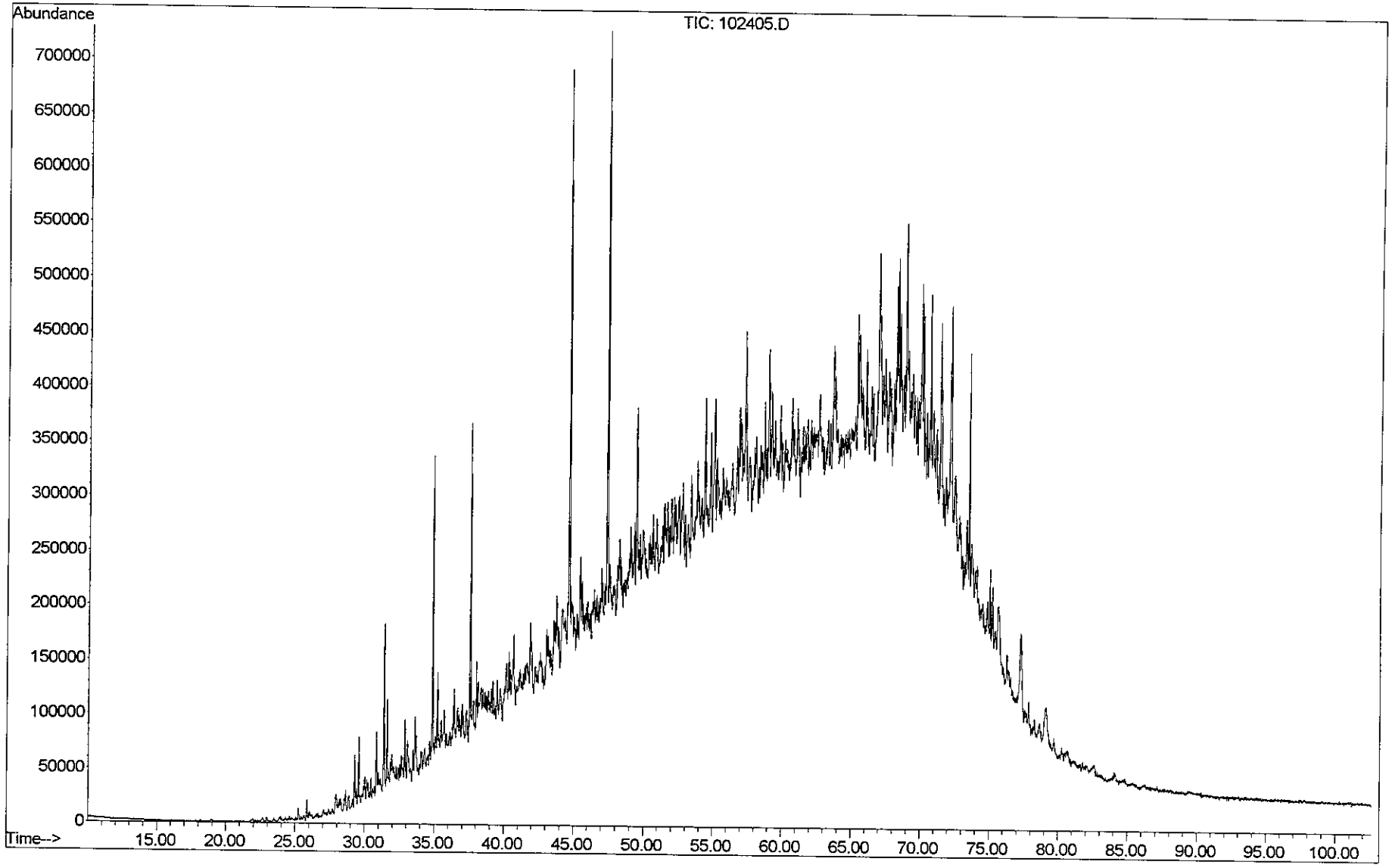
Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41343-11PNA.xls
STL/th

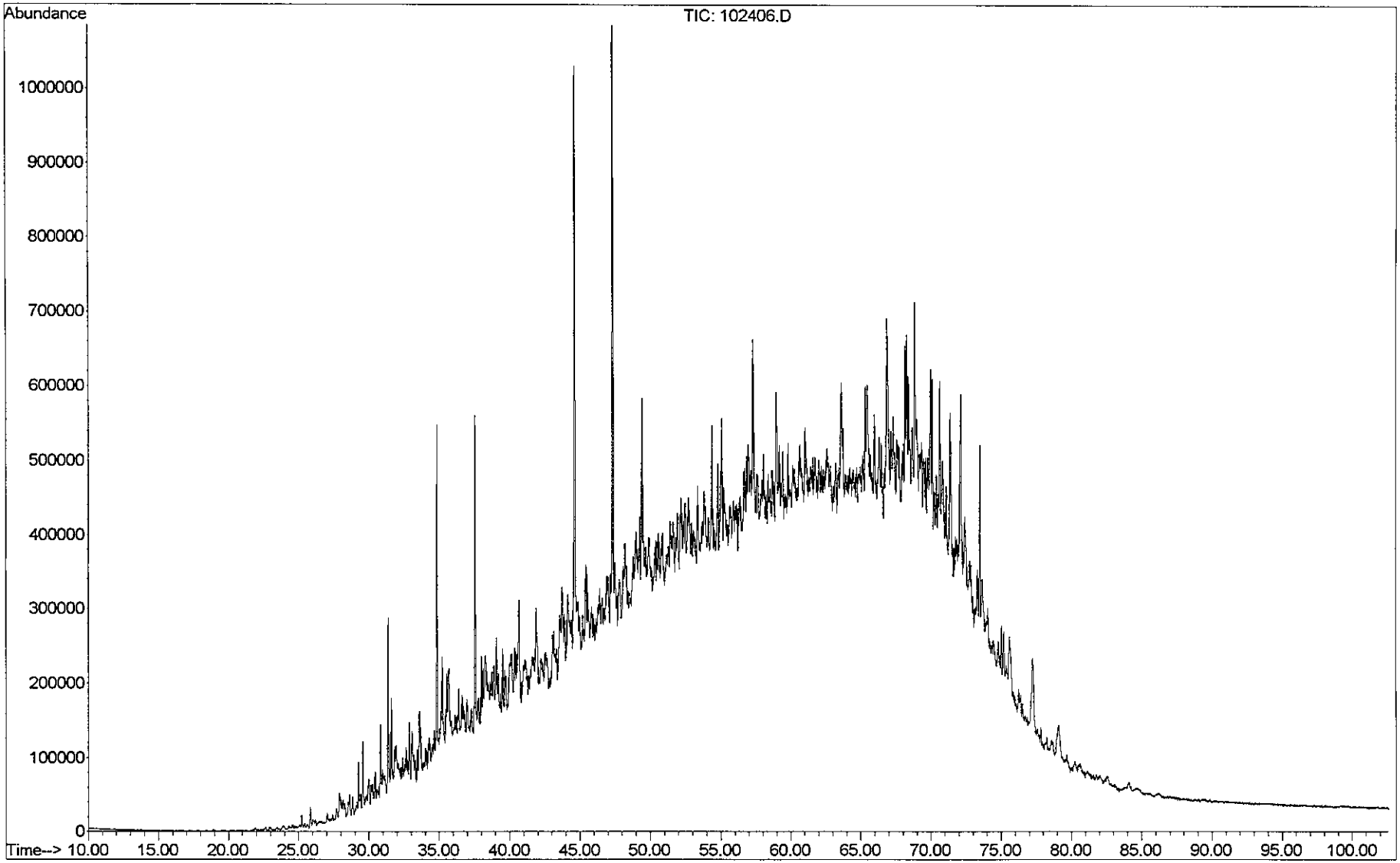
Sample Name: FTPH-FP-SB-D (41343-2) sheen
Misc Info : Follow on TPH investigation



Sample Name: FTPH-FP-UT-Y (41343-3) sheen
Misc Info : Follow on TPH investigation



Sample Name: FTPH-FP-UT-W (41343-4) Heavy oil
Misc Info : Follow on TPH investigation



Sample Name: FTPH-FP-SB-G (41343-5) sheen
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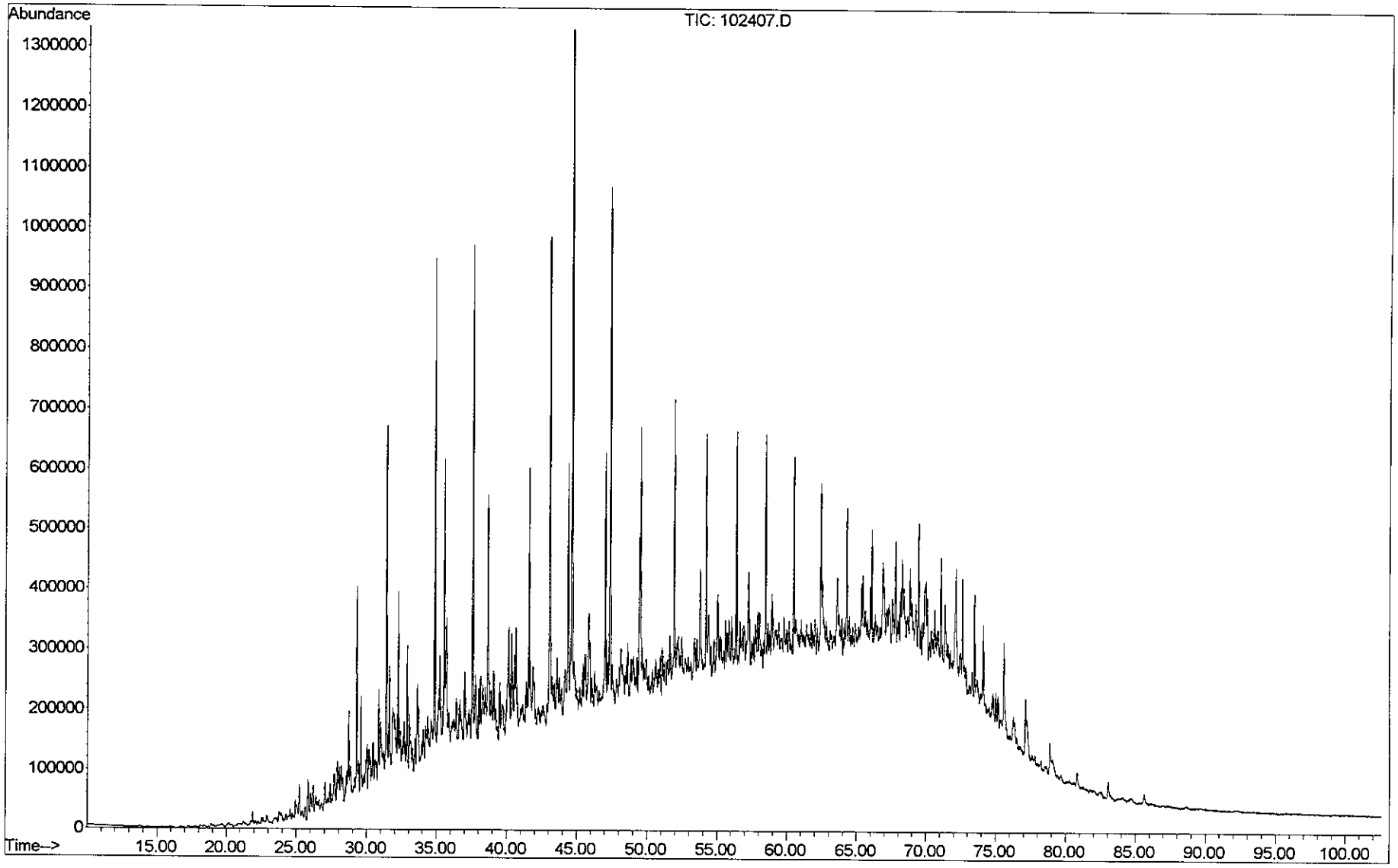
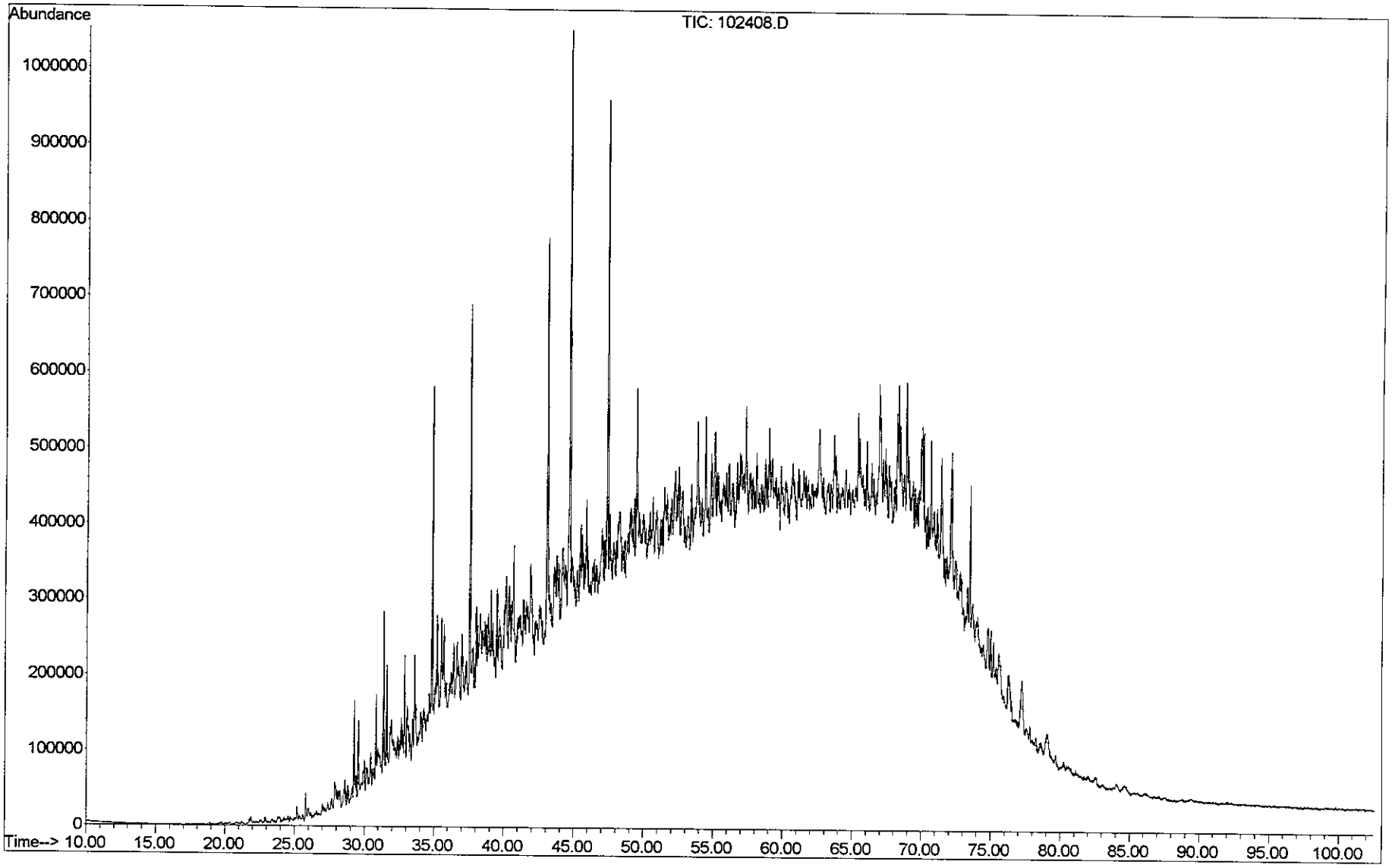


Sample Name: FTPH-FP-SB-K (41343-6) sheen
Misc Info : Follow on TPH investigation



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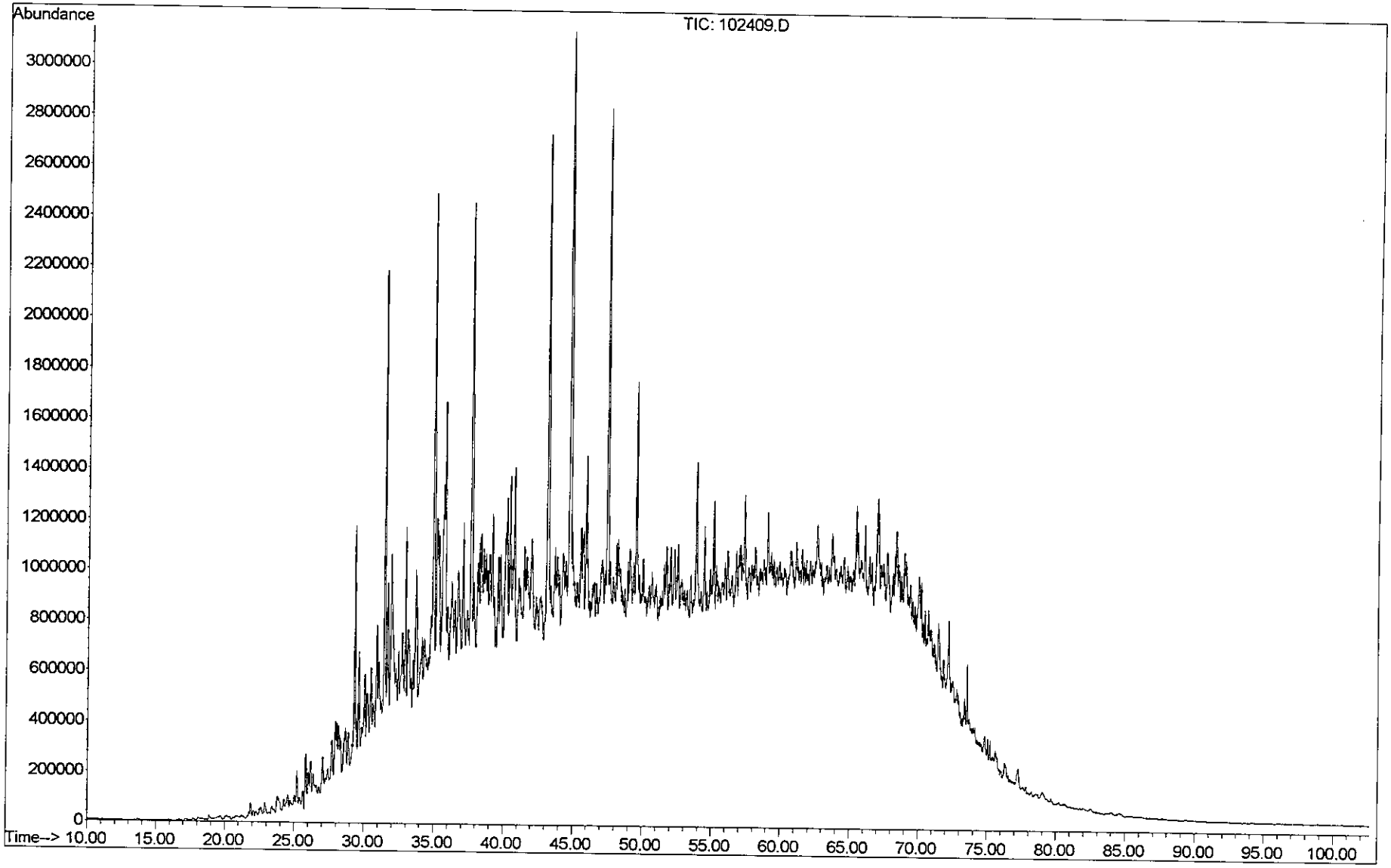
Misc Info : Follow on TPH investigation



Sample Name: FTPH-FP-SB-WWW (41343-8) Heavy oil
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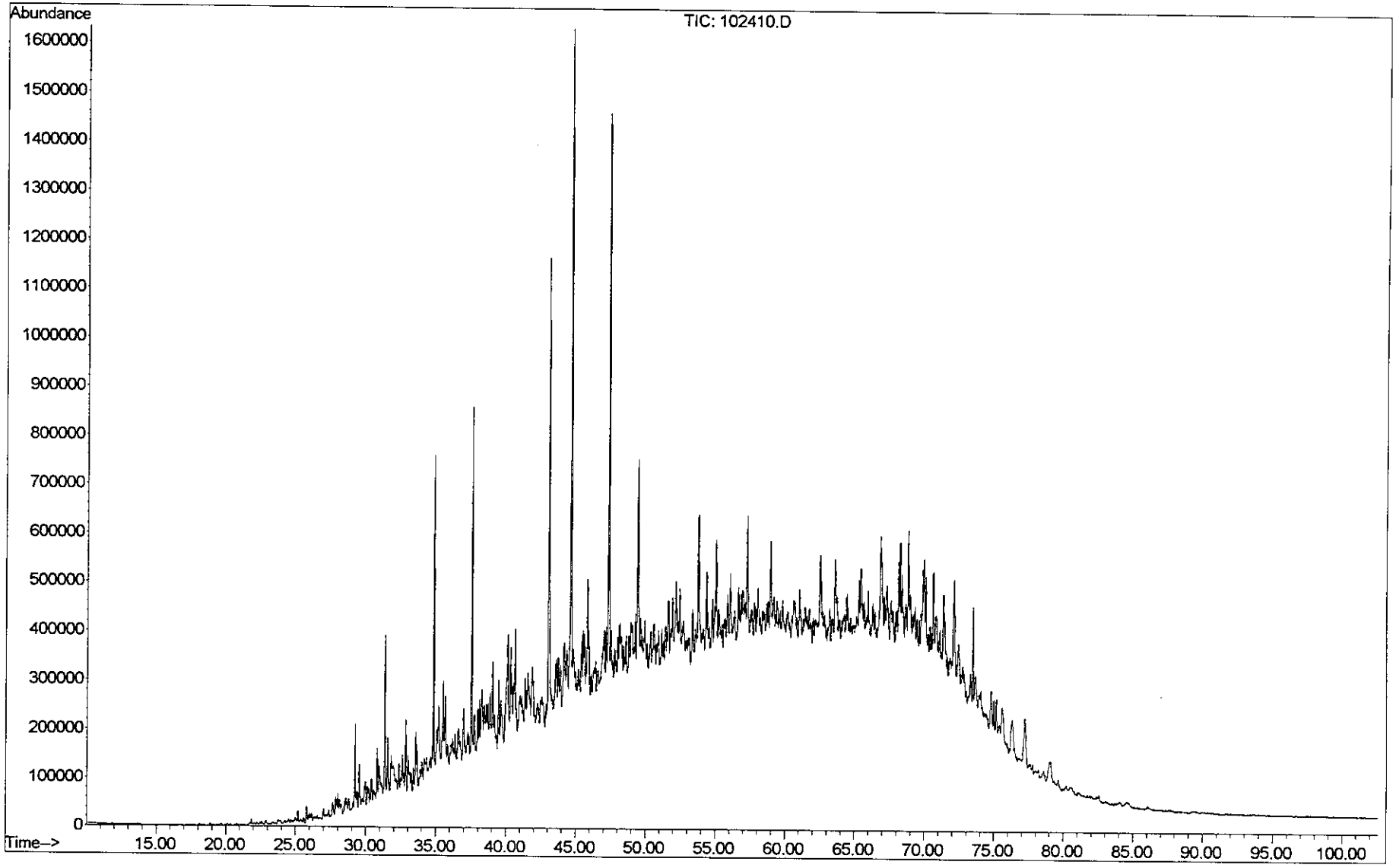

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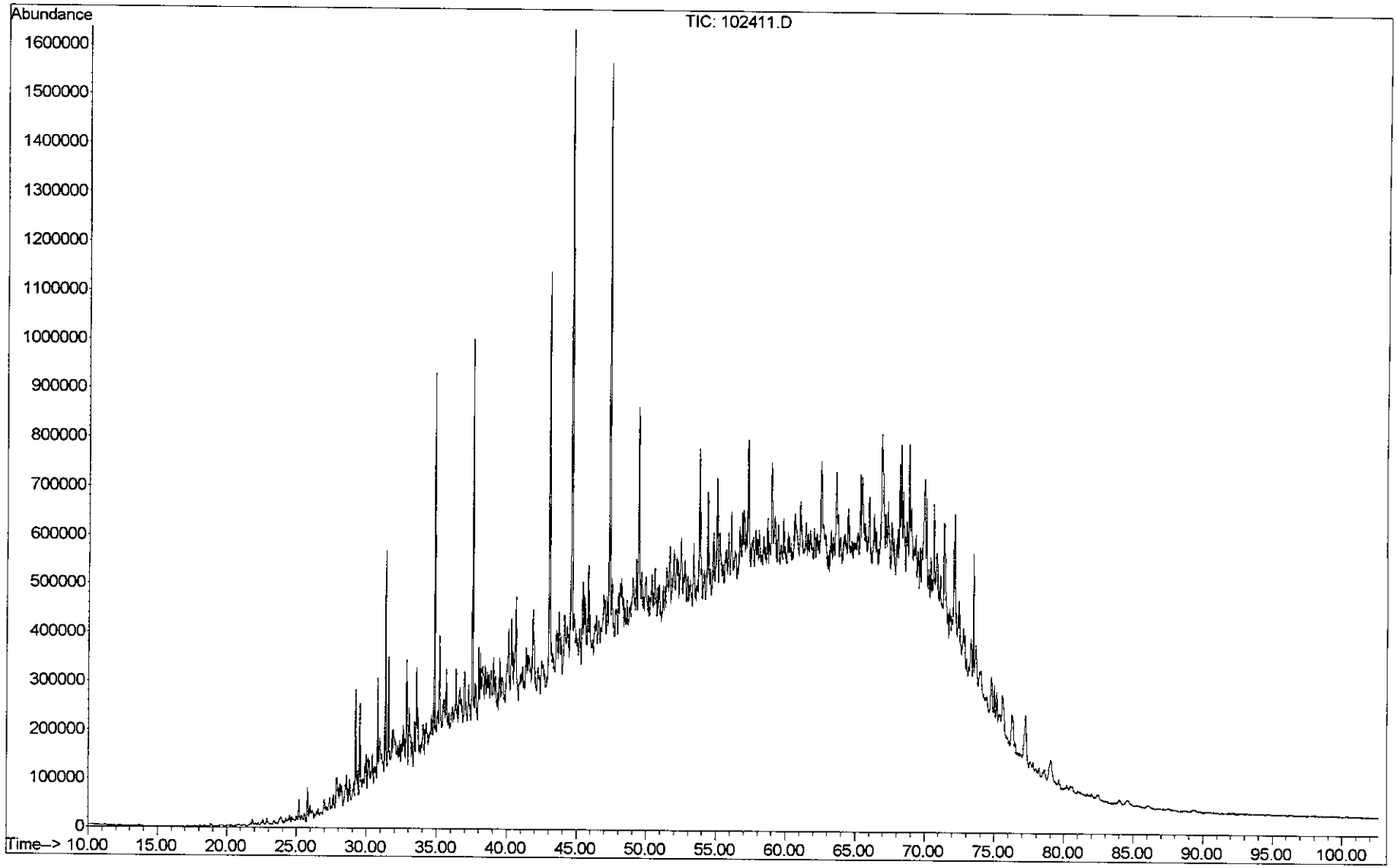
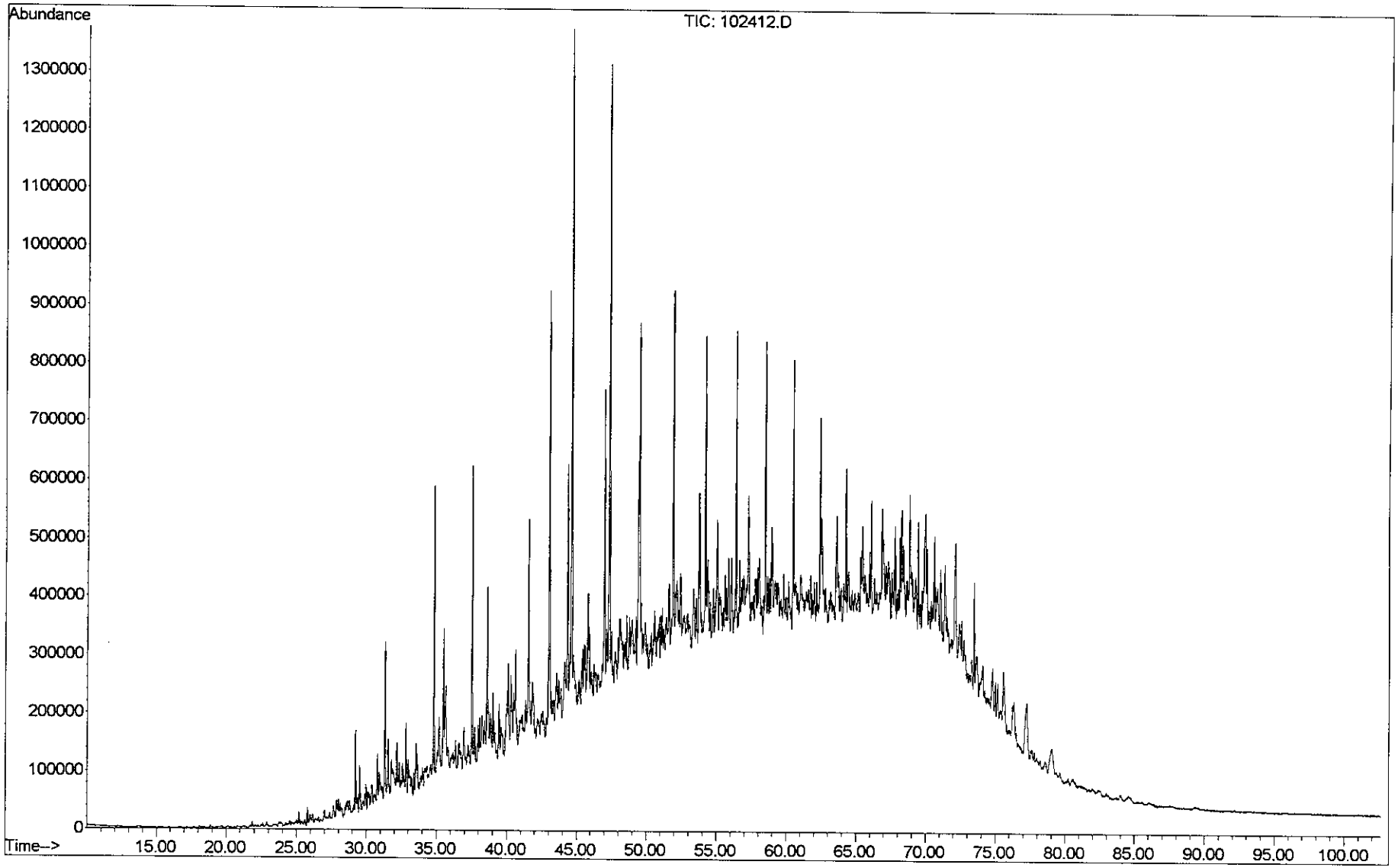


Sample Name: FTPH-FP-SB-R (41343-10) sheen
Misc Info : Follow on TPH investigation



Sample Name: FTPH-FP-UT-BB (41343-11) Heavy oil
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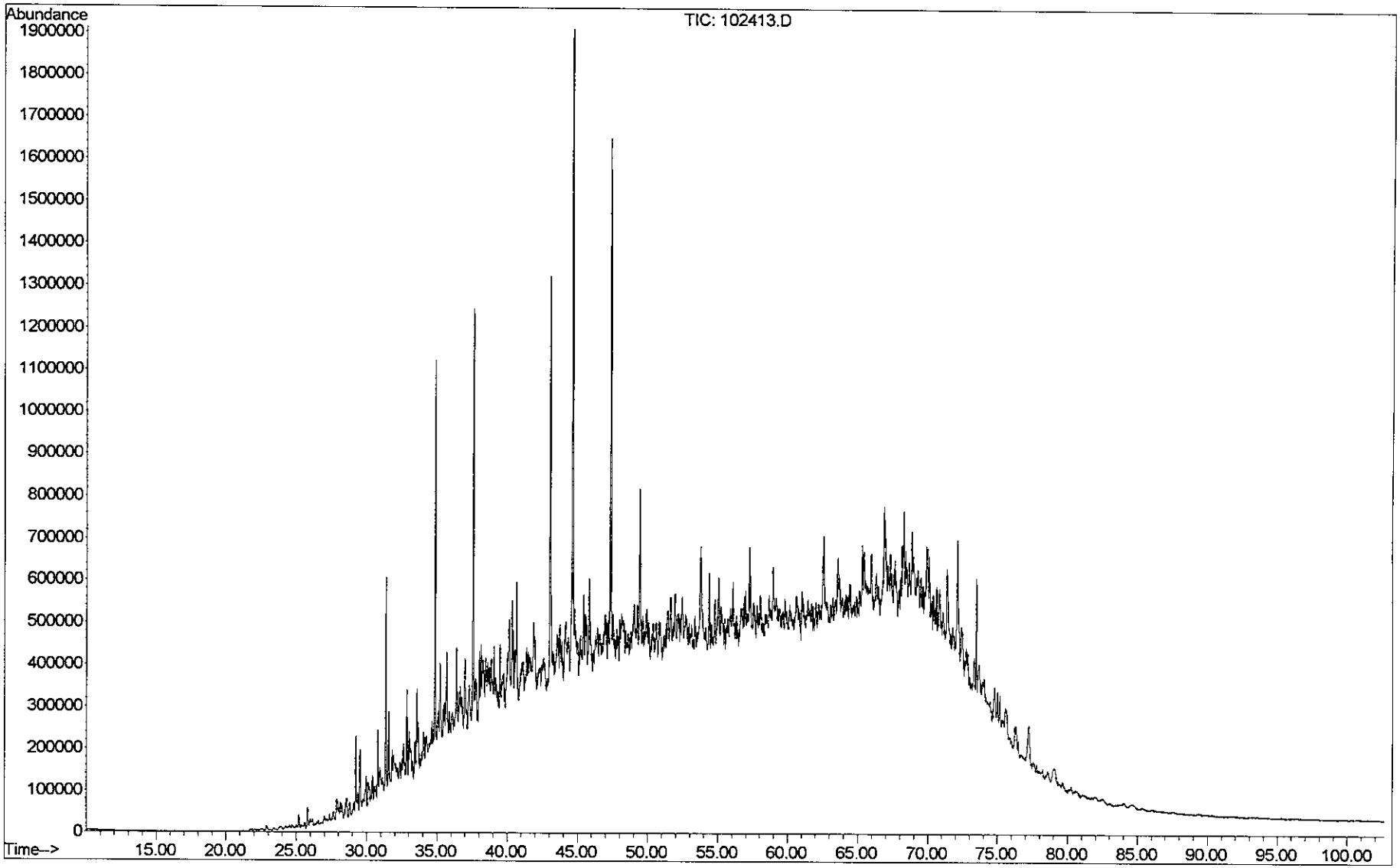
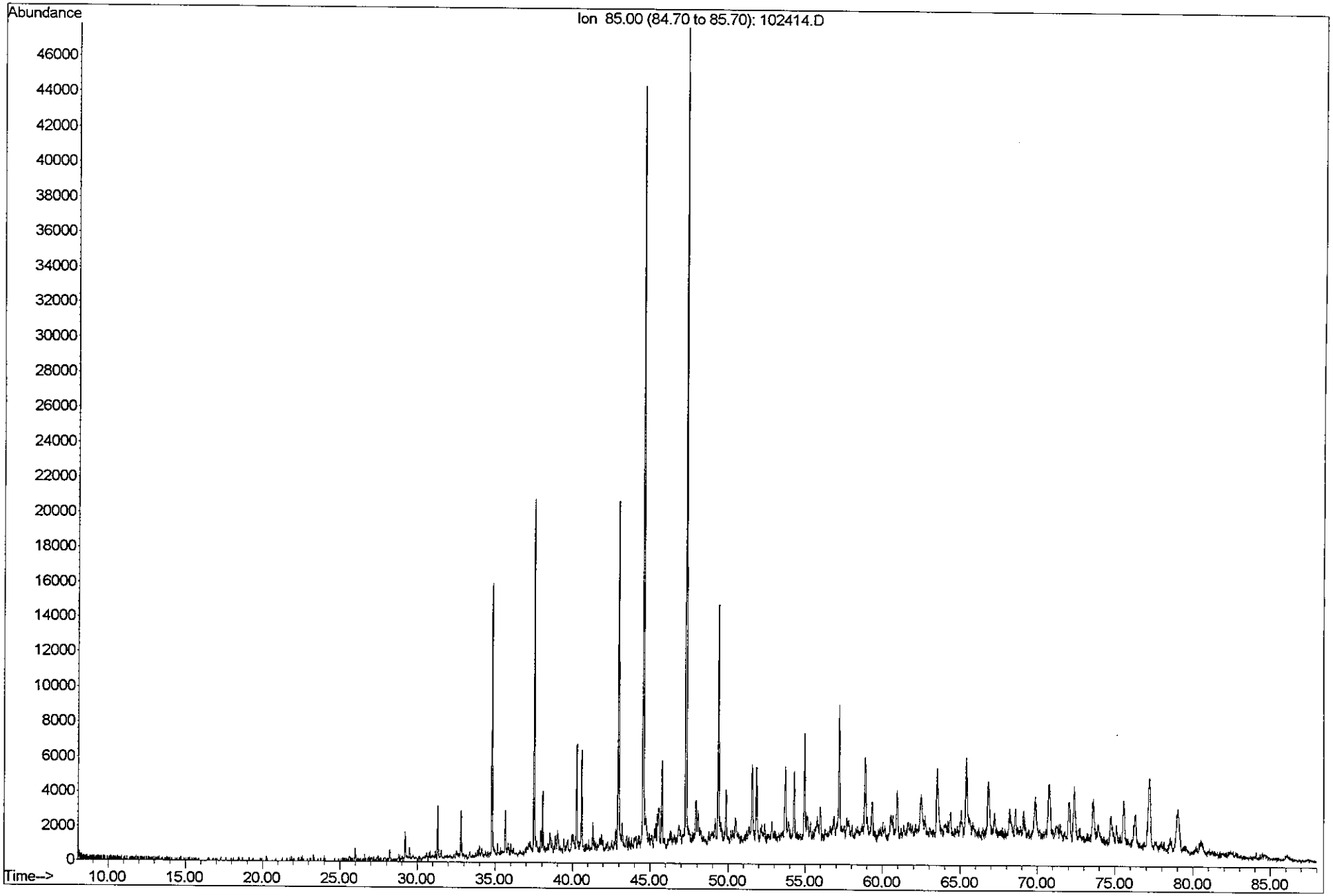


FTPH-FP-SB-D (41343-2) sheen
Follow on TPH investigation



FTPH-FP-UT-Y (41343-3) sheen
Follow on TPH investigation

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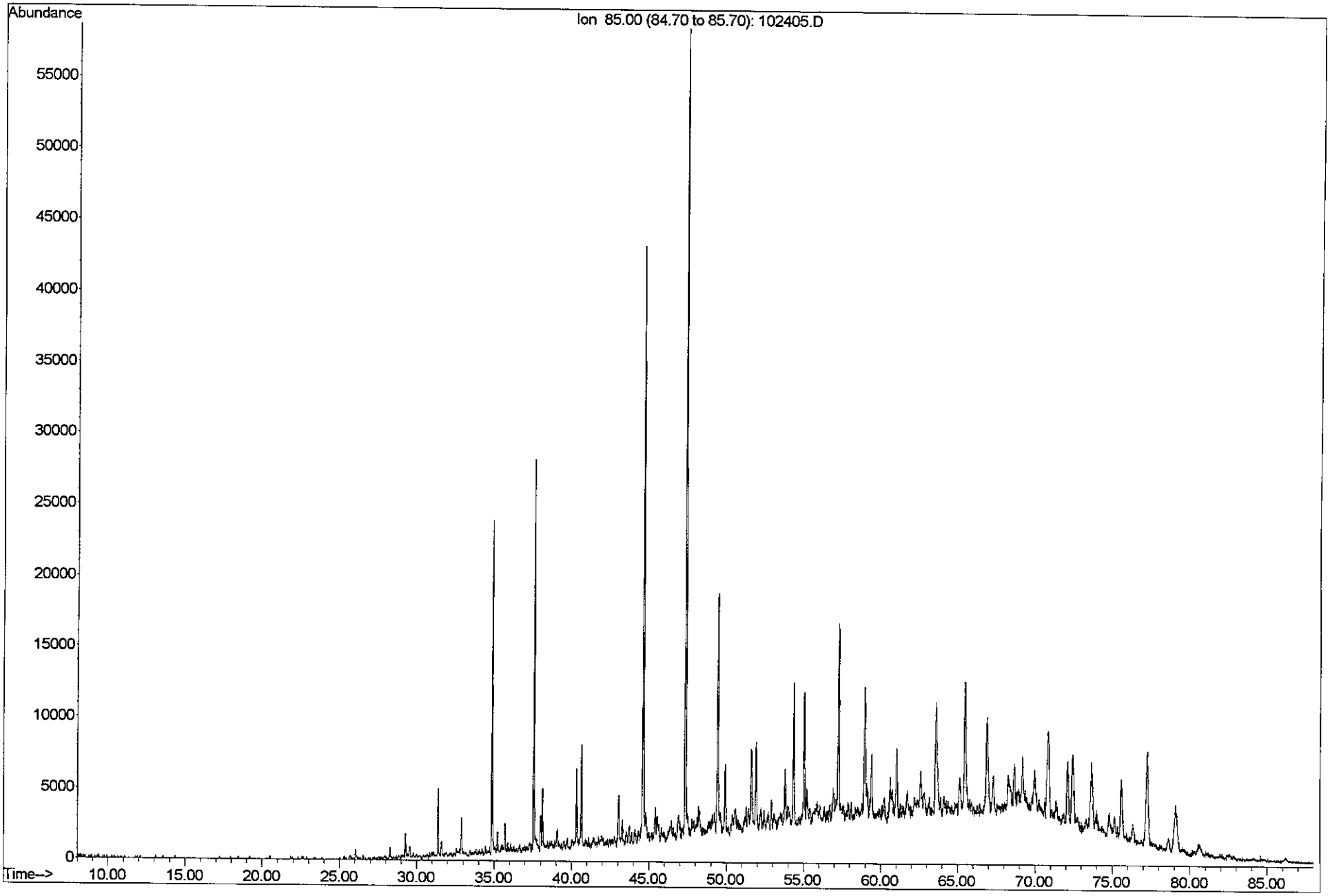
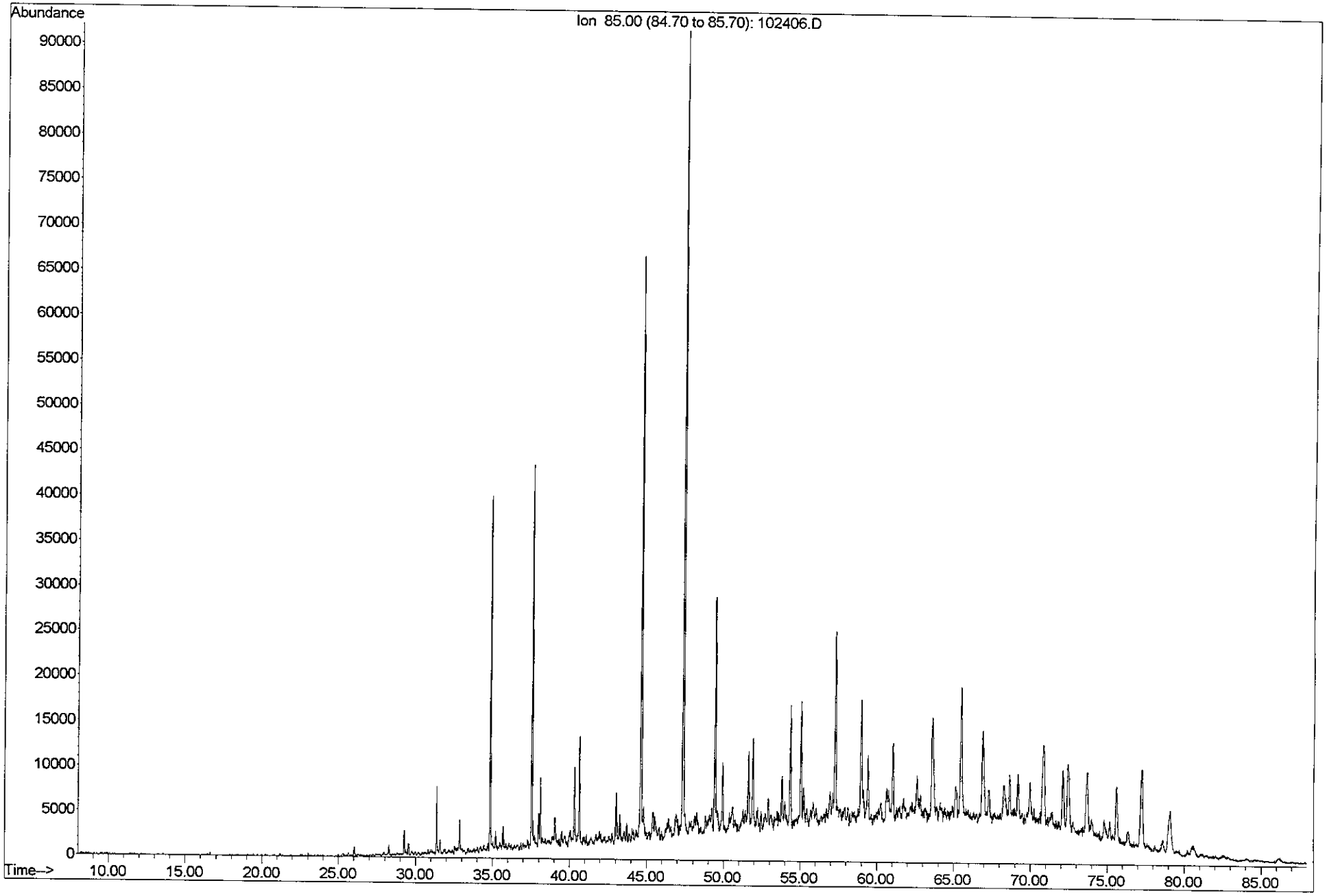
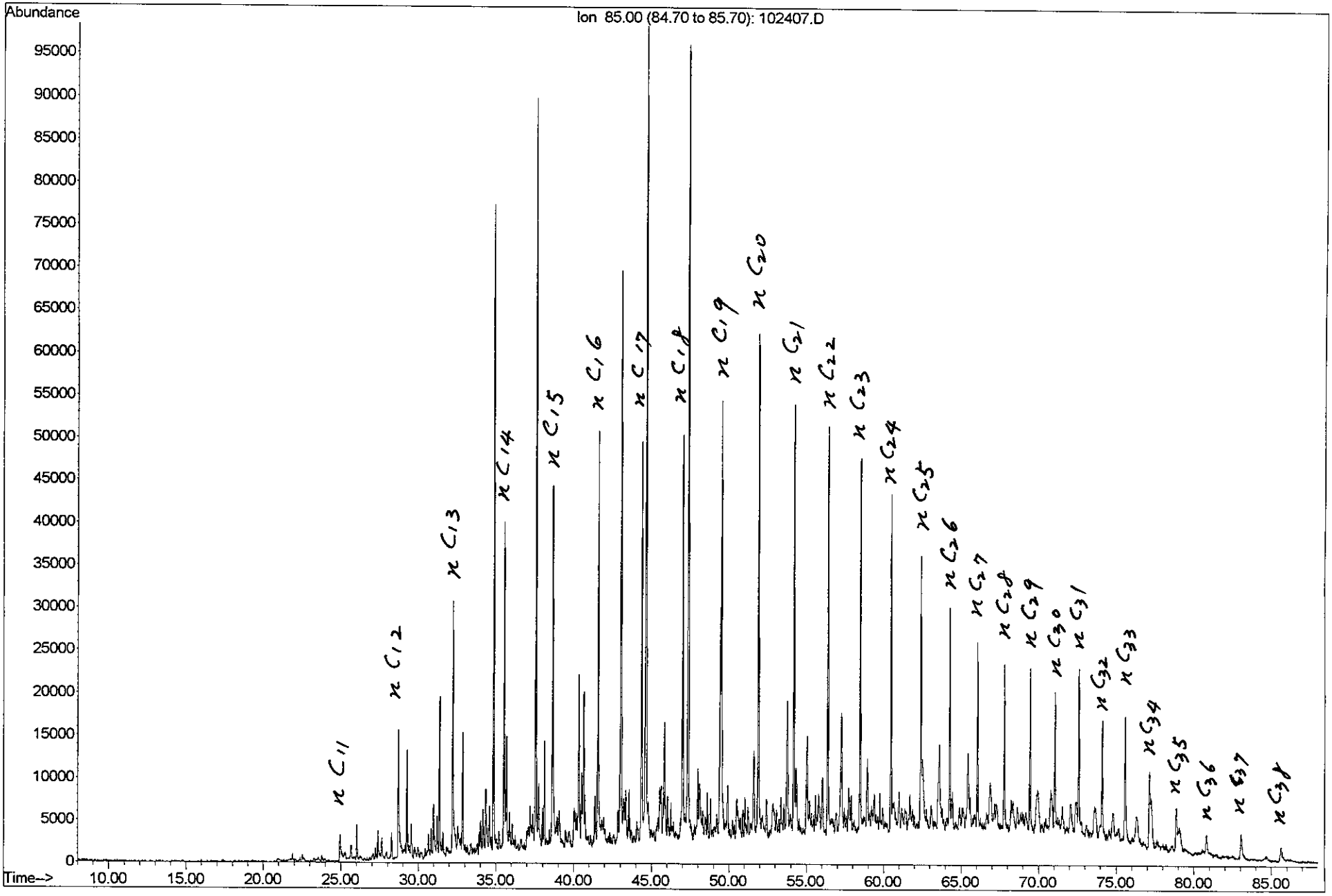


FTPH-FP-UT-W (41343-4) Heavy oil
Follow on TPH investigation

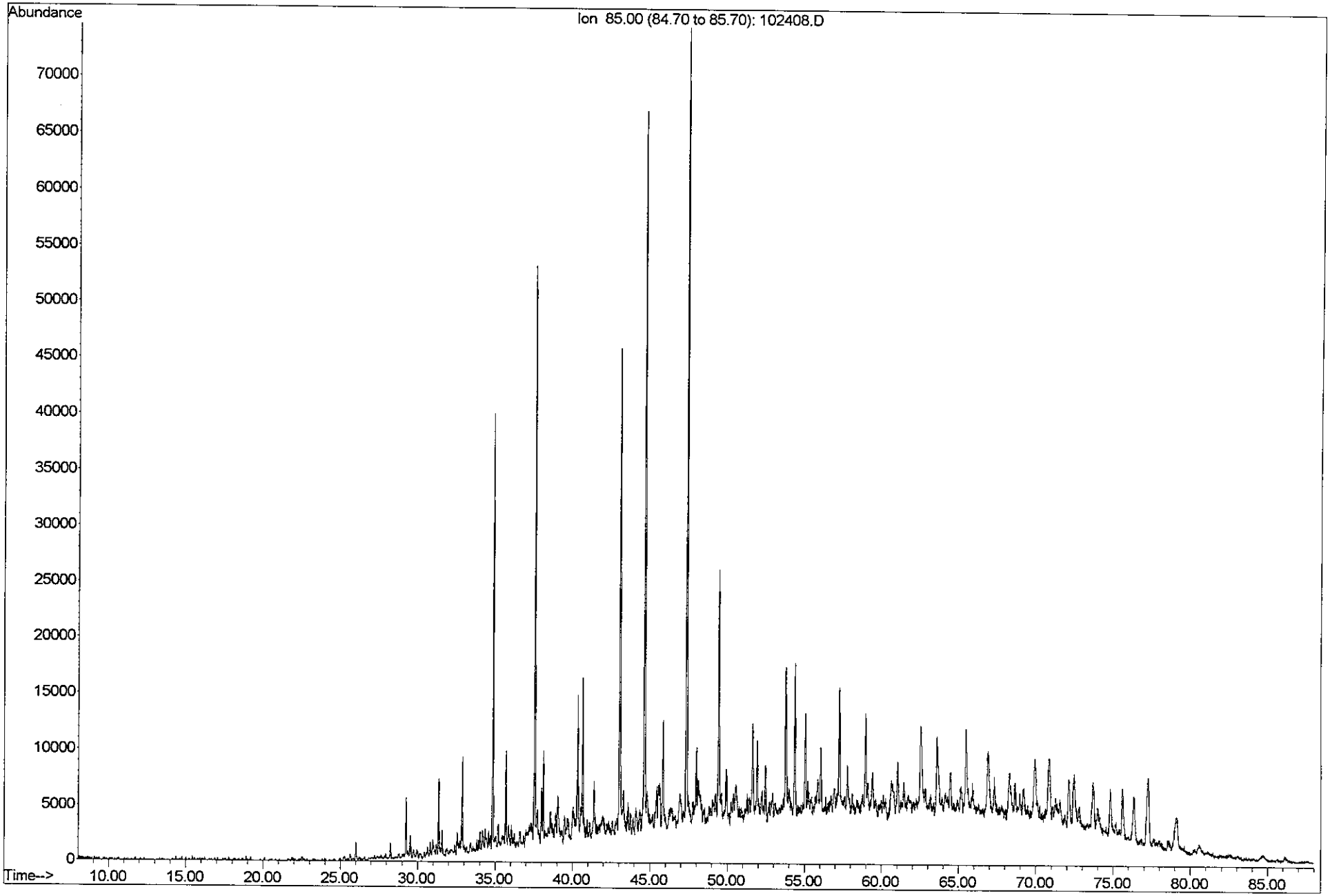


FTPH-FP-SB-G (41343-5) sheen
Follow on TPH investigation



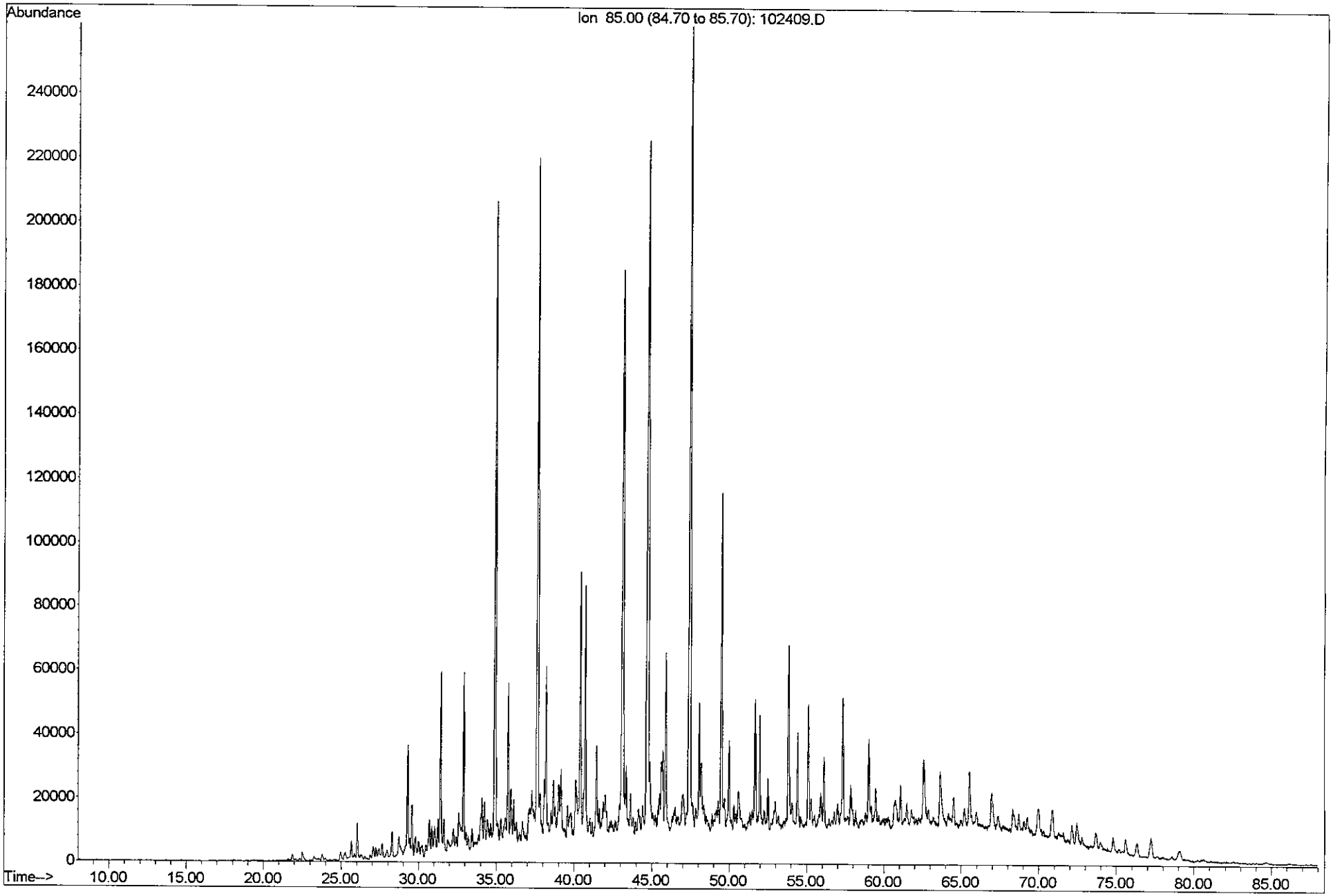
FTPH-FP-SB-K (41343-6) sheen
Follow on TPH investigation

ZymaX FORENSICS

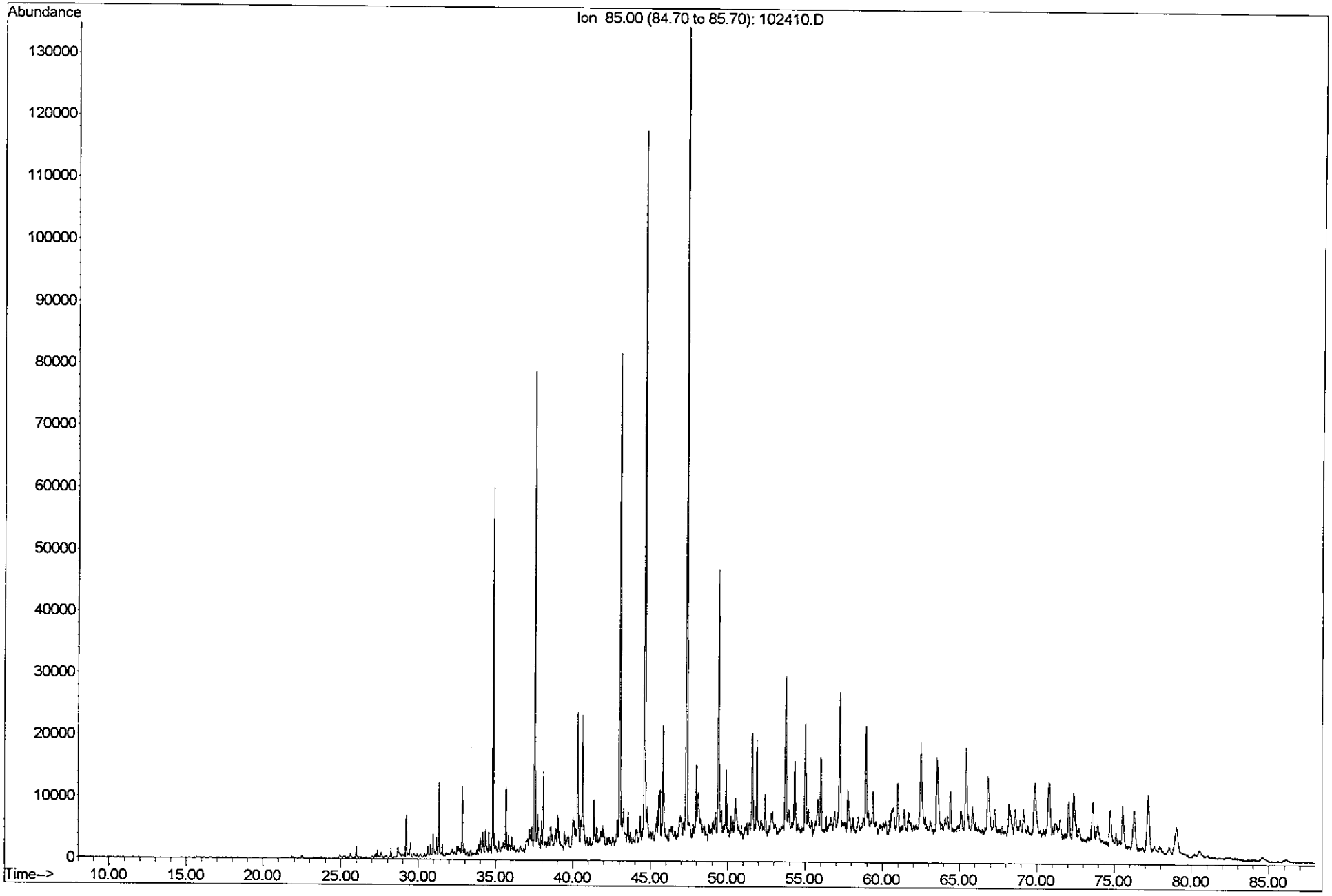


FTPH-FP-SB-L (41343-7) Heavy oil
Follow on TPH investigation

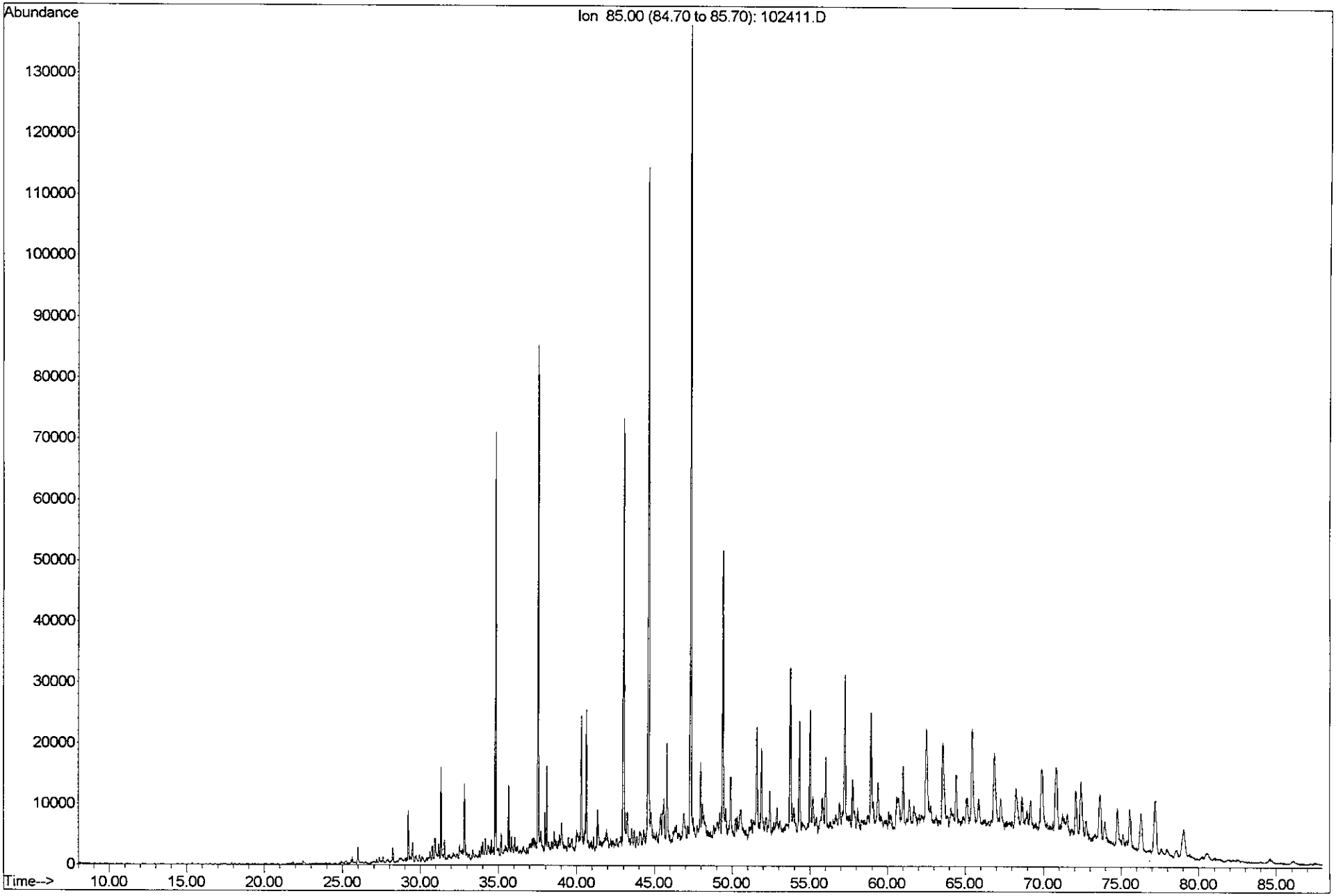
ZymaX FORENSICS



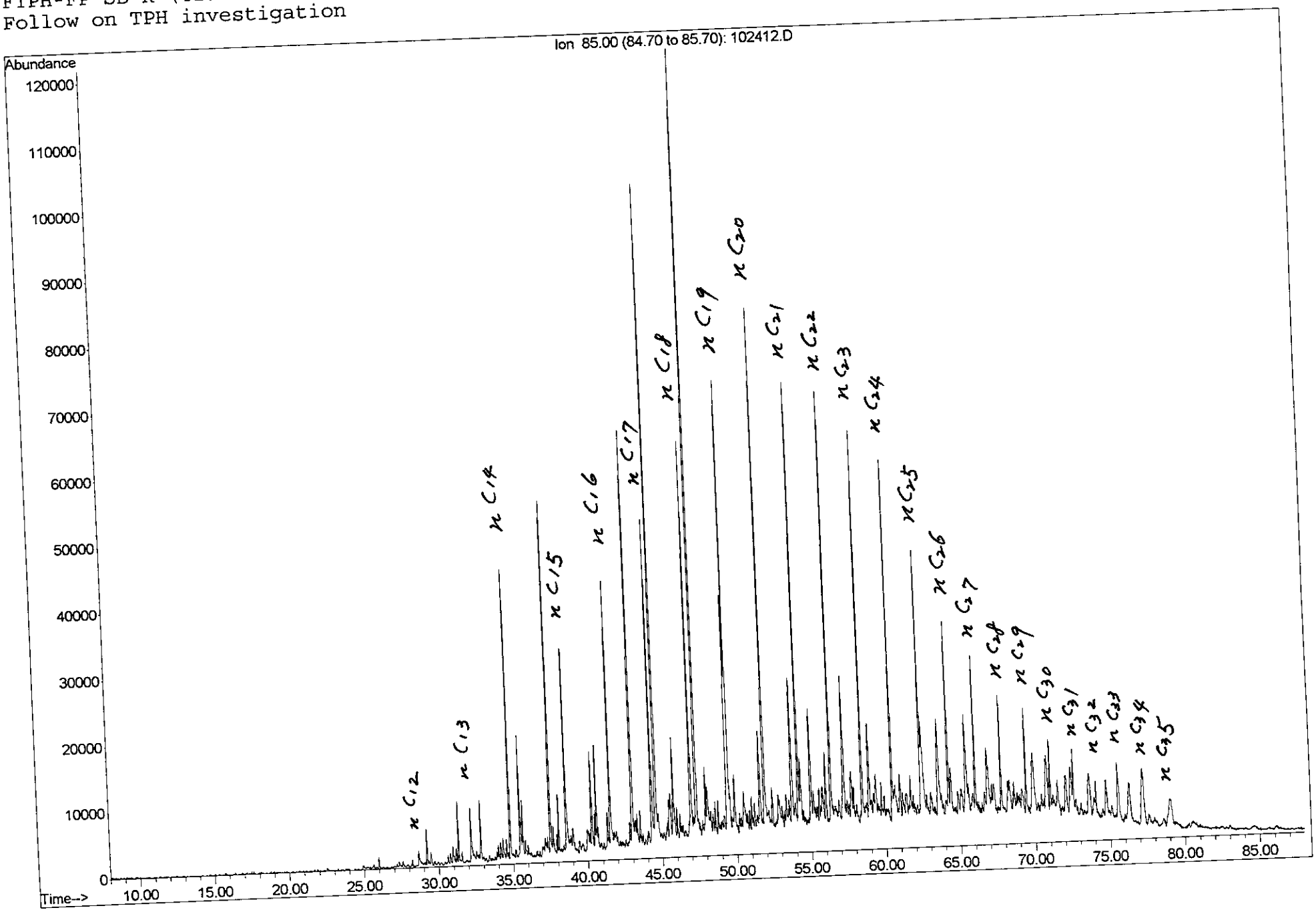
FTPH-FP-SB-WWW (41343-8) Heavy oil
Follow on TPH investigation



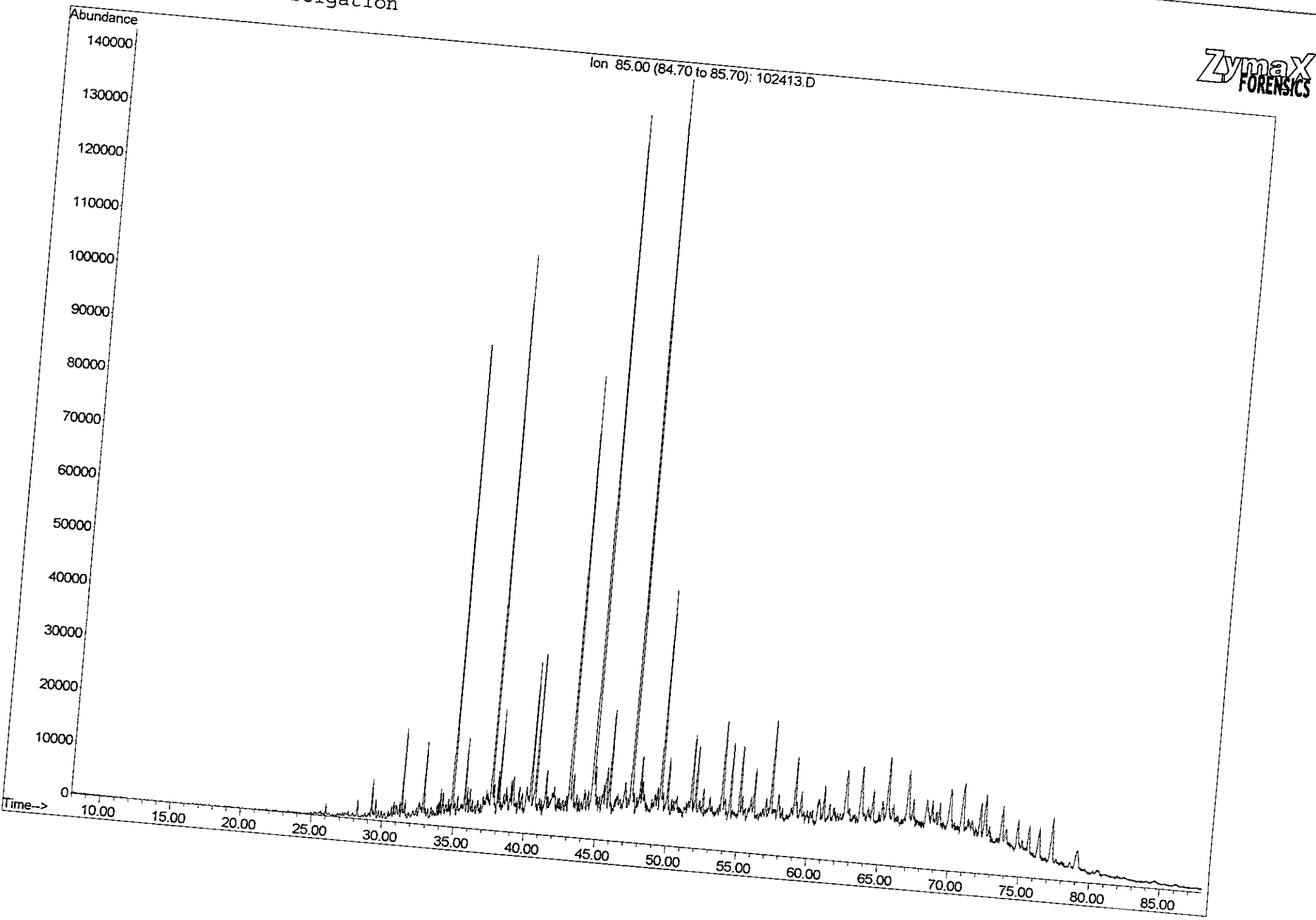
FTPH-FP-SB-O (41343-9) Heavy oil
Follow on TPH investigation



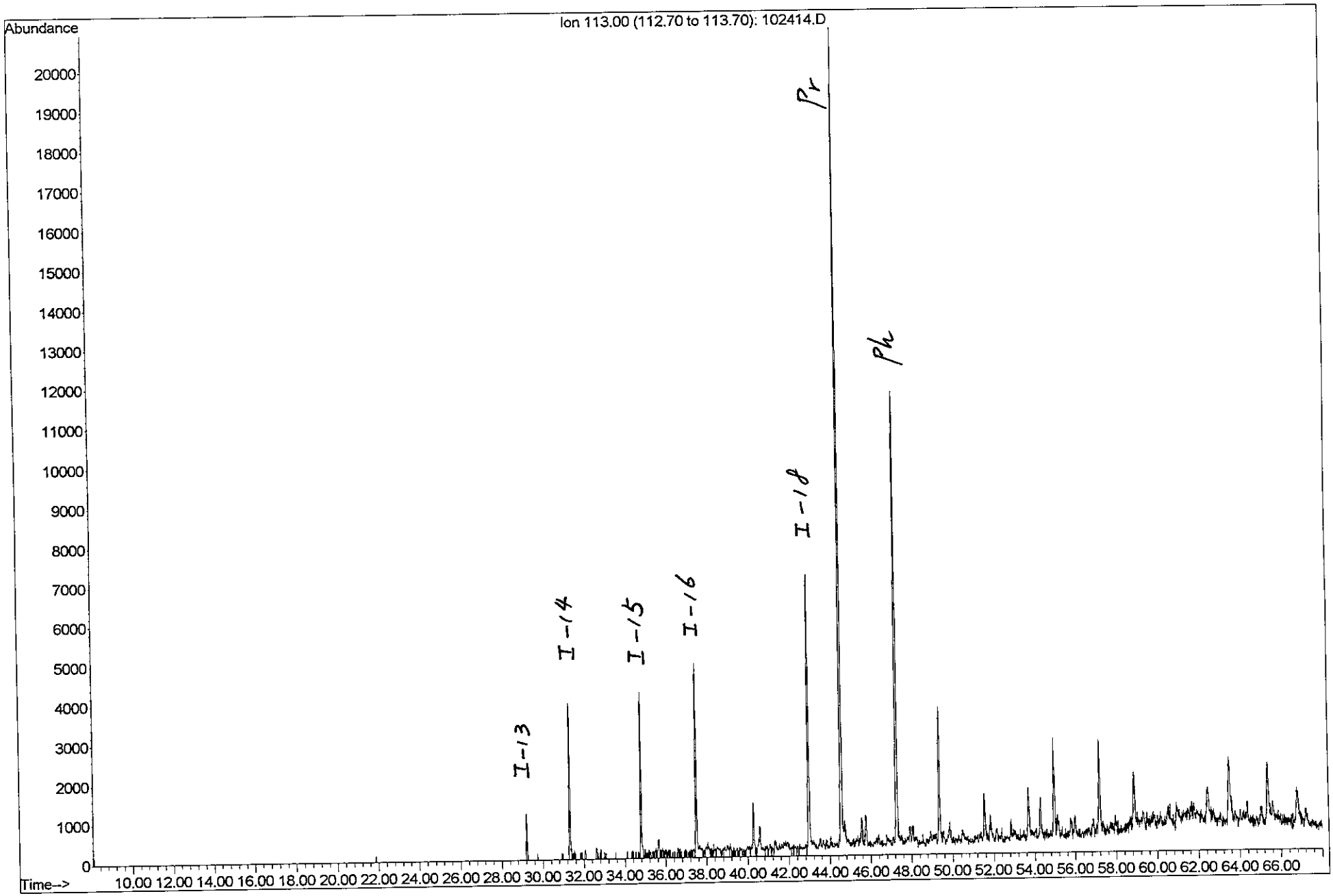
FTPH-FP-SB-R (41343-10) sheen
Follow on TPH investigation



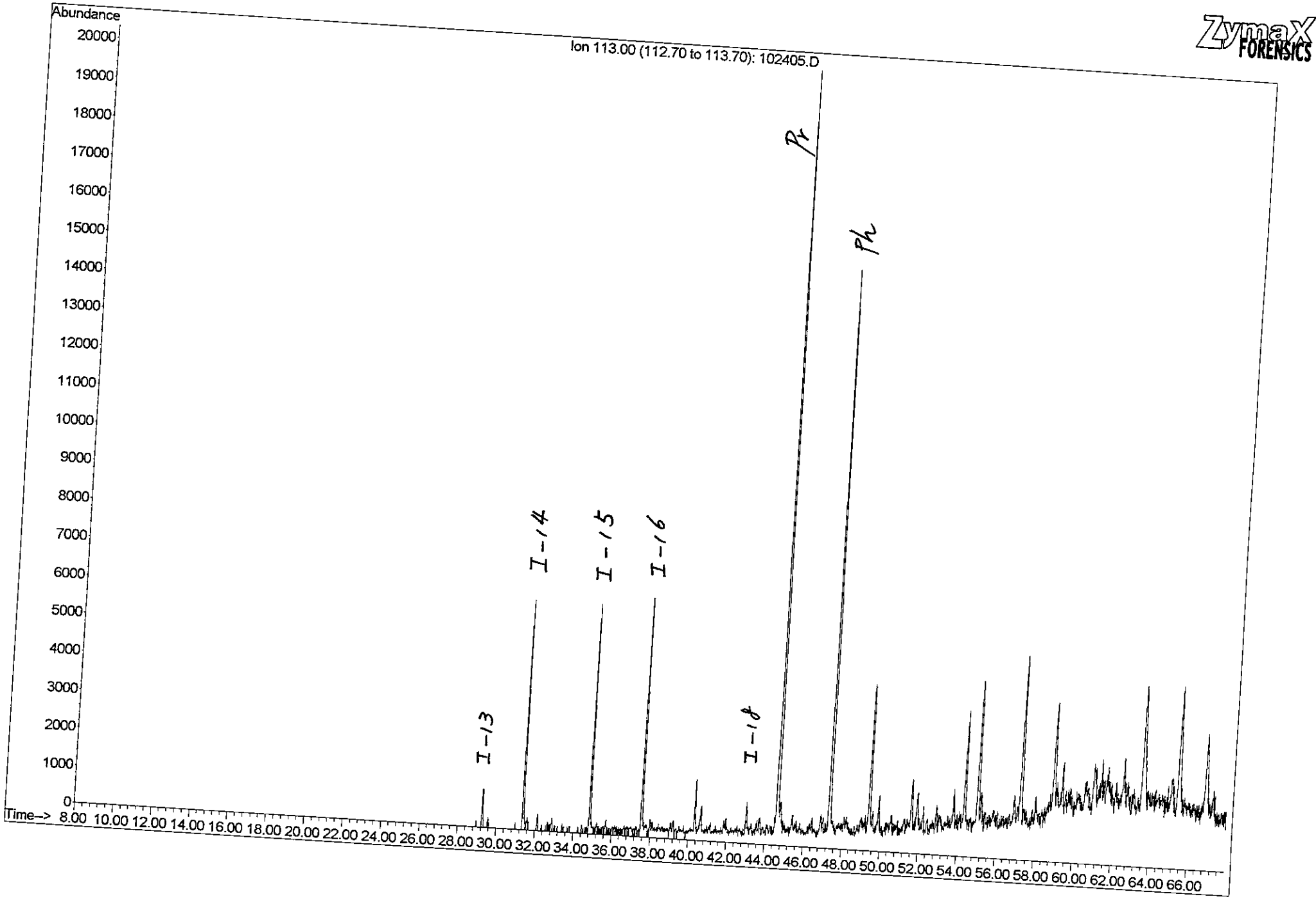
Follow on TPH investigation



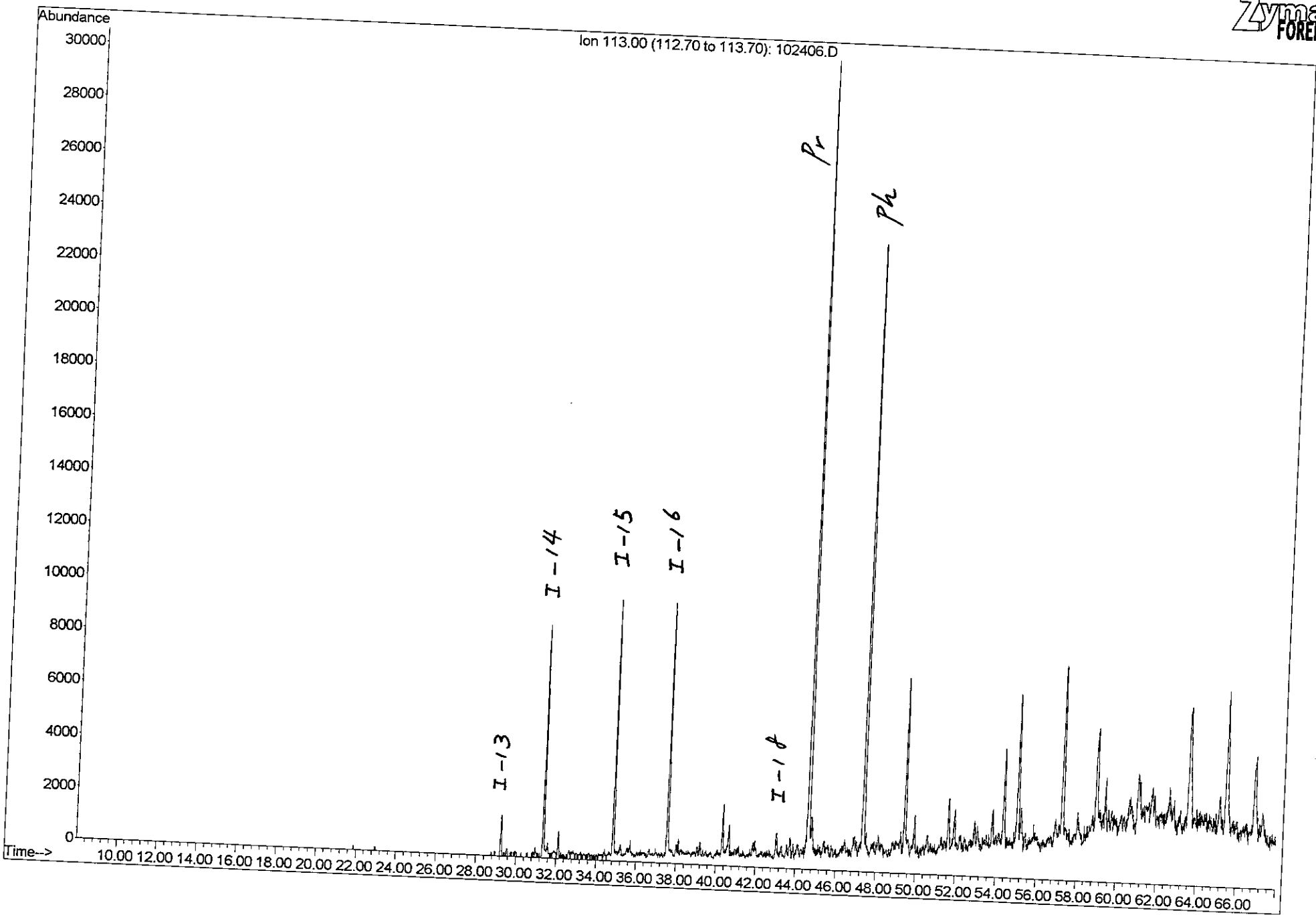
FTPH-FP-SB-D (41343-2) sheen
Follow on TPH investigation



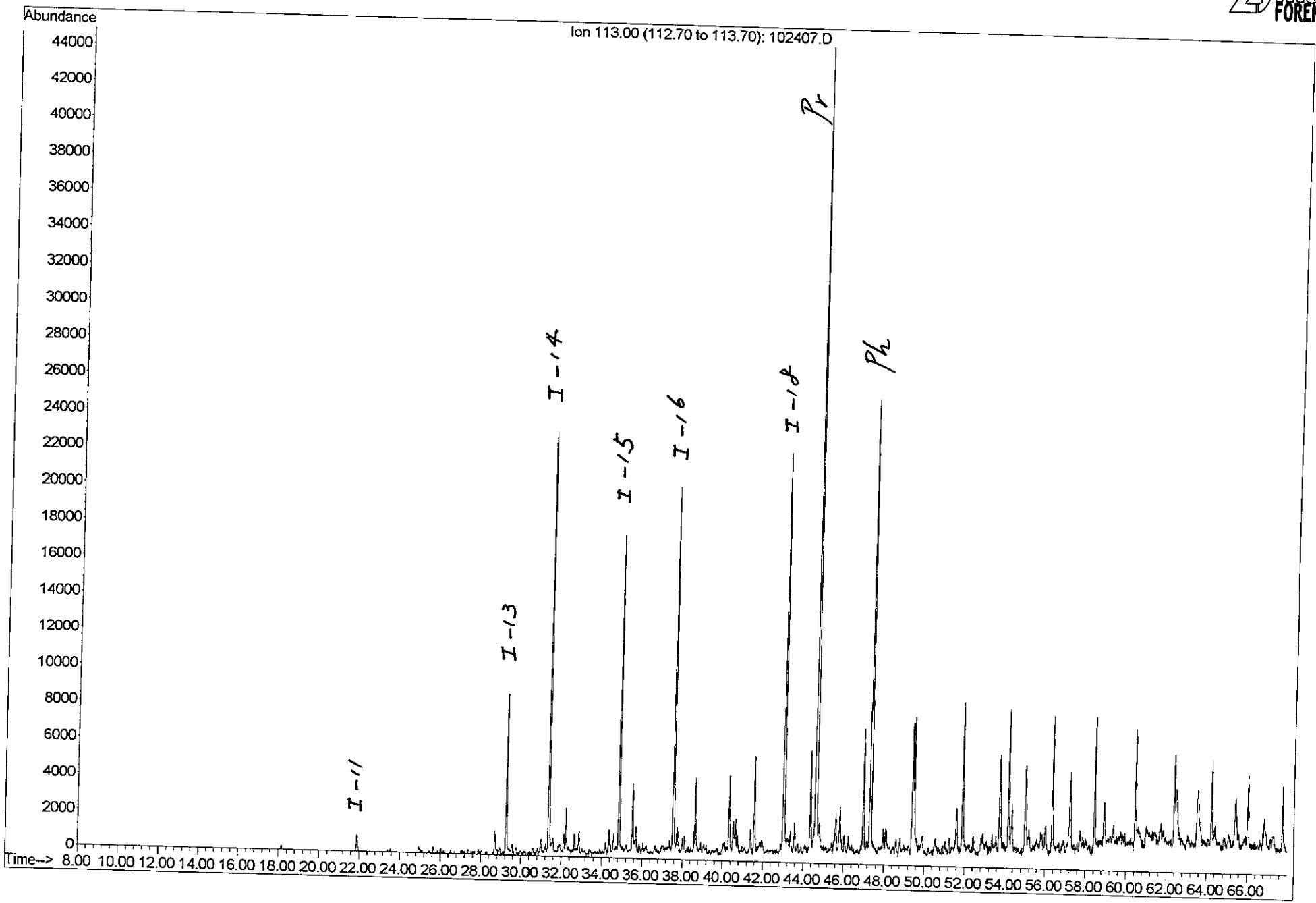
TPH TP-01-Y (41343-3) sheen
Follow on TPH investigation



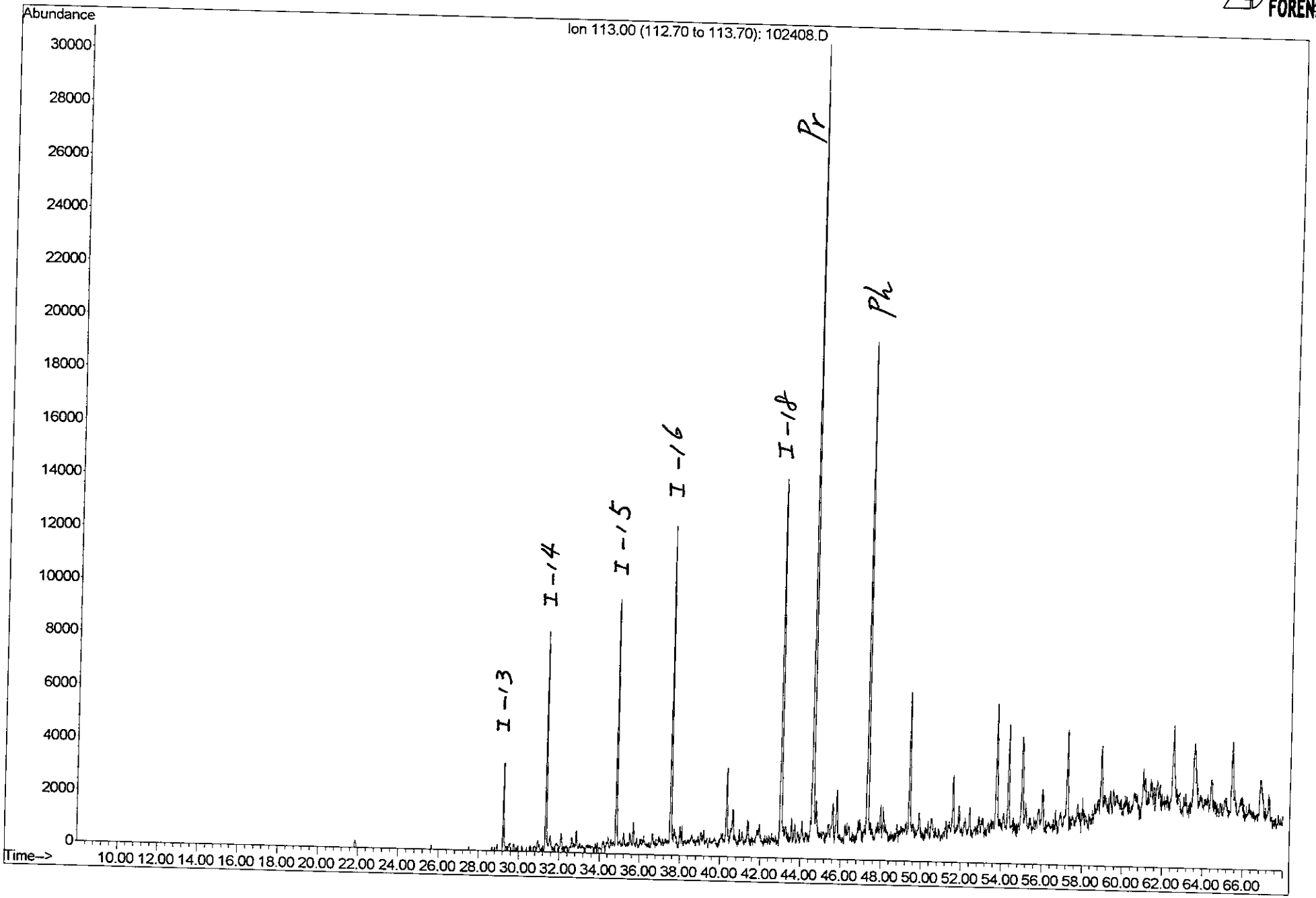
FTPH-FP-UT-W (41343-4) Heavy oil
Follow on TPH investigation



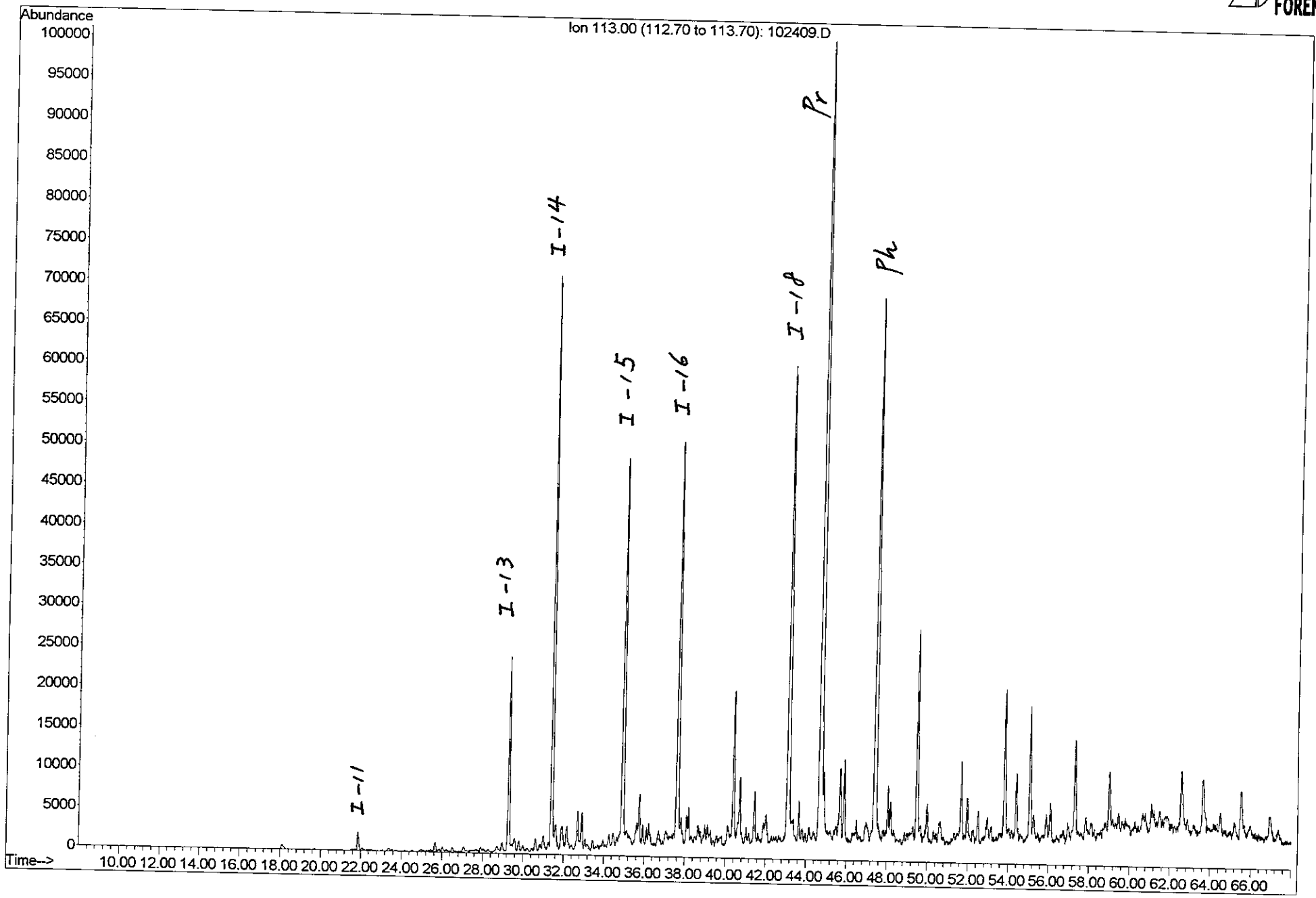
FTPH-FP-SB-G (41343-5) sheen
Follow on TPH investigation



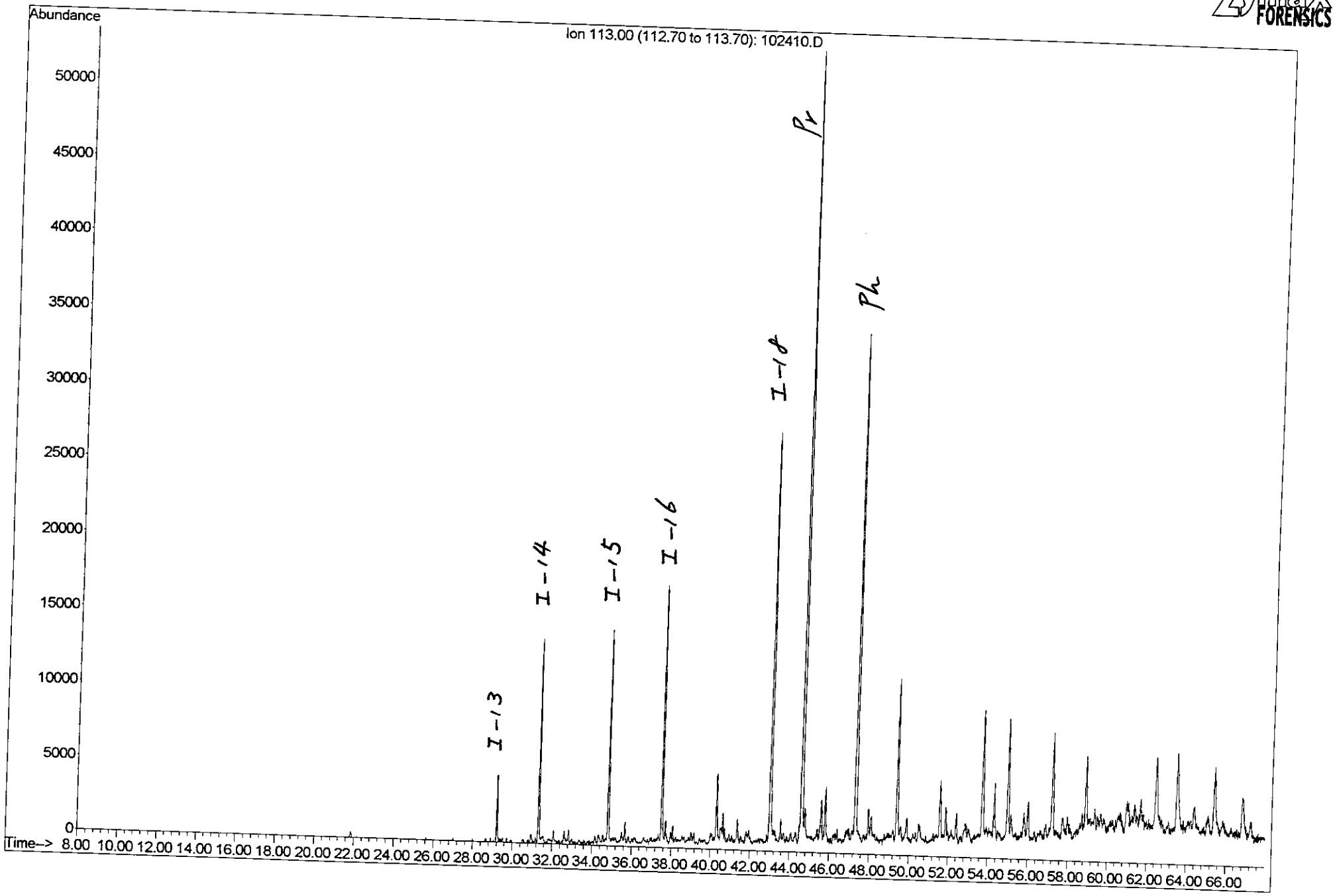
FTPH-FP-SB-K (41343-6) sheen
Follow on TPH investigation



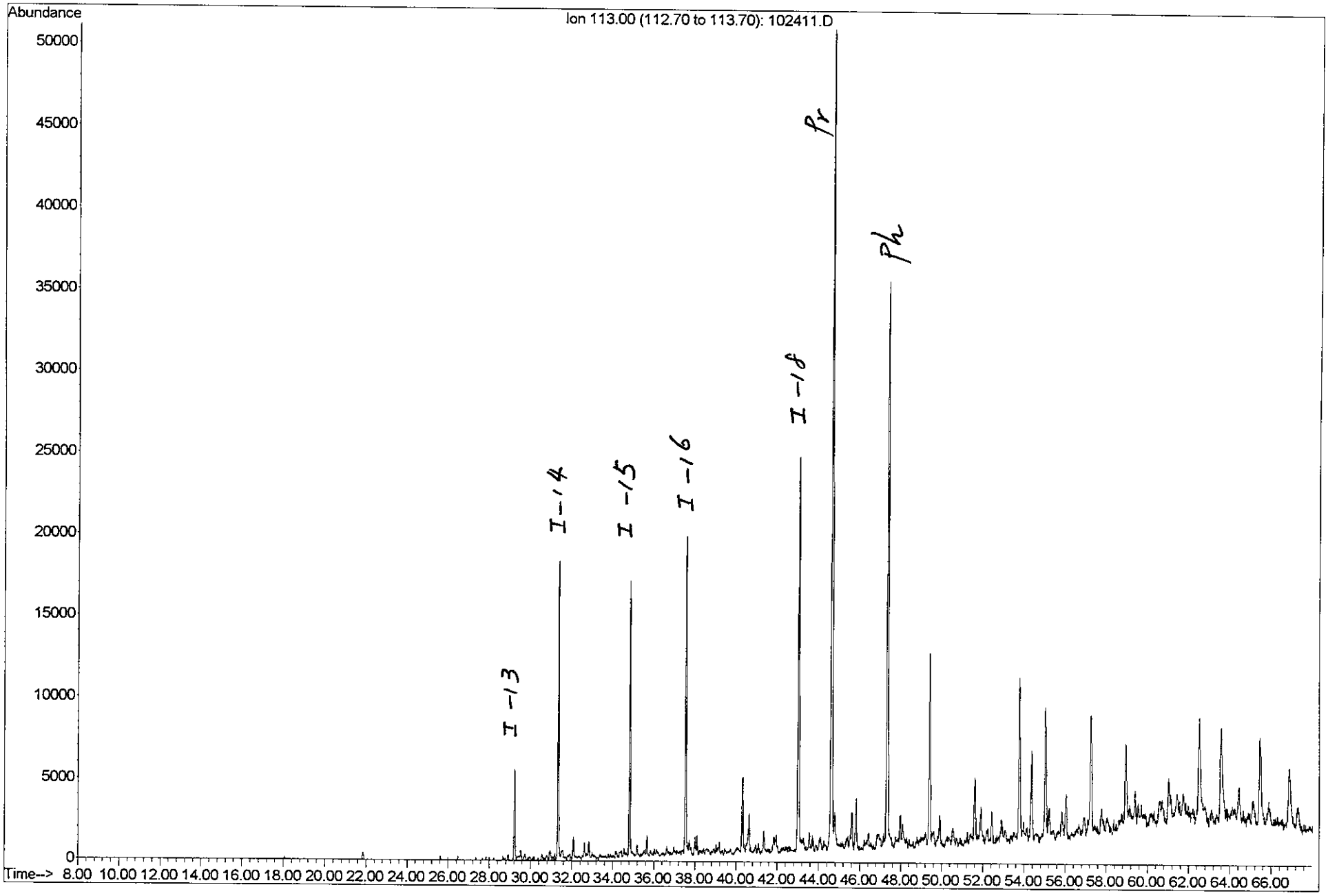
FTPH-FP-SB-L (41343-7) Heavy oil
Follow on TPH investigation



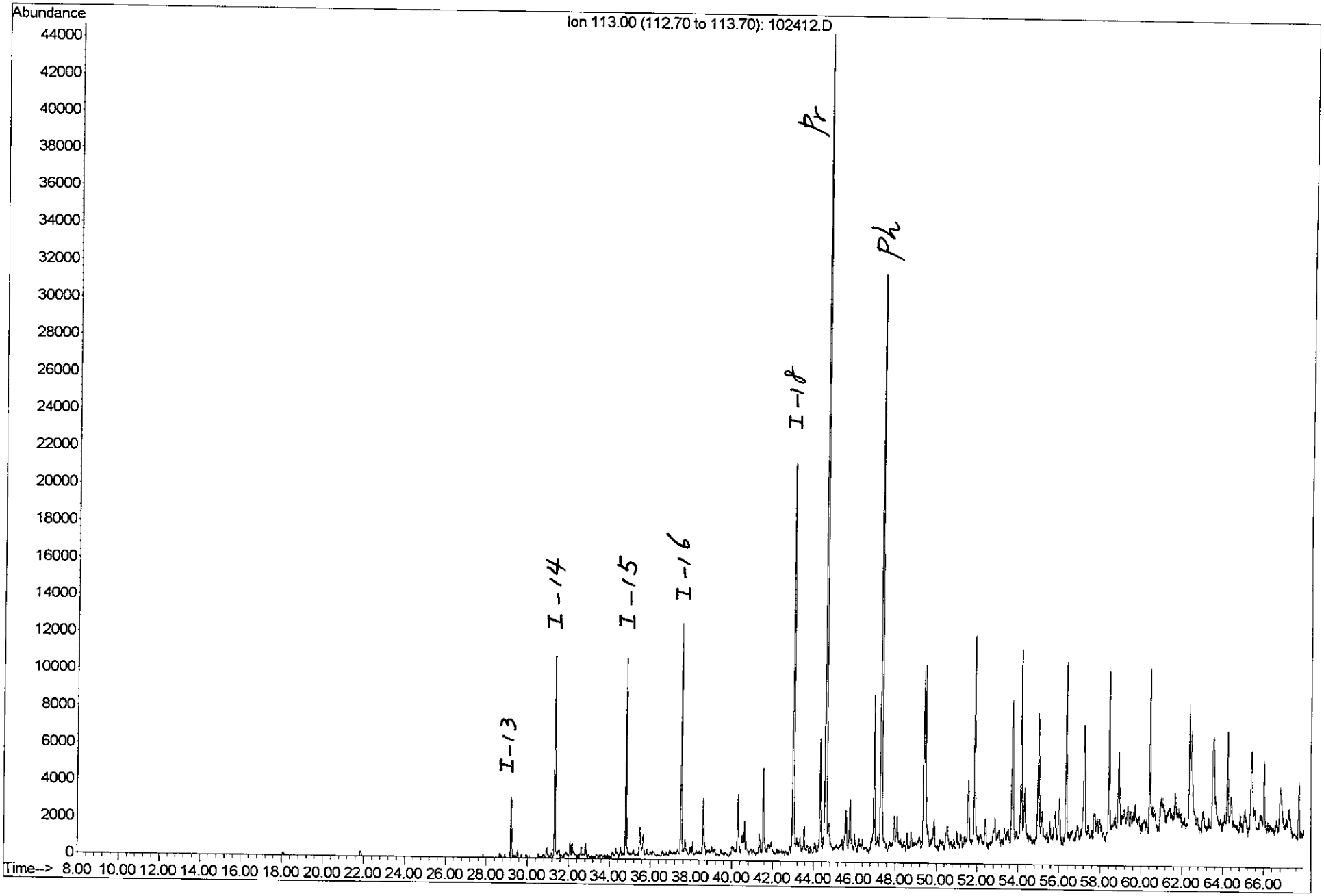
FTPH-FP-SB-WWW (41343-8) Heavy oil
Follow on TPH investigation



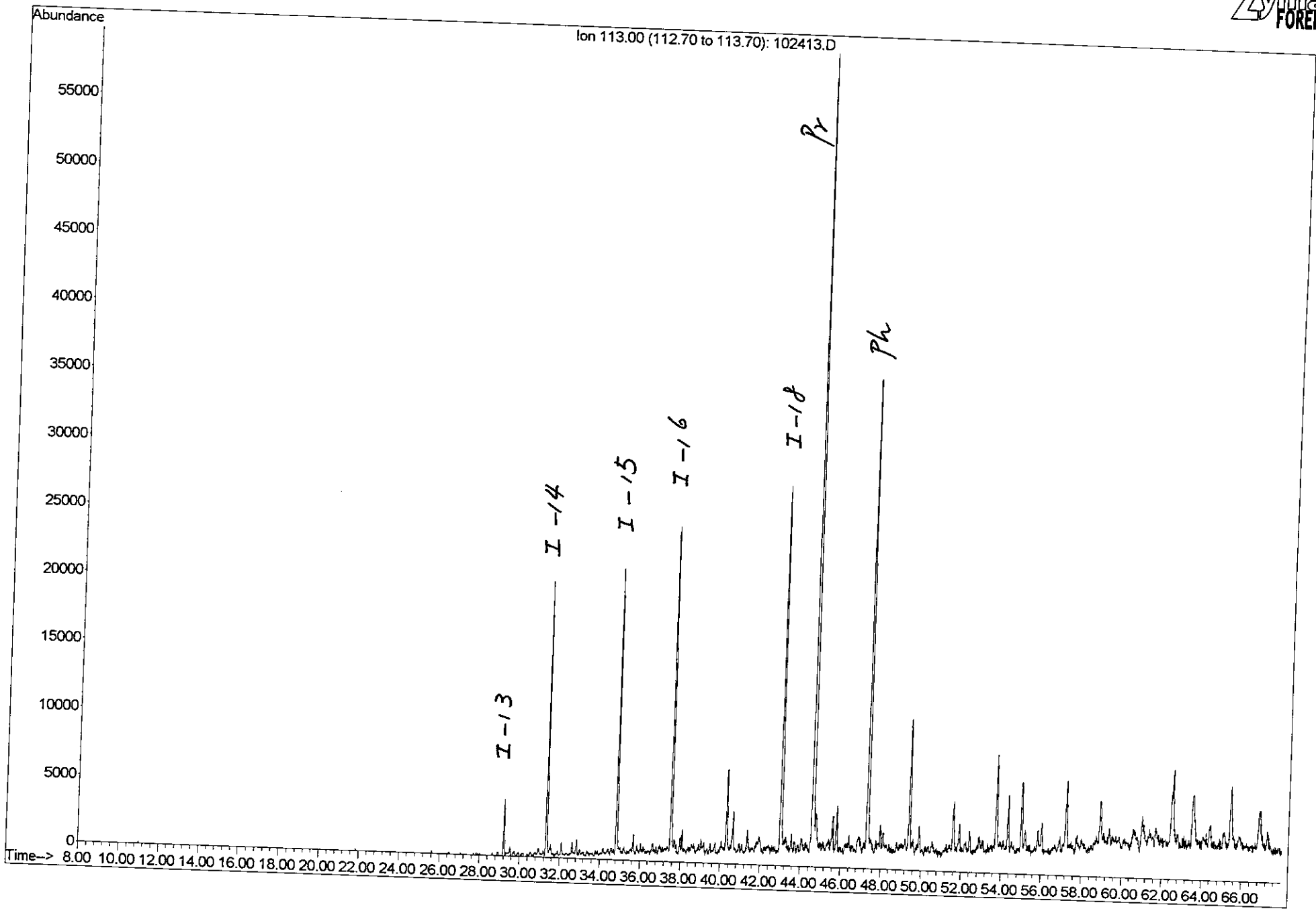
FTPH-FP-SB-O (41343-9) Heavy oil
Follow on TPH investigation



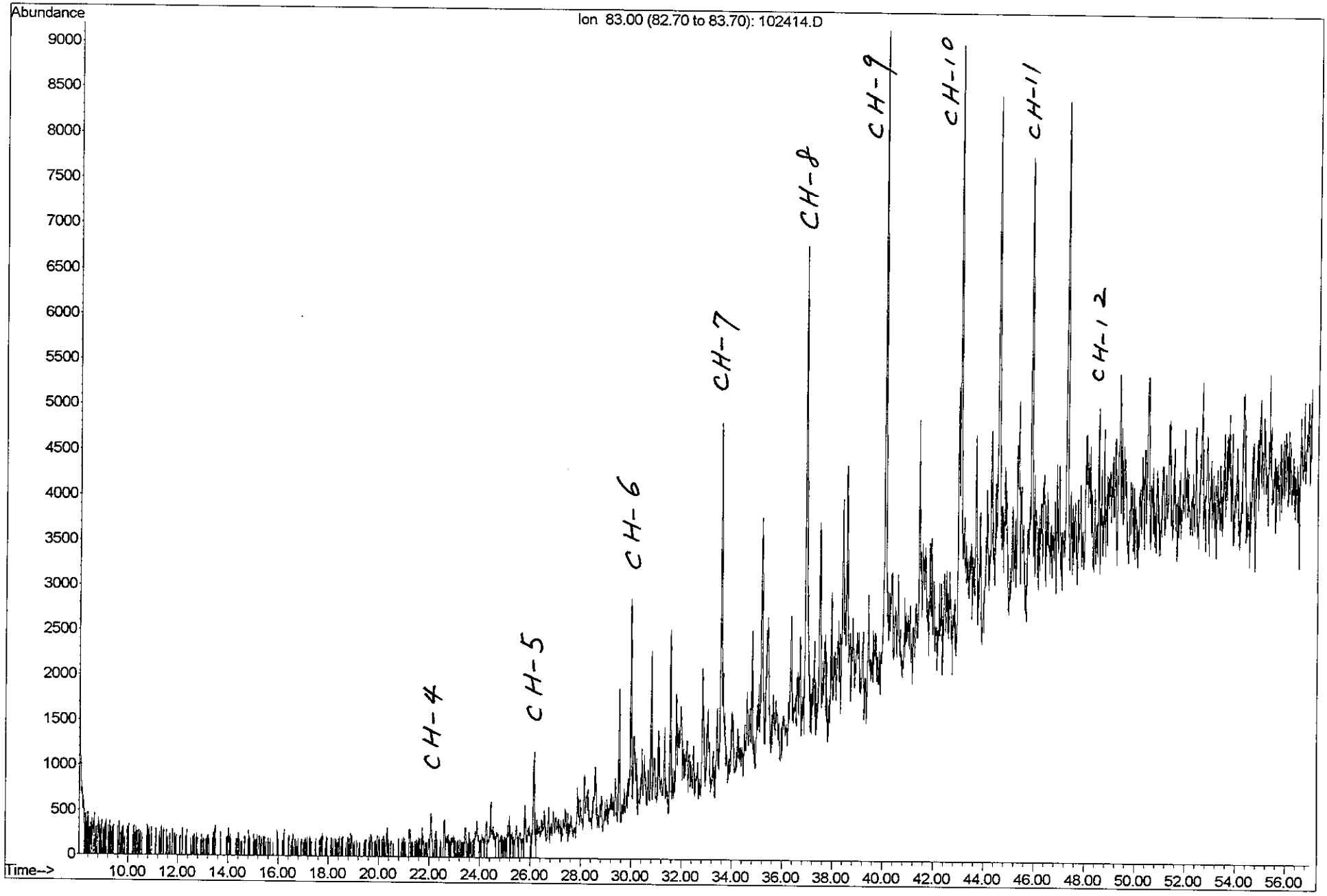
FTPH-FP-SB-R (41343-10) sheen
Follow on TPH investigation



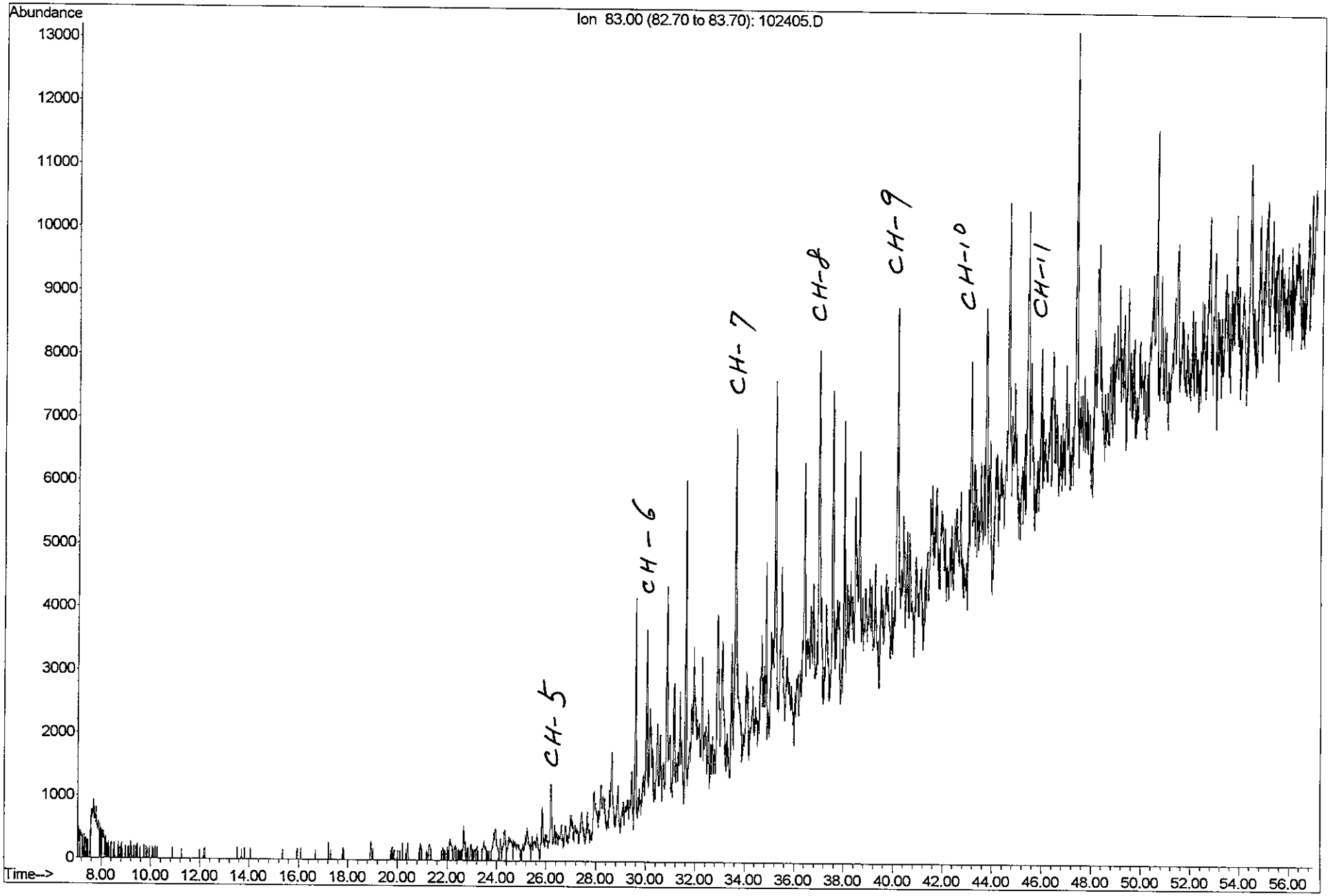
FTPH-FP-UT-BB (41343-11) Heavy oil
Follow on TPH investigation



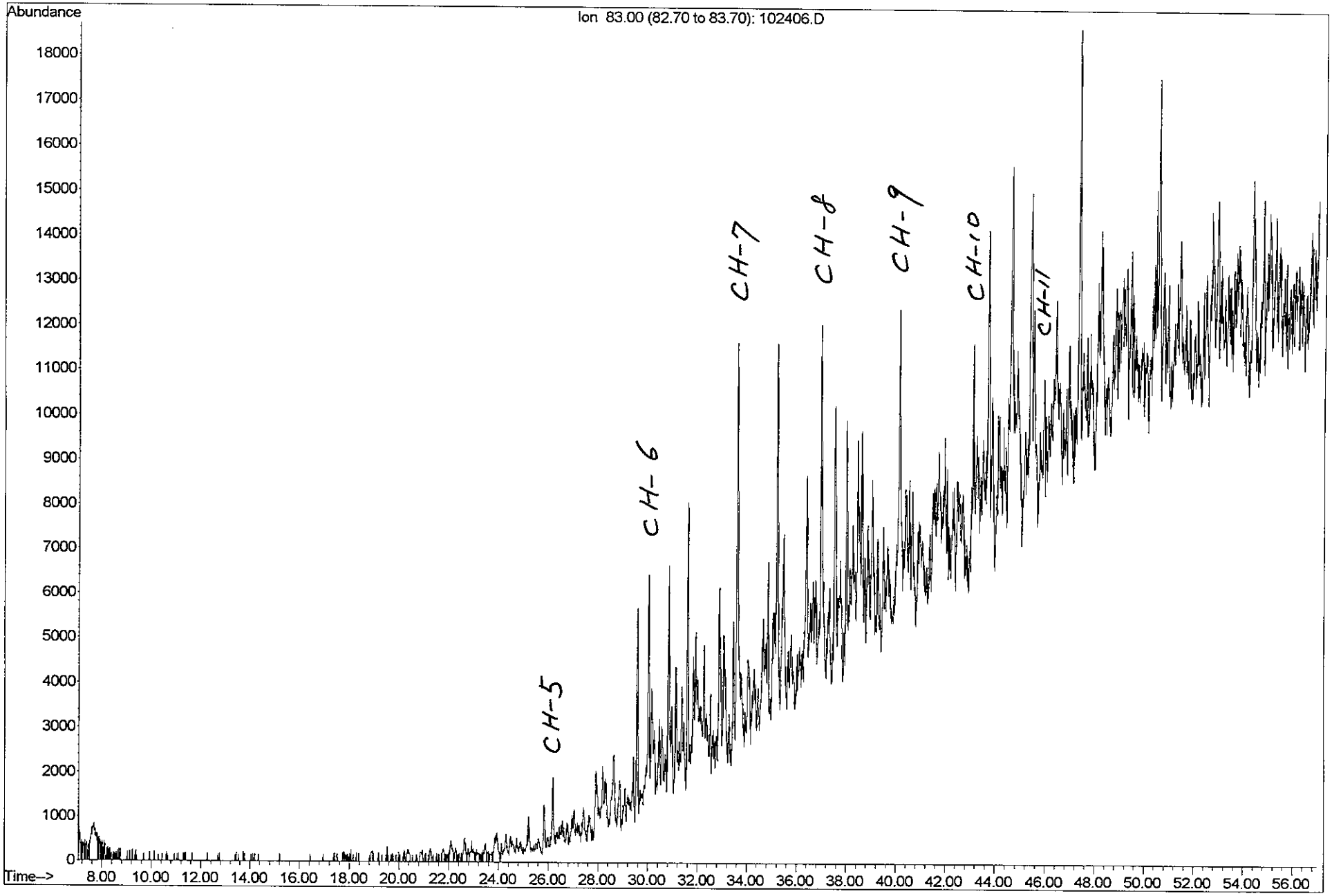
FTPH-FP-SB-D (41343-2) sheen
Follow on TPH investigation



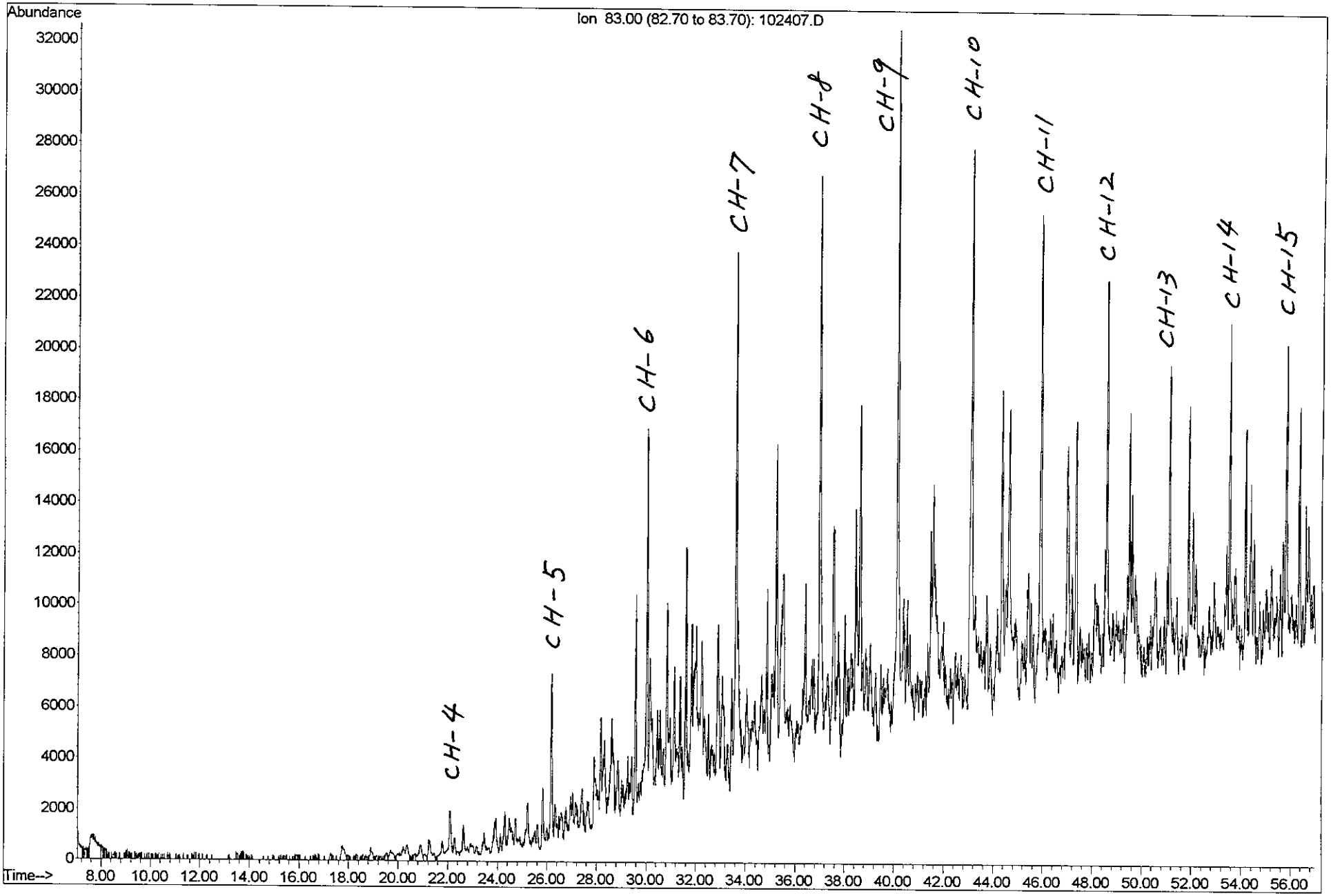
FTPH-FP-UT-Y (41343-3) sheen
Follow on TPH investigation



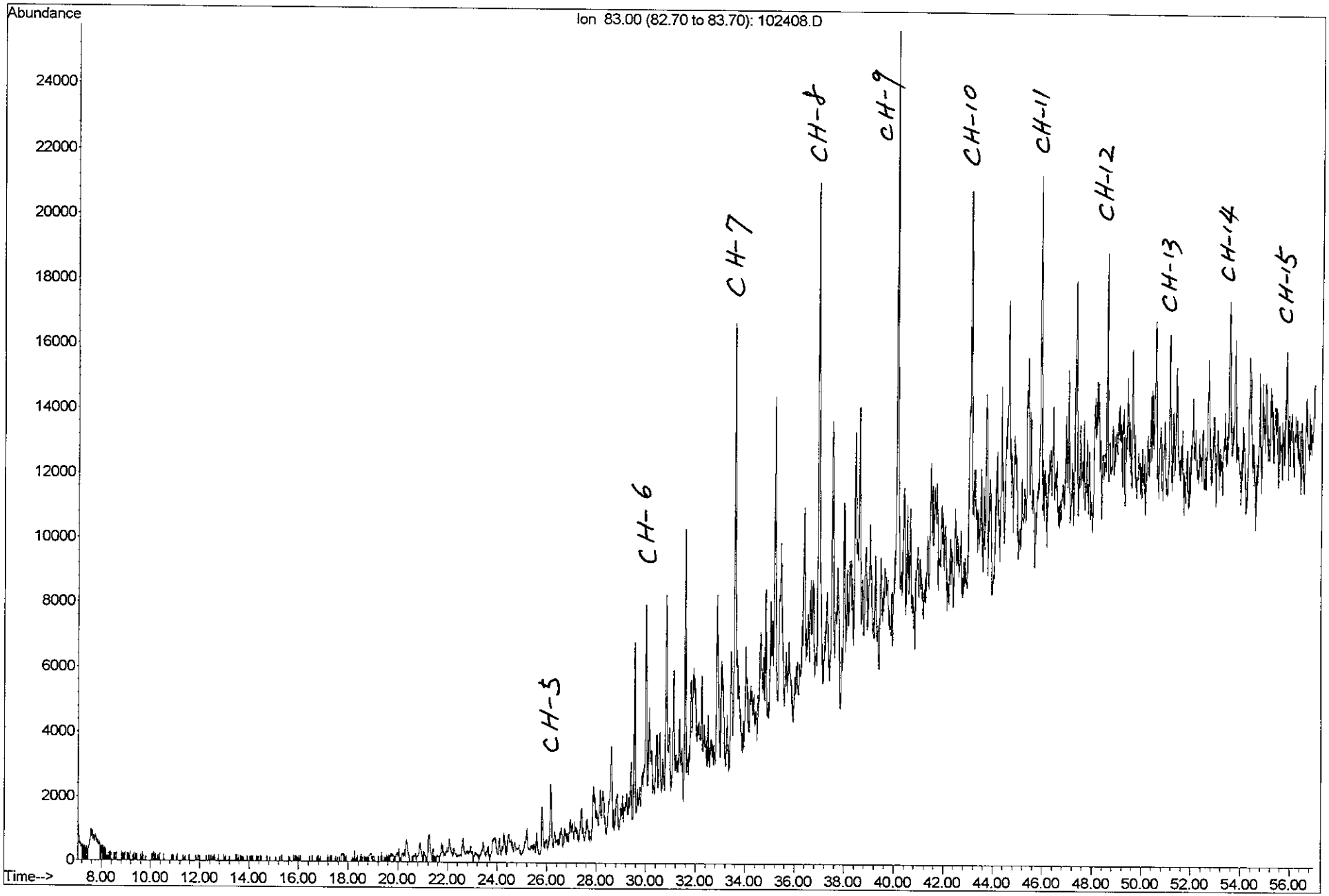
FTPH-FP-UT-W (41343-4) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-G (41343-5) sheen
Follow on TPH investigation



FTPH-FP-SB-K (41343-6) sheen
Follow on TPH investigation



FTPH-FP-SB-L (41343-7) Heavy oil
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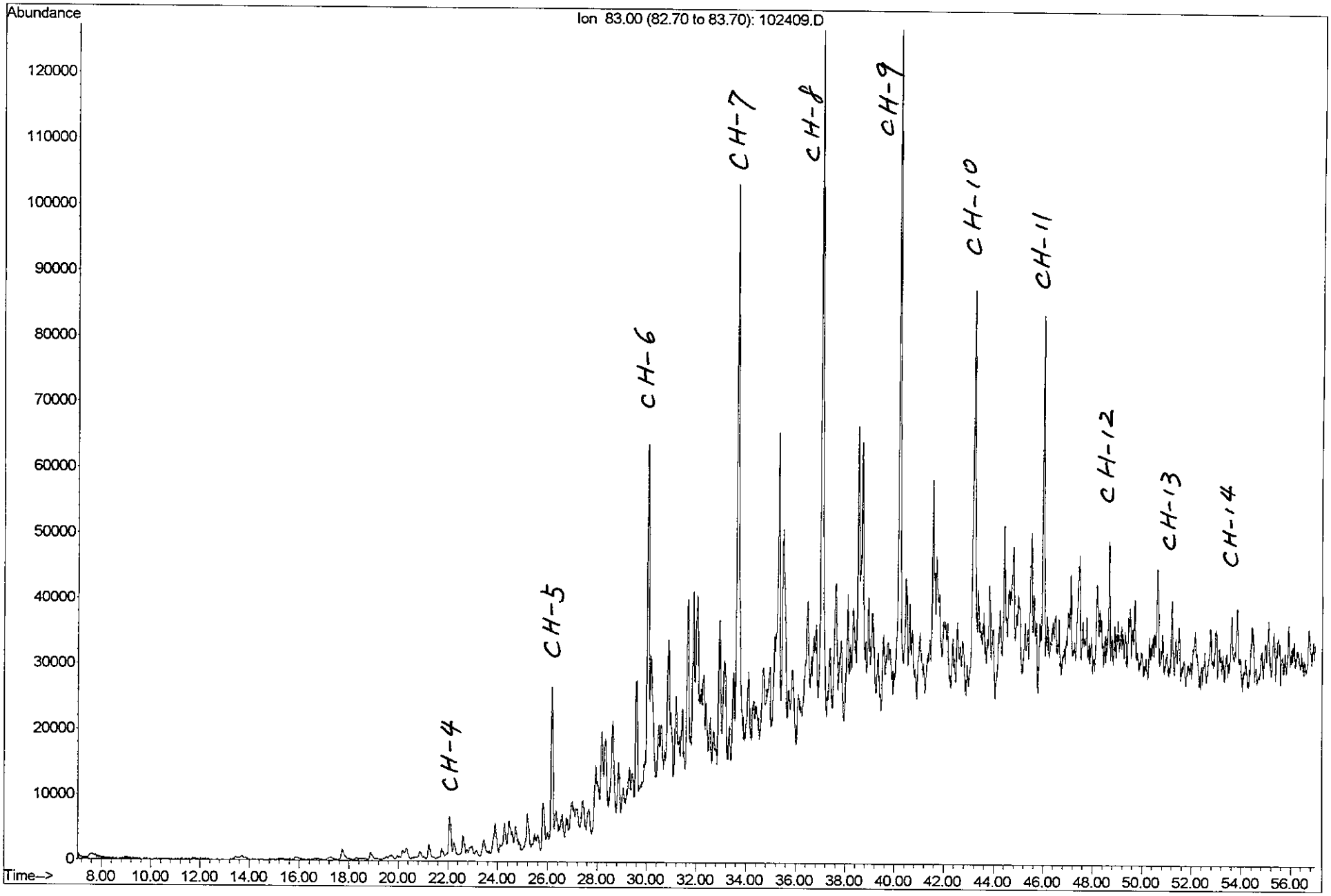

FTPH-FP-SB-WWW (41343-8) Heavy oil
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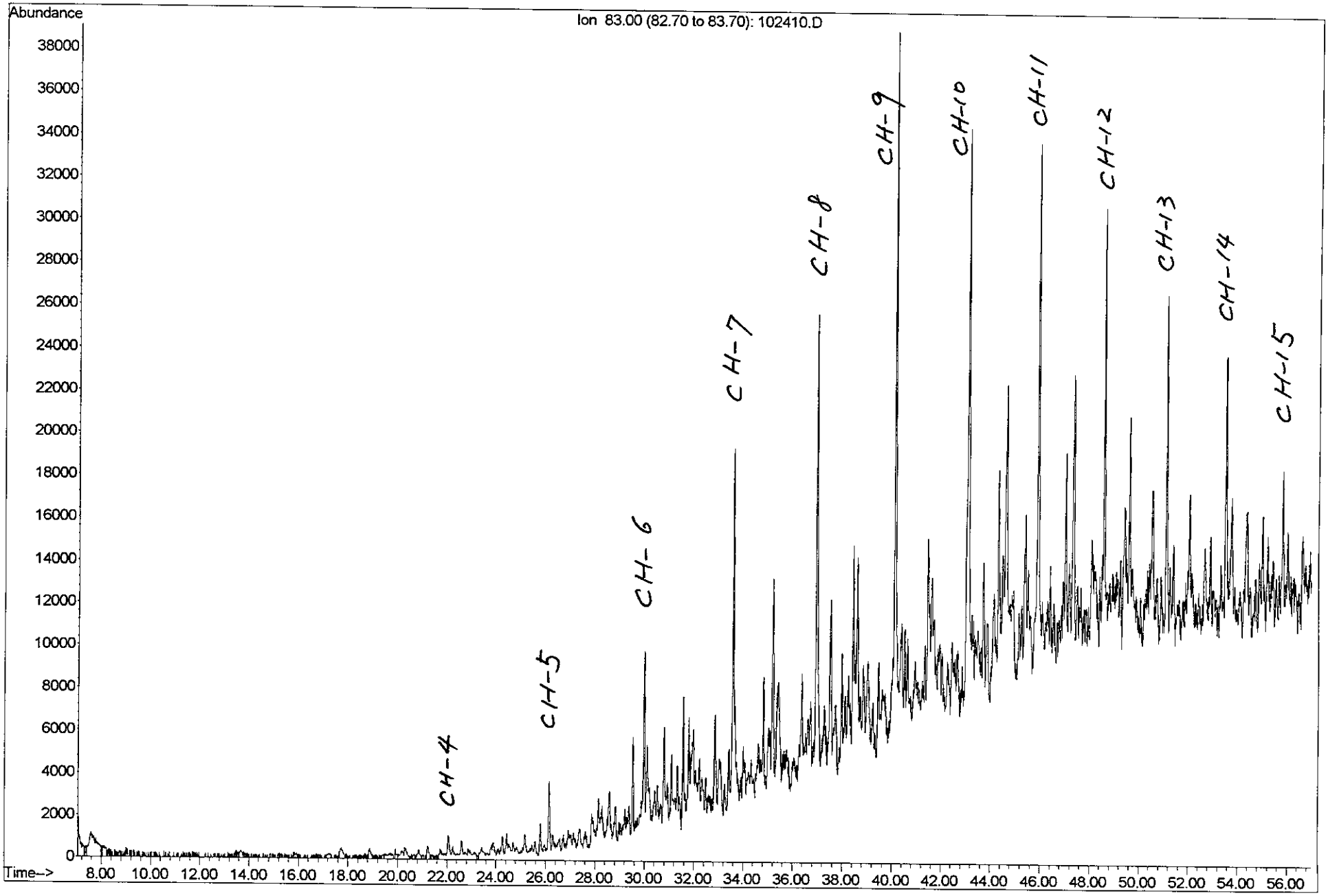

FTPH-FP-SB-O (41343-9) Heavy oil
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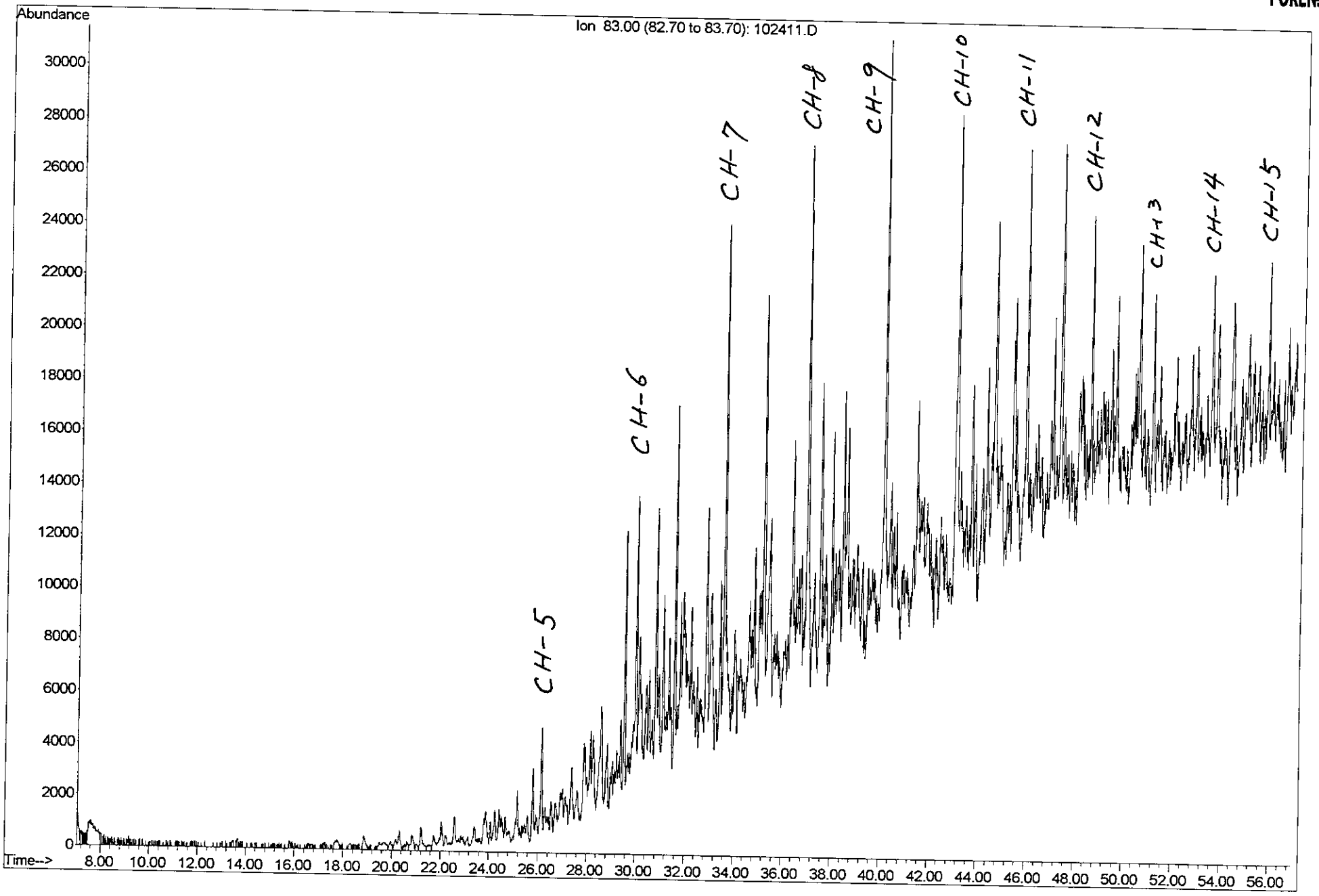

FTPH-FP-SB-R (41343-10) sheen
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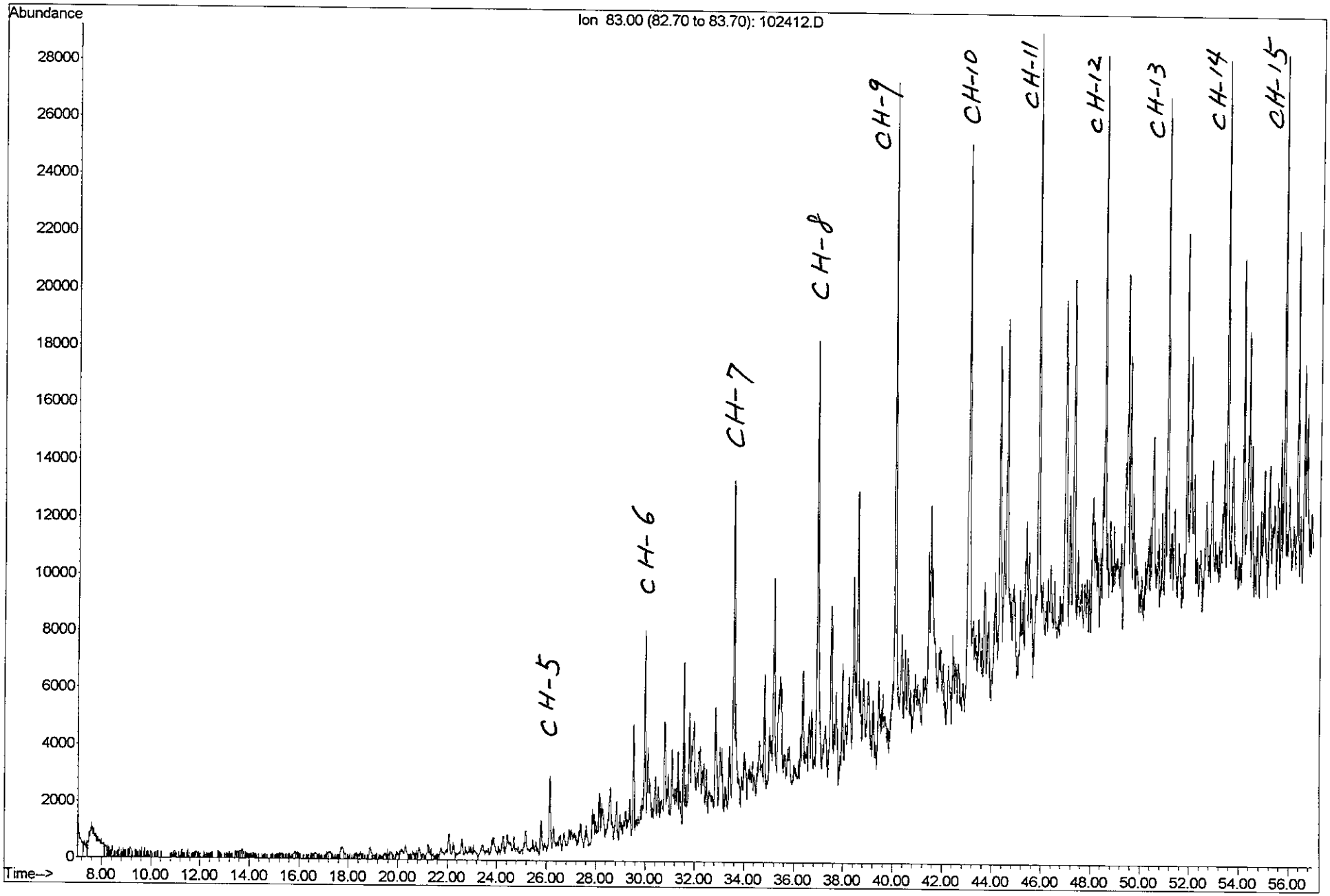

FTPH-FP-UT-BB (41343-11) Heavy oil
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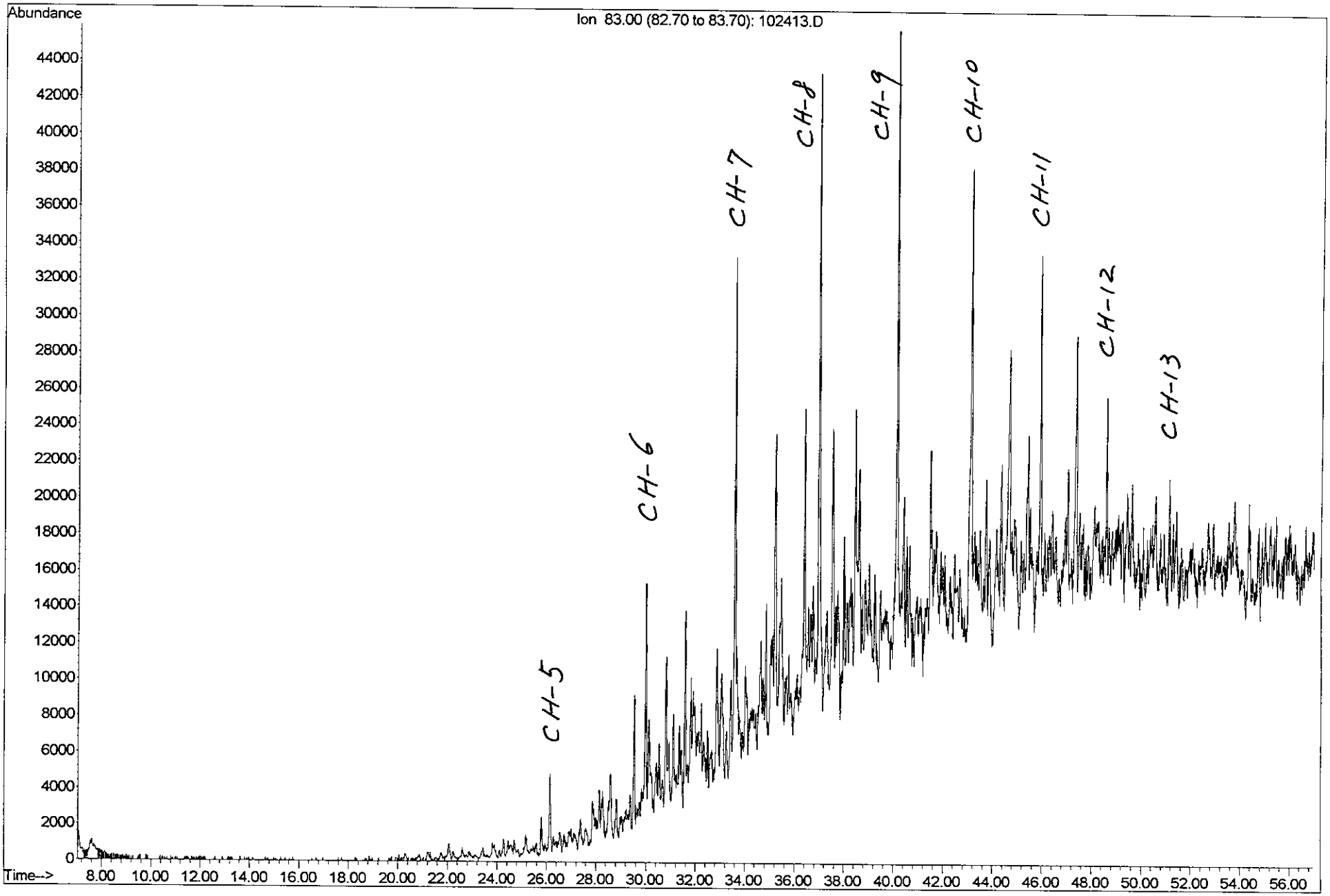

FTPH-FP-SB-D (41343-2) sheen
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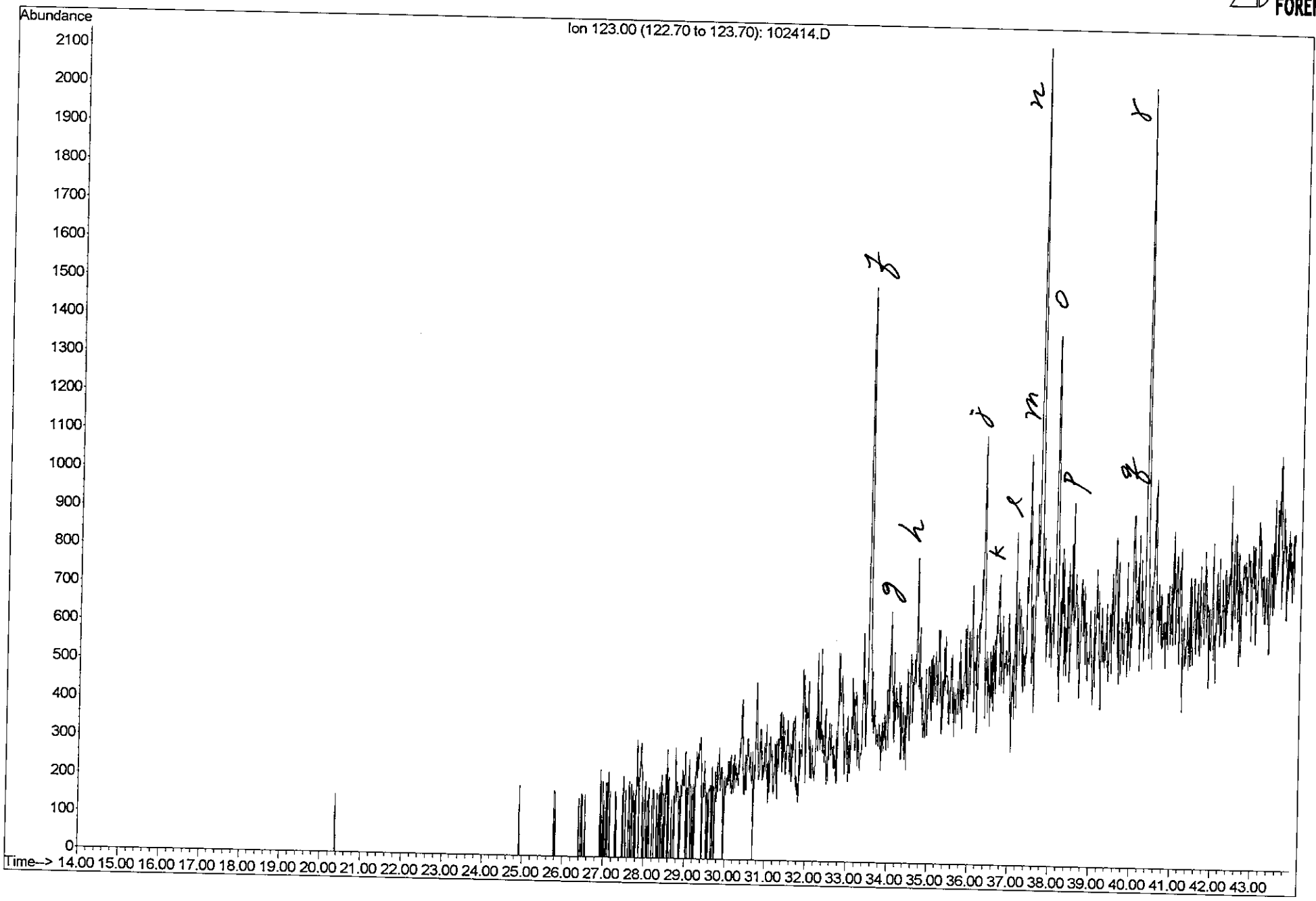

FTPH-FP-UT-Y (41343-3) sheen
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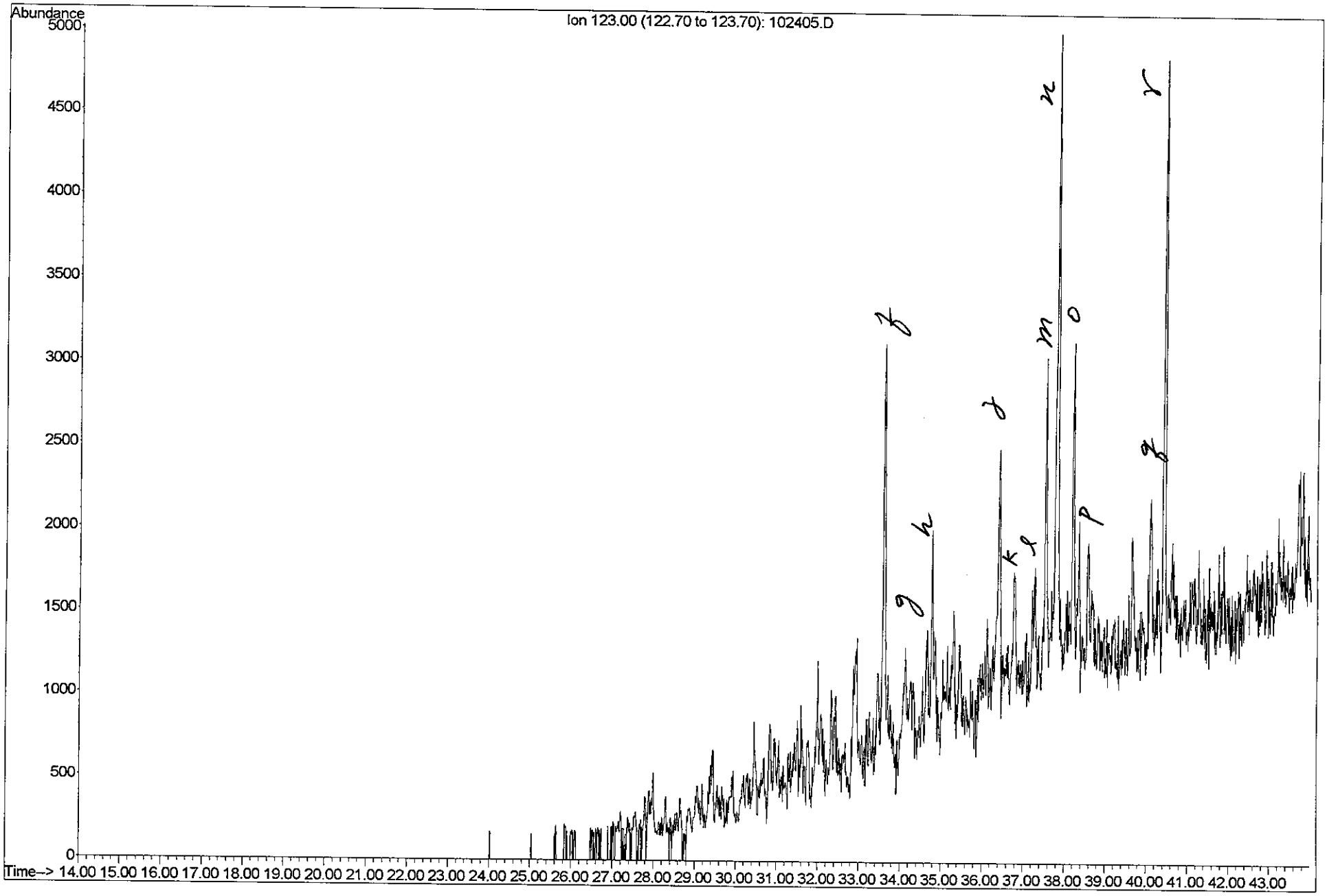
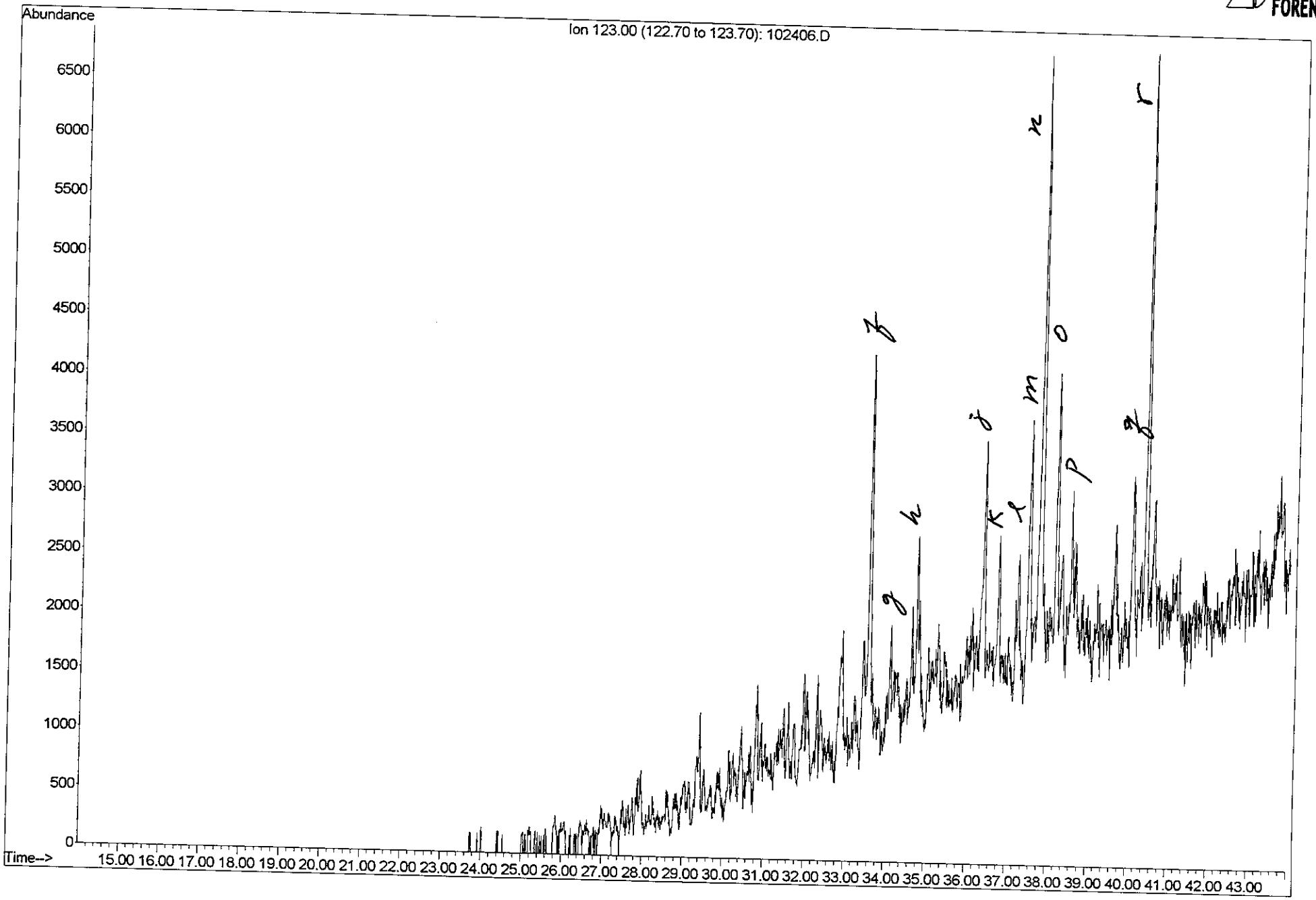


FTPH-FP-UT-W (41343-4) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-G (41343-5) sheen
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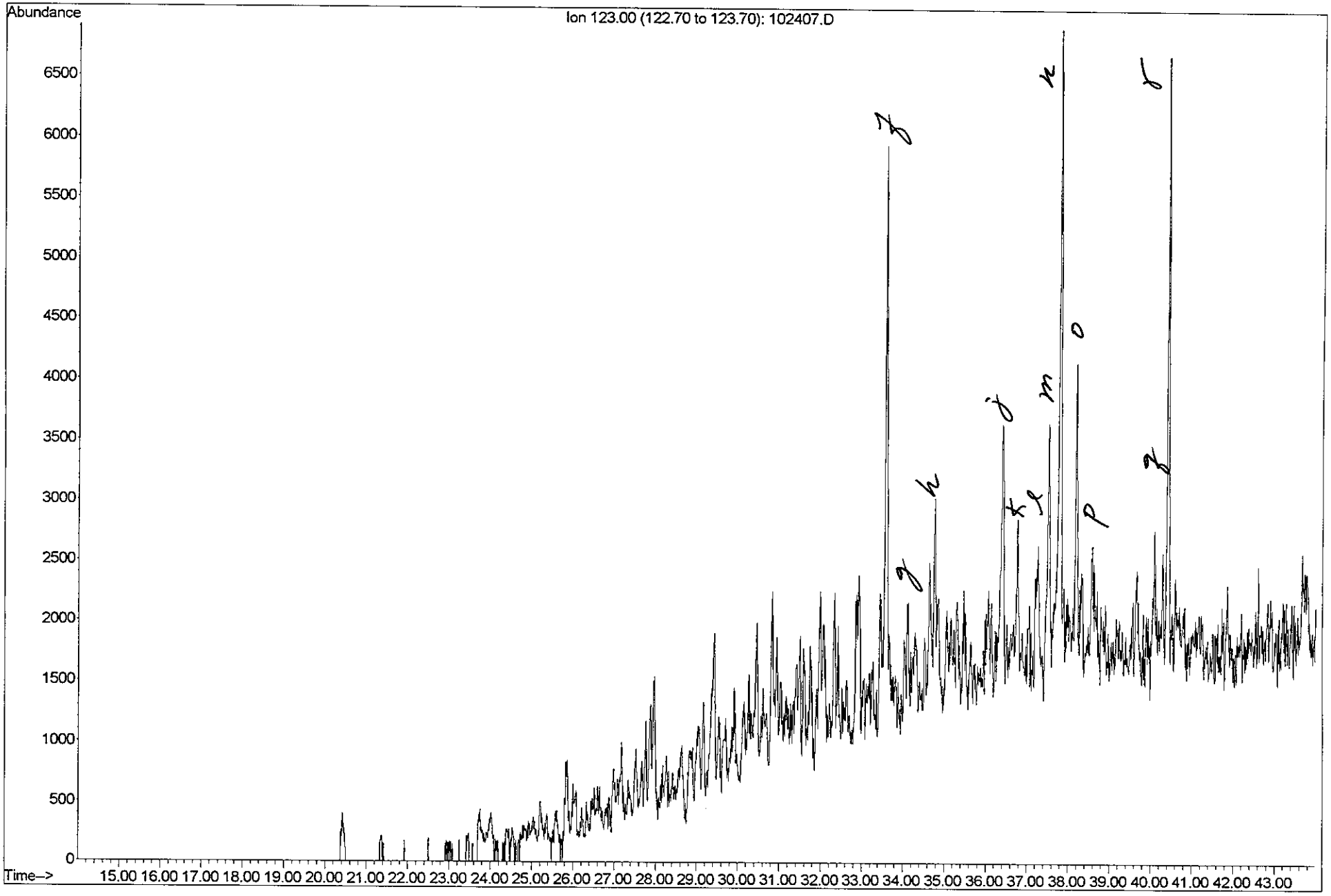
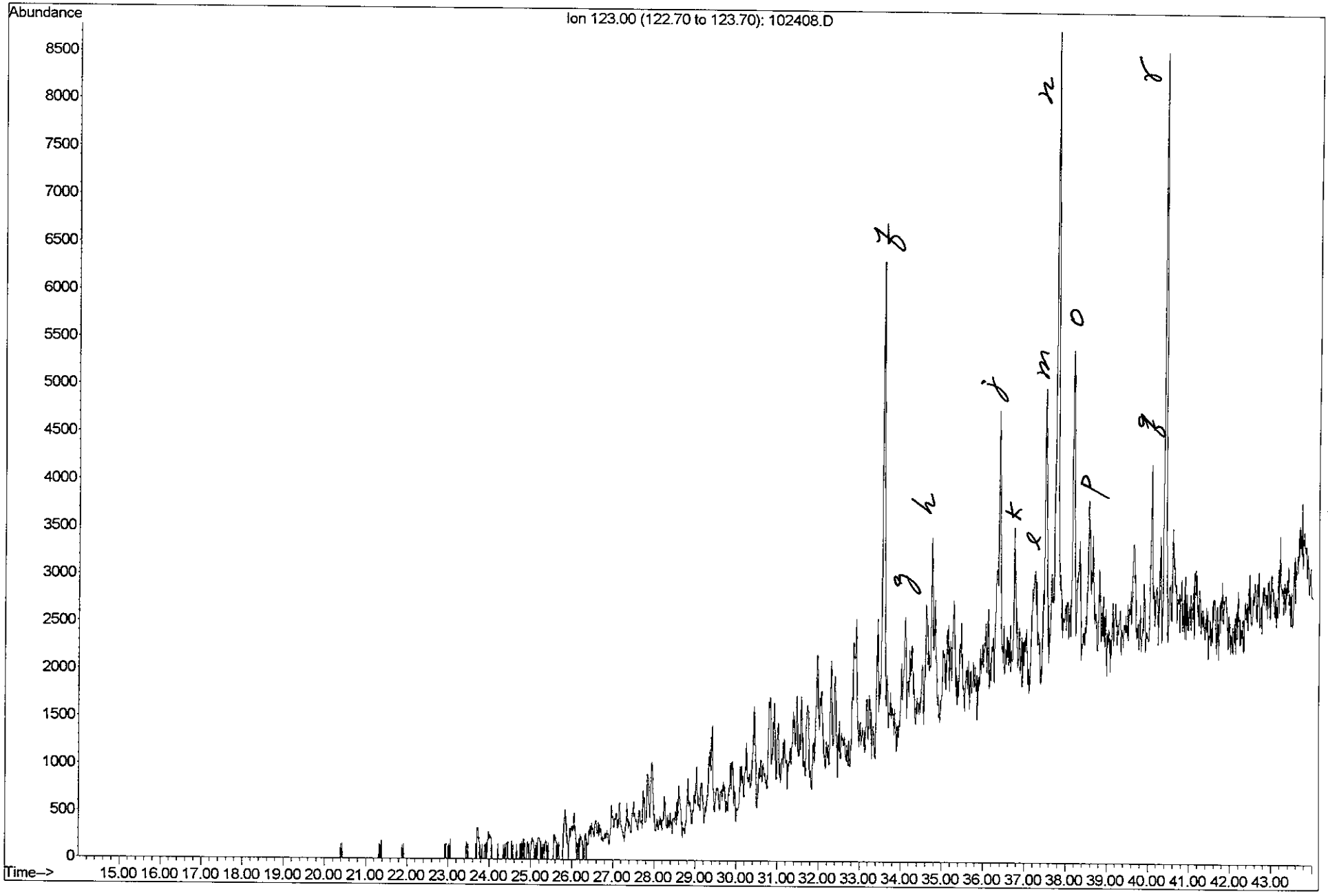
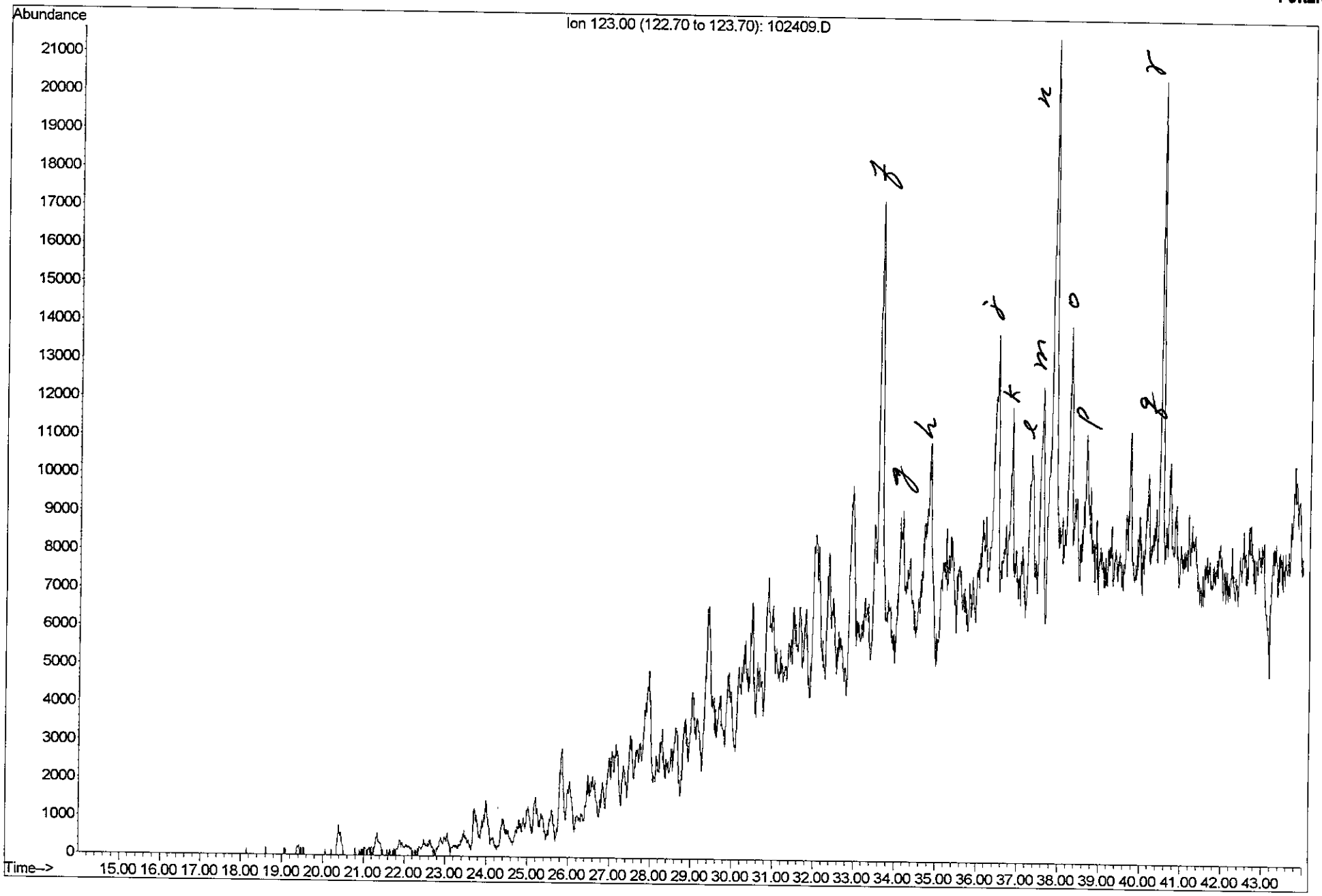


FTPH-FP-SB-K (41343-6) sheen
Follow on TPH investigation



FTPH-FP-SB-L (41343-7) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-WWW (41343-8) Heavy oil
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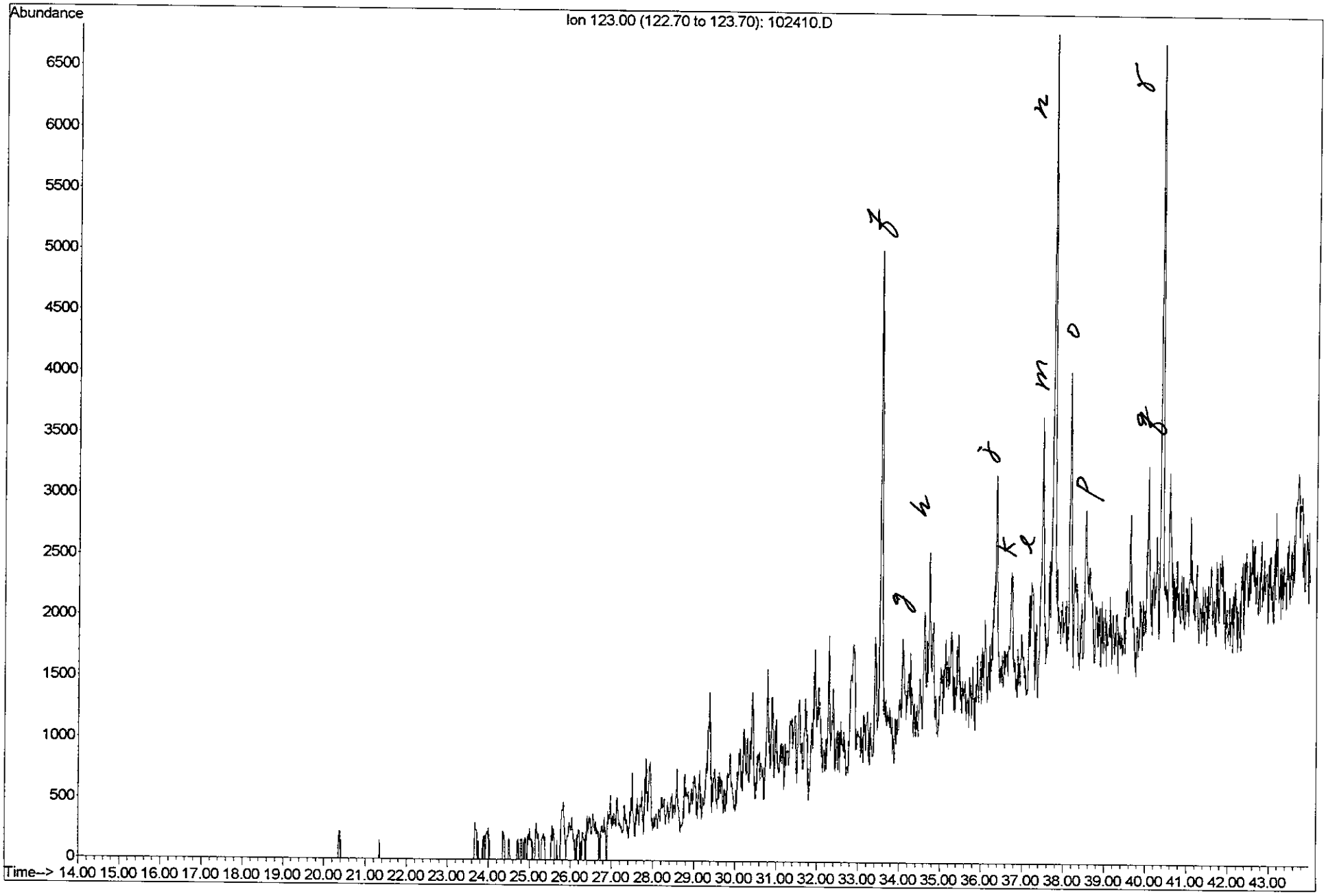

FTPH-FP-SB-O (41343-9) Heavy oil
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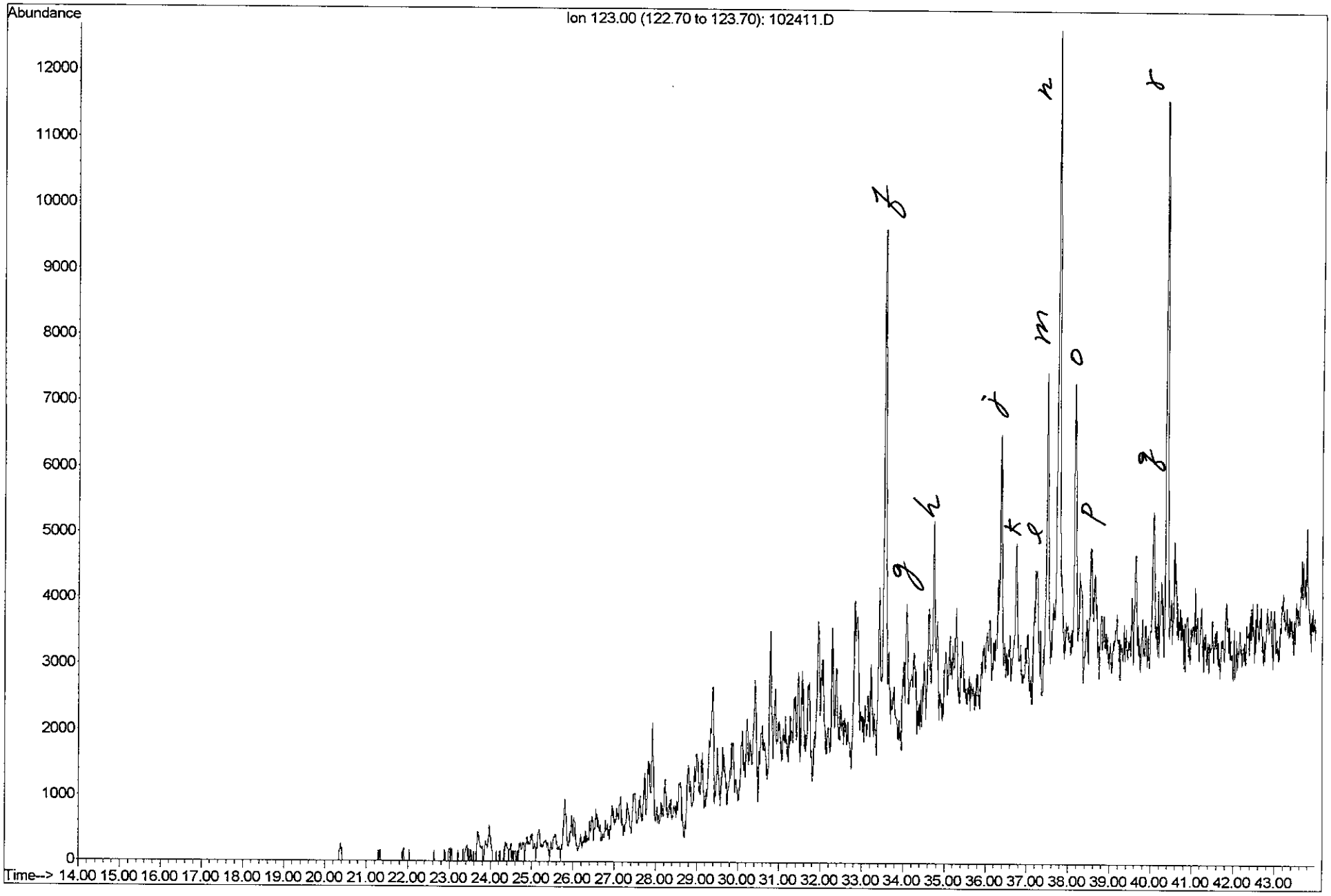

FTPH-FP-SB-R (41343-10) sheen
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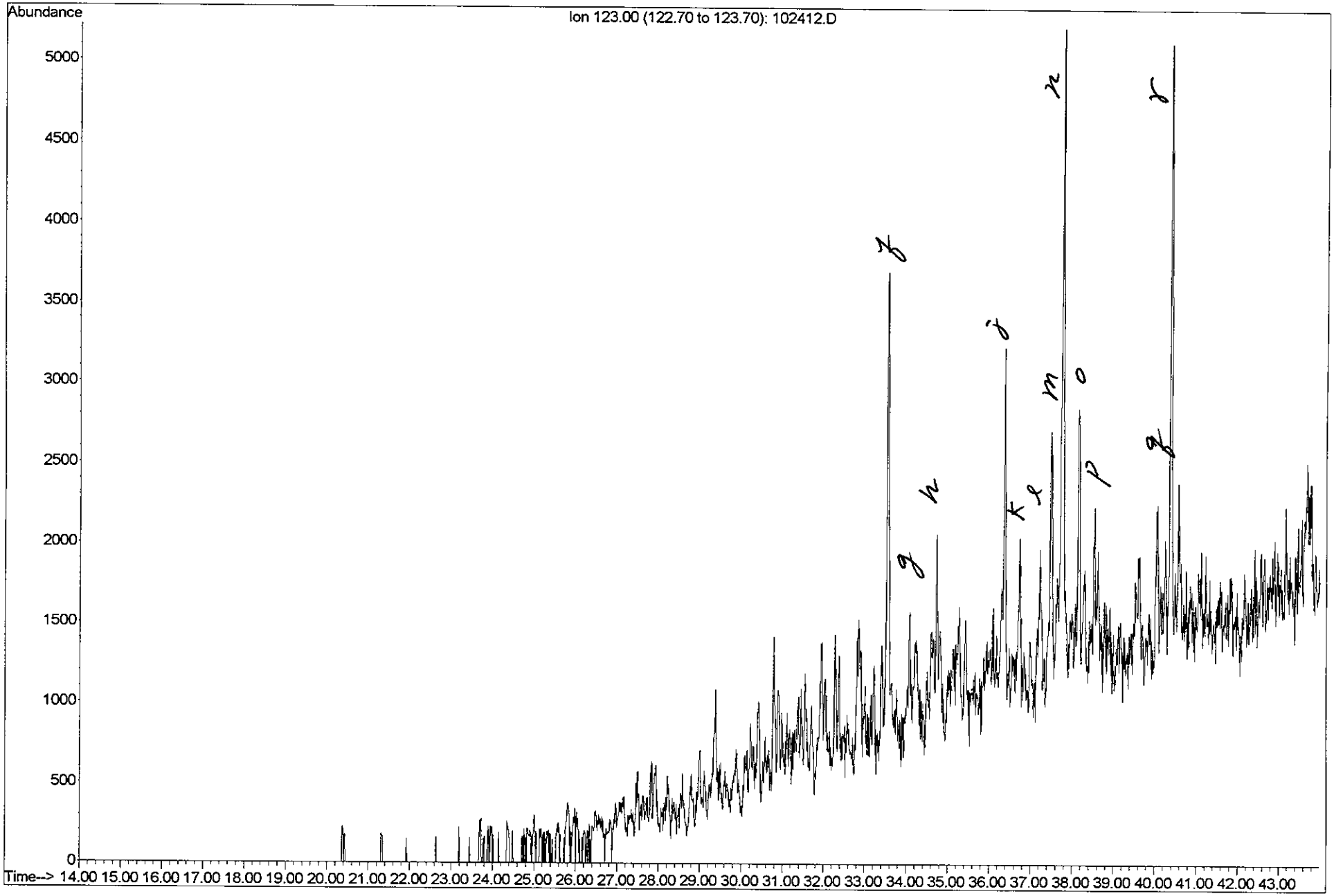

FTPH-FP-UT-BB (41343-11) Heavy oil
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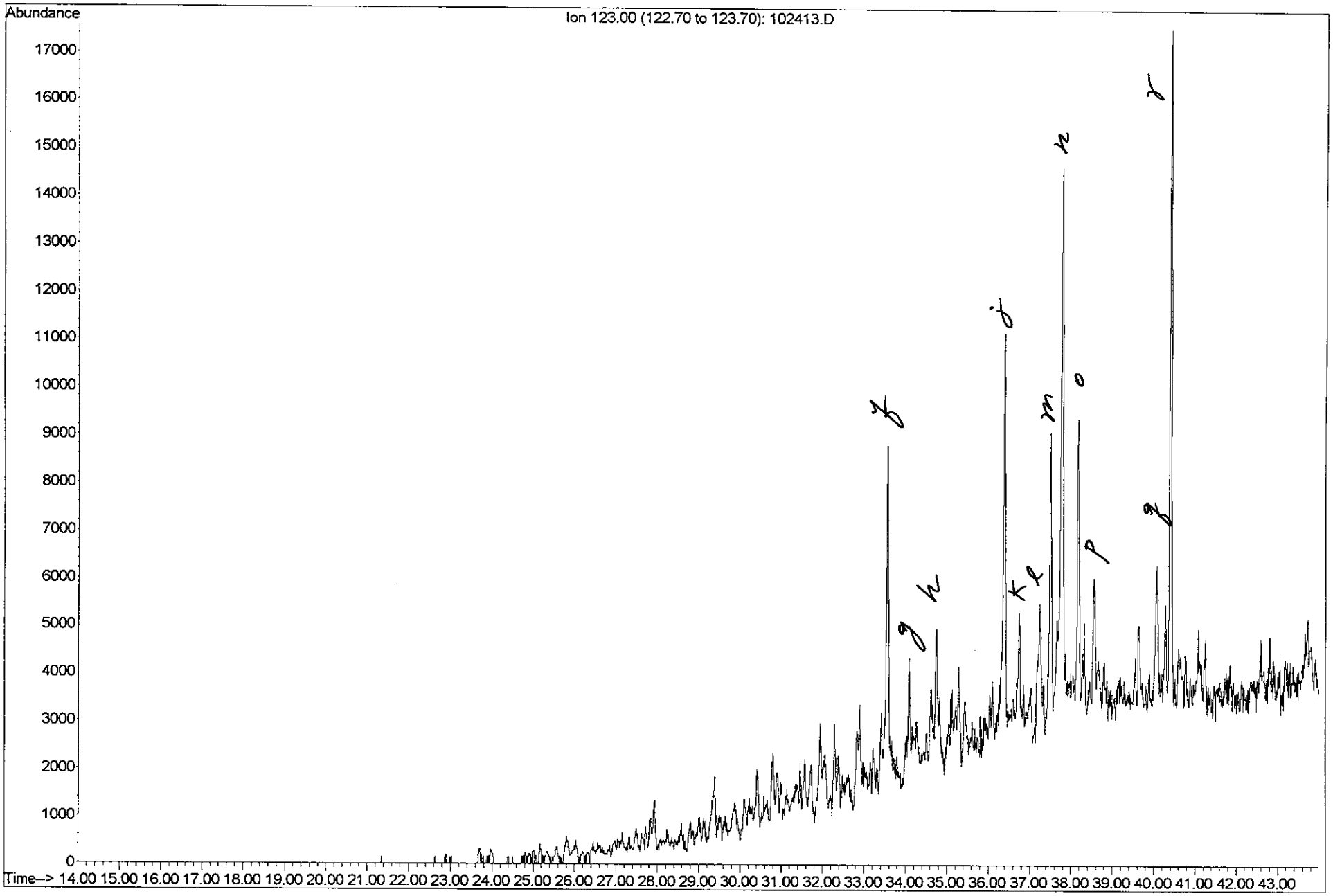

FTPH-FP-SB-D (41343-2) sheen
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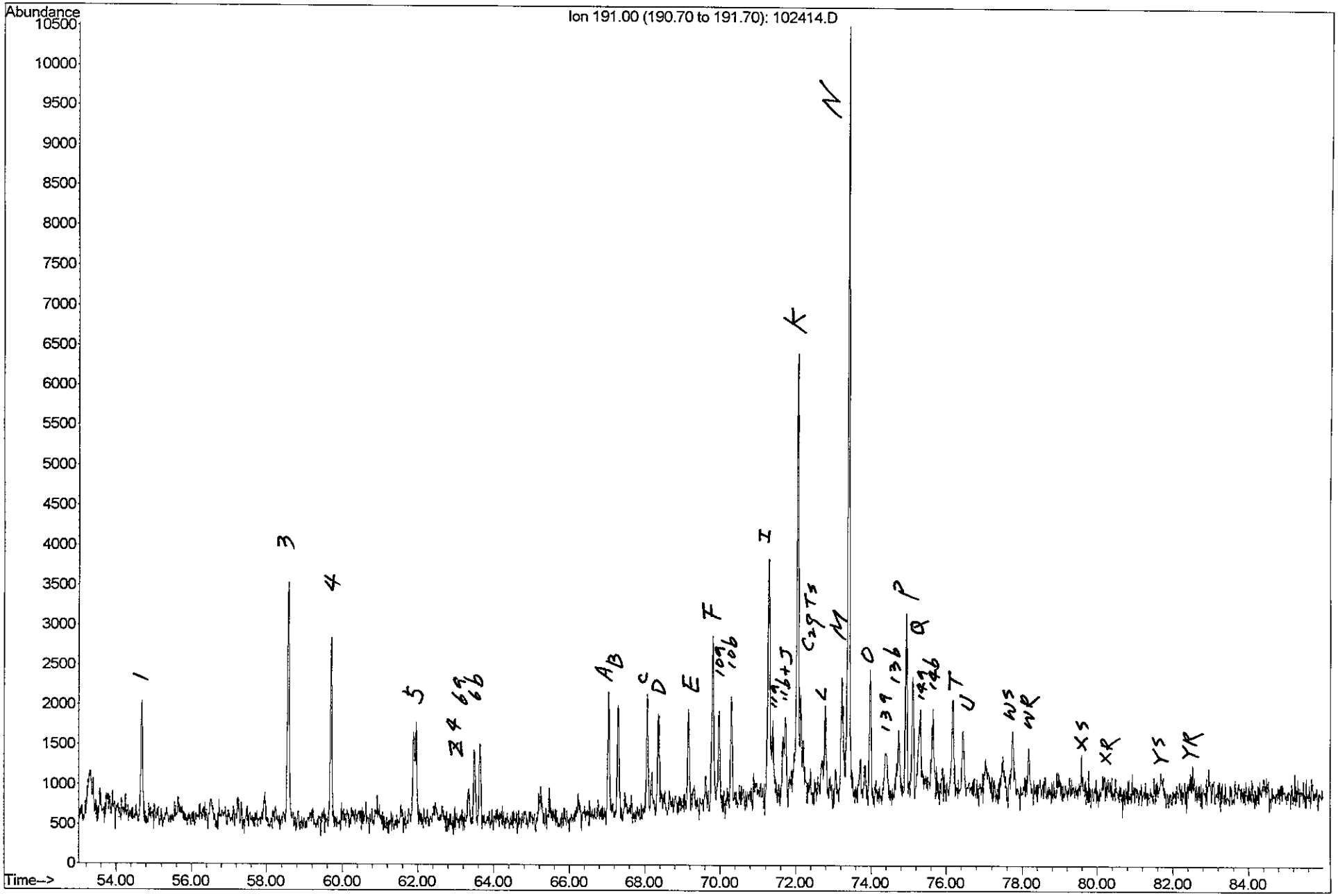

FTPH-FP-UT-Y (41343-3) sheen
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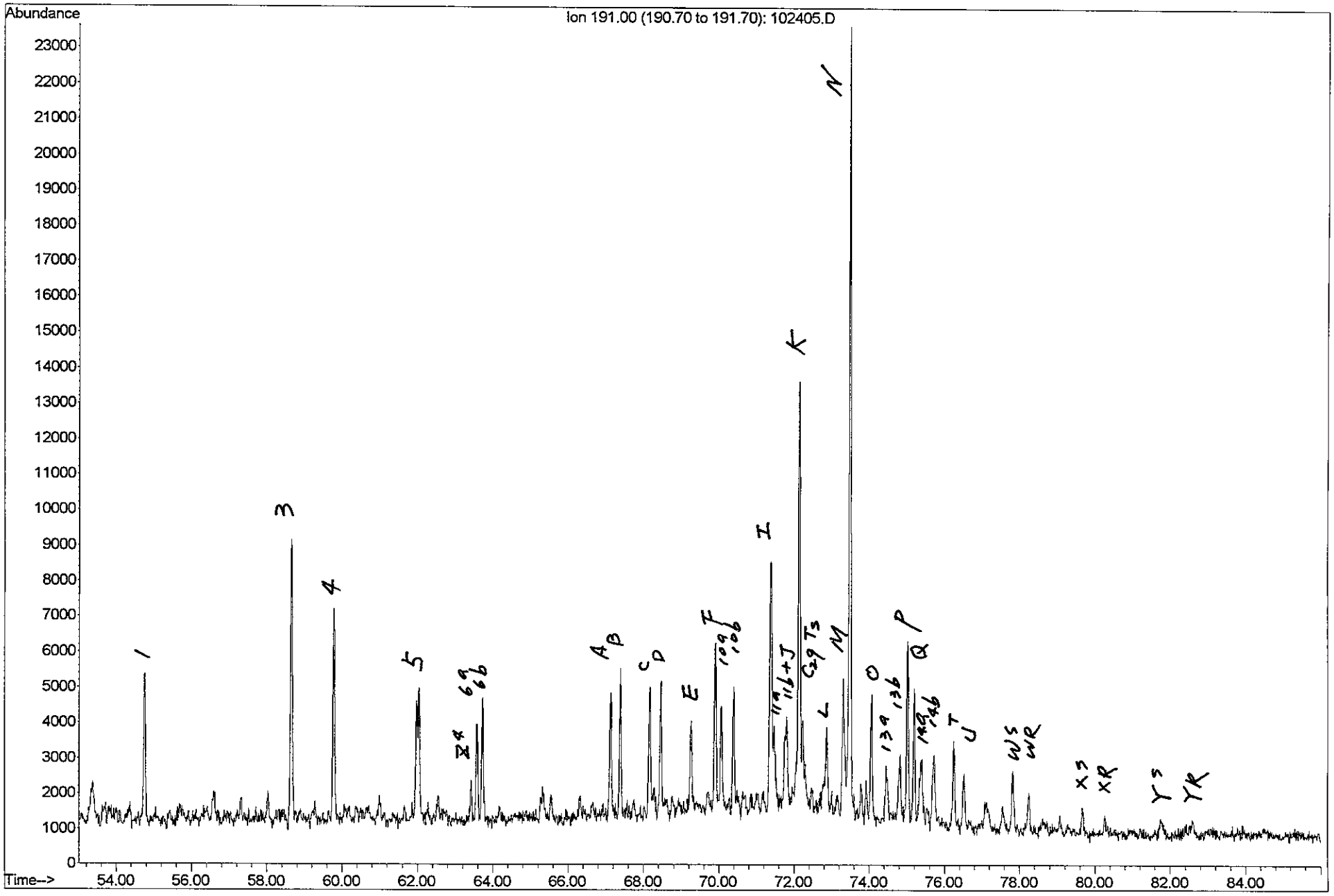

FTPH-FP-UT-W (41343-4) Heavy oil
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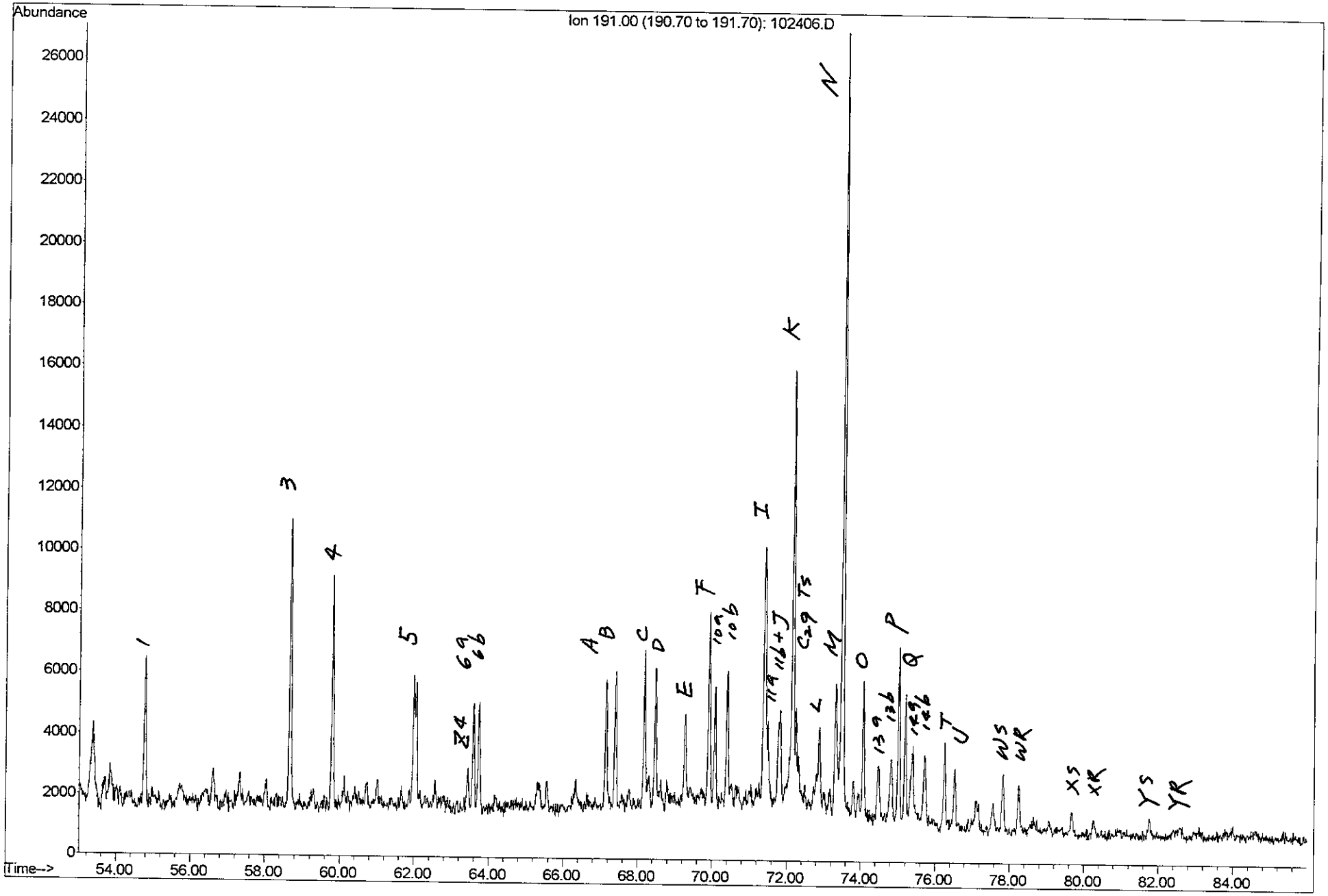

FTPH-FP-SB-G (41343-5) sheen
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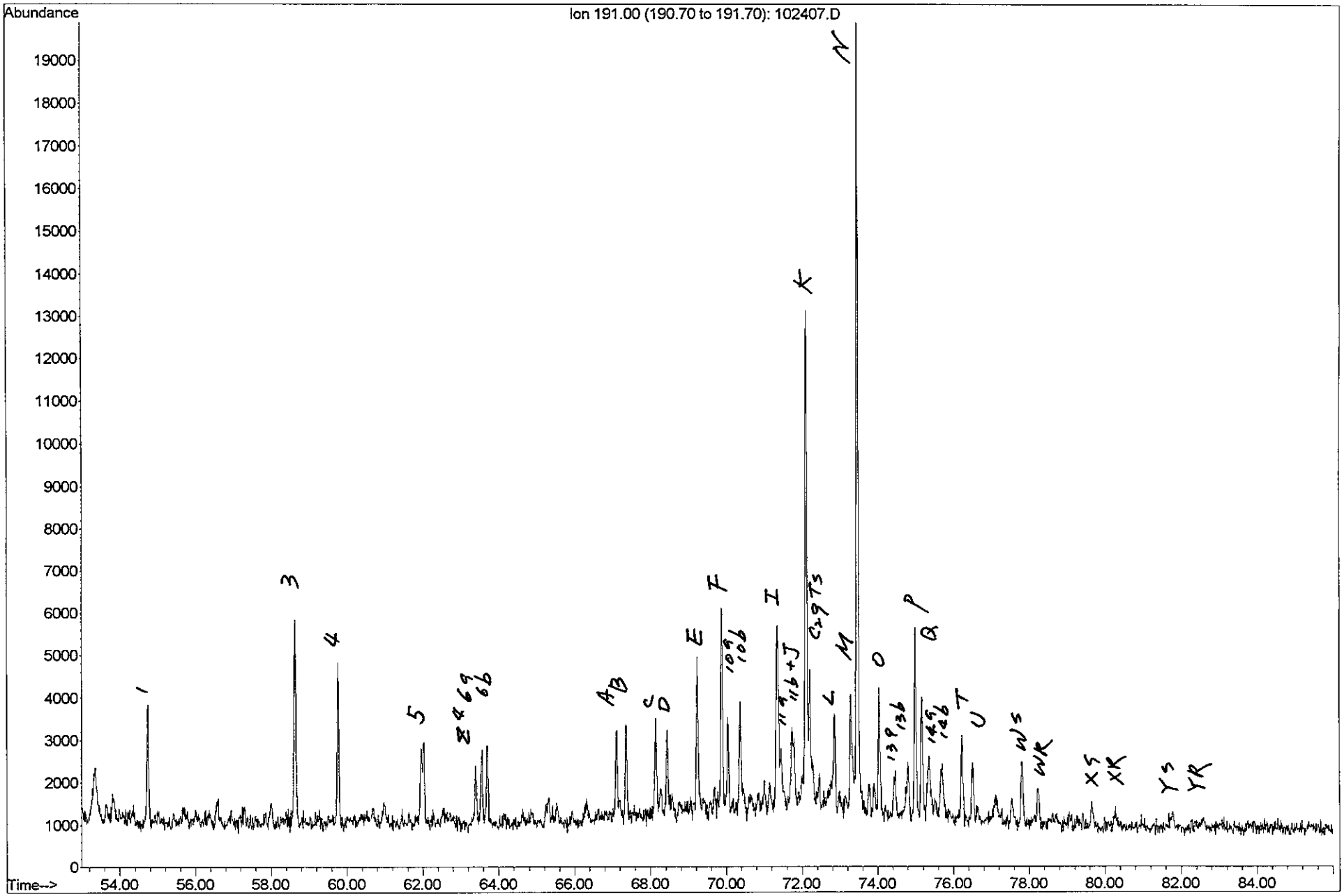

FTPH-FP-SB-K (41343-6) sheen
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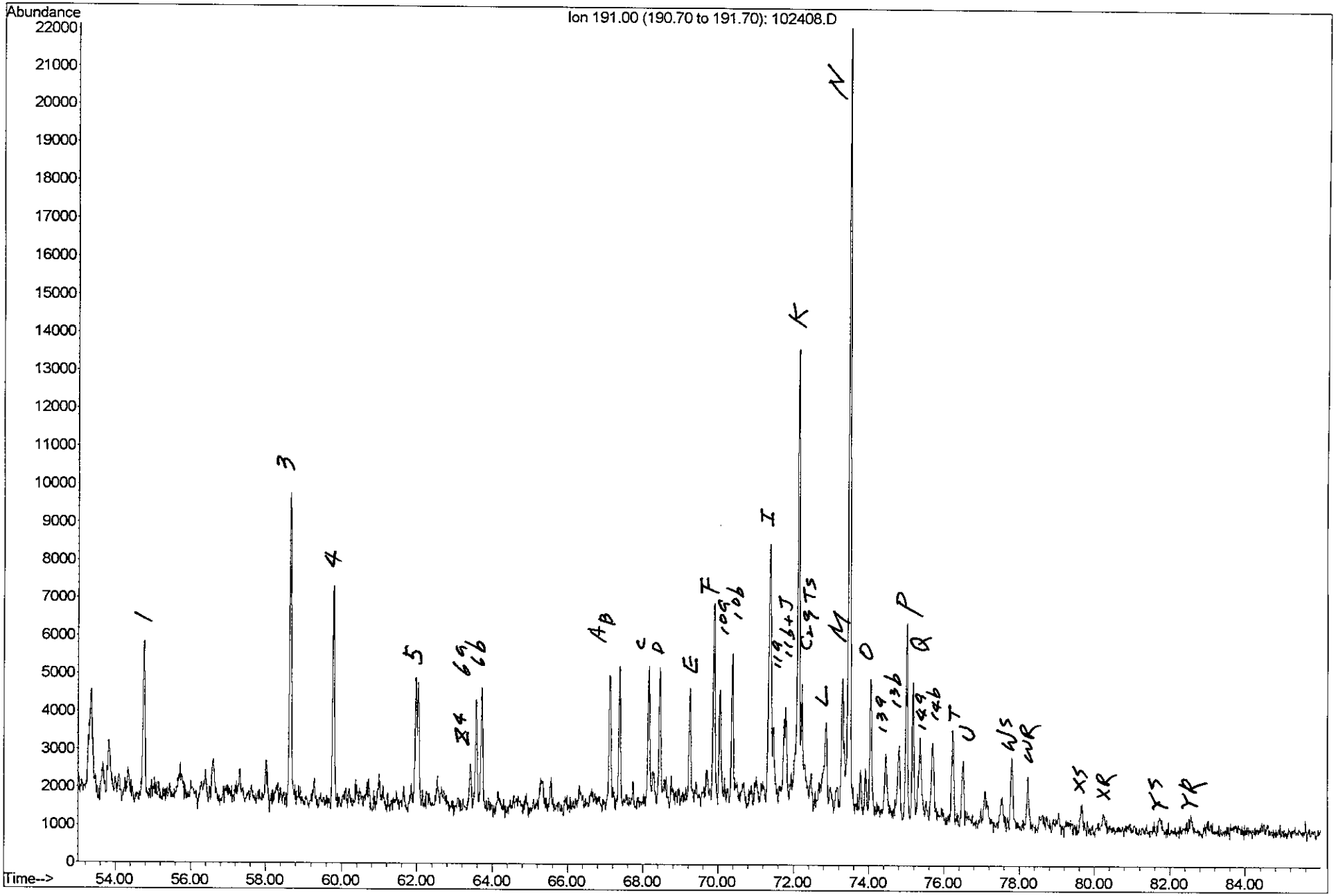

FTPH-FP-SB-L (41343-7) Heavy oil
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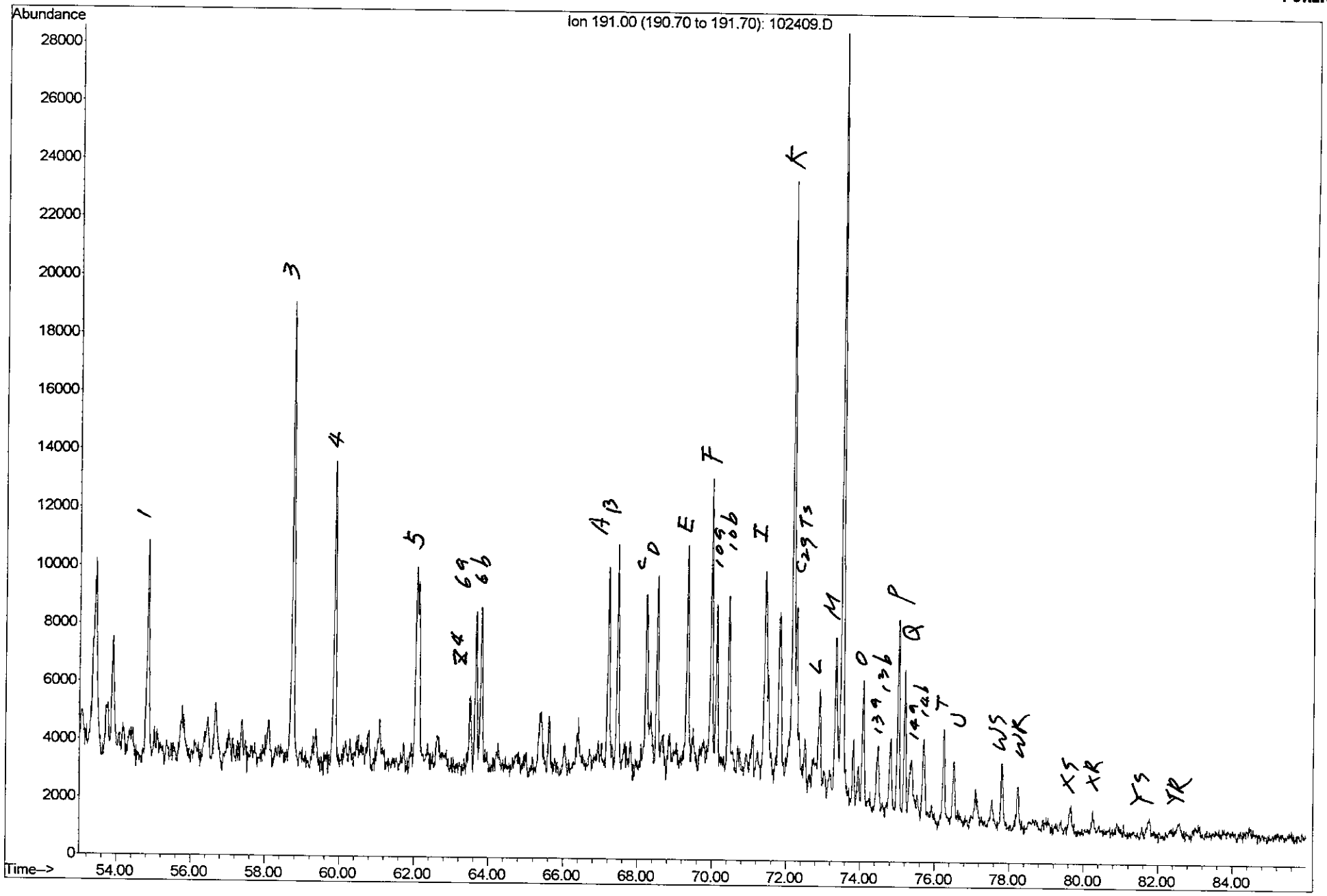

FTPH-FP-SB-WWW (41343-8) Heavy oil
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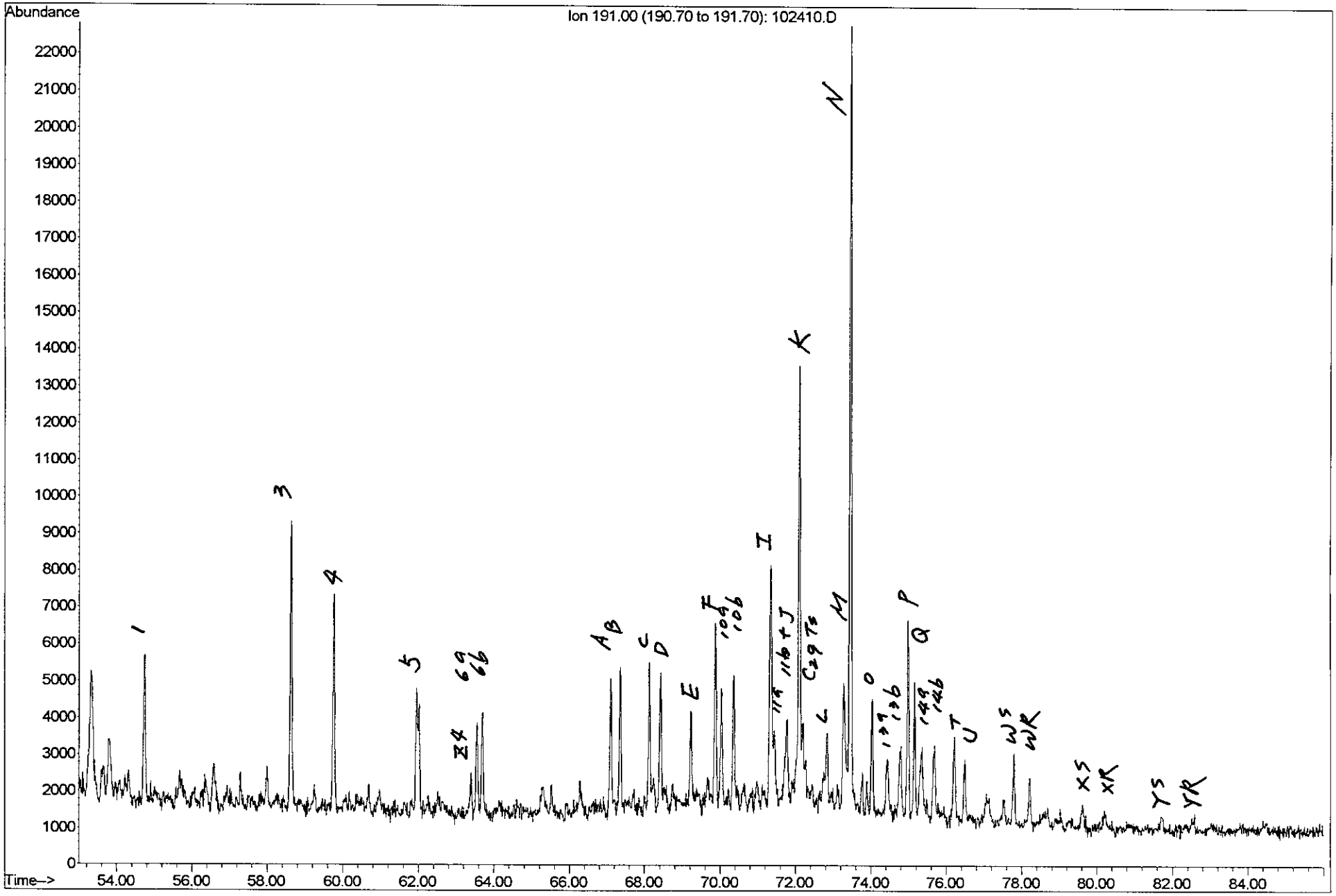

FTPH-FP-SB-O (41343-9) Heavy oil
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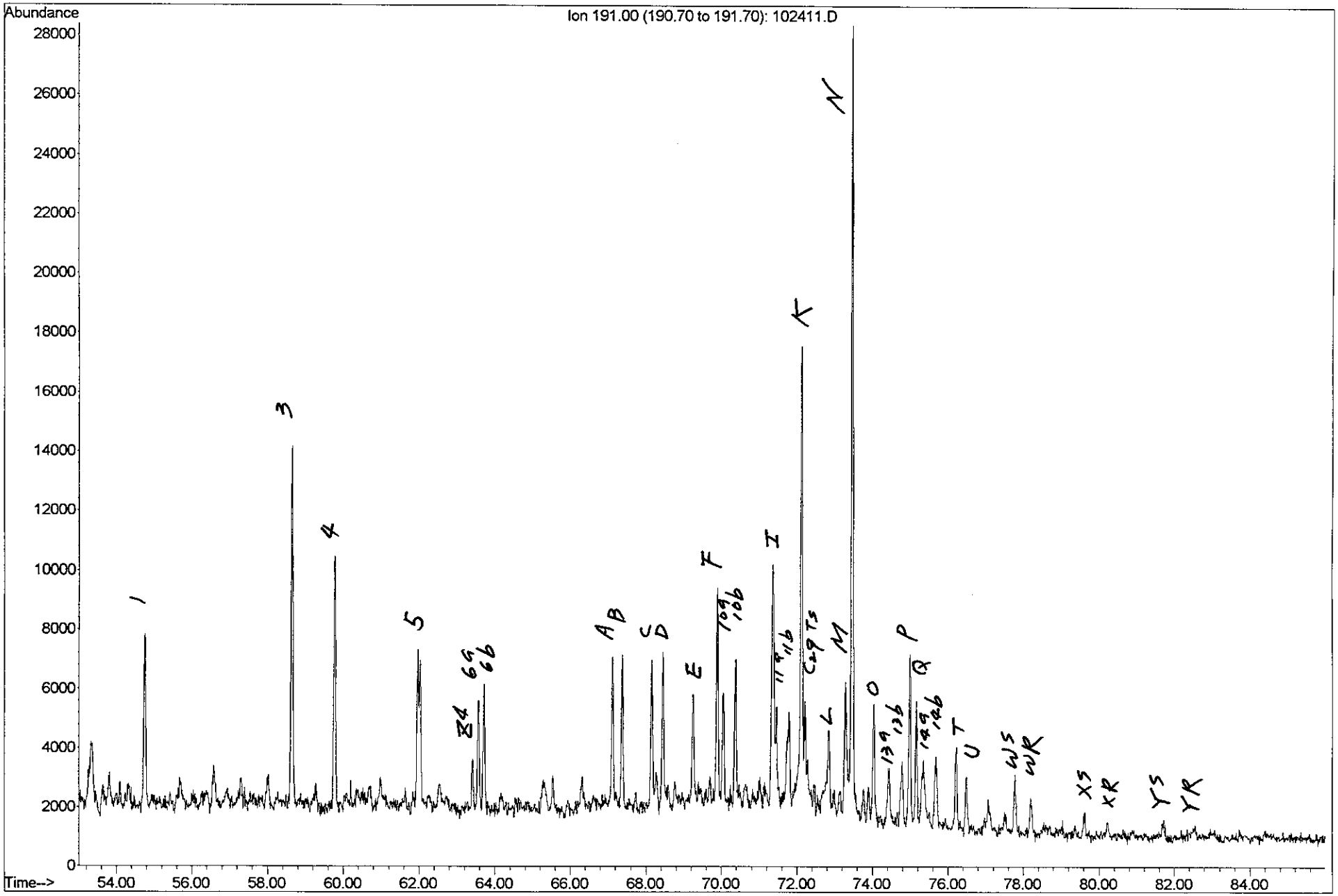

FTPH-FP-SB-R (41343-10) sheen
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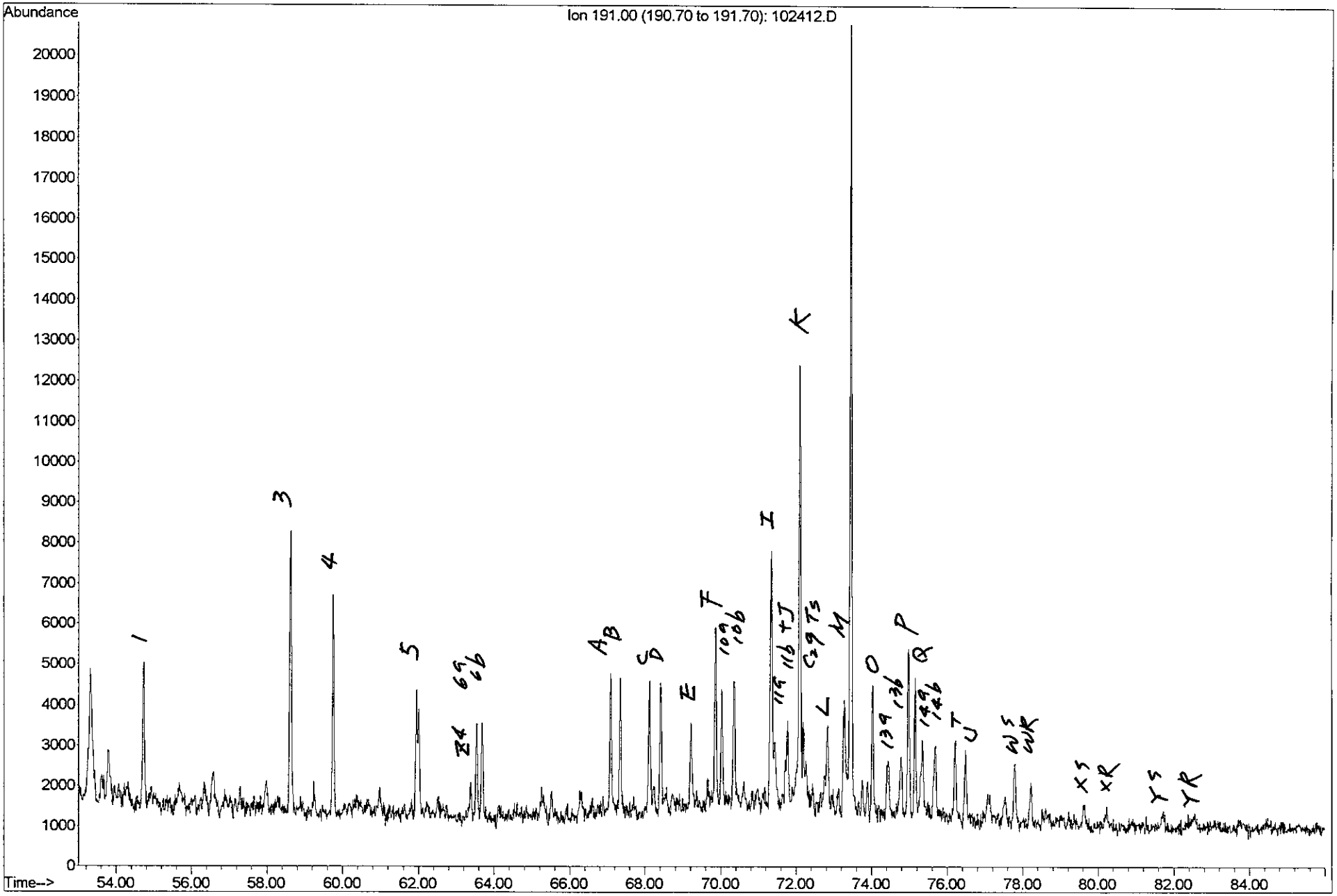
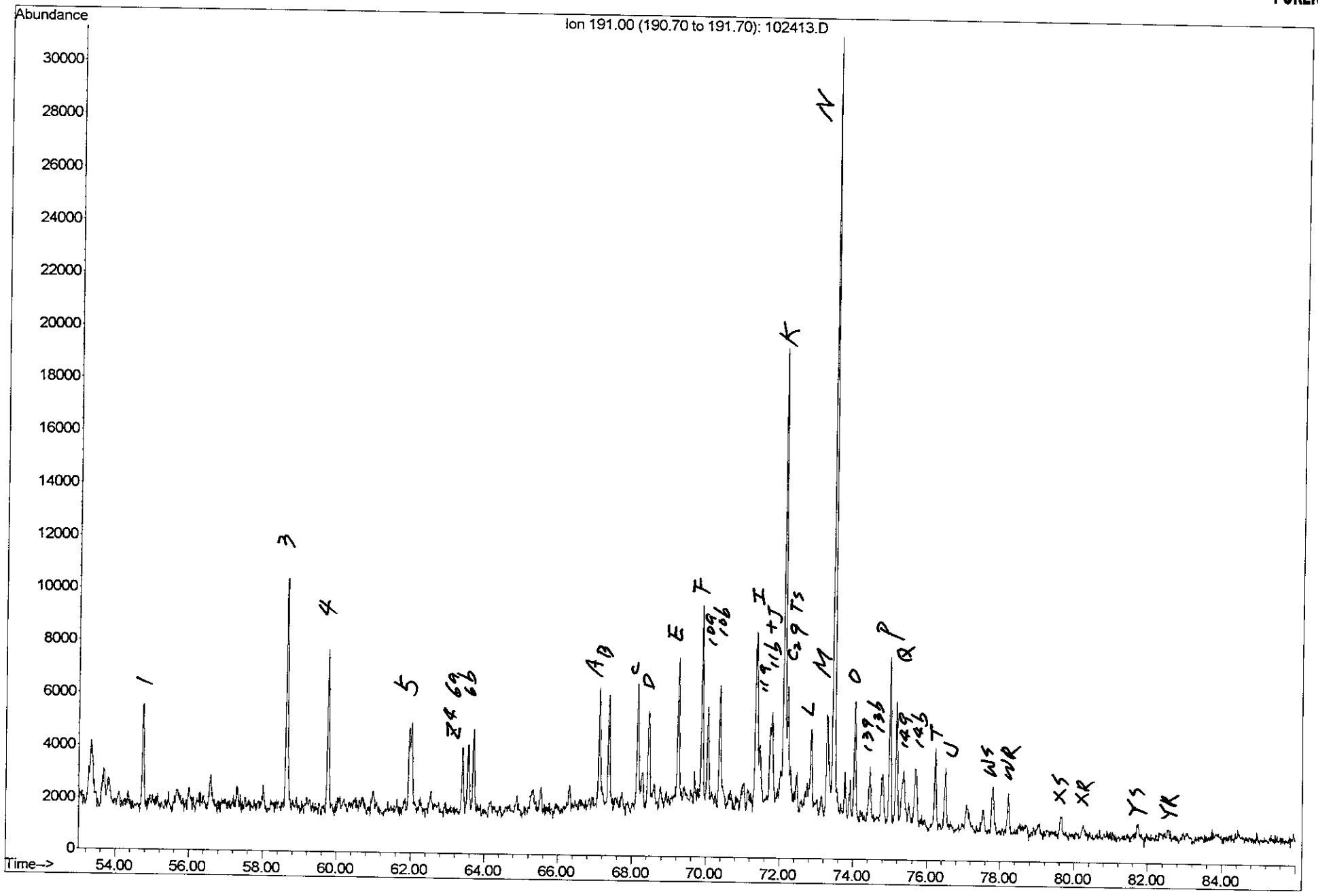


FTPH-FP-UT-BB (41343-11) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-D (41343-2) sheen
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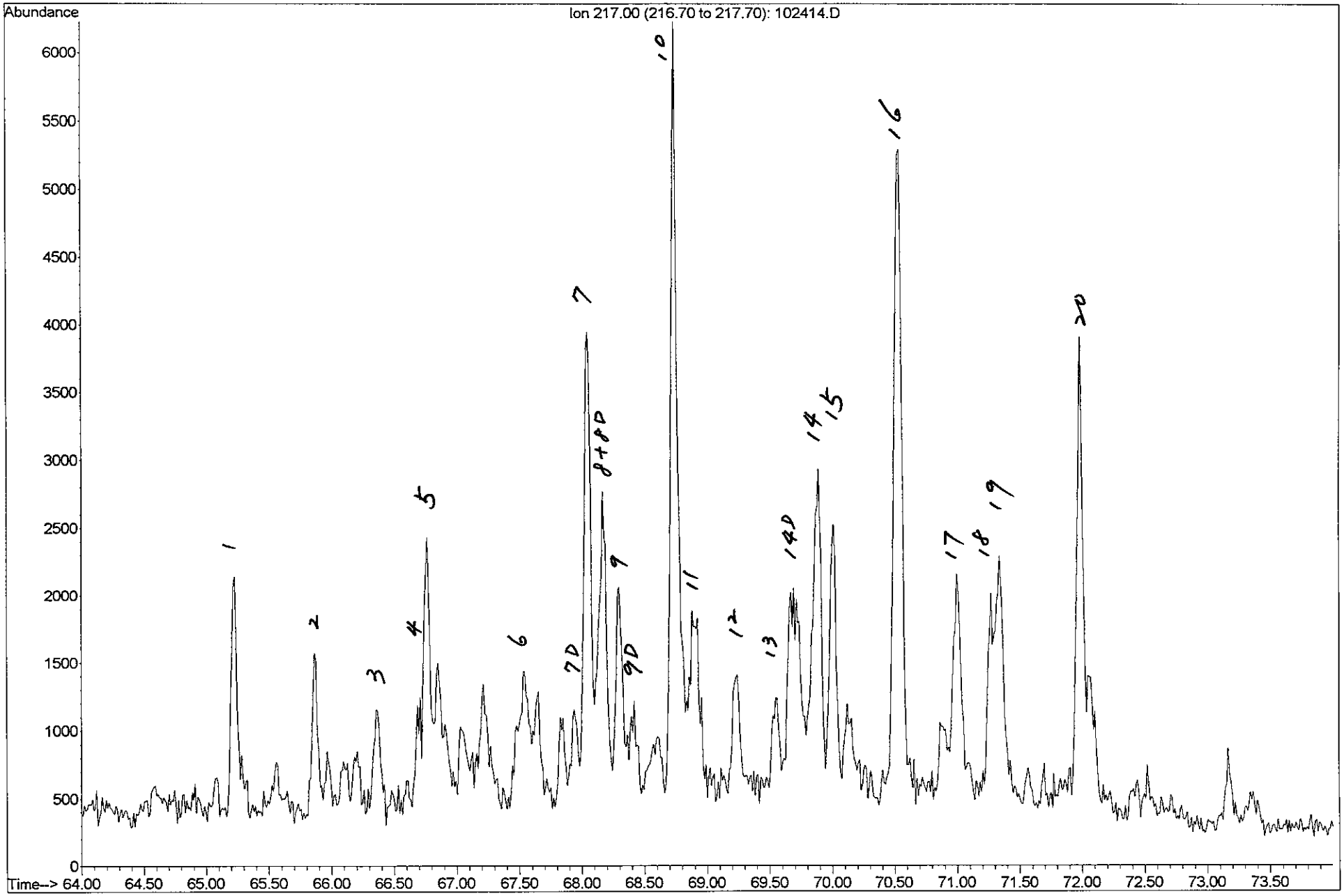

FTPH-FP-UT-Y (41343-3) sheen
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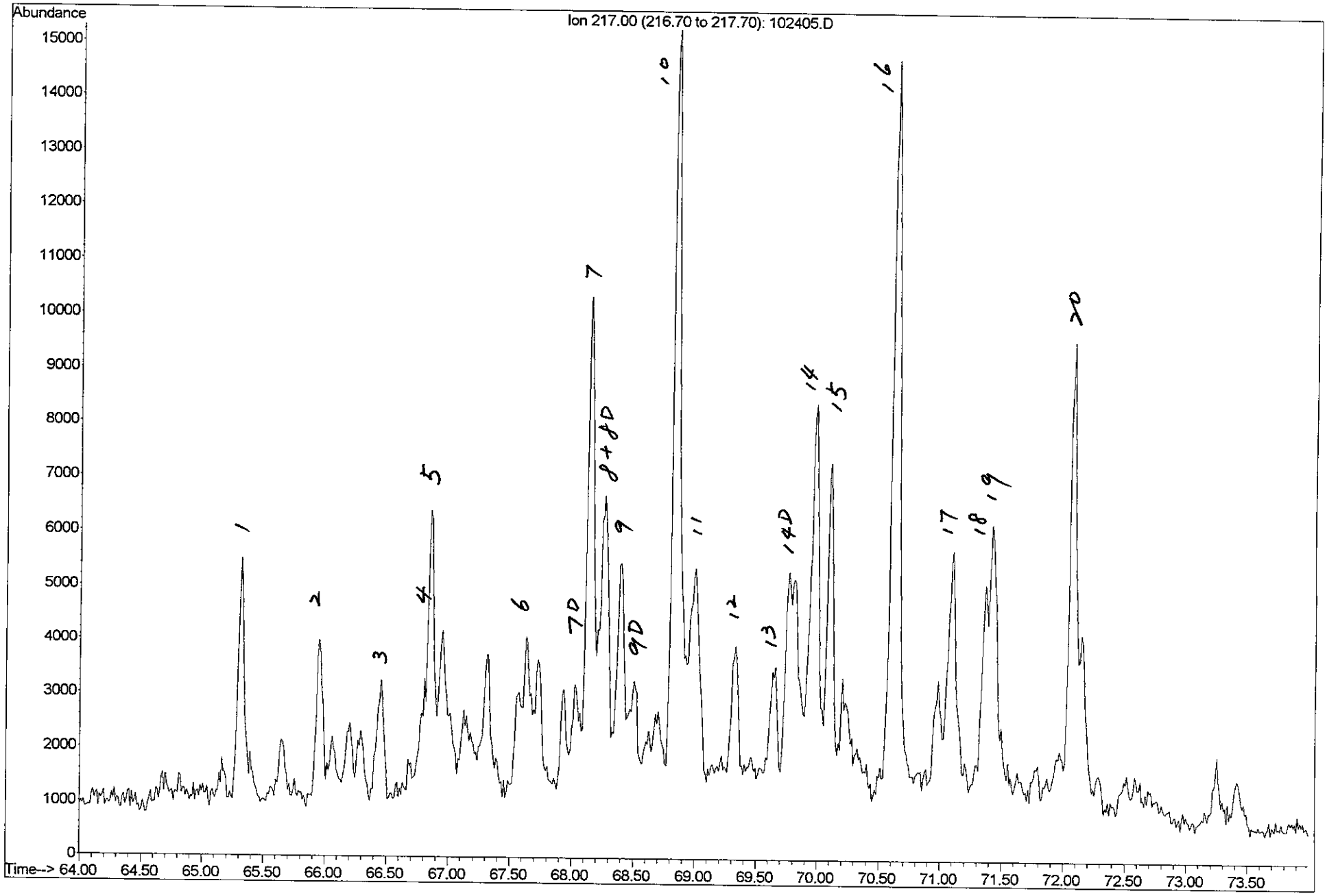

FTPH-FP-UT-W (41343-4) Heavy oil
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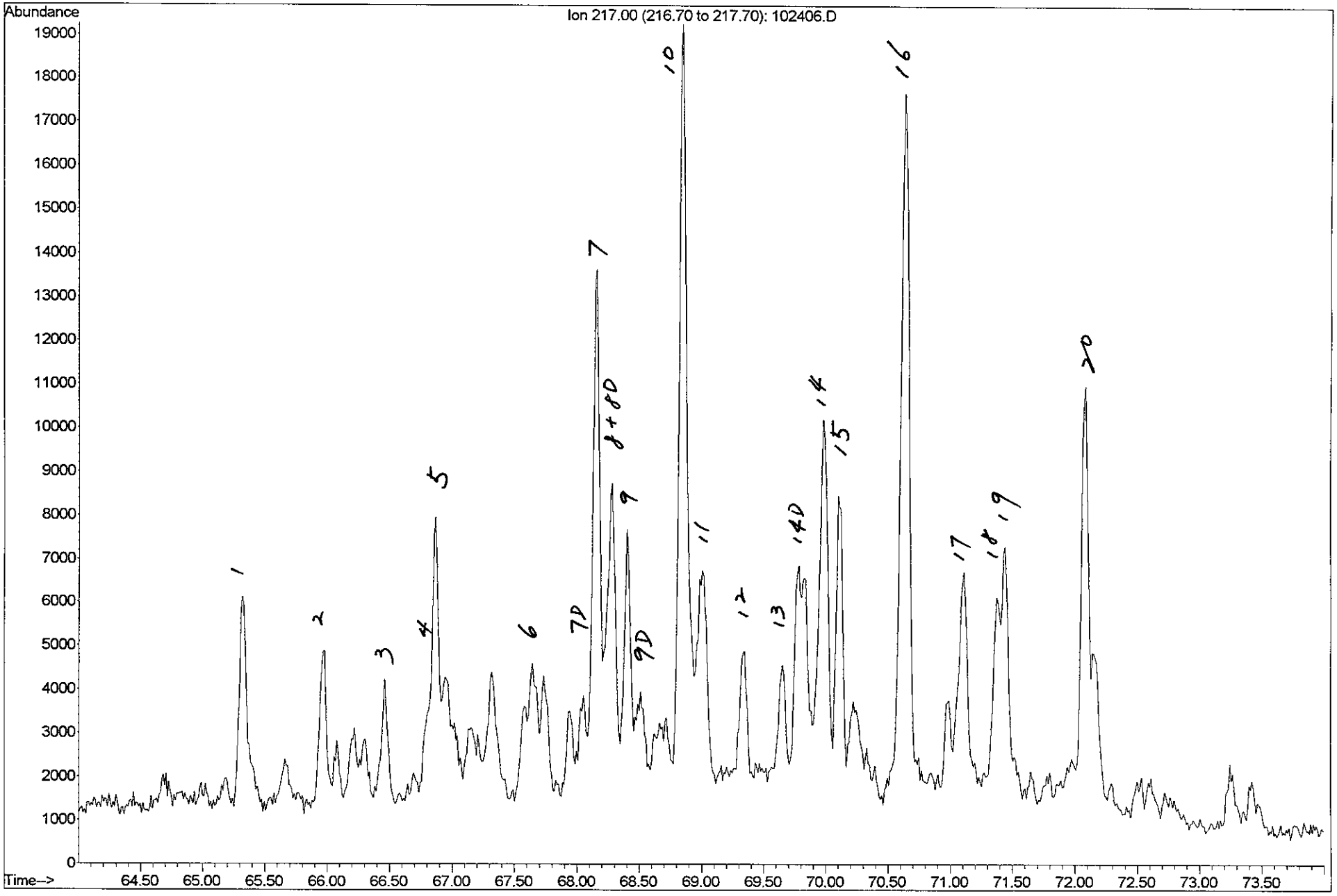

FTPH-FP-SB-G (41343-5) sheen
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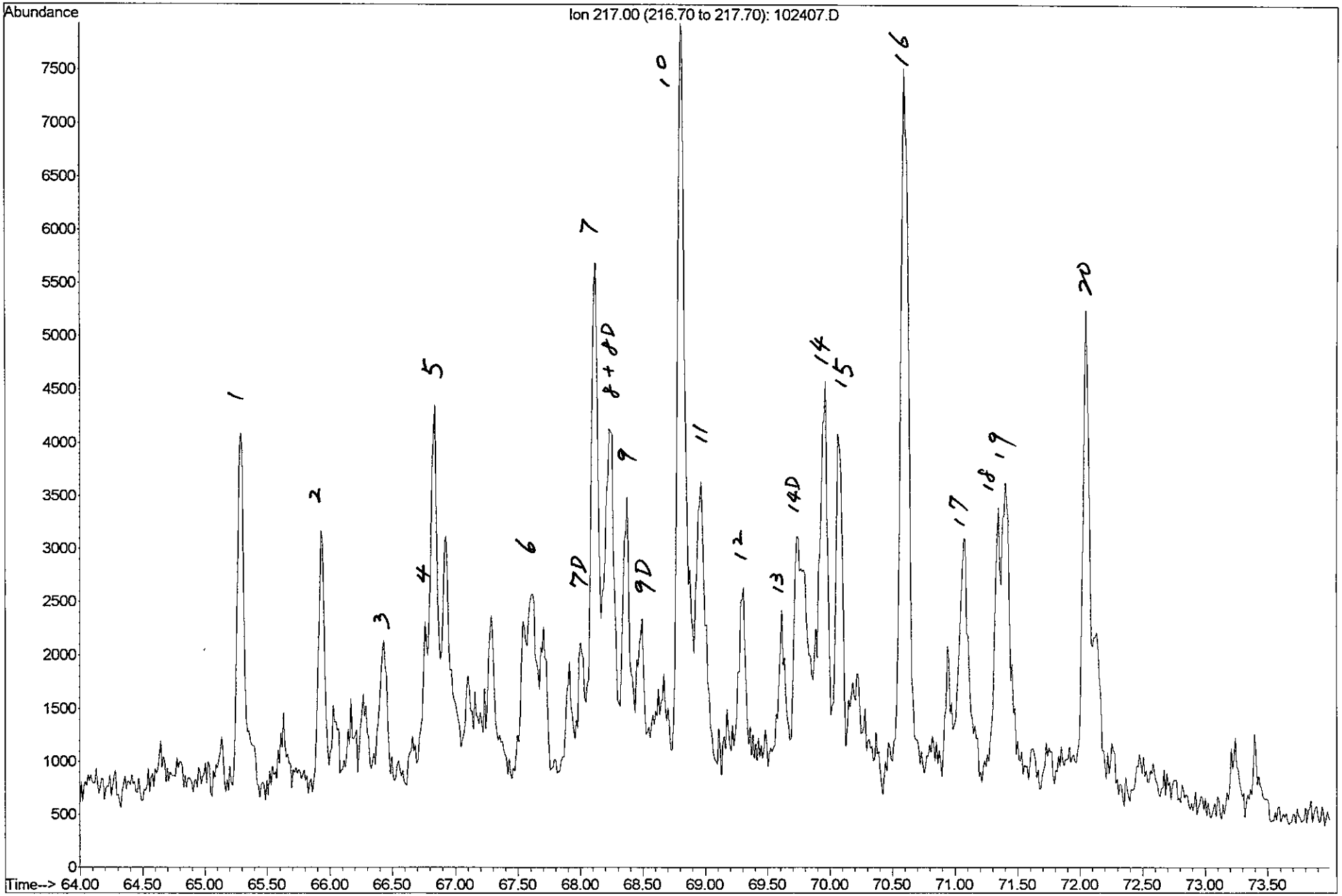

FTPH-FP-SB-K (41343-6) sheen
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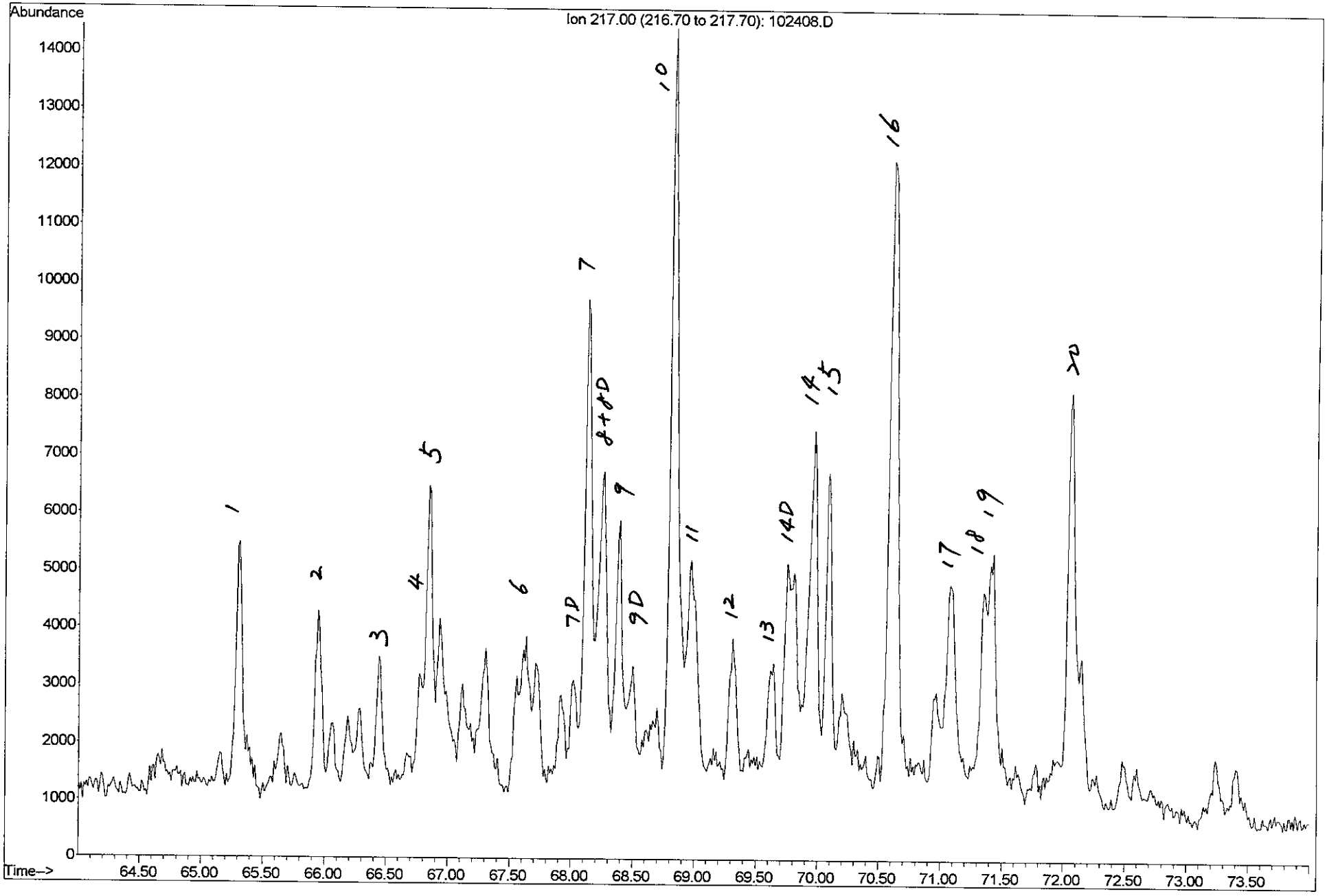
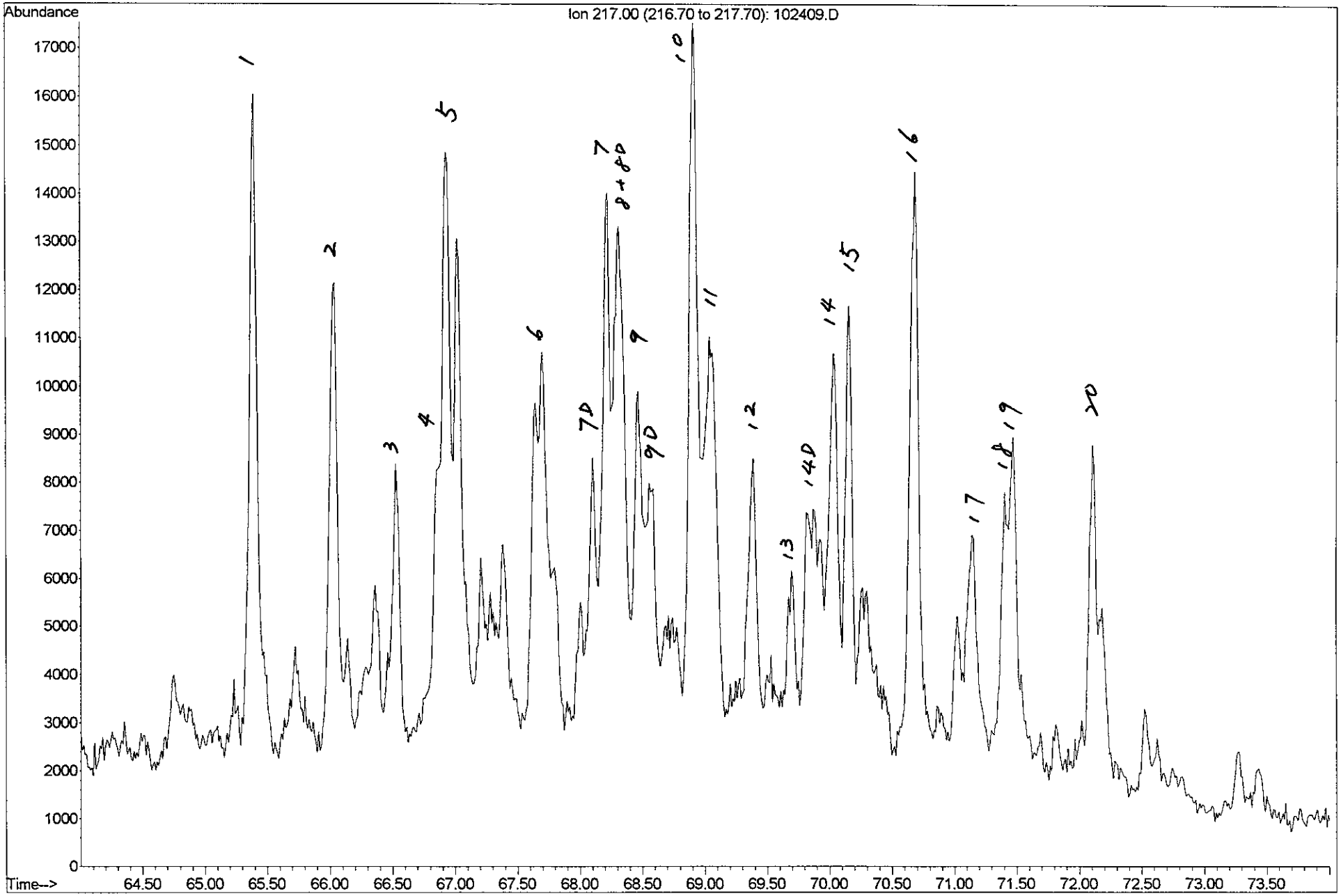


FTPH-FP-SB-L (41343-7) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-WWW (41343-8) Heavy oil
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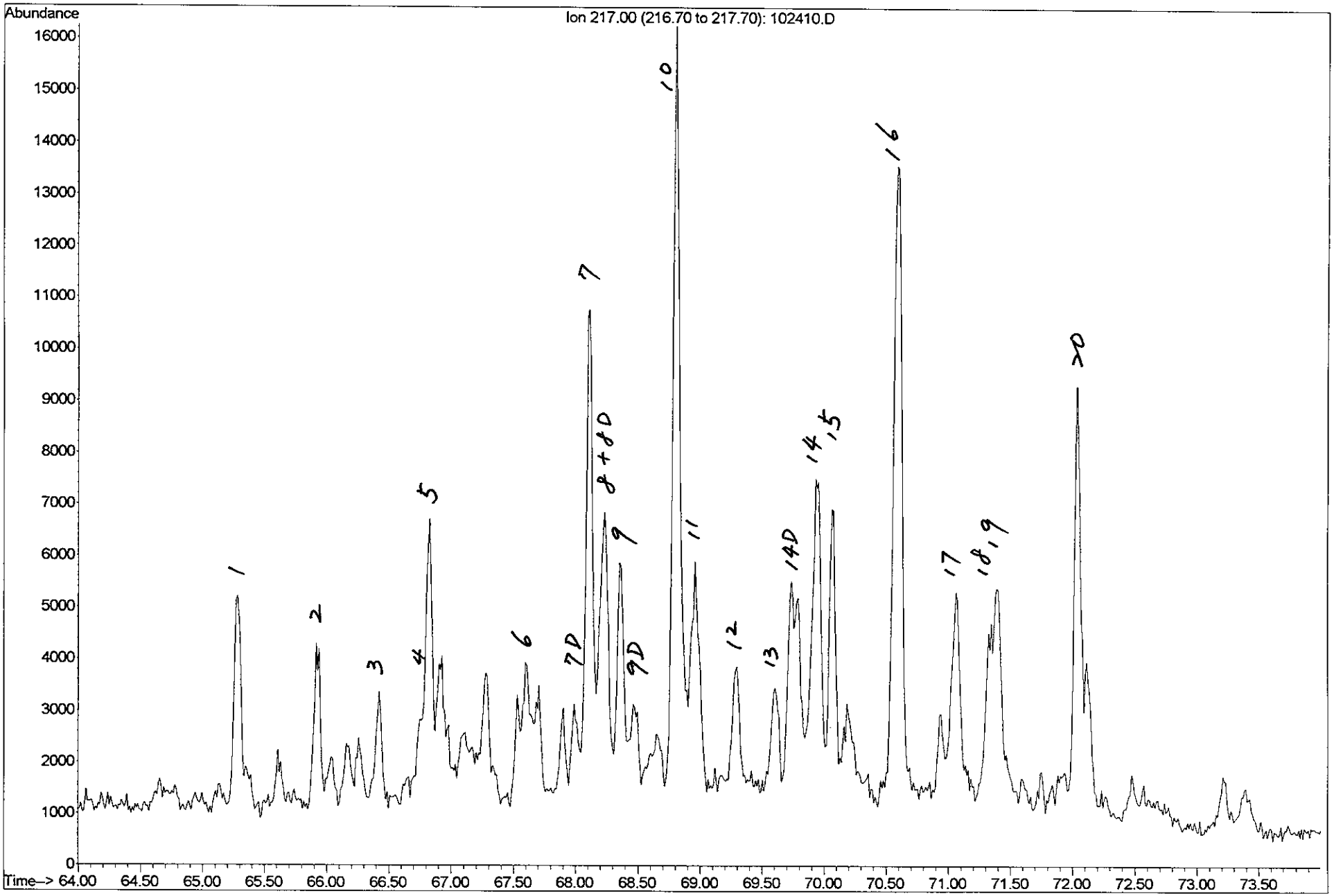

FTPH-FP-SB-O (41343-9) Heavy oil
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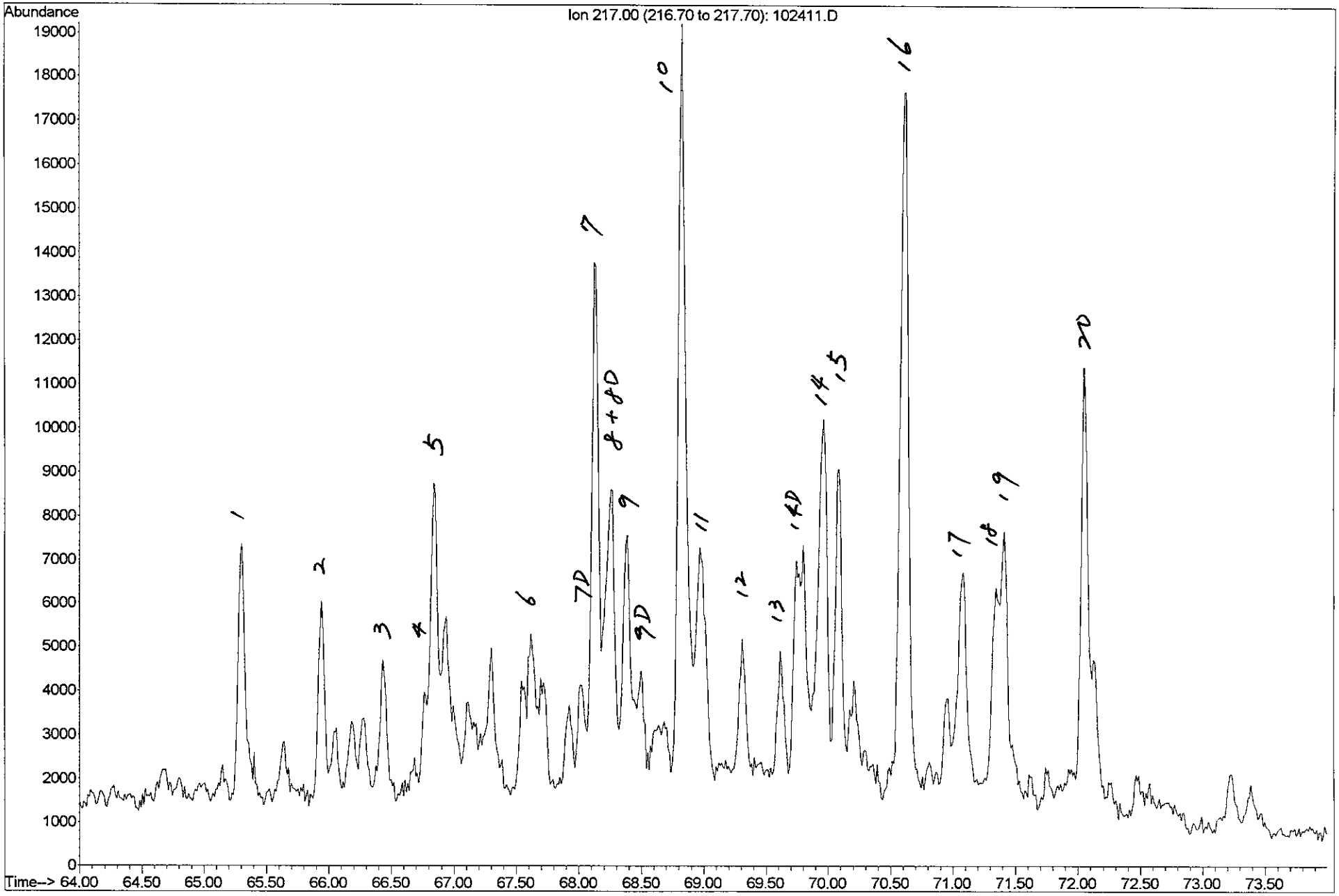

FTPH-FP-SB-R (41343-10) sheen
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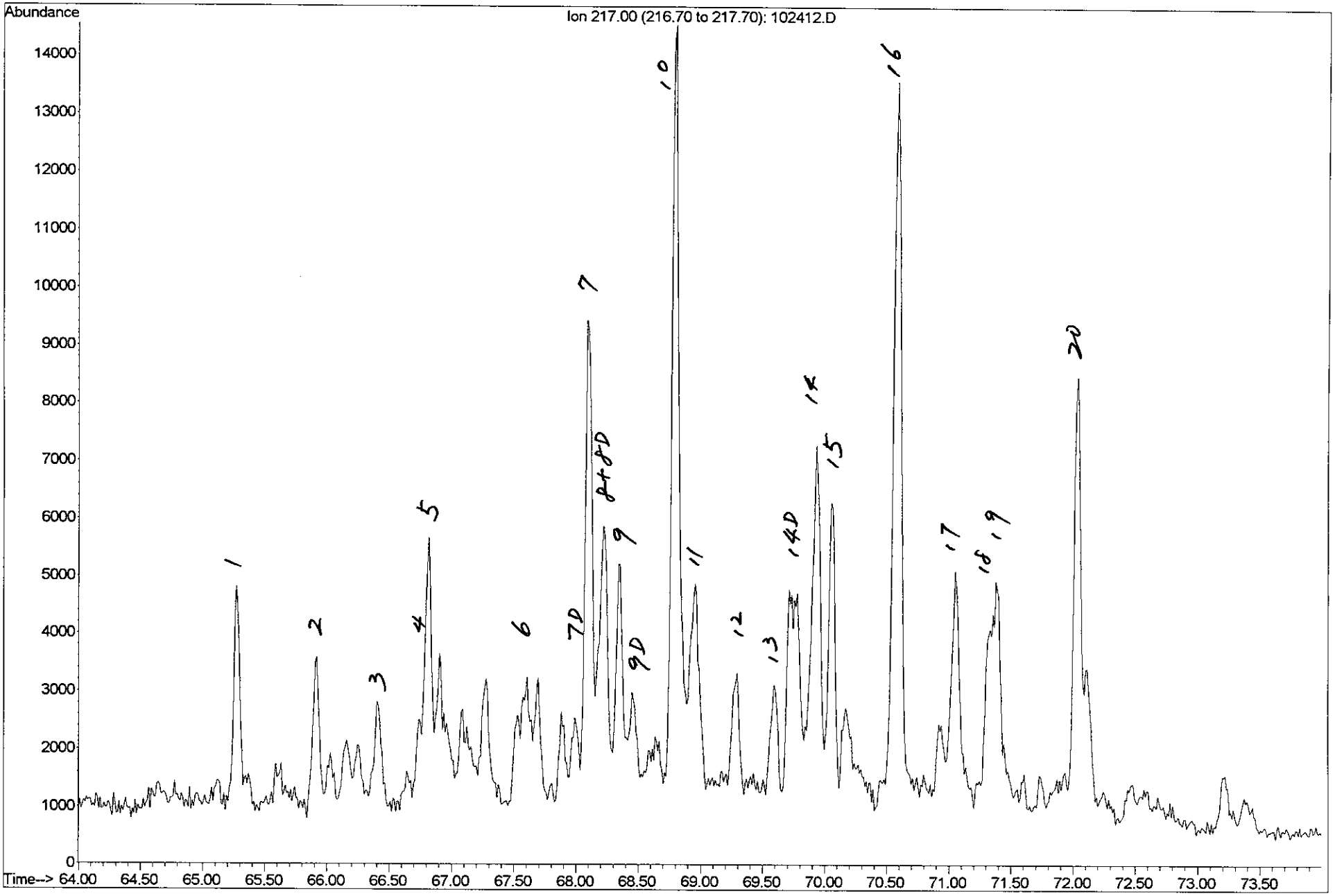

FTPH-FP-UT-BB (41343-11) Heavy oil
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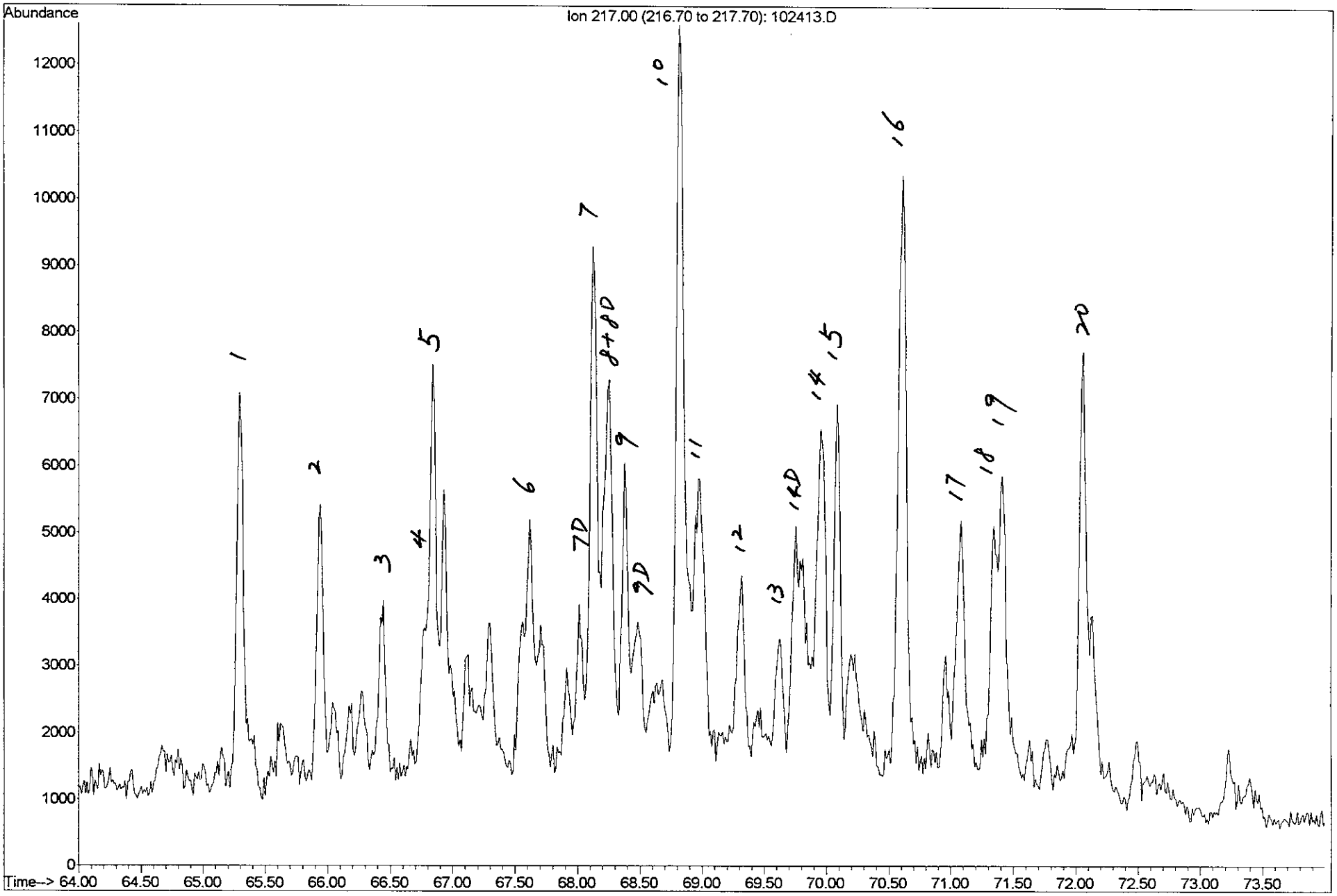

FTPH-FP-SB-D (41343-2) sheen
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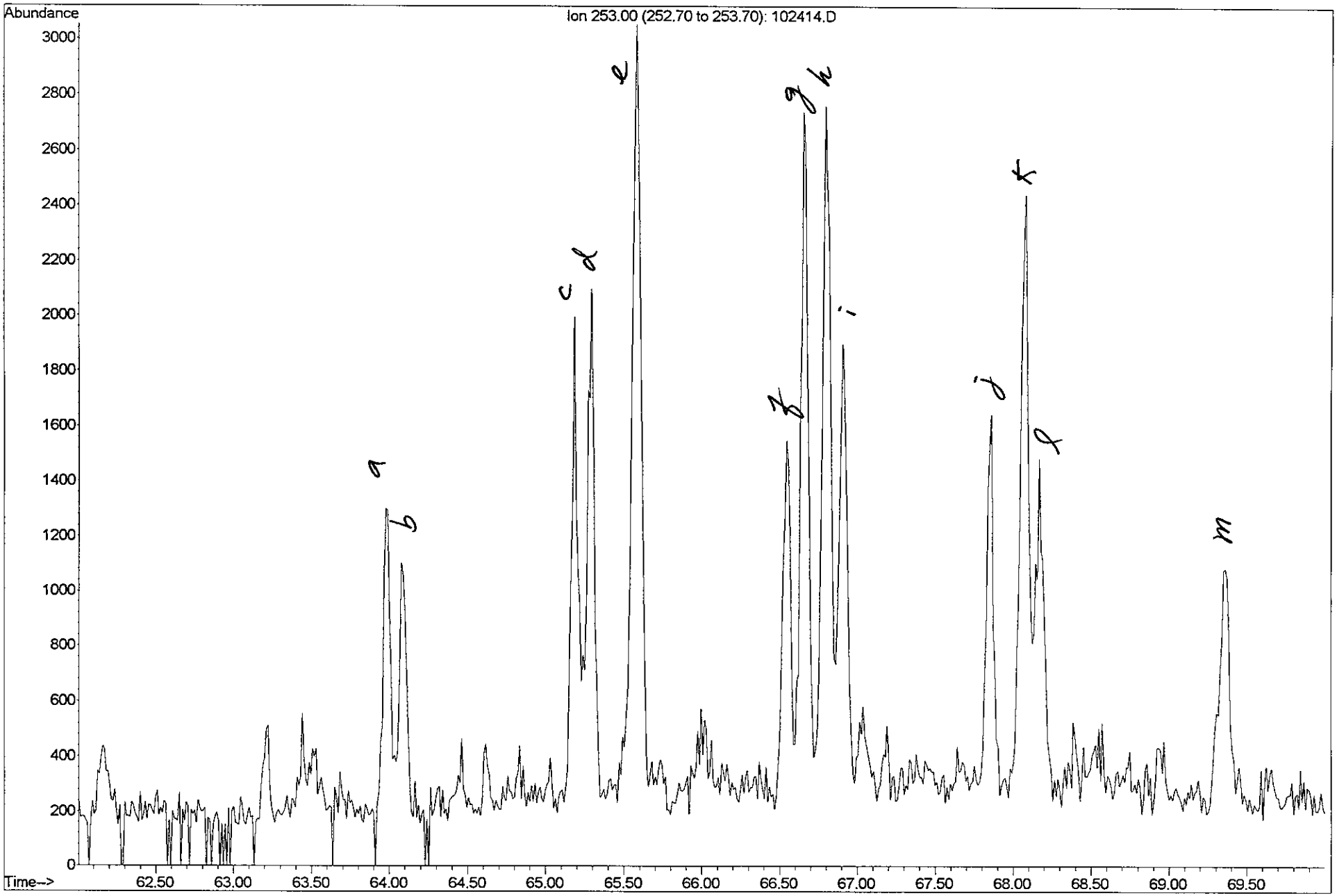

FTPH-FP-UT-Y (41343-3) sheen
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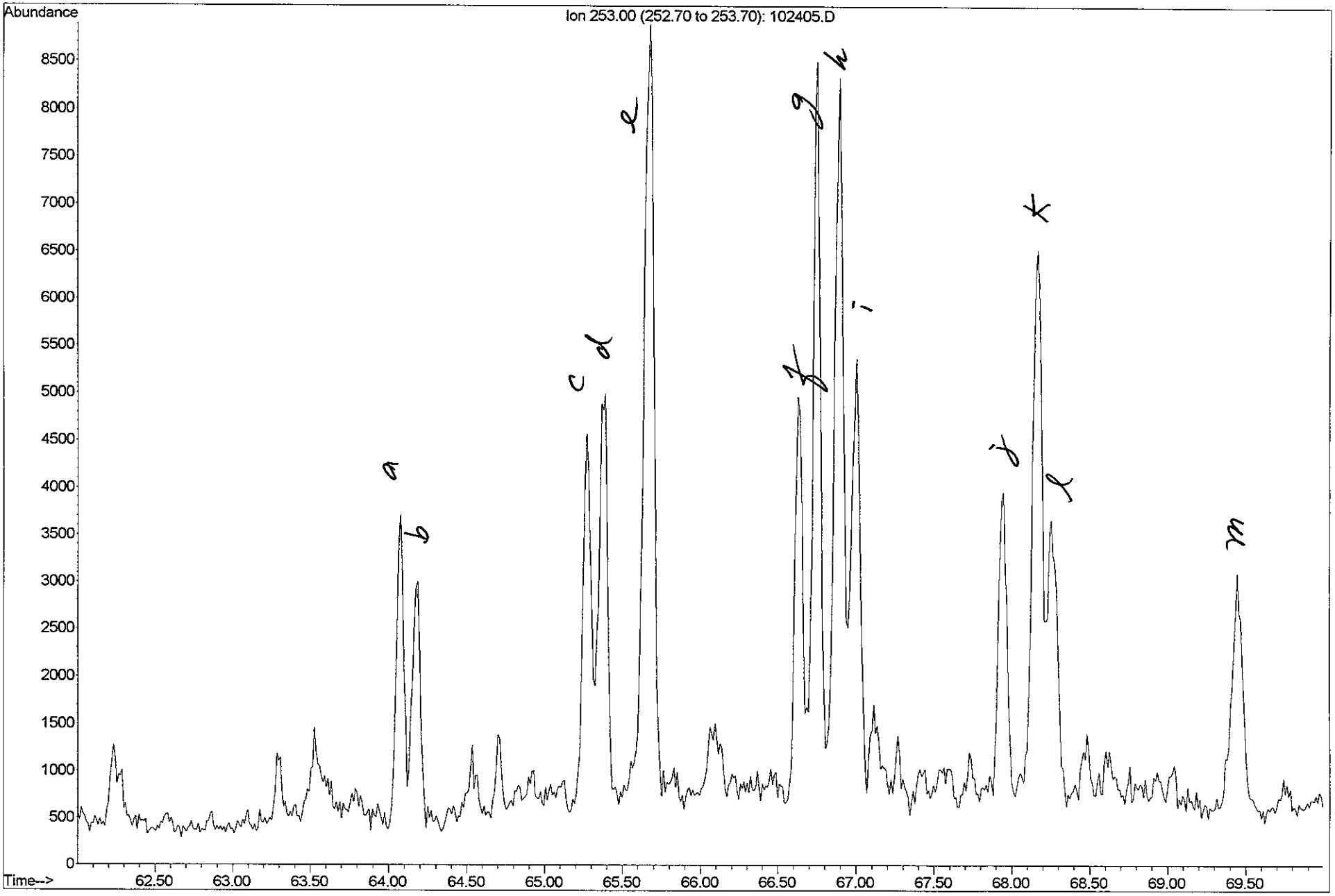

FTPH-FP-UT-W (41343-4) Heavy oil
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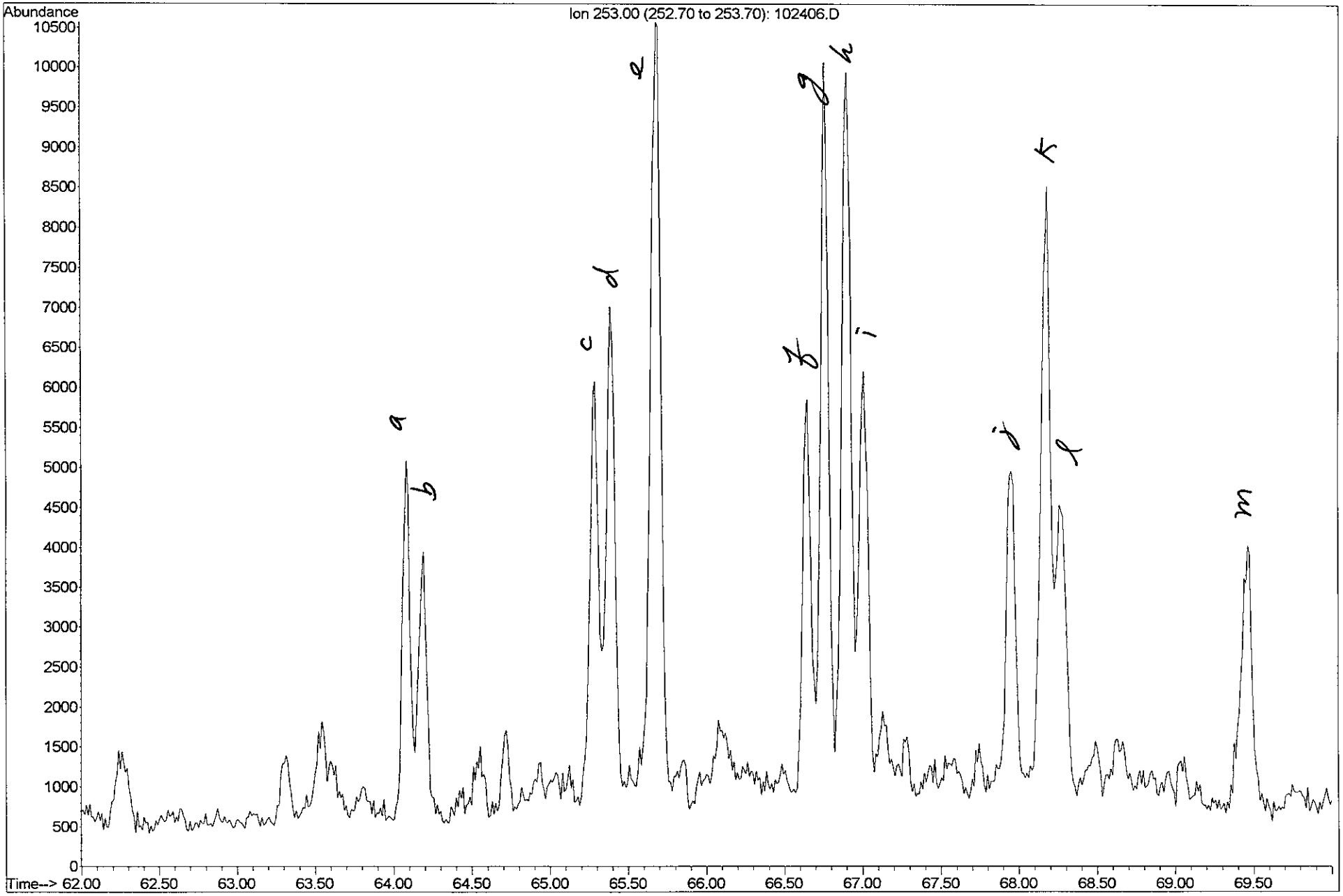

FTPH-FP-SB-G (41343-5) sheen
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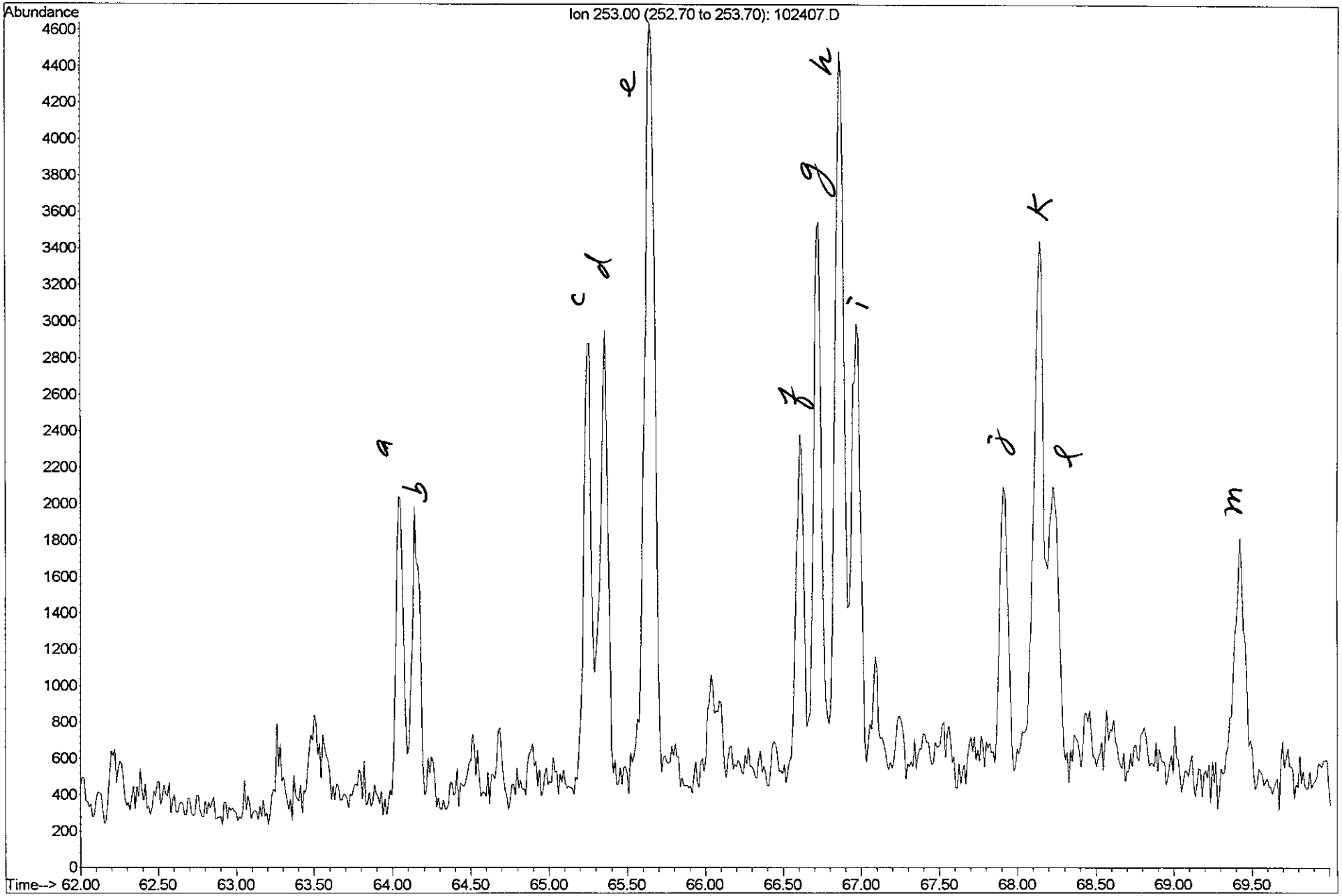

FTPH-FP-SB-K (41343-6) sheen
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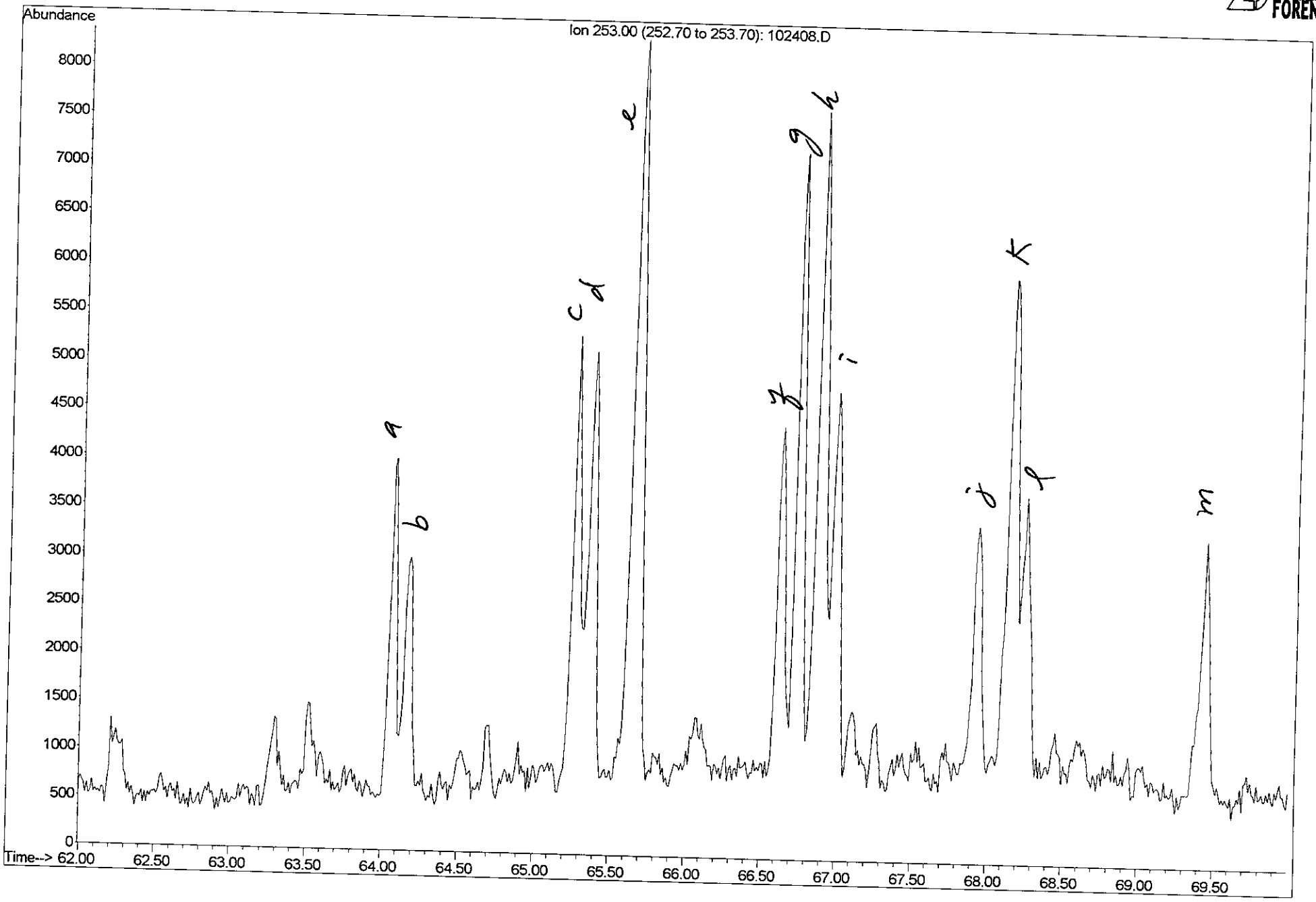

FTPH-FP-SB-L (41343-7) Heavy oil
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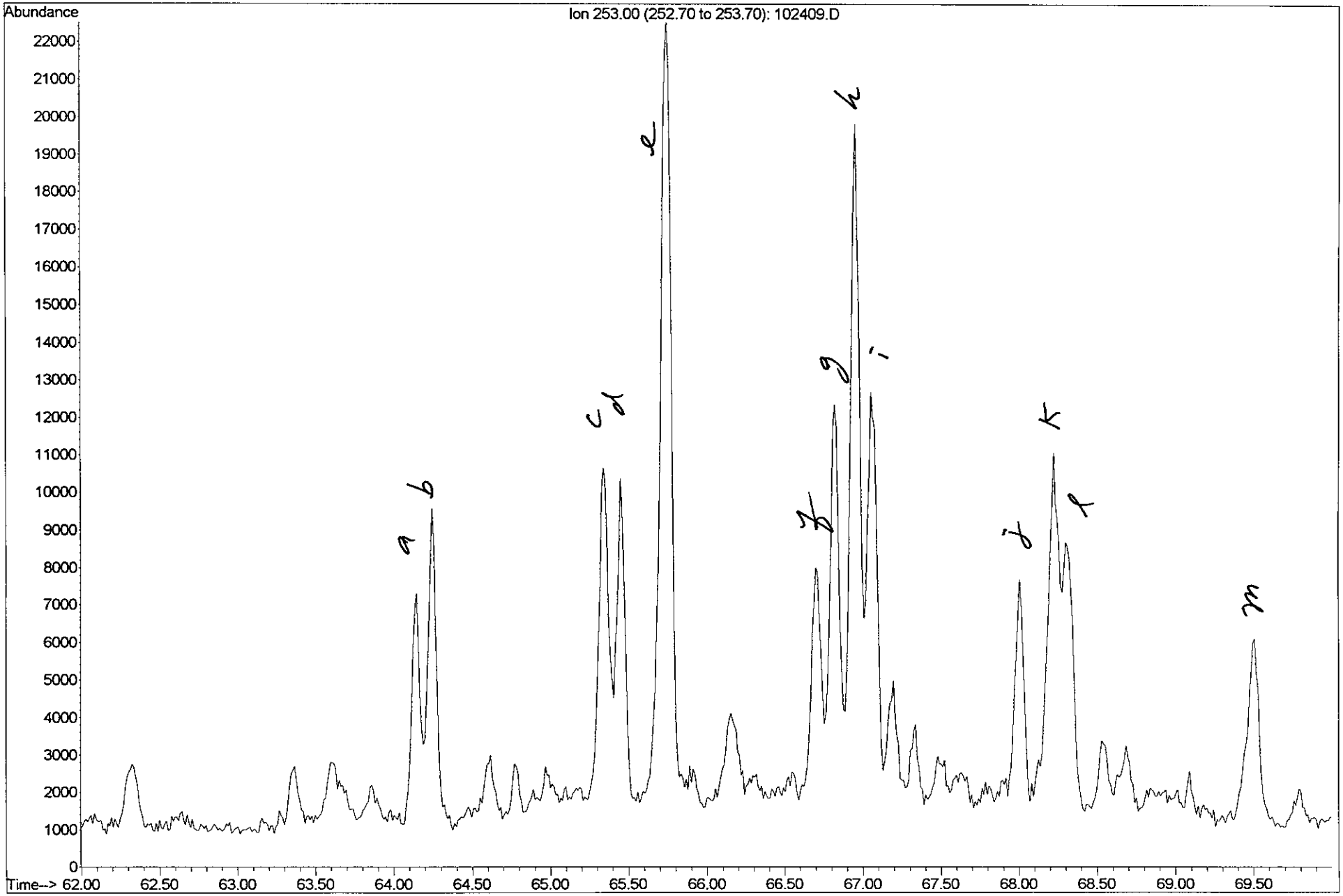

FTPH-FP-SB-WWW (41343-8) Heavy oil
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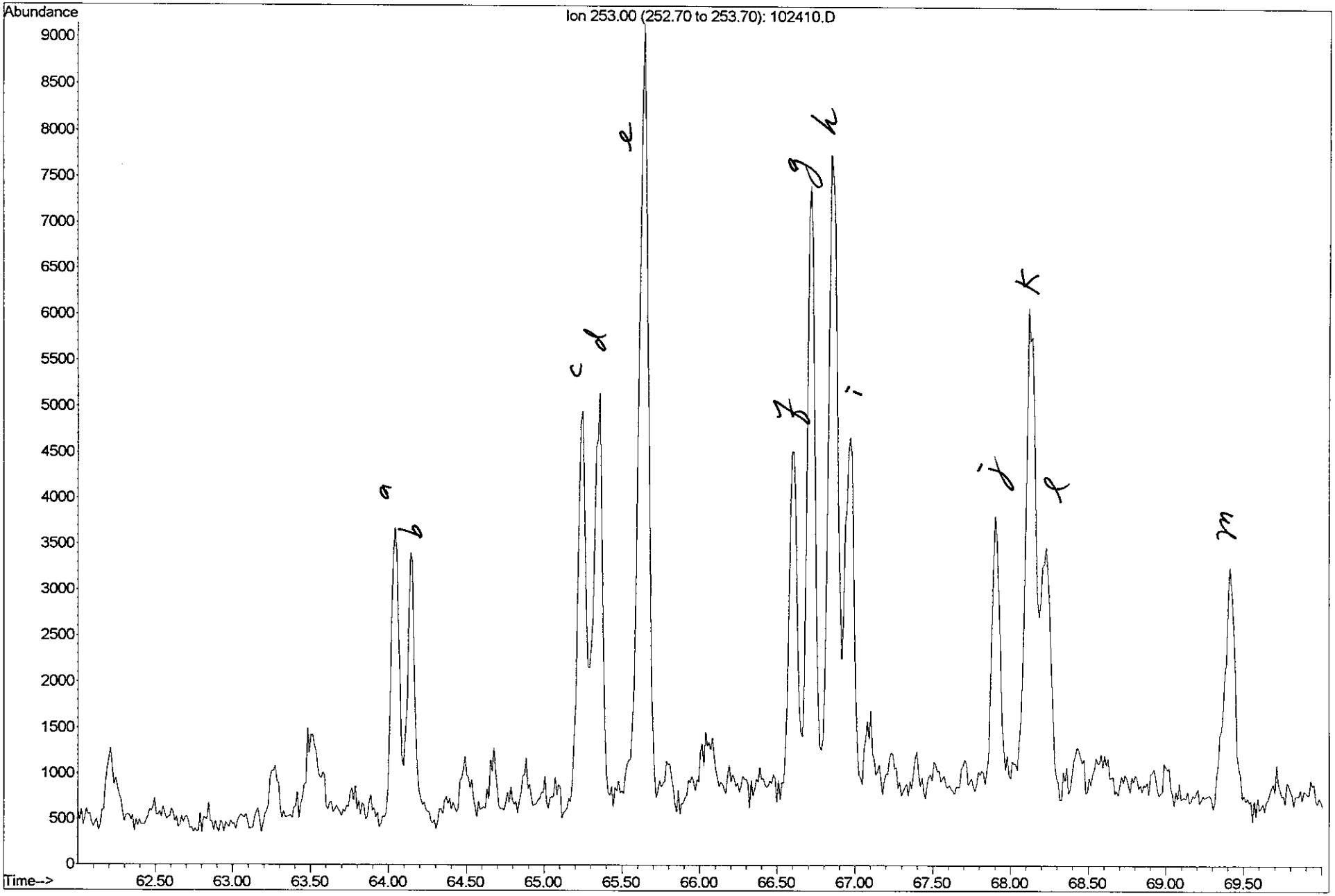

FTPH-FP-SB-O (41343-9) Heavy oil
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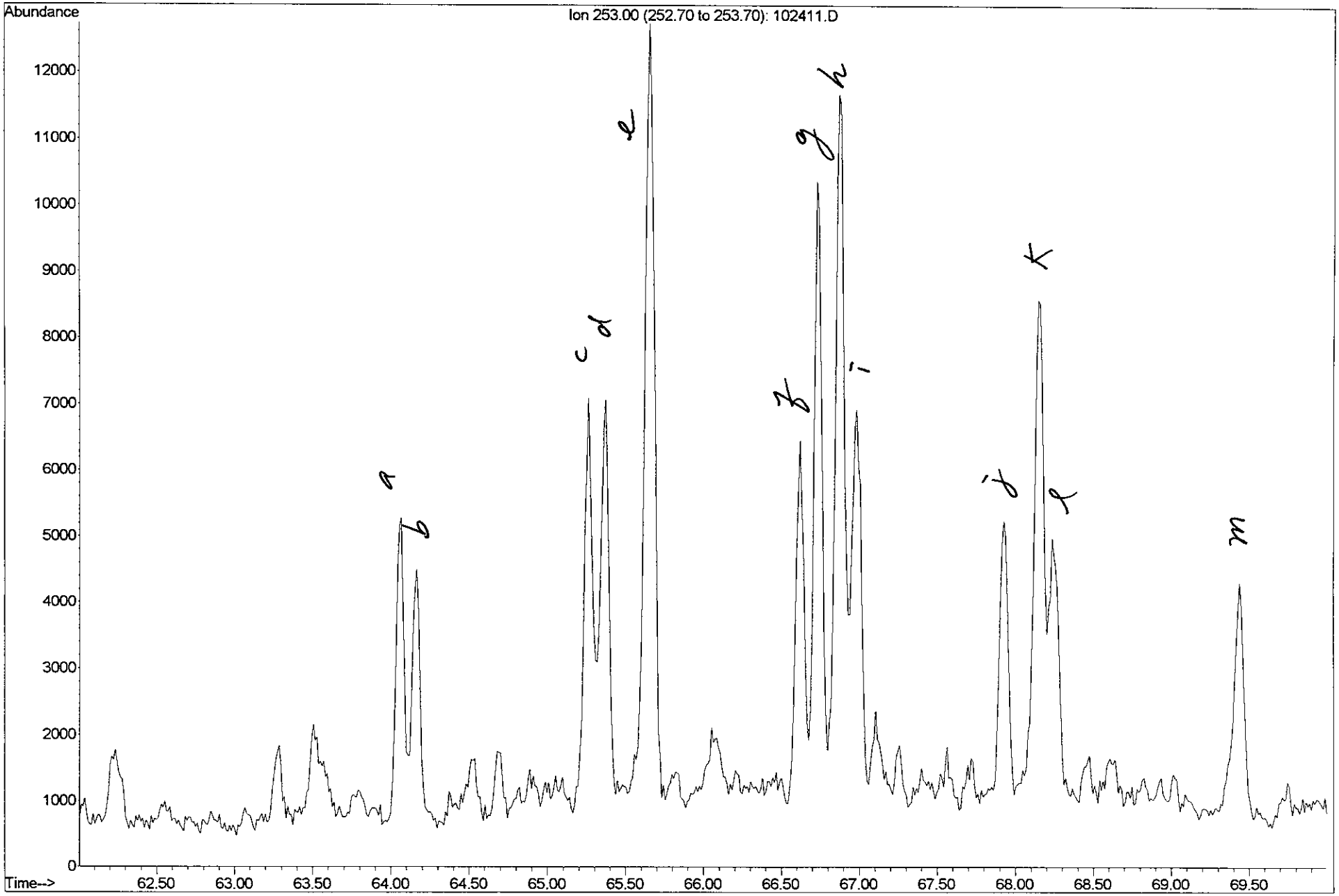

FTPH-FP-SB-R (41343-10) sheen
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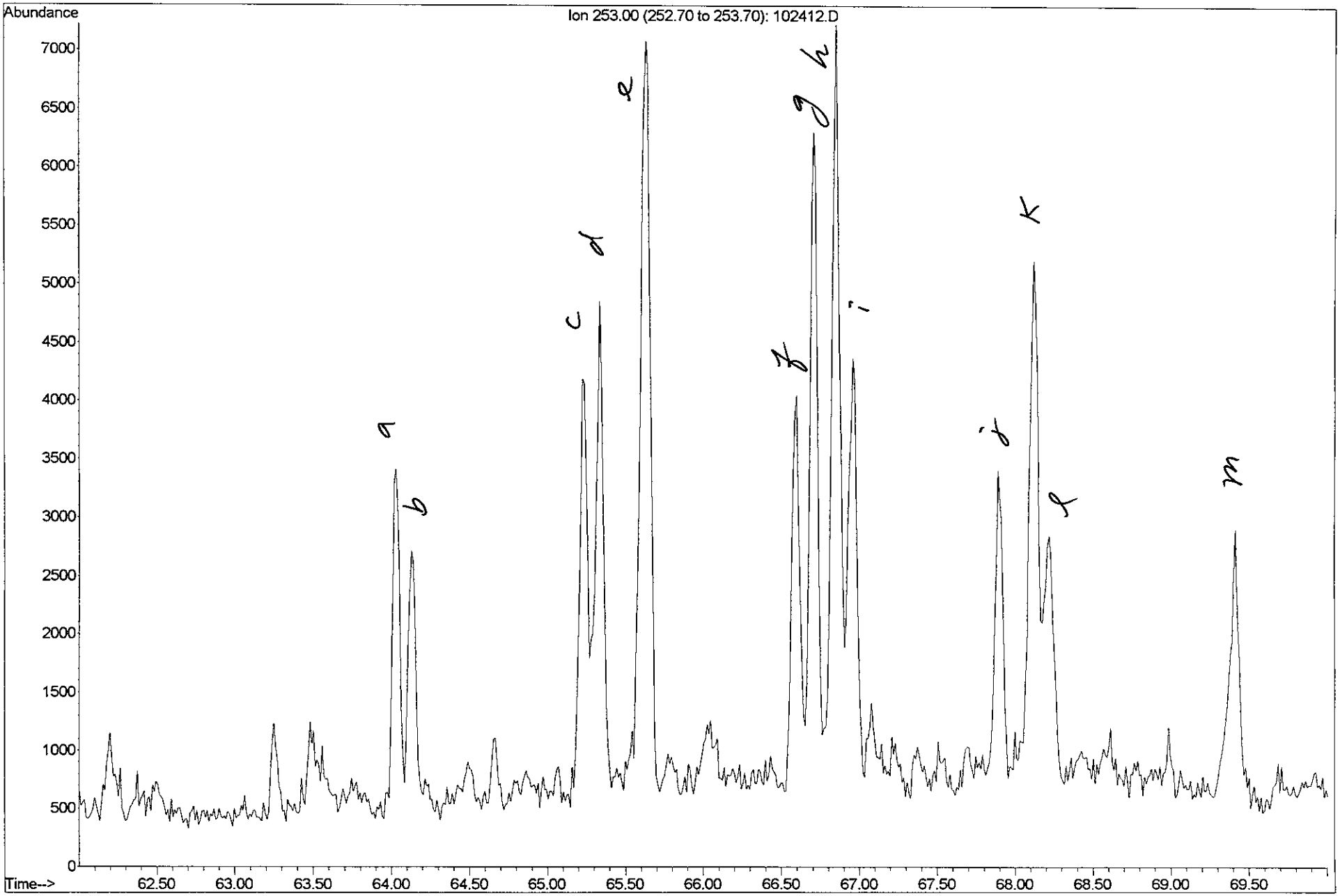

FTPH-FP-UT-BB (41343-11) Heavy oil
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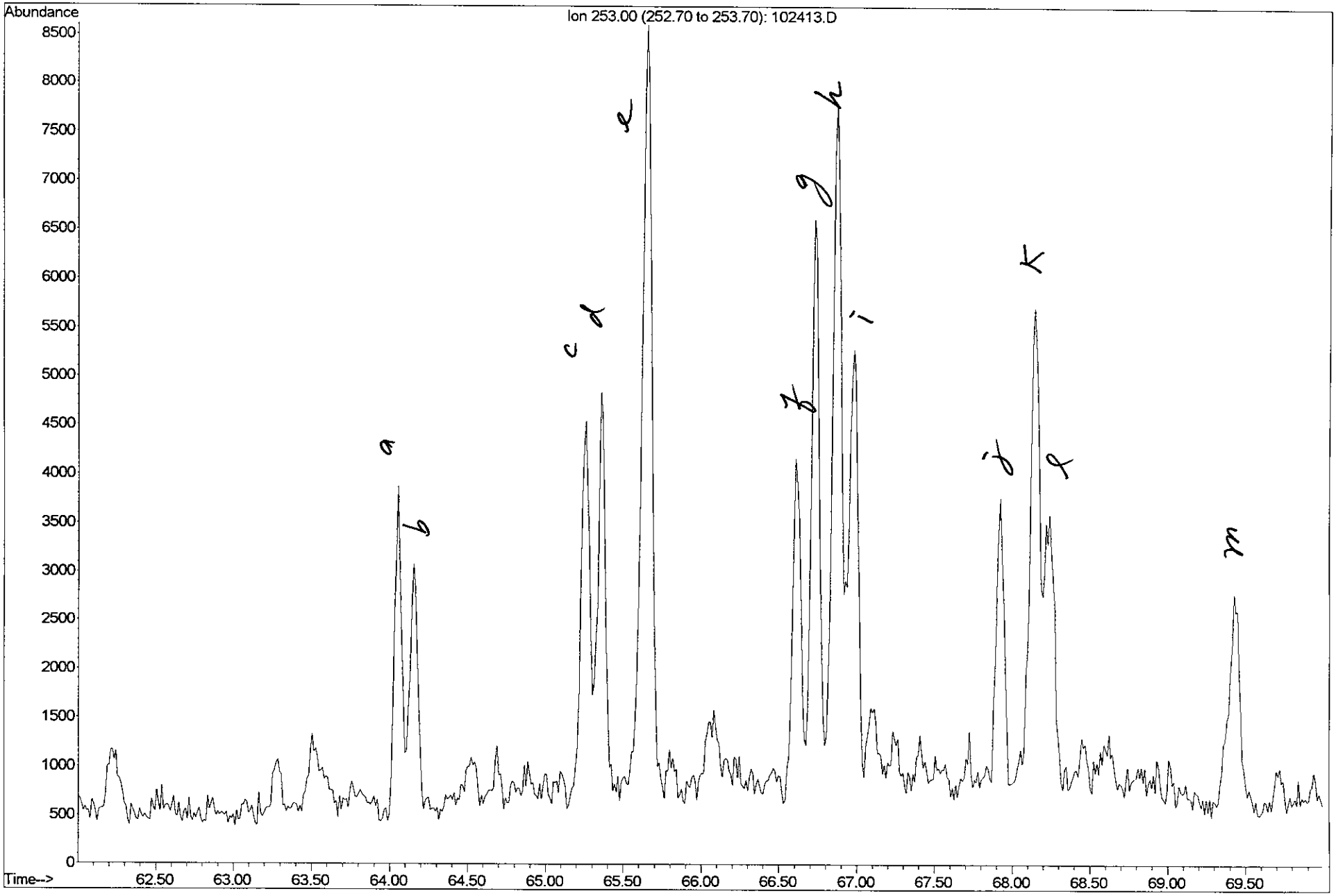

FTPH-FP-SB-D (41343-2) sheen
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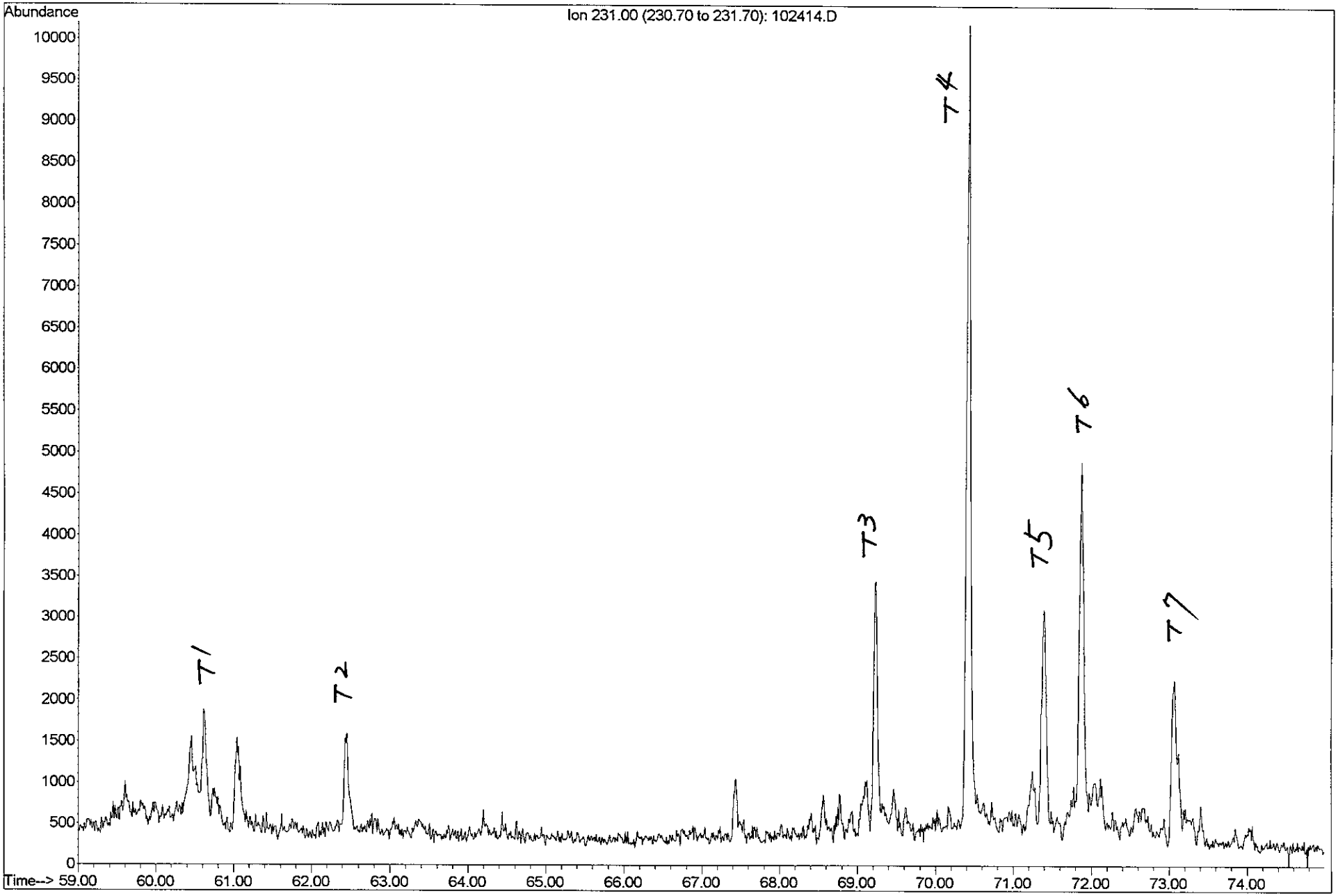

FTPH-FP-UT-Y (41343-3) sheen
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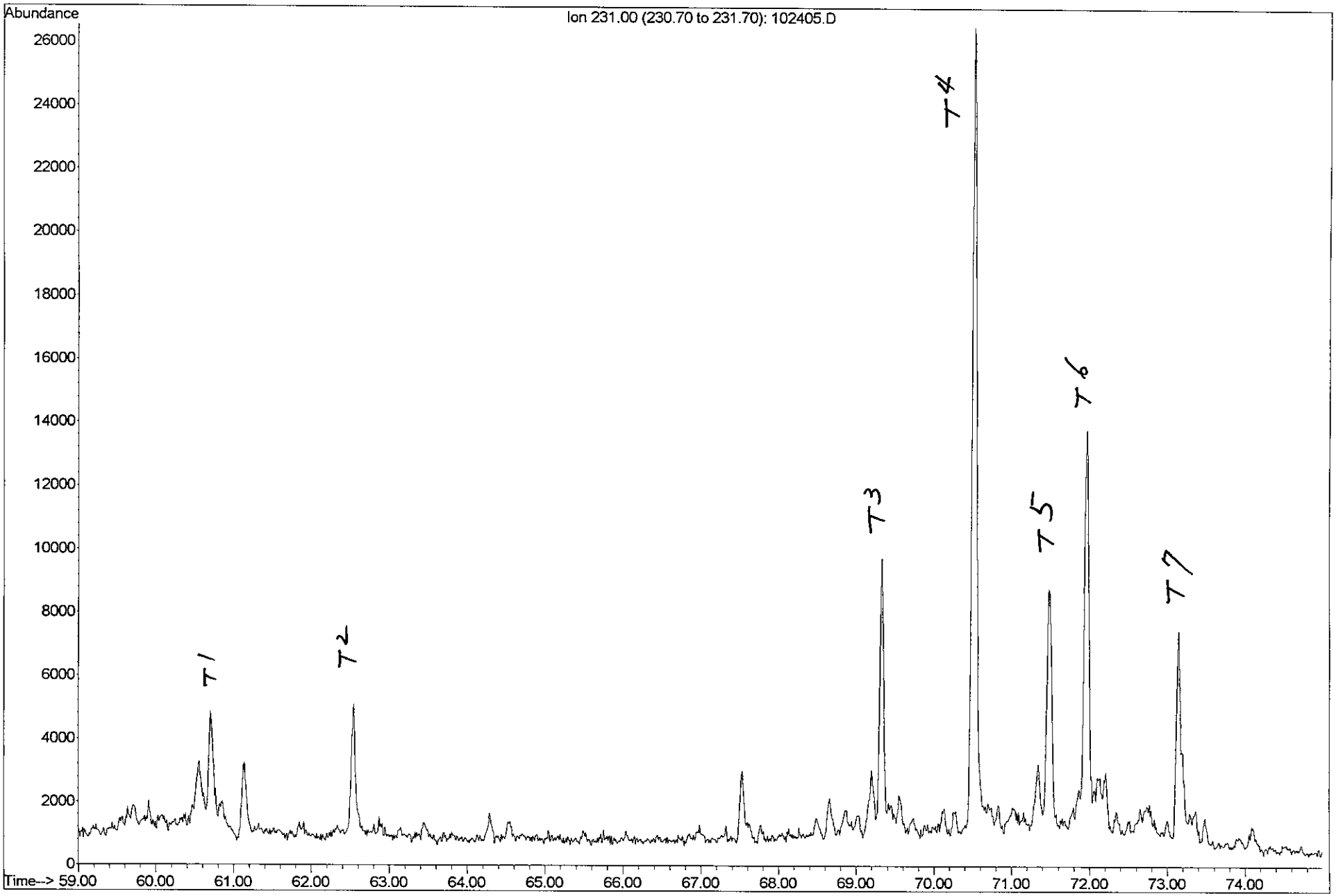

FTPH-FP-UT-W (41343-4) Heavy oil
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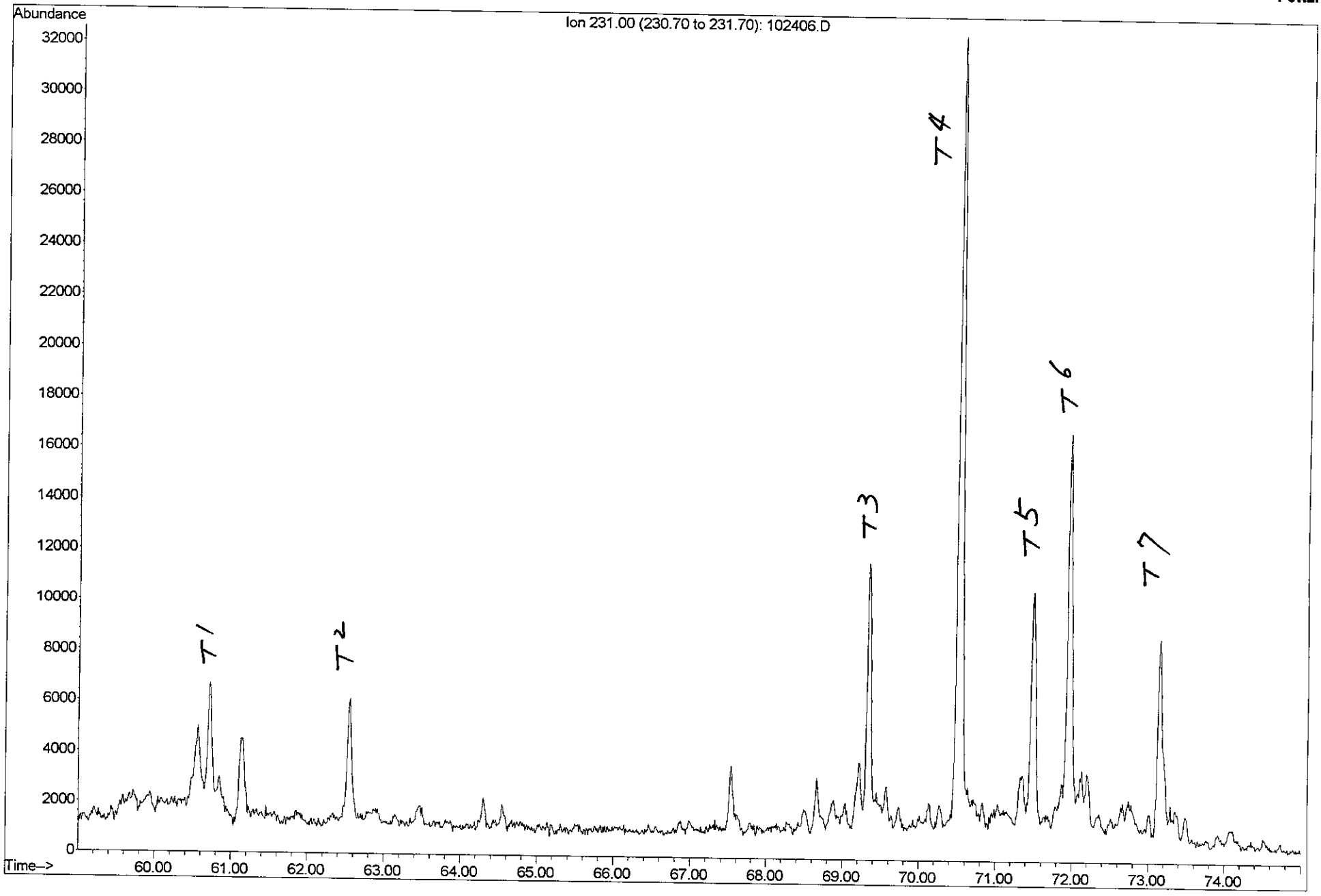

FTPH-FP-SB-G (41343-5) sheen
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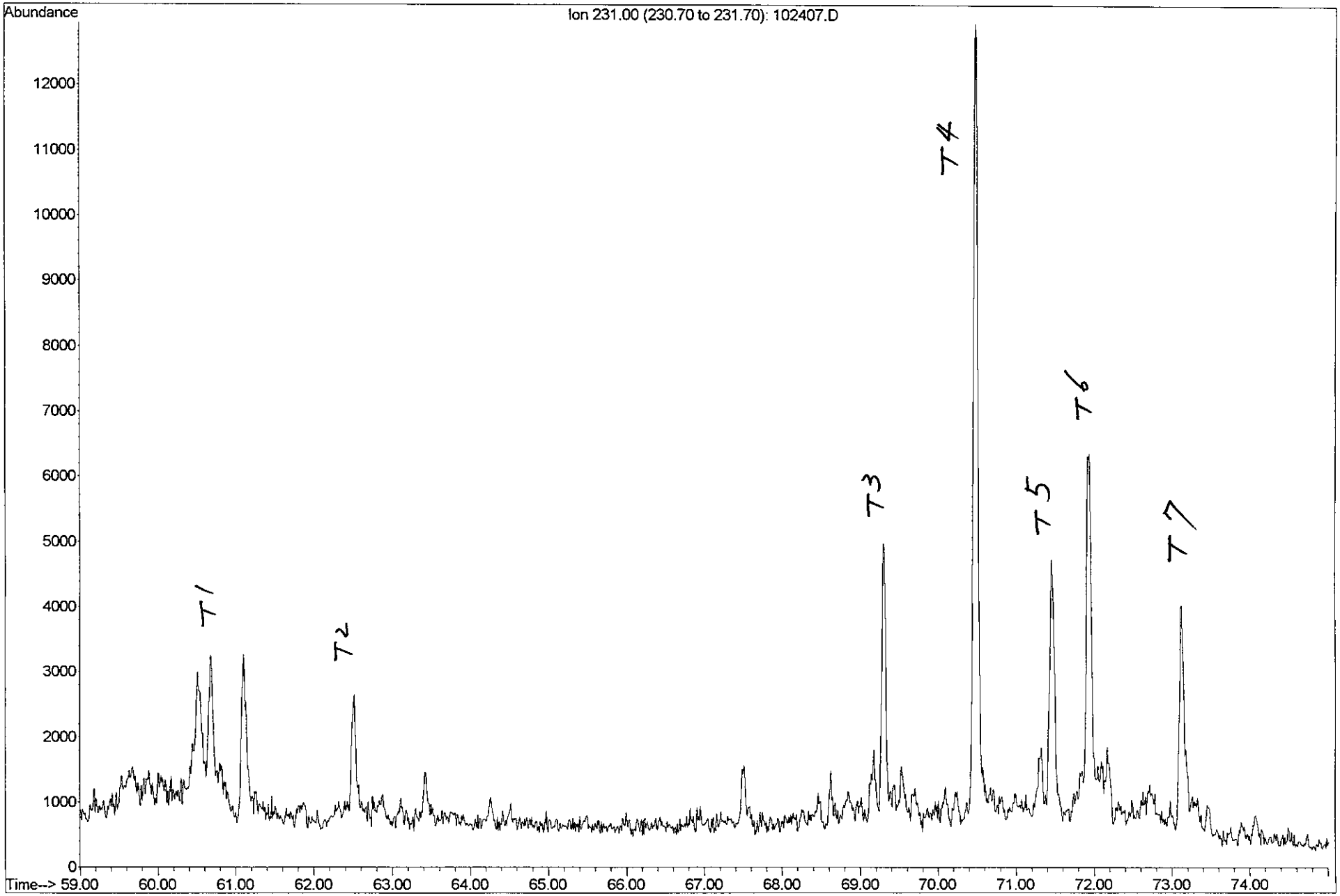

FTPH-FP-SB-K (41343-6) sheen
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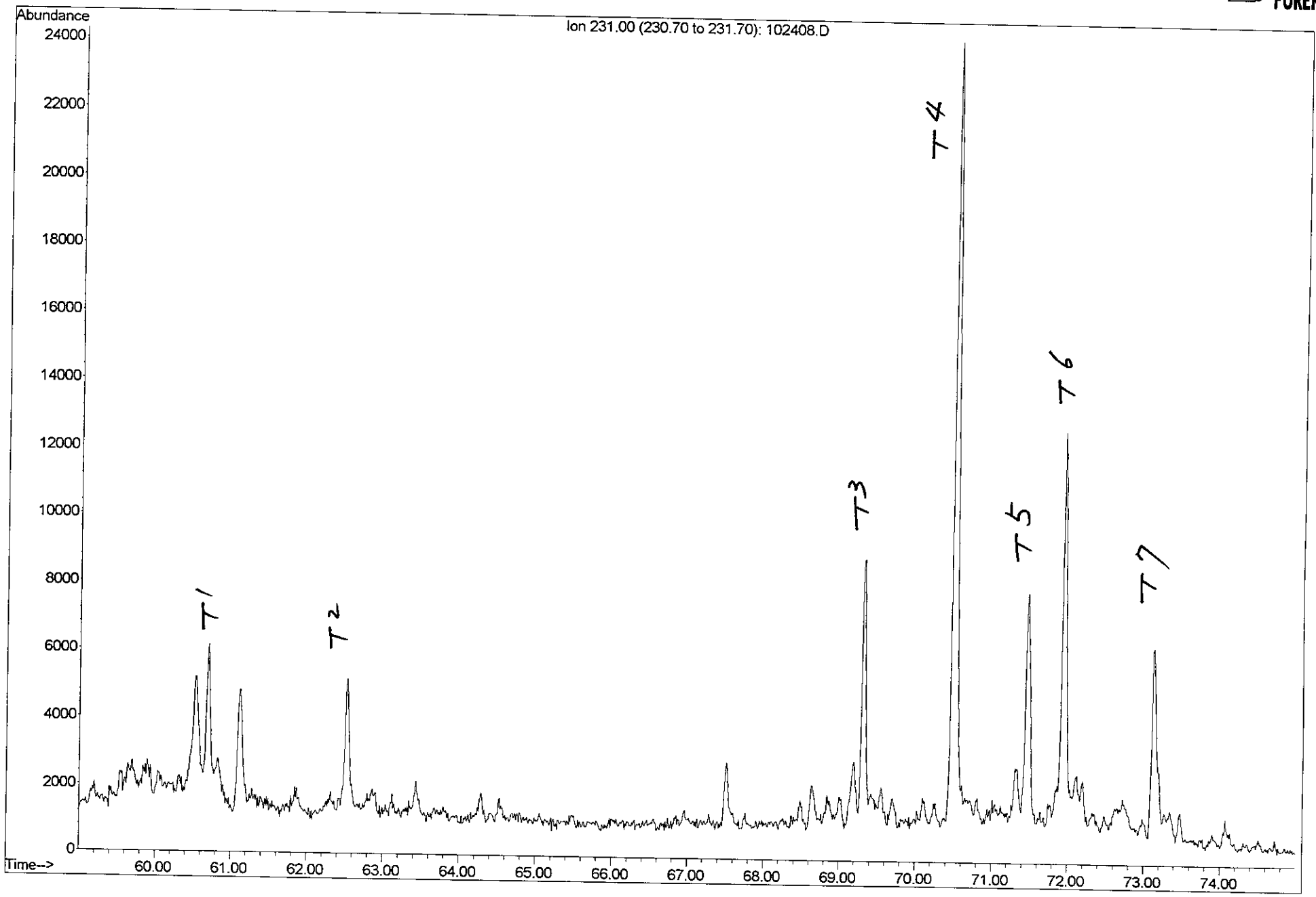
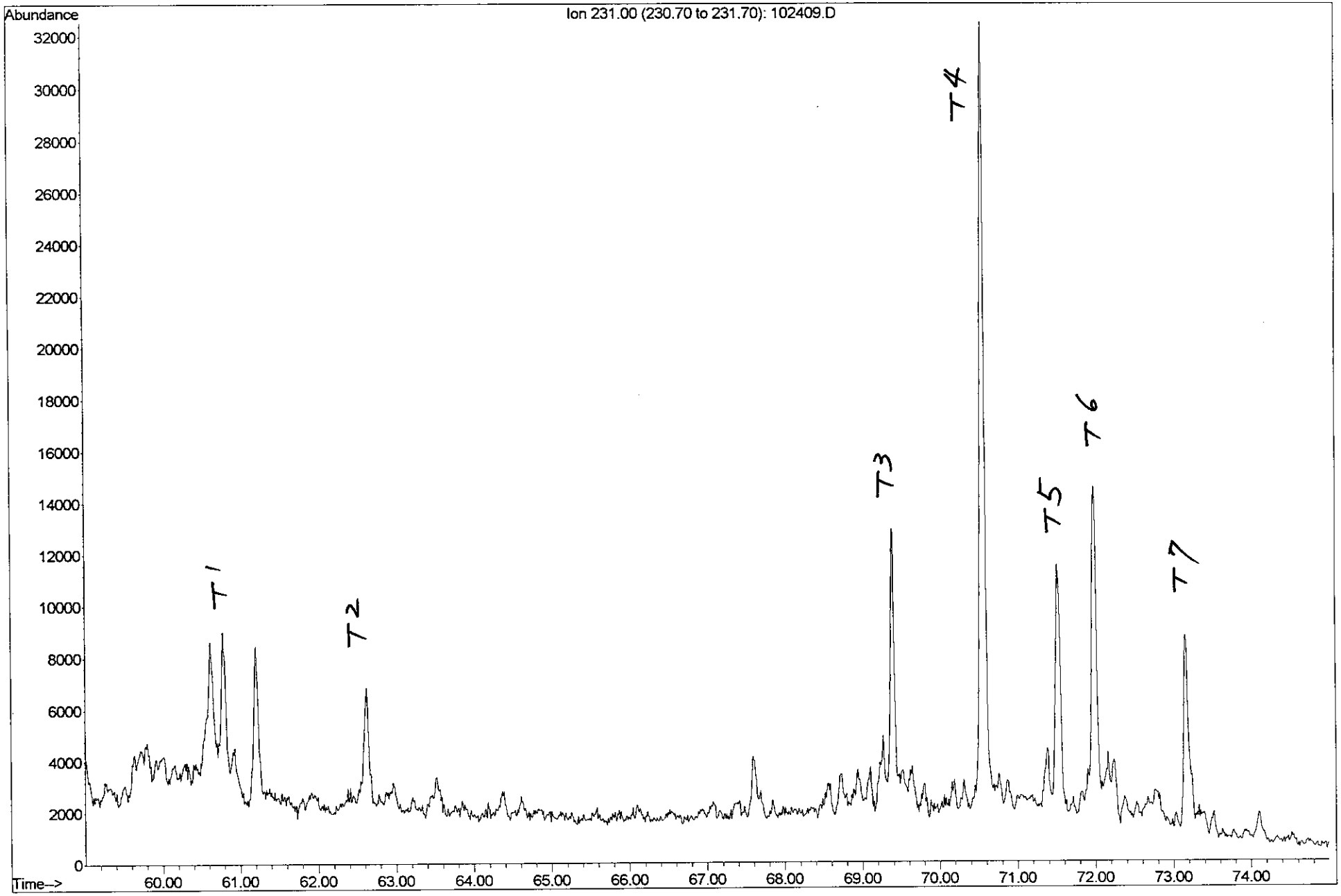
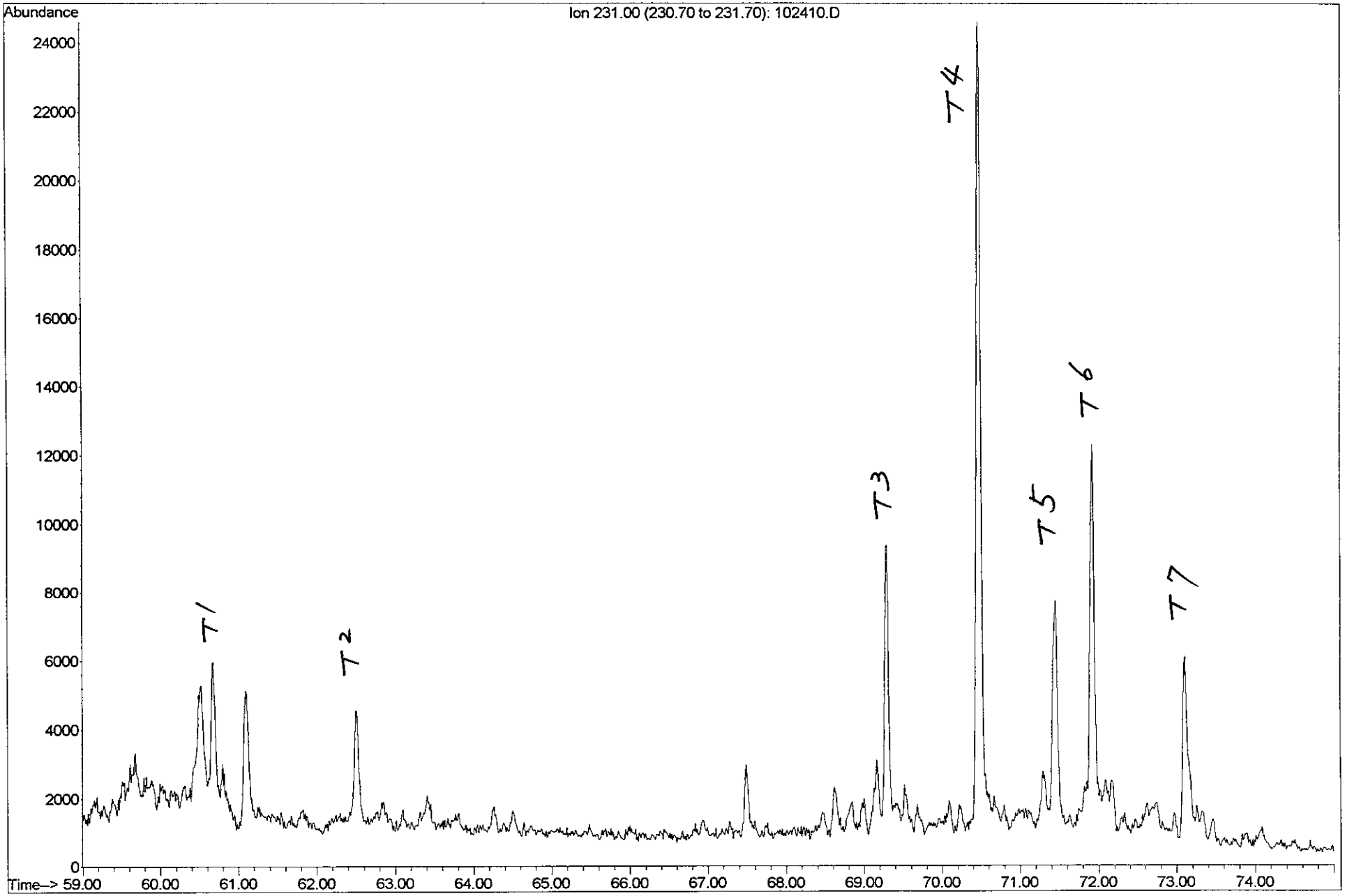


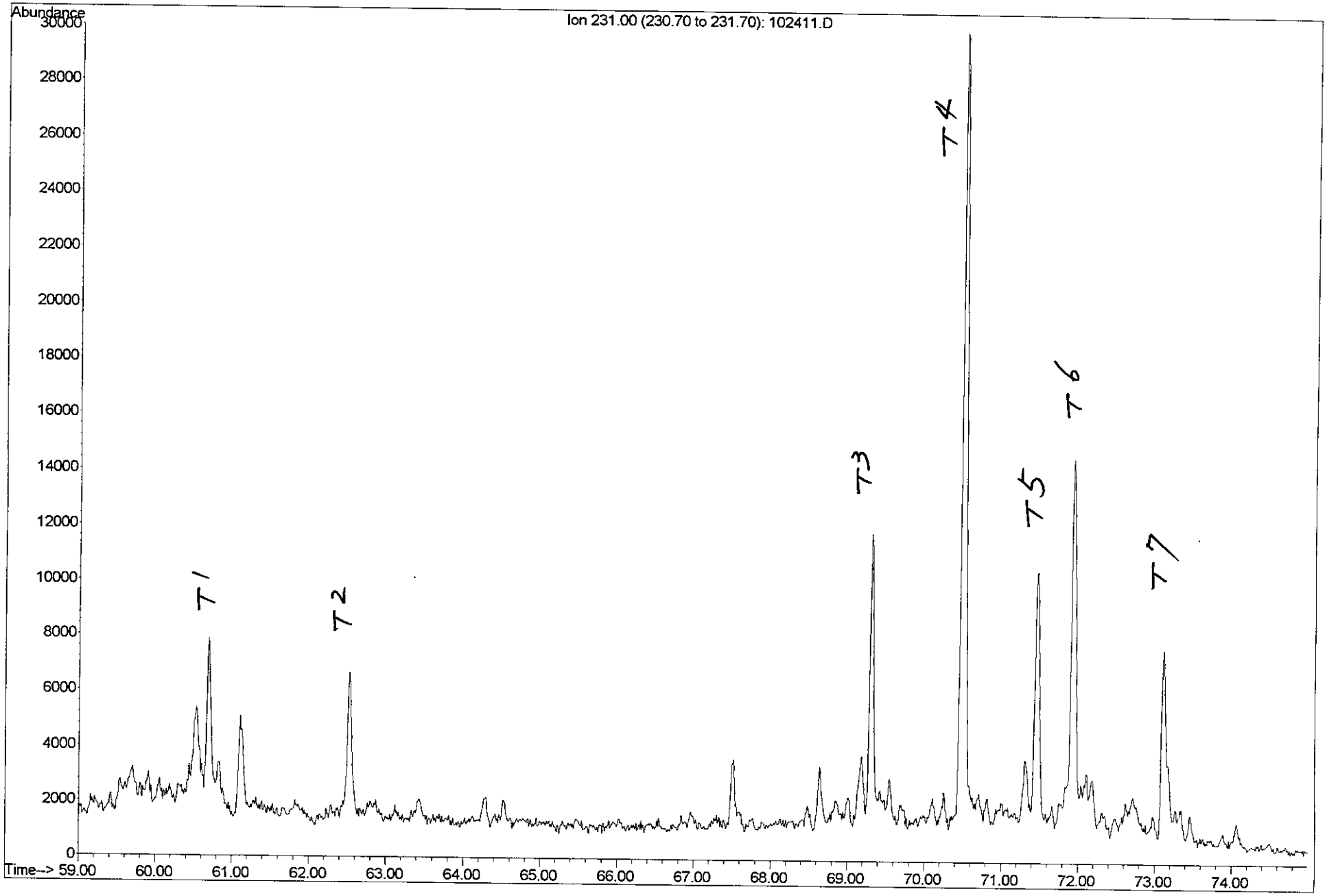
FTPH-FP-SB-L (41343-7) Heavy oil
Follow on TPH investigation



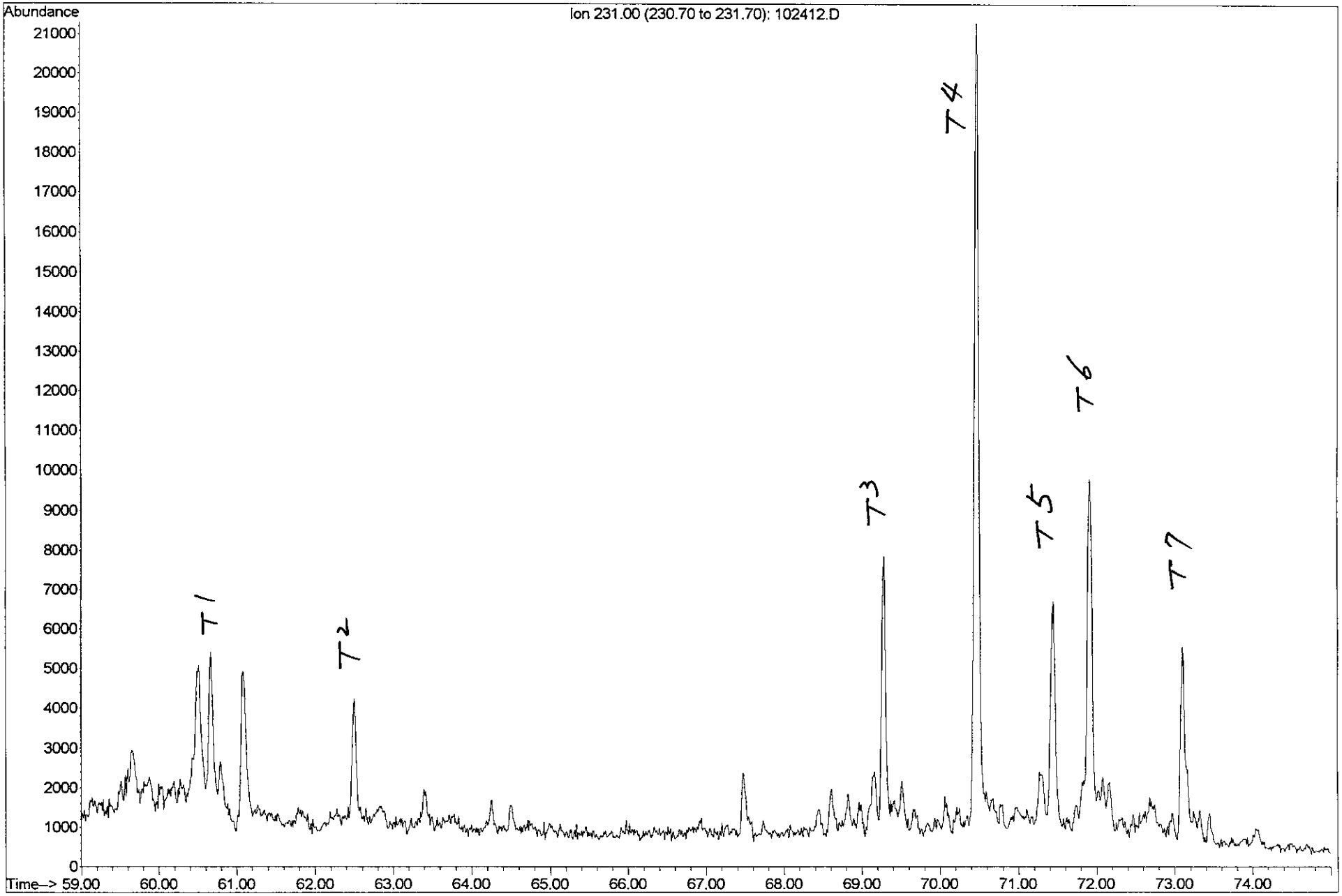
FTPH-FP-SB-WWW (41343-8) Heavy oil
Follow on TPH investigation



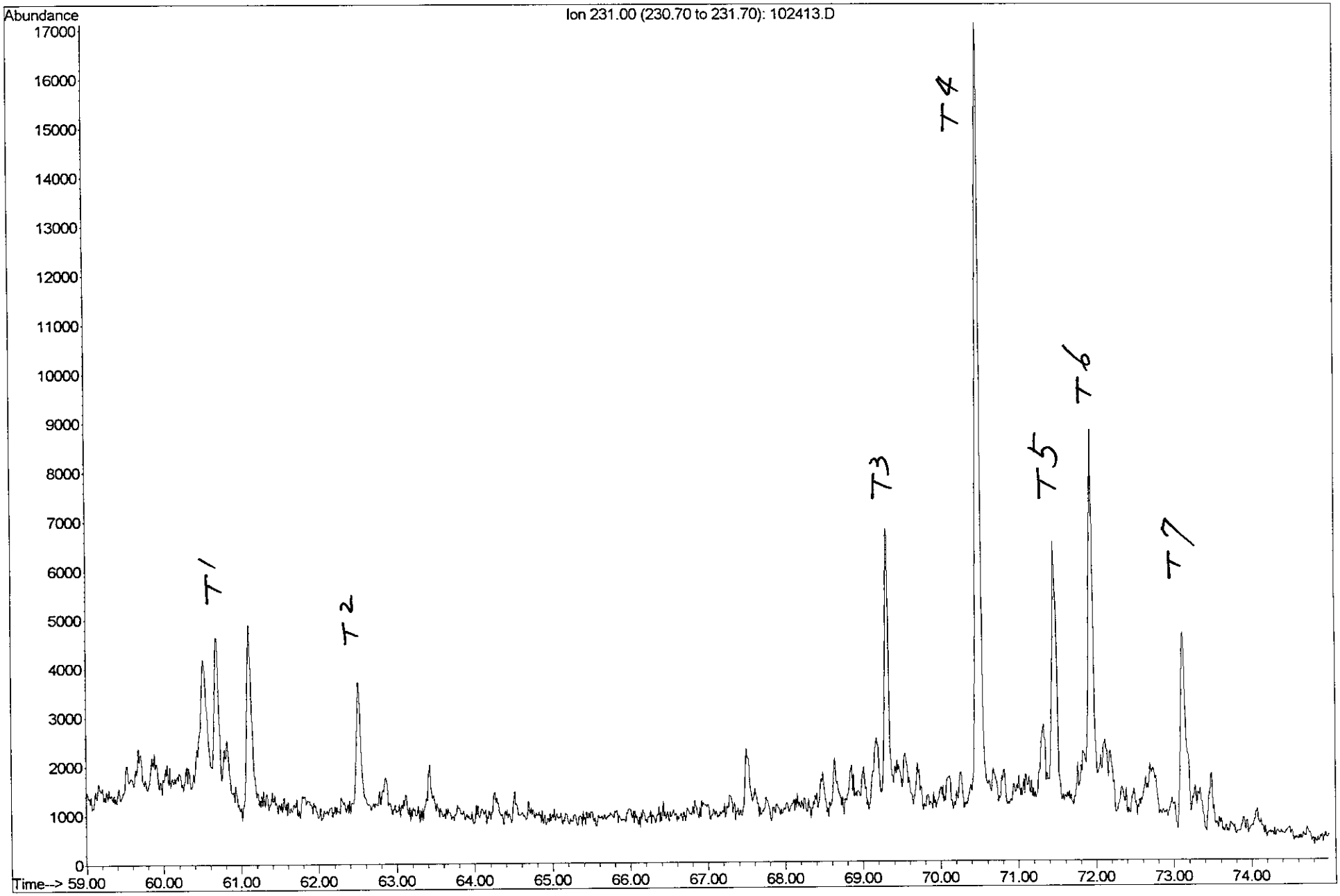
FTPH-FP-SB-O (41343-9) Heavy oil
Follow on TPH investigation



FTPH-FP-SB-R (41343-10) sheen
Follow on TPH investigation

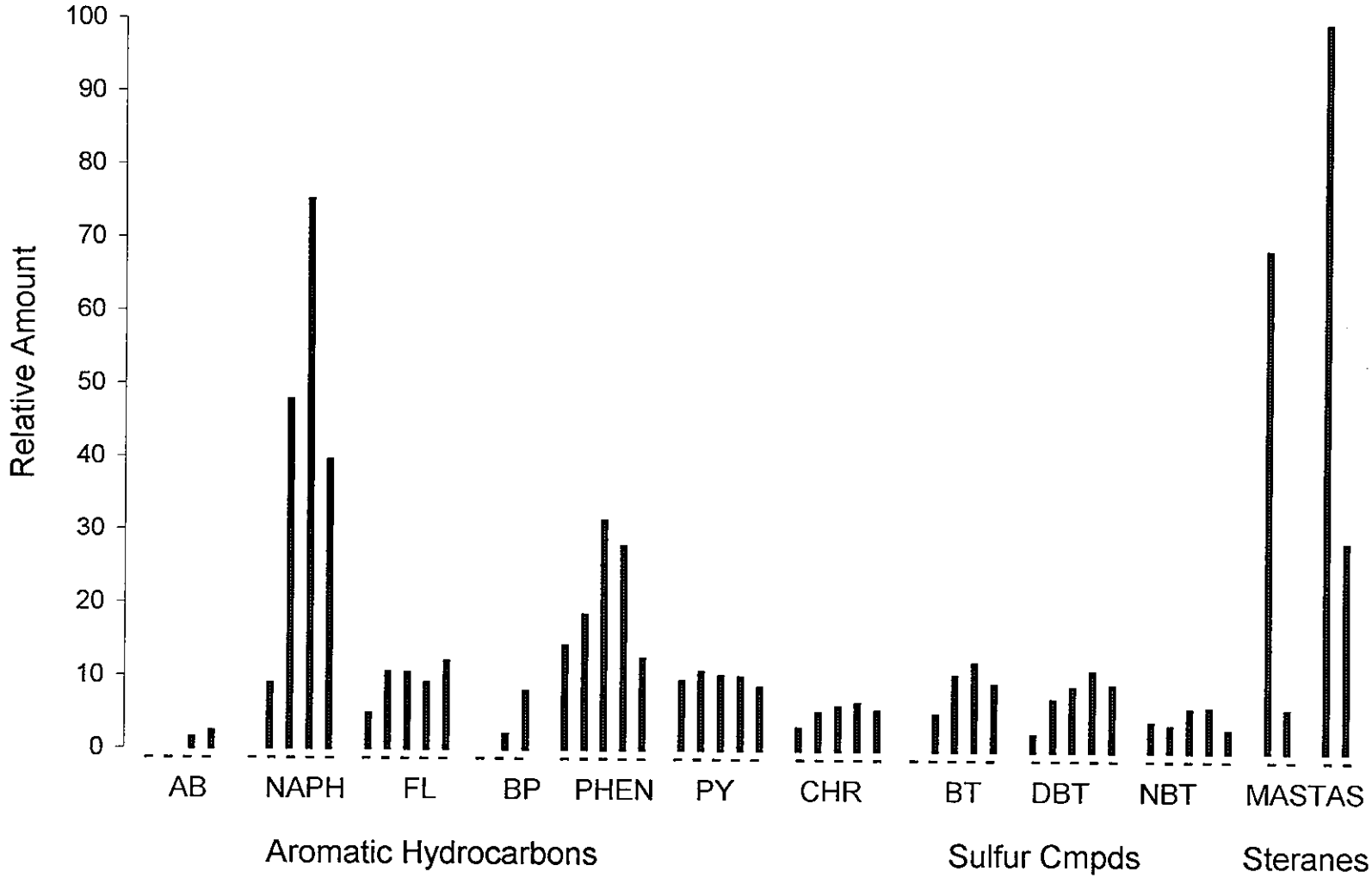


FTPH-FP-UT-BB (41343-11) Heavy oil
Follow on TPH investigation



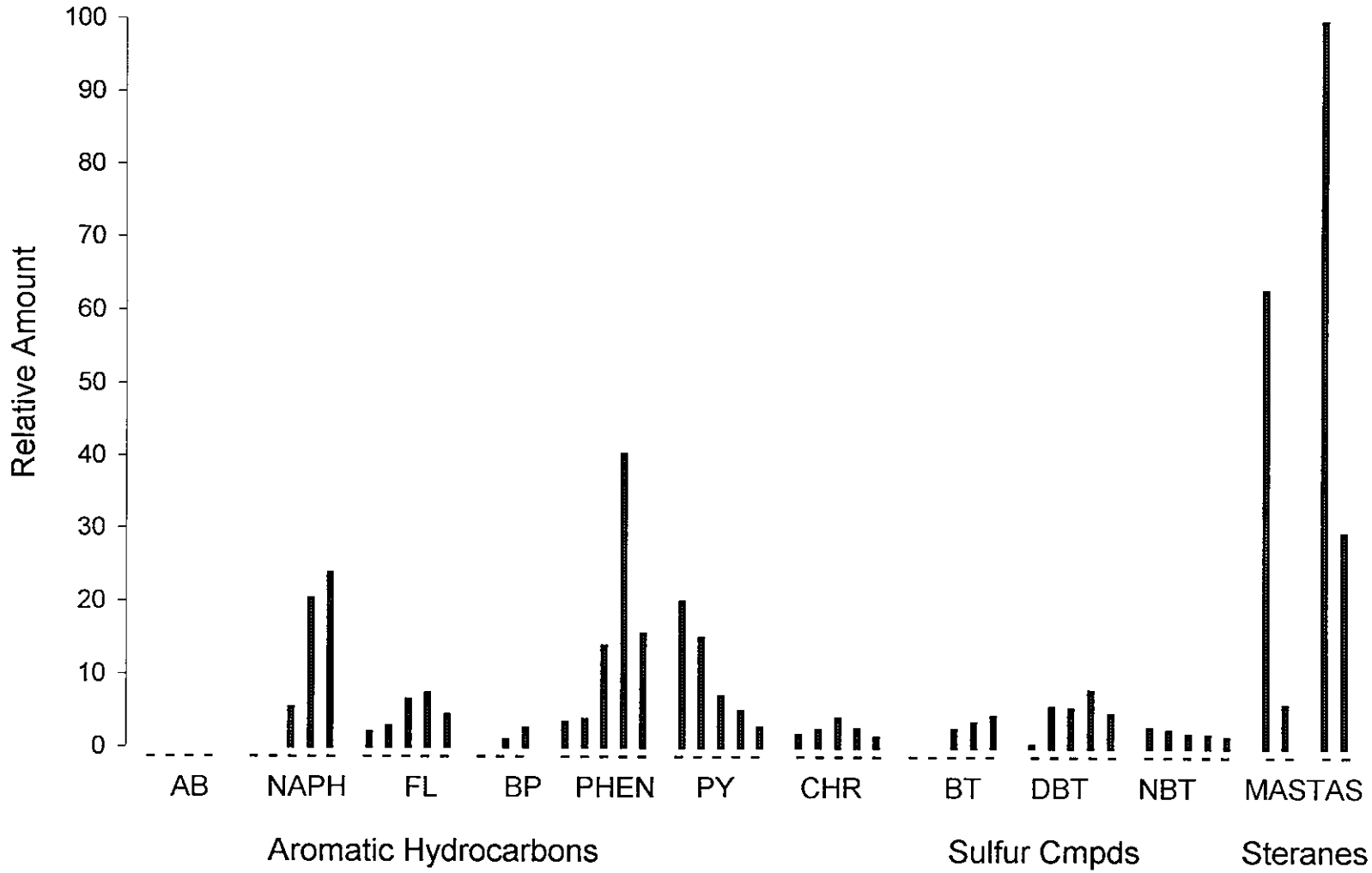
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-D



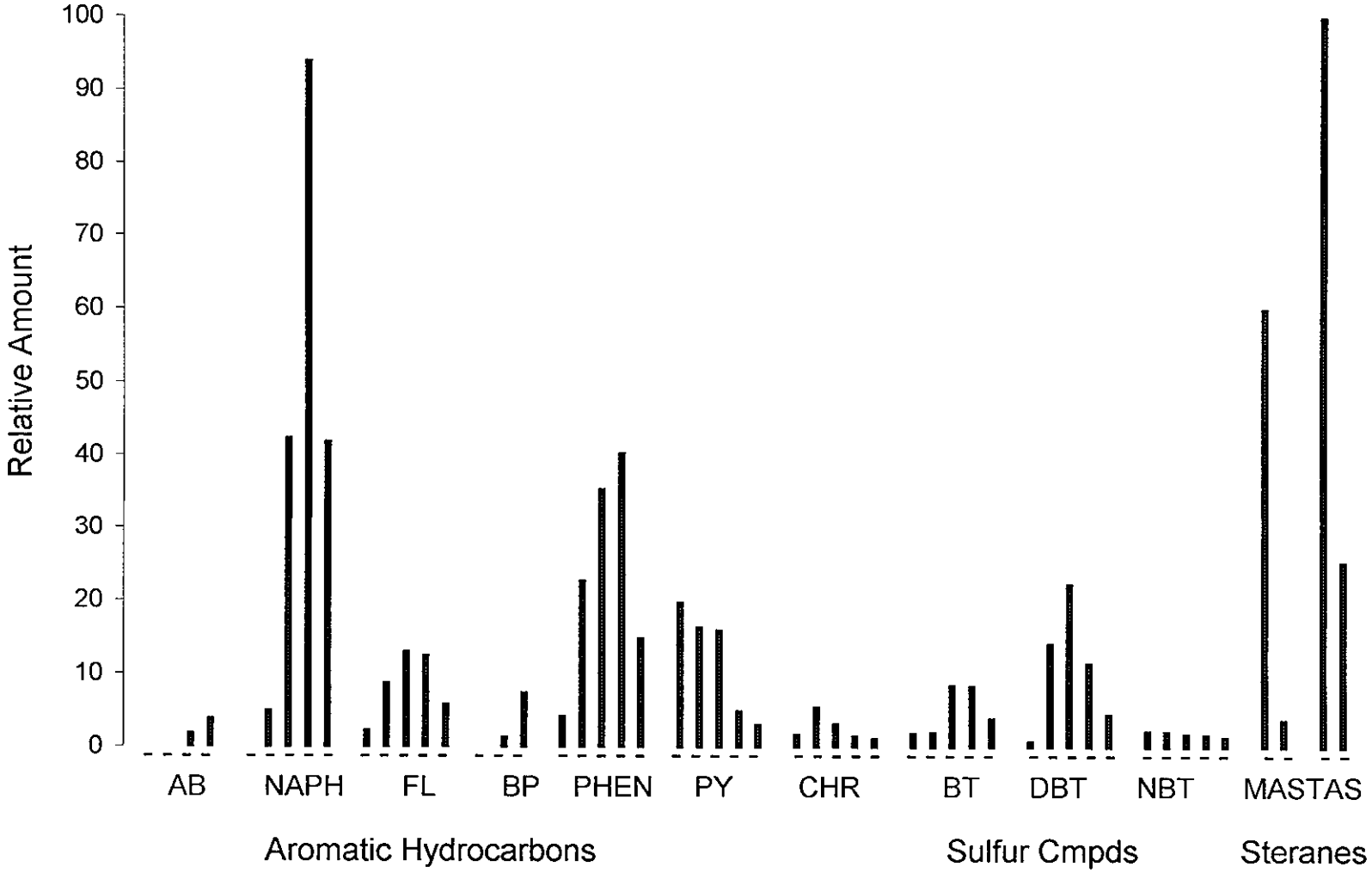
Aromatic Hydrocarbon Distribution

FTPH-FP-UT-Y



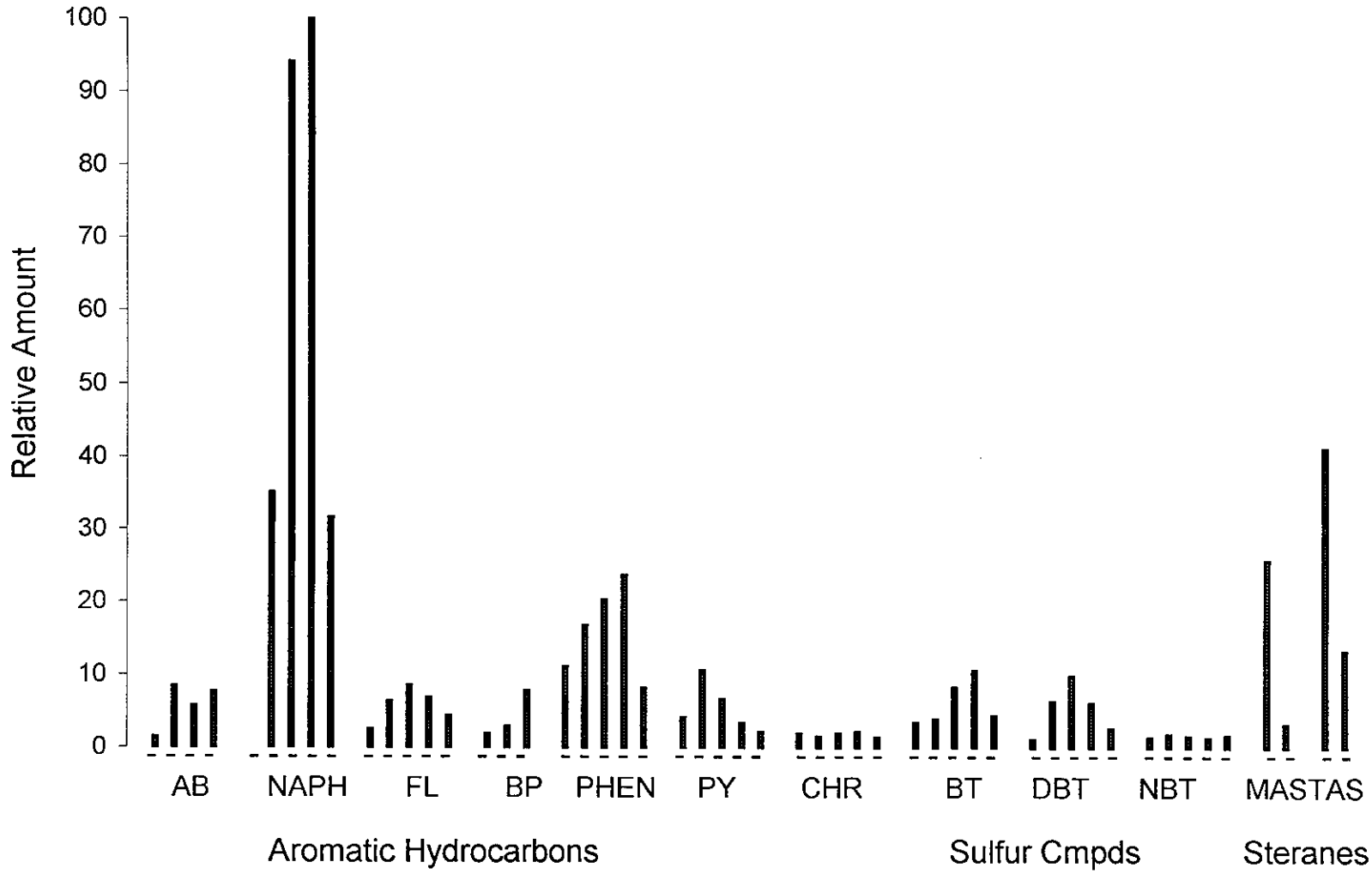
Aromatic Hydrocarbon Distribution

FTPH-FP-UT-W



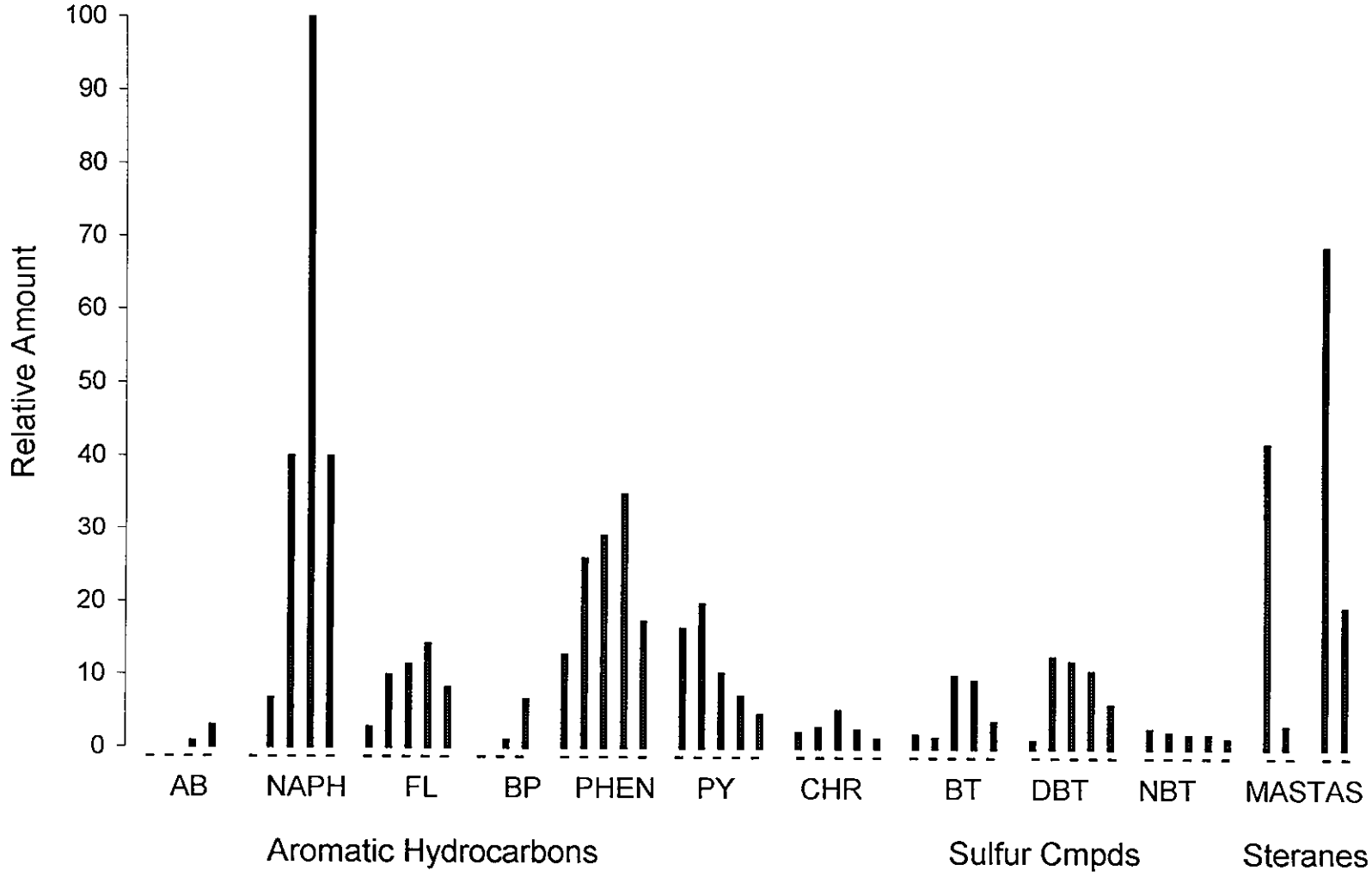
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-G



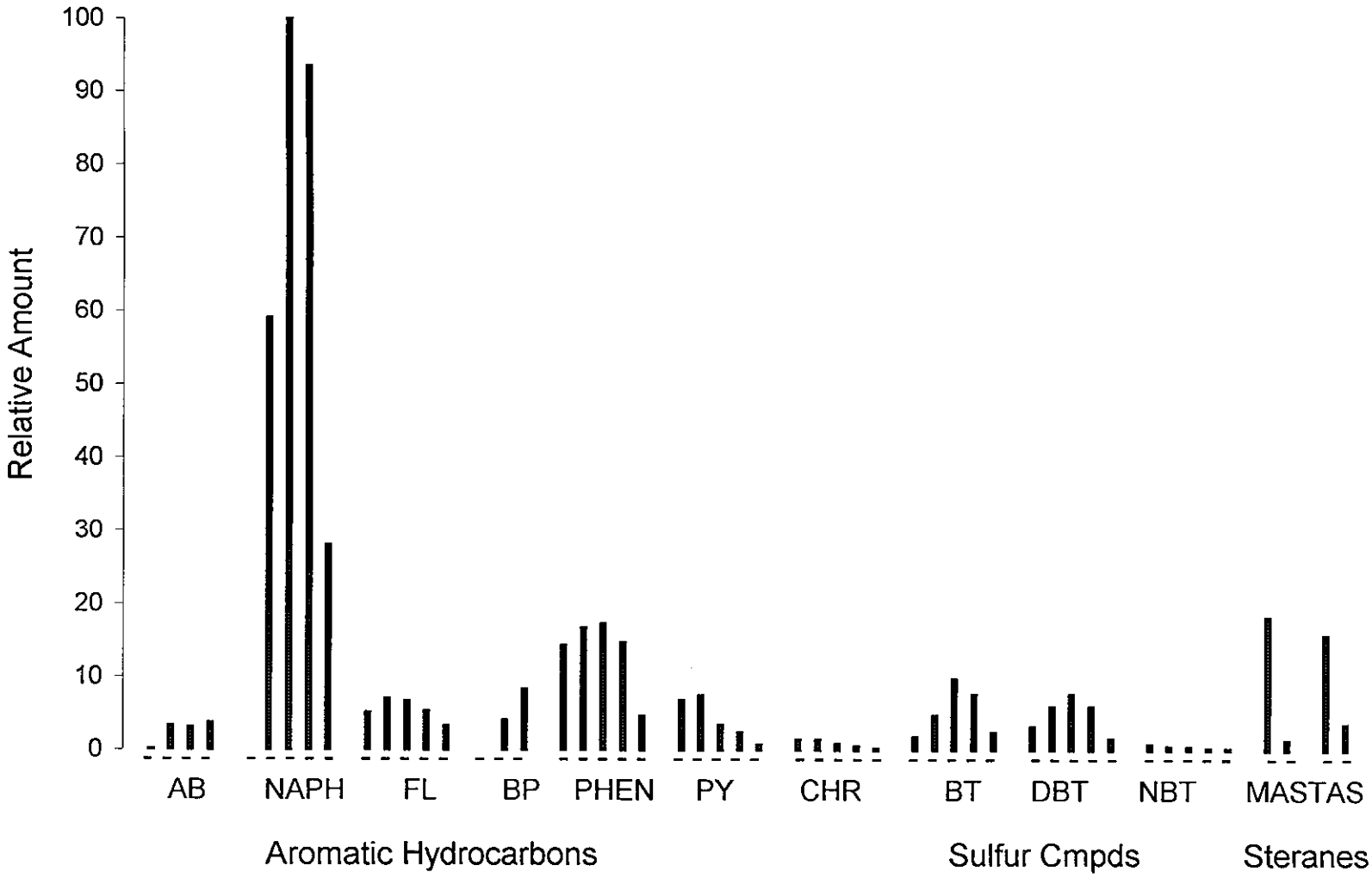
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-K



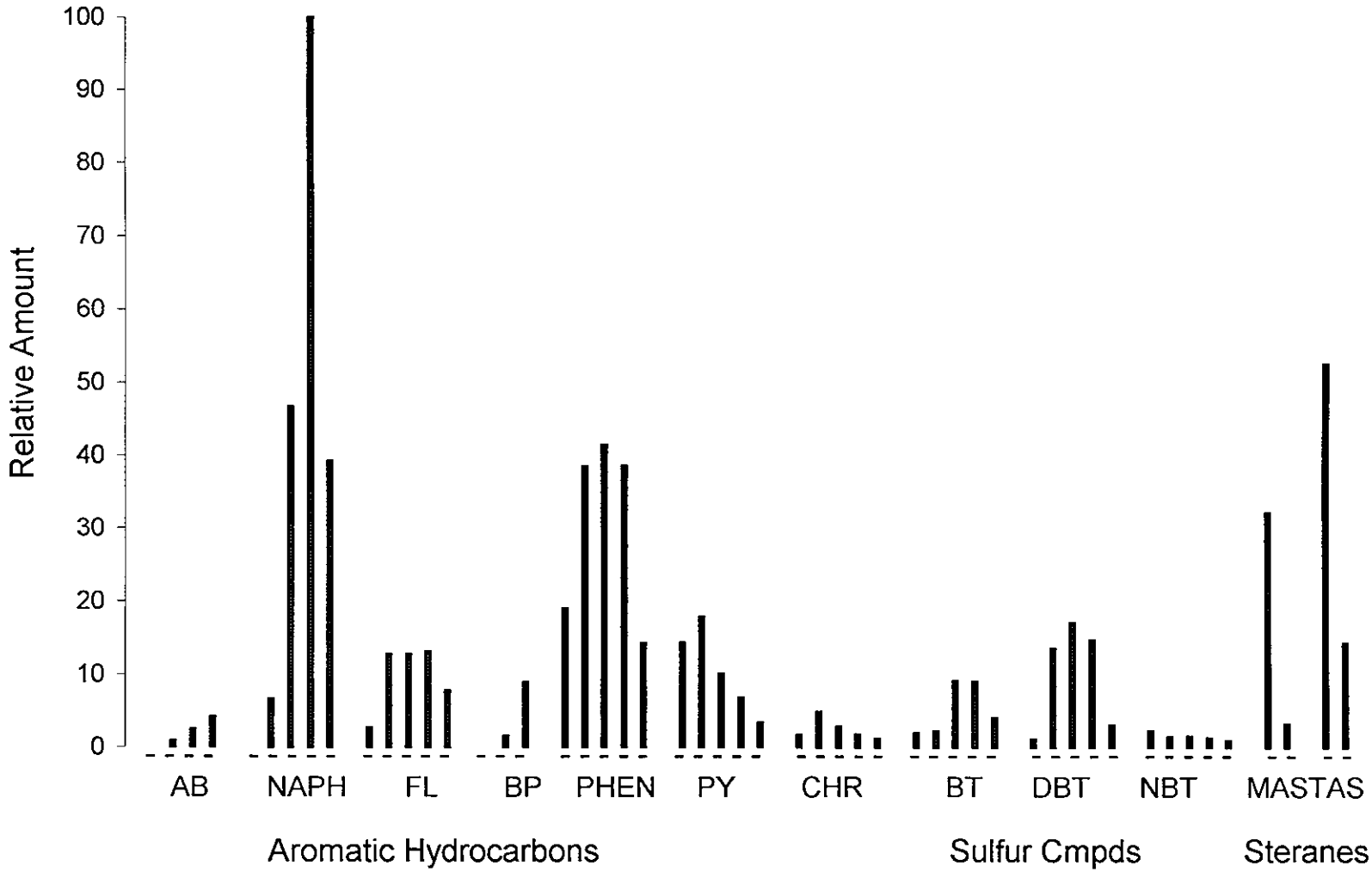
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-L



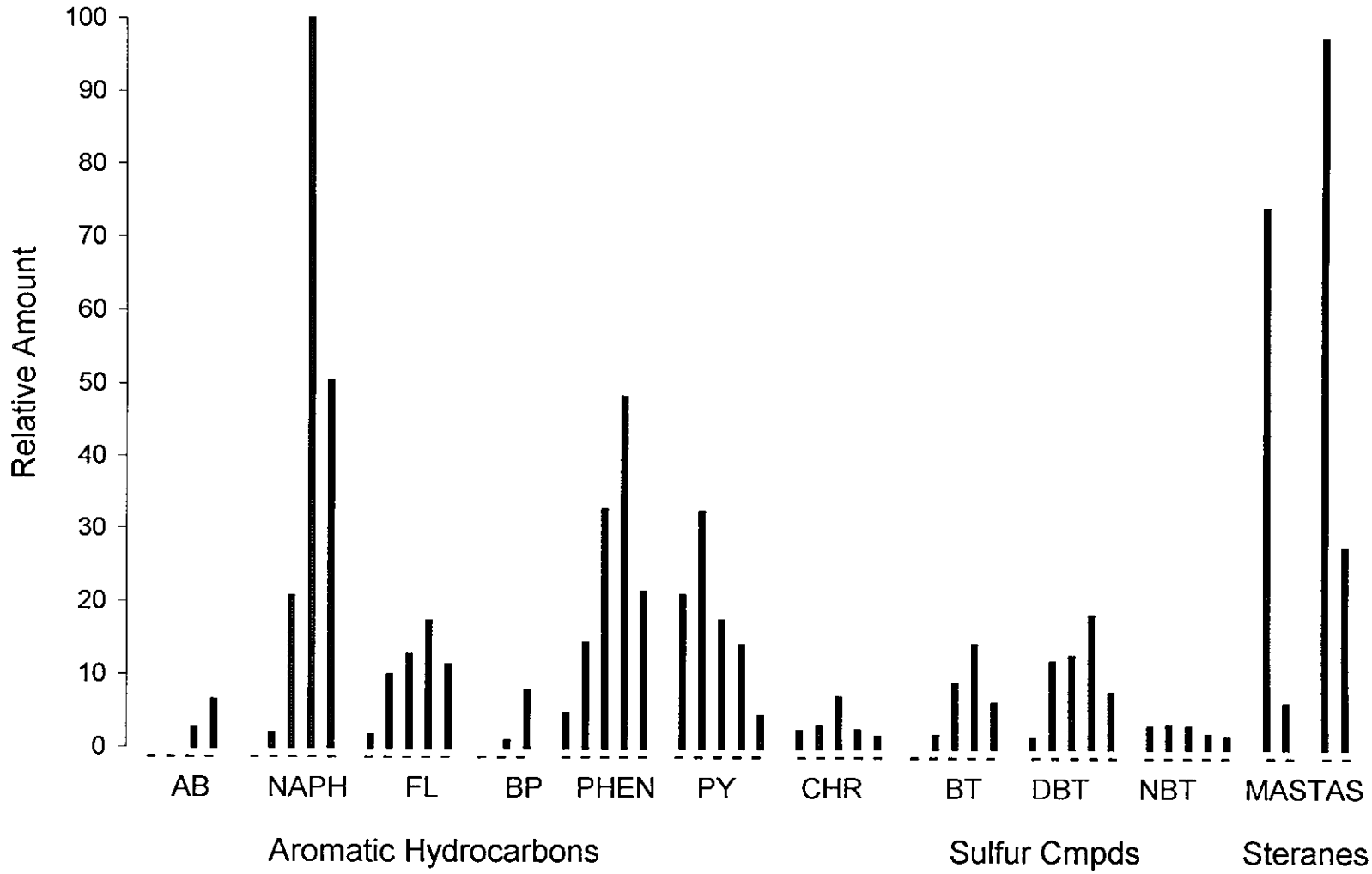
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-WWW



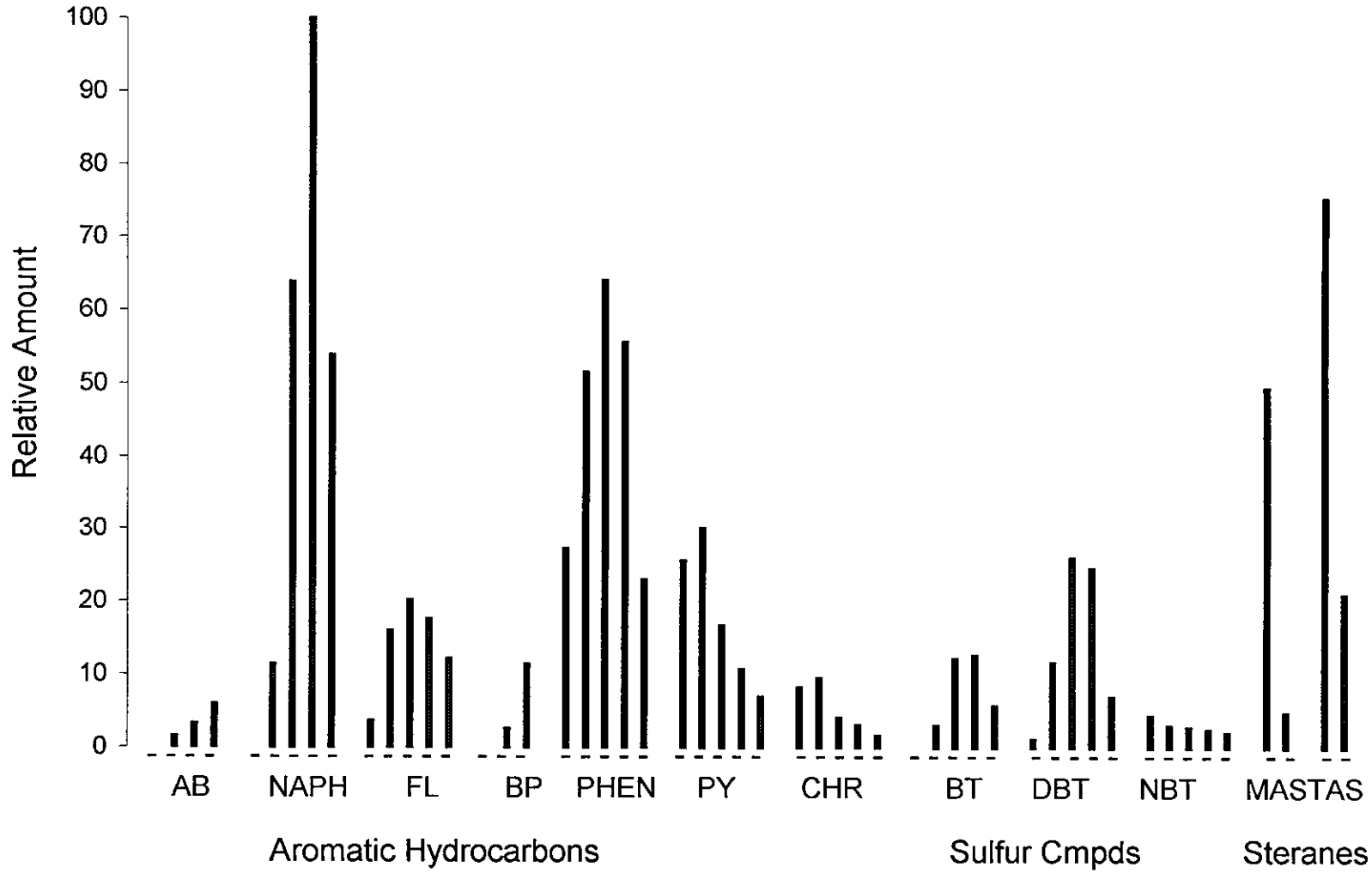
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-O



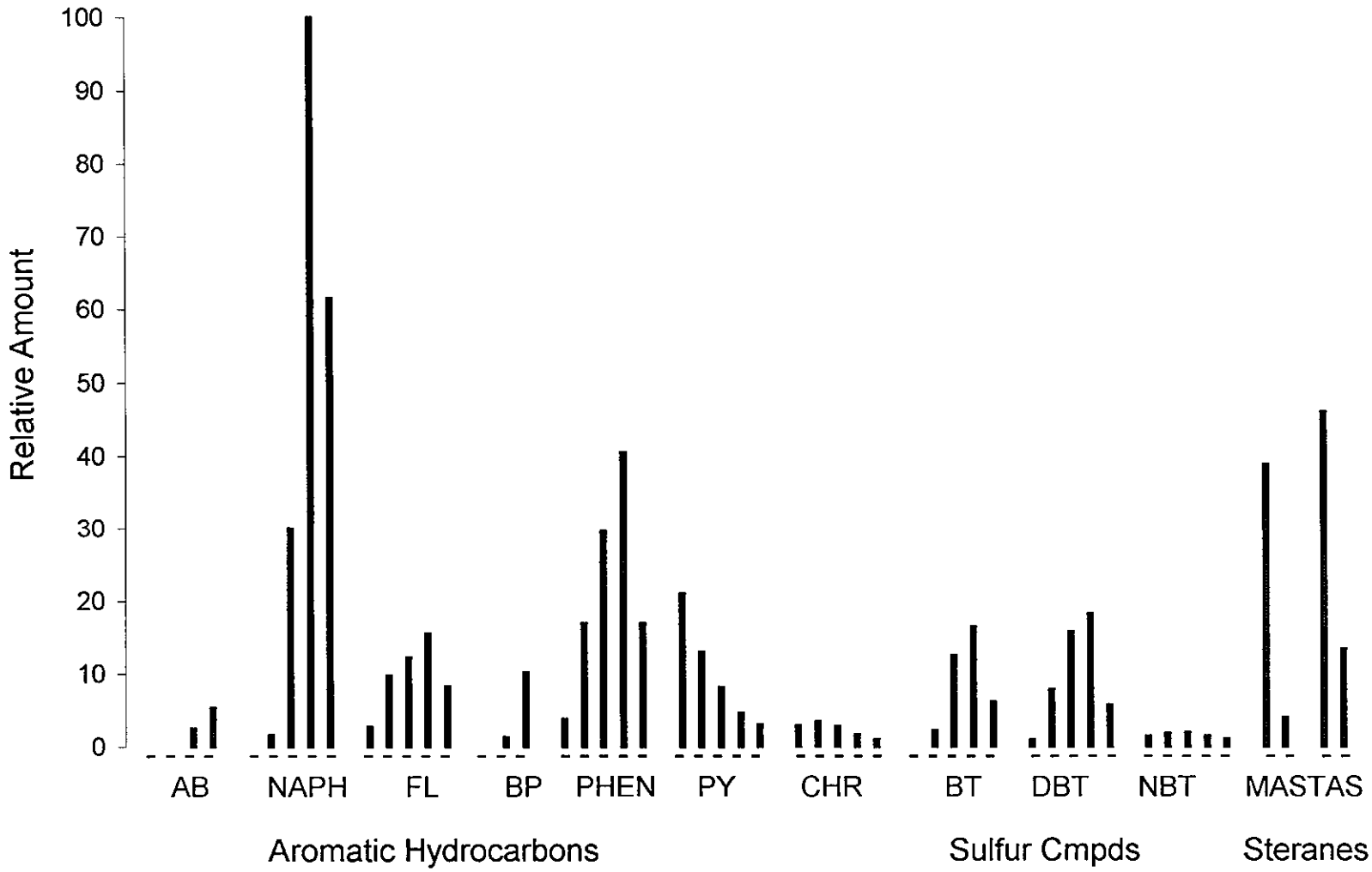
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-R



Aromatic Hydrocarbon Distribution

FTPH-FP-UT-BB



Chain of Custody Record

COC Number: **ZYMA-02**

CH2MHILL *11/3/2008 4:38:22 PM* Page 1 of 2

Project Name Mare Island **Location** Mare Island
Task Order 14.01 **Project:** Followon TPH Investigation DRMO Site
Project Number 273939.14.01
Project Manager Ellen Hedfield
Sample Manager Mike Godwin (707) 246-5781
Turnaround Time 21 Days
PO Number 273939.14.01

Sample ID	Sample Date/Time	Type	Matrix	# Containers	Preserv	FORENSIC ANALYSES	GC/MS Full Scan	Extended PAHs	C+H Isotopes
41362-1 FTPH-FP-SB-GG	24-Oct-08 14:30	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered:☐ 1	HCl, pH<2, 4'C	☑	☐	☒	☒	☒
				Total Containers:		1/2			
2 FTPH-FP-SB-MM	24-Oct-08 15:30	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered:☐ 1	HCl, pH<2, 4'C	☑	☐	☒	☐	☒
				Total Containers:		1/2			
3 FTPH-FP-SB-NN	27-Oct-08 14:45	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered:☐ 1	HCl, pH<2, 4'C	☑	☐	☒	☒	☒
				Total Containers:		1/2			
4 ~~FTPH-FP-SB-RR~~ SBQ PP	28-Oct-08 14:30	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered:☐ 1	HCl, pH<2, 4'C	☑	☐	☒	☒	☒
				Total Containers:		1/2			

MS = Matrix Spike SD = Matrix Spike Duplicate

	Signatures	Date/Time
Approved by		
Sampled by		11-5-08
Relinquished by		1800
Received by		11/6/08
Relinquished by		10:20
Received by		

Shipping Details
Method of Shipment: FedEx
On Ice: (yes) / no
Airbill No:
Lab Name: Zymax Forensics
Lab Phone: (805) 544-4696

ATTN:
Sample Custody
and
Alan Jeffrey

Special Instructions:

Report Copy to
Artemis Antipas
(425) 453-5005

Chain of Custody Record

COC Number: **ZYMA-02**

CH2MHILL *11/3/2008 4:38:26 PM*

Project Name Mare Island **Location** Mare Island
Task Order 14.01 **Project:** Followon TPH Investigation DRMO Site
Project Number 273939.14.01
Project Manager Ellen Hedfield
Sample Manager Mike Godwin (707) 246-5781
Turnaround Time 21 Days
PO Number 273939.14.01

Sample ID	Sample Date/Time	Type	Matrix	# Containers	Preserv	FORENSIC ANALYSES	GC/MS	EtCl. PAHs	C+H ISOTOPES
5 FTPH-FP-UT-QE	24-Oct-08 17:10	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS			Field Filtered: ☐	1/2	HCl, pH<2, 4°C	☑	☐	☒	☐	☒
			Total Containers:	1					
6 FTPH-FP-UT-QT	24-Oct-08 17:30	N	Water						
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS			Field Filtered: ☐	1/2	HCl, pH<2, 4°C	☑	☐	☒	☒	☒
			Total Containers:	1					

MS = Matrix Spike **SD = Matrix Spike Duplicate**

	Signatures	Date/Time
Approved by		
Sampled by		11-5-08
Relinquished by		1800
Received by		
Relinquished by		
Received by		

Shipping Details
Method of Shipment: FedEx
On Ice: (yes) / no
Airbill No:
Lab Name: Zymax Forensics
Lab Phone: (805) 544-4696

ATTN:
Sample Custody
and
Alan Jeffrey

Special Instructions:

Report Copy to
Artemis Antipas
(425) 453-5005

Chain of Custody Record

COC Number: **ZYMA-03**

CH2MHILL *11/5/2008 5:26:01 PM* Page 1 of 1

Project Name Mare Island **Location** Mare Island
Task Order 14.01 **Project:** Followon TPH Investigation DRMO Site
Project Number 273939.14.01
Project Manager Ellen Hedfield
Sample Manager Mike Godwin (707) 246-5781
Turnaround Time 21 Days
PO Number 273939.14.01

Sample ID	Sample Date/Time	Type	Matrix	# Containers	Preserv	FORENSIC ANALYSES		GC/MS	Ext PAHs	C+H ISOTOPES																
7 FTPH-FP-SB-C	05-Nov-08 8:35	N	Water																							
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				1	HCl, pH<2, 4'C	☑	☐	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Total Containers:	SBR 1/2																					
8 FTPH-FP-SB-VV	05-Nov-08 8:00	N	Water																							
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				1	HCl, pH<2, 4'C	☑	☐	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
				Total Containers:	SBR 1/2																					

MS = Matrix Spike SD = Matrix Spike Duplicate

	Signatures	Date/Time
Approved by		
Sampled by	Steph B. Gust	11-5-08
Relinquished by		1800
Received by		
Relinquished by		
Received by		

Shipping Details
Method of Shipment: FedEx
On Ice: (yes) no
Airbill No: 790129594382
Lab Name: Zymax Forensics
Lab Phone: (805) 544-4696

ATTN:
Sample Custody
and
Alan Jeffrey

Special Instructions:

Report Copy to
Artemis Antipas
(425) 453-5005

Isotech Data
Job 10644
Project 41362

Isotech Lab No.	Sample Name	δ^2H ‰
149753	41362-1	-131
149754	41362-2	-132
149755	41362-3	-138
149756	41362-4	-148
149757	41362-5	-132
149758	41362-6	-134
149759	41362-7	-134
149760	41362-8	-139

REPORT OF ANALYTICAL RESULTS

ZymaX FORENSICS

Client:	**Ellen Hedfield** **CH2M HILL** **690 Walnut Ave., Ste. 230** **Vallejo, CA 94592**	**Lab Number:** **Received:** **Matrix:**	**41362** **11/6/2008** **Fractions**
Project: **Project Number:** **Collected by:**	**Mare Island** **273939.14.01** **Mike Godwin**	**Sample Description:** **See Below** **Analyzed:** **Method:**	 **11/7/2008** **CF-IRMS**

$\delta^{13}C$

LAB NUMBER	SAMPLE DESCRIPTION	$\delta^{13}C$ ‰
41362-1	FTPH-FP-SB-GG	-23.4
41362-2	FTPH-FP-SB-MM	-23.8
41362-3	FTPH-FP-SB-NN	-23.0
41362-4	FTPH-FP-SB-PP	-23.7
41362-5	FTPH-FP-UT-QE	-23.2
41362-6	FTPH-FP-UT-QT	-22.5
41362-7	FTPH-FP-SB-C	-23.7
41362-8	FTPH-FP-SB-VV	-23.3
Analytical Precision (1-sigma)		0.2

Submitted by,
ZymaX FORENSICS

River He, PhD
Isotope Lab Manager

41362c.xls
RH/JH D12.03 04

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-1
Collected:	10/24/08
Received:	11/06/08
Matrix:	Heavy Oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-GG
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	24.5
C2 Benzothiophenes	2.5	48.0
C3 Benzothiophenes	2.5	64.5
C4 Benzothiophenes	2.5	73.0
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	228.8
2-Methylnaphthalene	2.5	23.7
C2 Naphthalenes	2.5	634.4
C3 Naphthalenes	2.5	584.5
C4 Naphthalenes	2.5	519.7
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	4.4
Acenaphthene	2.5	3.1
Fluorene	2.5	40.2
C1 Fluorenes	2.5	69.5
C2 Fluorenes	2.5	30.9
C3 Fluorenes	2.5	52.0
Anthracene	2.5	27.5
Phenanthrene	2.5	120.3
C1 Phenanthrenes/Anthracenes	2.5	263.9
C2 Phenanthrenes/Anthracenes	2.5	345.1
C3 Phenanthrenes/Anthracenes	2.5	293.6
C4 Phenanthrenes/Anthracenes	2.5	97.2

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-1pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-1
Collected:	10/24/08
Received:	11/06/08
Matrix:	Heavy Oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-GG
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	7.5
C1 Dibenzothiophenes	2.5	92.0
C2 Dibenzothiophenes	2.5	109.1
C3 Dibenzothiophenes	2.5	88.0
C4 Dibenzothiophenes	2.5	75.3
Fluoranthene	2.5	12.0
Pyrene	2.5	50.0
C1 Pyrenes/Fluoranthenes	2.5	194.0
C2 Pyrenes/Fluoranthenes	2.5	177.5
C3 Pyrenes/Fluoranthenes	2.5	82.5
Benz(a)anthracene	2.5	8.8
Chrysene	2.5	25.0
C1 Chrysenes	2.5	126.2
C2 Chrysenes	2.5	88.7
C3 Chrysenes	2.5	49.9
C4 Chrysenes	2.5	16.4
Benzo(b)fluroanthene	2.5	3.1
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	7.1
Benzo(a)pyrene	2.5	3.7
Perylene	2.5	10.2
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	2.7

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

for Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-1pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-3
Collected:	10/27/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-NN
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	38.9
C2 Benzothiophenes	2.5	59.9
C3 Benzothiophenes	2.5	82.6
C4 Benzothiophenes	2.5	110.4
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	252.4
2-Methylnaphthalene	2.5	124.2
C2 Naphthalenes	2.5	761.2
C3 Naphthalenes	2.5	994.1
C4 Naphthalenes	2.5	883.7
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	9.9
Acenaphthene	2.5	14.9
Fluorene	2.5	60.7
C1 Fluorenes	2.5	89.9
C2 Fluorenes	2.5	42.6
C3 Fluorenes	2.5	81.7
Anthracene	2.5	30.4
Phenanthrene	2.5	129.9
C1 Phenanthrenes/Anthracenes	2.5	300.1
C2 Phenanthrenes/Anthracenes	2.5	446.6
C3 Phenanthrenes/Anthracenes	2.5	446.1
C4 Phenanthrenes/Anthracenes	2.5	139.7

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-3pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-3
Collected:	10/27/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-NN
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	26.5
C1 Dibenzothiophenes	2.5	116.7
C2 Dibenzothiophenes	2.5	159.7
C3 Dibenzothiophenes	2.5	151.9
C4 Dibenzothiophenes	2.5	135.8
Fluoranthene	2.5	16.8
Pyrene	2.5	37.4
C1 Pyrenes/Fluoranthenes	2.5	170.4
C2 Pyrenes/Fluoranthenes	2.5	206.7
C3 Pyrenes/Fluoranthenes	2.5	117.1
Benz(a)anthracene	2.5	8.2
Chrysene	2.5	25.9
C1 Chrysenes	2.5	148.1
C2 Chrysenes	2.5	120.6
C3 Chrysenes	2.5	59.8
C4 Chrysenes	2.5	21.2
Benzo(b)fluroanthene	2.5	5.6
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	8.2
Benzo(a)pyrene	2.5	4.8
Perylene	2.5	7.5
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	3.1

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

for Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-3pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-4
Collected:	10/28/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-PP
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	34.4
C2 Benzothiophenes	2.5	60.5
C3 Benzothiophenes	2.5	97.4
C4 Benzothiophenes	2.5	134.0
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	316.3
2-Methylnaphthalene	2.5	242.7
C2 Naphthalenes	2.5	1276.4
C3 Naphthalenes	2.5	1263.2
C4 Naphthalenes	2.5	1115.5
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	13.0
Acenaphthene	2.5	20.7
Fluorene	2.5	92.5
C1 Fluorenes	2.5	139.0
C2 Fluorenes	2.5	59.7
C3 Fluorenes	2.5	94.7
Anthracene	2.5	19.2
Phenanthrene	2.5	208.2
C1 Phenanthrenes/Anthracenes	2.5	456.6
C2 Phenanthrenes/Anthracenes	2.5	609.8
C3 Phenanthrenes/Anthracenes	2.5	494.1
C4 Phenanthrenes/Anthracenes	2.5	177.1

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-4pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-4
Collected:	10/28/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-PP
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	39.6
C1 Dibenzothiophenes	2.5	173.3
C2 Dibenzothiophenes	2.5	207.3
C3 Dibenzothiophenes	2.5	166.9
C4 Dibenzothiophenes	2.5	136.9
Fluoranthene	2.5	24.8
Pyrene	2.5	29.9
C1 Pyrenes/Fluoranthenes	2.5	171.8
C2 Pyrenes/Fluoranthenes	2.5	204.2
C3 Pyrenes/Fluoranthenes	2.5	112.4
Benz(a)anthracene	2.5	9.0
Chrysene	2.5	28.4
C1 Chrysenes	2.5	126.8
C2 Chrysenes	2.5	118.8
C3 Chrysenes	2.5	53.5
C4 Chrysenes	2.5	19.4
Benzo(b)fluroanthene	2.5	ND
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	ND
Benzo(a)pyrene	2.5	ND
Perylene	2.5	ND
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	ND

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

for Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-4pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-6
Collected:	10/24/08
Received:	11/06/08
Matrix:	Heavy Oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-UT-QT
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	ND
C2 Benzothiophenes	2.5	25.4
C3 Benzothiophenes	2.5	59.7
C4 Benzothiophenes	2.5	83.3
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	21.7
2-Methylnaphthalene	2.5	ND
C2 Naphthalenes	2.5	215.9
C3 Naphthalenes	2.5	467.7
C4 Naphthalenes	2.5	570.9
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	3.0
Acenaphthene	2.5	9.6
Fluorene	2.5	27.6
C1 Fluorenes	2.5	54.2
C2 Fluorenes	2.5	34.5
C3 Fluorenes	2.5	61.6
Anthracene	2.5	15.9
Phenanthrene	2.5	18.2
C1 Phenanthrenes/Anthracenes	2.5	110.6
C2 Phenanthrenes/Anthracenes	2.5	311.7
C3 Phenanthrenes/Anthracenes	2.5	300.6
C4 Phenanthrenes/Anthracenes	2.5	114.1

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-6pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-6
Collected:	10/24/08
Received:	11/06/08
Matrix:	Heavy Oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-UT-QT
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	8.9
C1 Dibenzothiophenes	2.5	73.4
C2 Dibenzothiophenes	2.5	107.3
C3 Dibenzothiophenes	2.5	106.6
C4 Dibenzothiophenes	2.5	97.4
Fluoranthene	2.5	20.7
Pyrene	2.5	71.3
C1 Pyrenes/Fluoranthenes	2.5	239.0
C2 Pyrenes/Fluoranthenes	2.5	235.1
C3 Pyrenes/Fluoranthenes	2.5	115.6
Benz(a)anthracene	2.5	13.1
Chrysene	2.5	26.7
C1 Chrysenes	2.5	177.4
C2 Chrysenes	2.5	119.5
C3 Chrysenes	2.5	54.1
C4 Chrysenes	2.5	22.8
Benzo(b)fluroanthene	2.5	5.4
Benzo(k)fluoranthene	2.5	3.0
Benzo(e)pyrene	2.5	11.1
Benzo(a)pyrene	2.5	6.3
Perylene	2.5	14.4
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	5.3

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

for Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-6pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-7
Collected:	11/05/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-C
Analyzed:	11/06/0/
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	33.1
C2 Benzothiophenes	2.5	54.0
C3 Benzothiophenes	2.5	76.7
C4 Benzothiophenes	2.5	85.6
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	235.8
2-Methylnaphthalene	2.5	291.0
C2 Naphthalenes	2.5	806.8
C3 Naphthalenes	2.5	736.0
C4 Naphthalenes	2.5	636.2
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	6.7
Acenaphthene	2.5	13.7
Fluorene	2.5	47.6
C1 Fluorenes	2.5	75.7
C2 Fluorenes	2.5	37.1
C3 Fluorenes	2.5	65.1
Anthracene	2.5	36.6
Phenanthrene	2.5	154.1
C1 Phenanthrenes/Anthracenes	2.5	332.3
C2 Phenanthrenes/Anthracenes	2.5	418.7
C3 Phenanthrenes/Anthracenes	2.5	314.6
C4 Phenanthrenes/Anthracenes	2.5	106.0

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-7pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-7
Collected:	11/05/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-C
Analyzed:	11/06/0/
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	32.0
C1 Dibenzothiophenes	2.5	126.6
C2 Dibenzothiophenes	2.5	165.8
C3 Dibenzothiophenes	2.5	122.5
C4 Dibenzothiophenes	2.5	102.9
Fluoranthene	2.5	20.5
Pyrene	2.5	60.6
C1 Pyrenes/Fluoranthenes	2.5	234.4
C2 Pyrenes/Fluoranthenes	2.5	199.3
C3 Pyrenes/Fluoranthenes	2.5	97.2
Benz(a)anthracene	2.5	11.9
Chrysene	2.5	28.8
C1 Chrysenes	2.5	169.2
C2 Chrysenes	2.5	92.6
C3 Chrysenes	2.5	48.8
C4 Chrysenes	2.5	14.4
Benzo(b)fluroanthene	2.5	7.0
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	11.6
Benzo(a)pyrene	2.5	12.1
Perylene	2.5	13.6
Indeno(1,2,3-c,d)pyrene	2.5	2.7
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	3.9

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

for Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-7pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-8
Collected:	11/05/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-VV
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	ND
C2 Benzothiophenes	2.5	ND
C3 Benzothiophenes	2.5	49.1
C4 Benzothiophenes	2.5	73.8
Naphthalene	2.5	ND
1-Methylnaphthalene	2.5	ND
2-Methylnaphthalene	2.5	ND
C2 Naphthalenes	2.5	365.1
C3 Naphthalenes	2.5	541.4
C4 Naphthalenes	2.5	556.4
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	3.5
Acenaphthene	2.5	7.6
Fluorene	2.5	22.9
C1 Fluorenes	2.5	57.1
C2 Fluorenes	2.5	28.8
C3 Fluorenes	2.5	56.6
Anthracene	2.5	8.8
Phenanthrene	2.5	44.9
C1 Phenanthrenes/Anthracenes	2.5	138.5
C2 Phenanthrenes/Anthracenes	2.5	243.8
C3 Phenanthrenes/Anthracenes	2.5	234.3
C4 Phenanthrenes/Anthracenes	2.5	106.5

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41362-8pna.xls
STL/th

ZymaX FORENSICS

Client:	Ellen Hedfield
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	41362-8
Collected:	11/05/08
Received:	11/06/08
Matrix:	Heavy oil

Project:	Mare Island
Project Number:	273939.14.01
Collected by:	Mike Godwin

Sample Description:	FTPH-FP-SB-VV
Analyzed:	11/06/08
Method:	8270M

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	35.3
C1 Dibenzothiophenes	2.5	100.0
C2 Dibenzothiophenes	2.5	94.6
C3 Dibenzothiophenes	2.5	93.9
C4 Dibenzothiophenes	2.5	105.5
Fluoranthene	2.5	12.9
Pyrene	2.5	25.4
C1 Pyrenes/Fluoranthenes	2.5	106.5
C2 Pyrenes/Fluoranthenes	2.5	152.3
C3 Pyrenes/Fluoranthenes	2.5	89.6
Benz(a)anthracene	2.5	5.2
Chrysene	2.5	18.4
C1 Chrysenes	2.5	91.9
C2 Chrysenes	2.5	78.3
C3 Chrysenes	2.5	35.1
C4 Chrysenes	2.5	16.6
Benzo(b)fluroanthene	2.5	ND
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	8.0
Benzo(a)pyrene	2.5	12.9
Perylene	2.5	13.3
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	3.3

*PQL - Practical Quantitation Limit
**Results listed as ND would have been reported if present at or above the listed PQL.

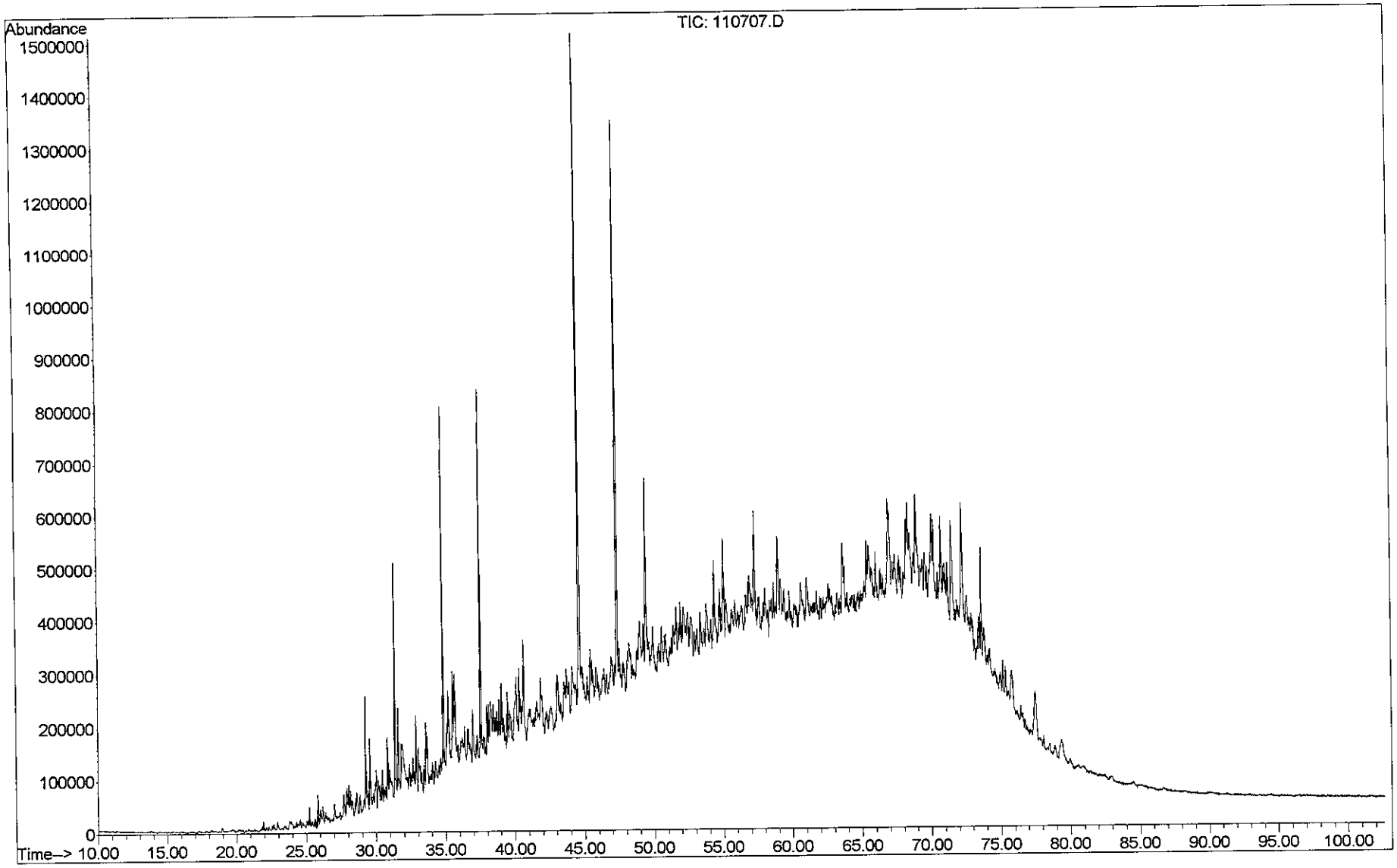
Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

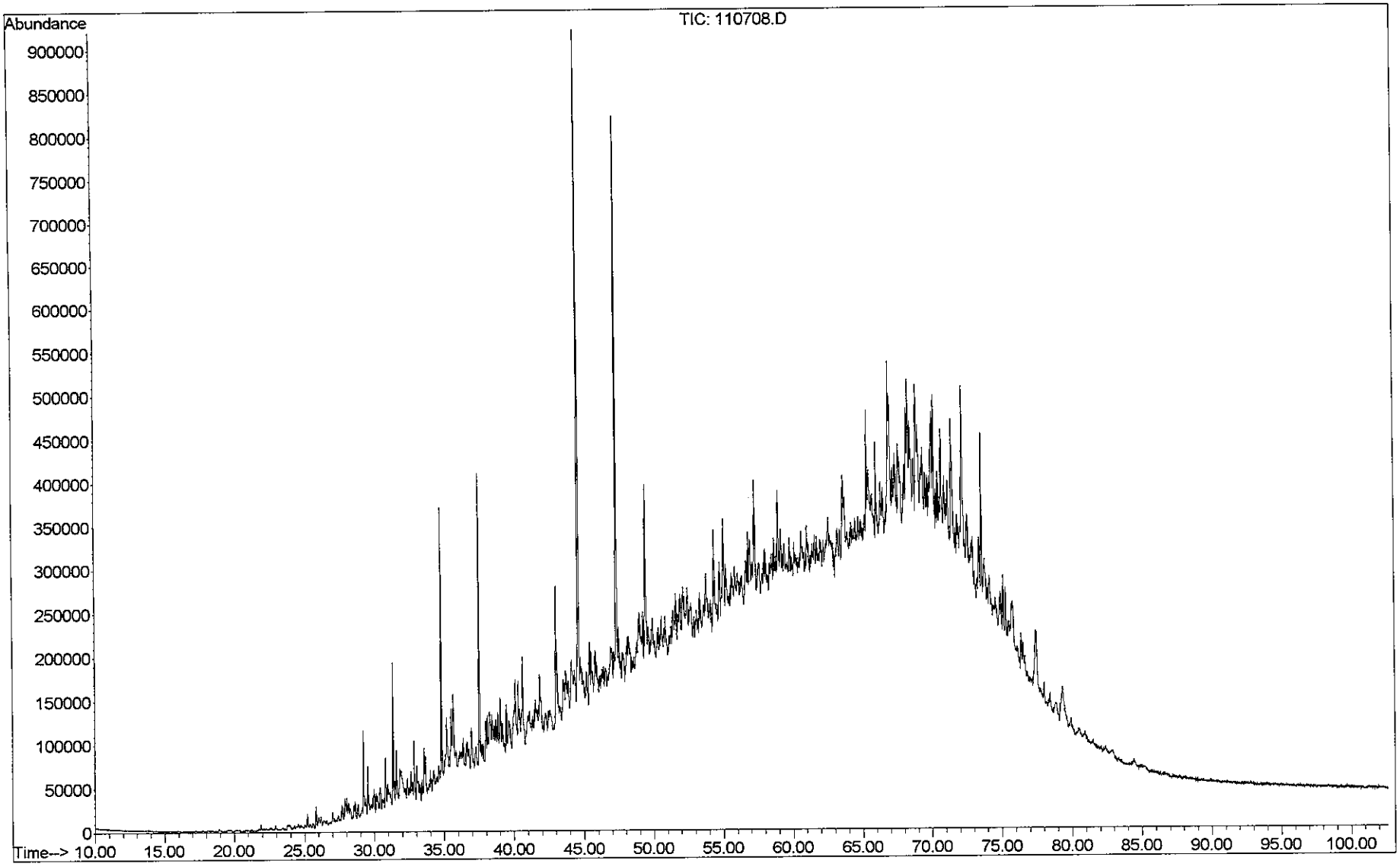
Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41362-8pna.xls
STL/th

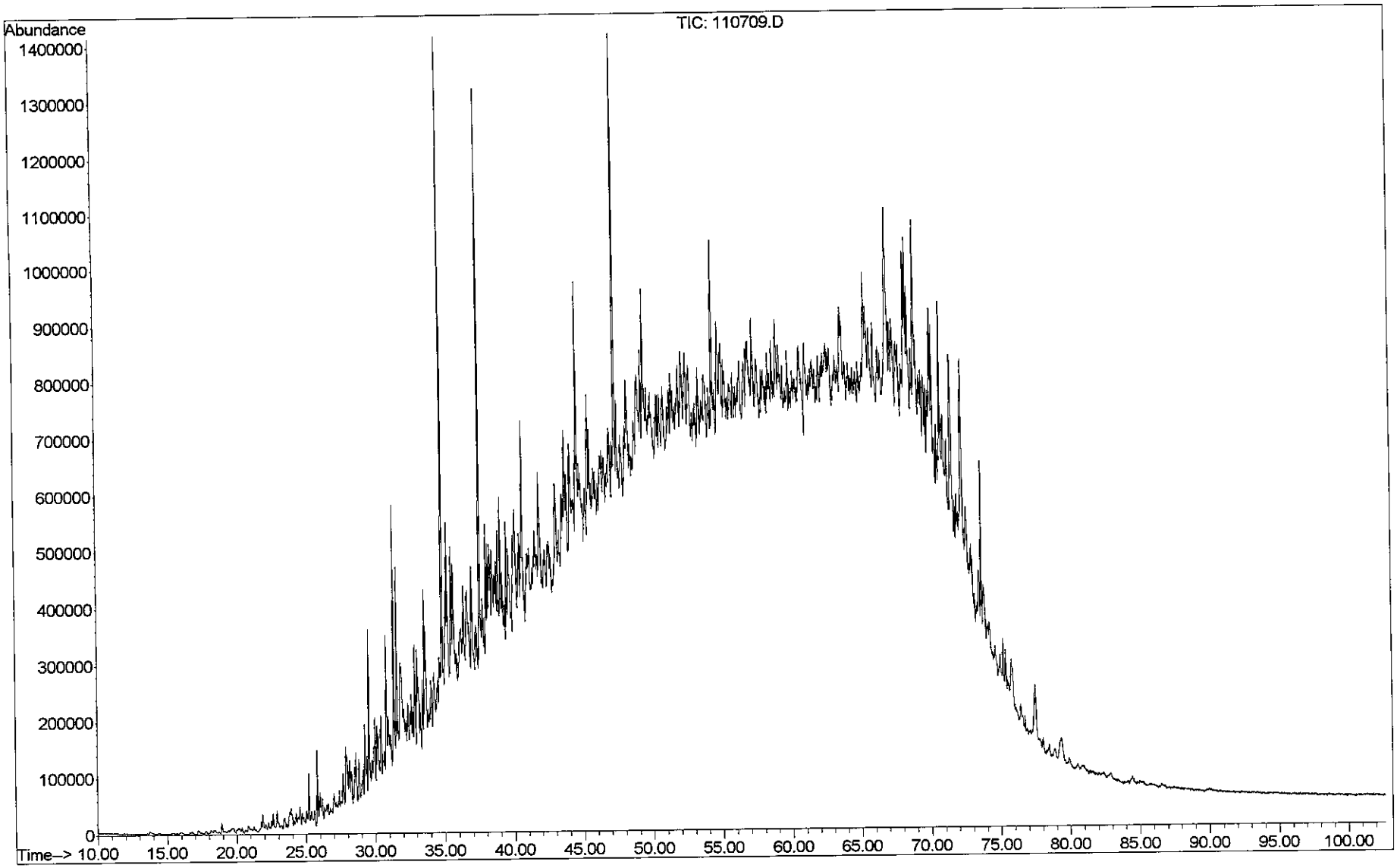
Sample Name: FTPH-FP-SB-GG (41362-1) product
Misc Info : Mare Island, CH2M HILL



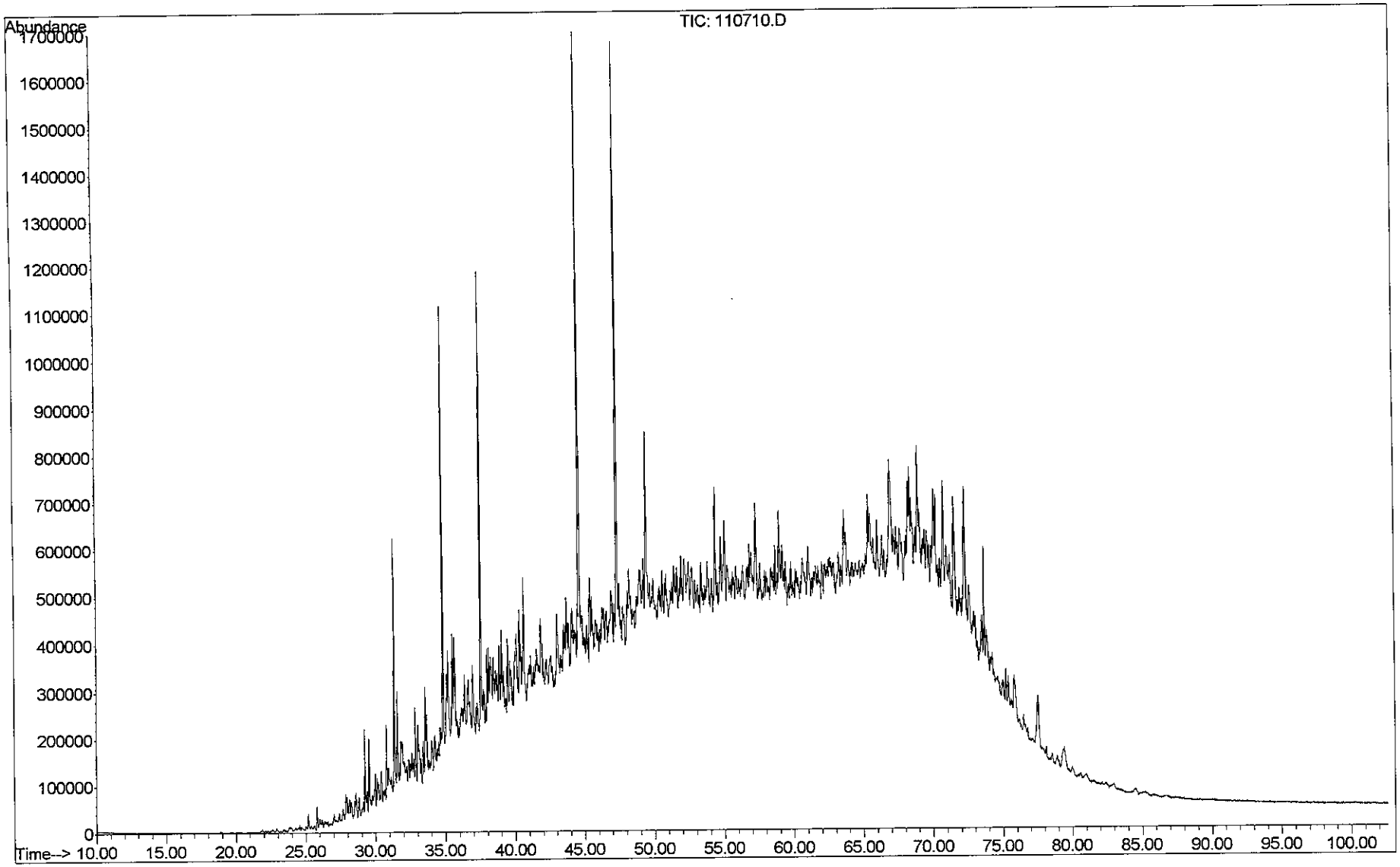
Sample Name: FTPH-FP-SB-MM (41362-2) product
Misc Info : Mare Island, CH2M HILL



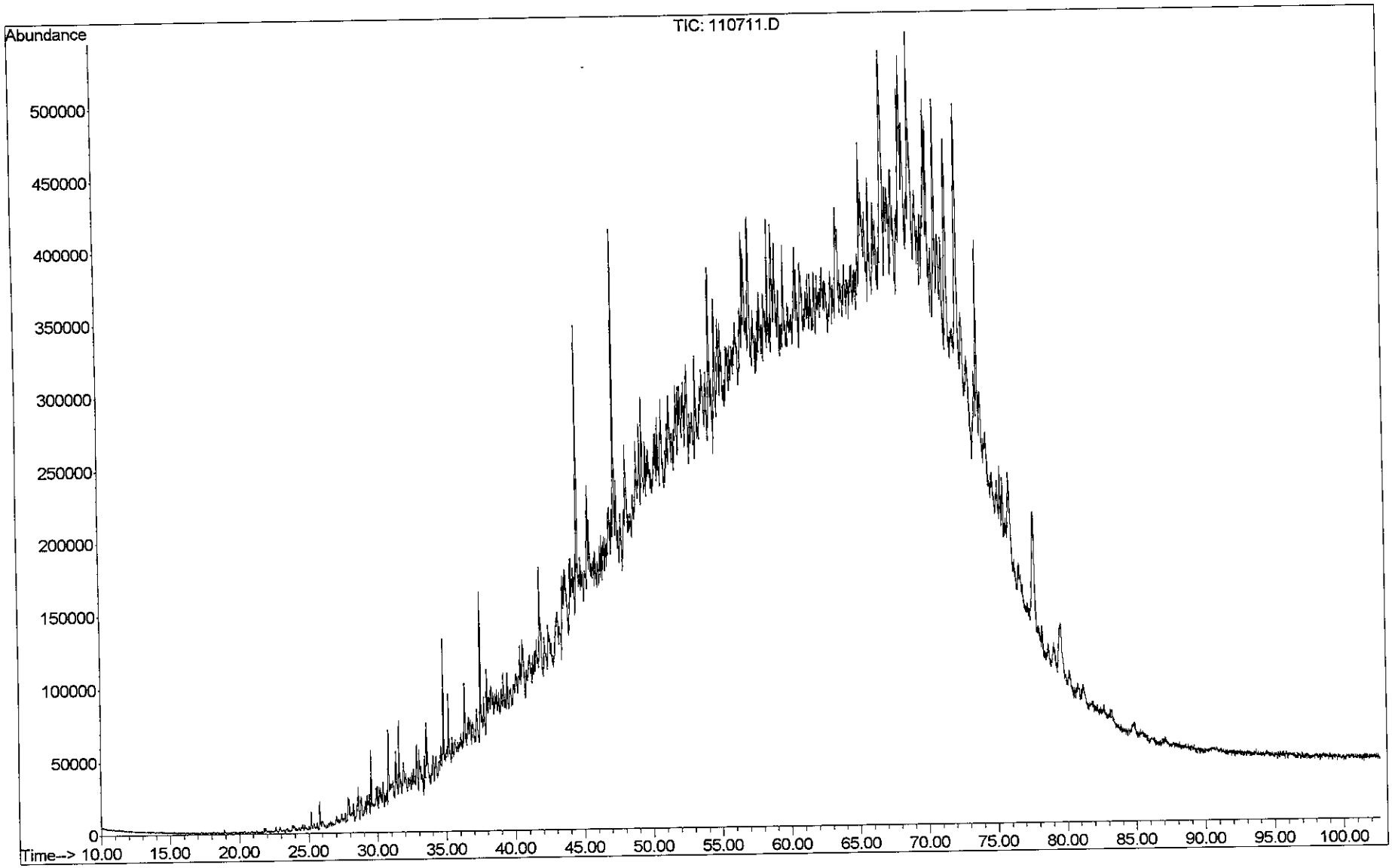
Sample Name: FTPH-FP-SB-NN (41362-3) product
Misc Info : Mare Island, CH2M HILL



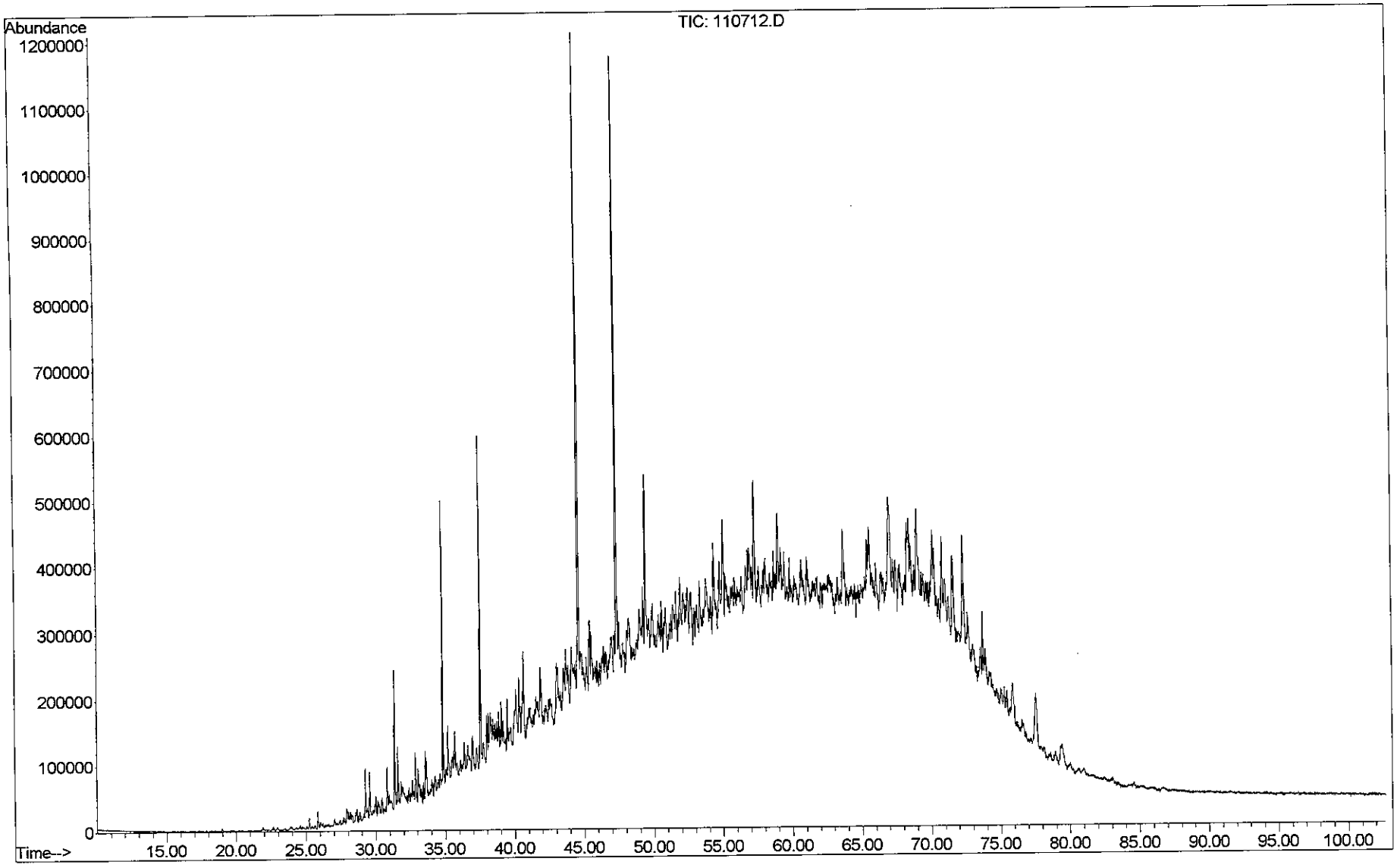
Sample Name: FTPH-FP-SB-PP (41362-4) product
Misc Info : Mare Island, CH2M HILL



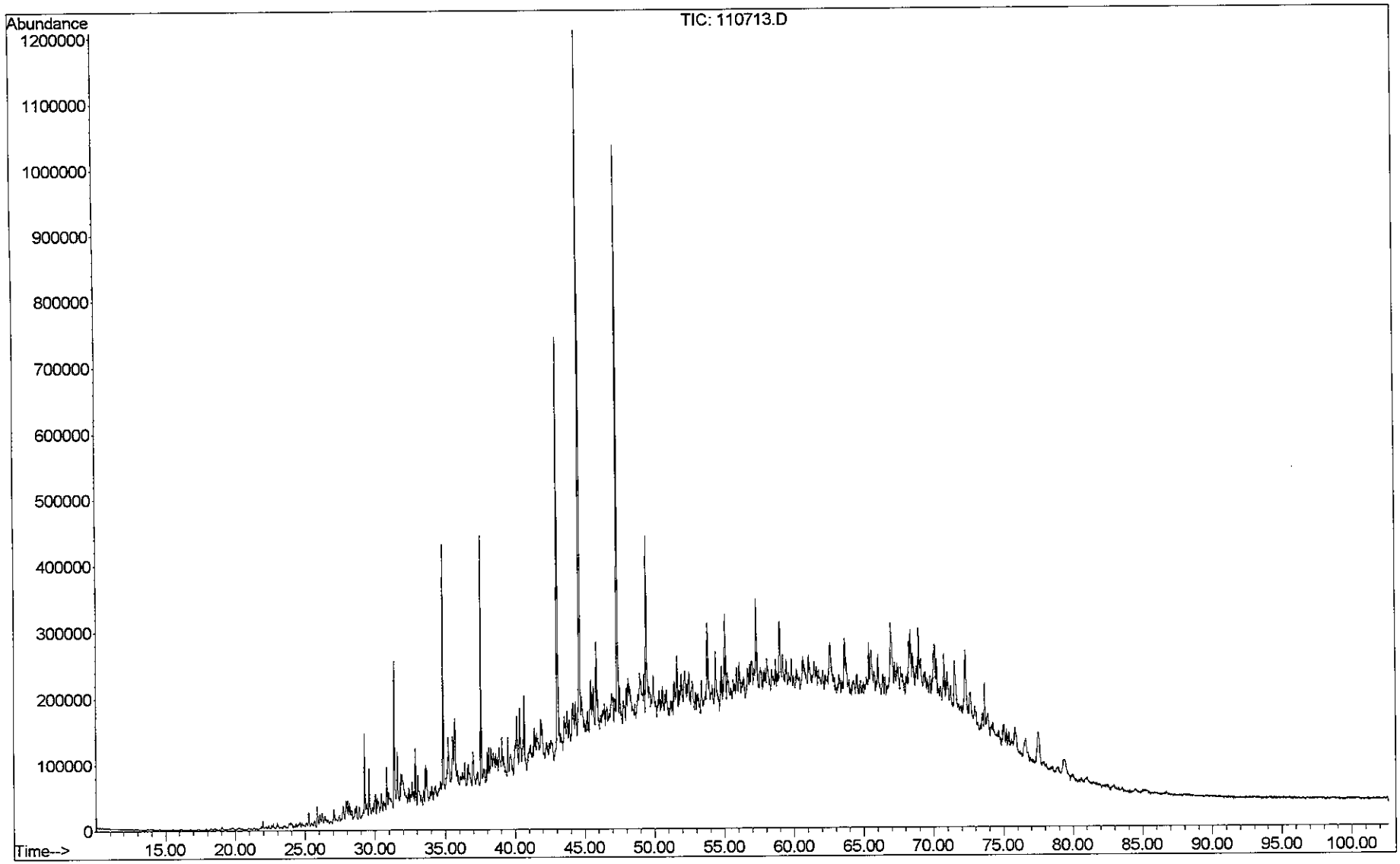
Sample Name: FTPH-FP-UT-QE (41362-5) product
Misc Info : Mare Island, CH2M HILL



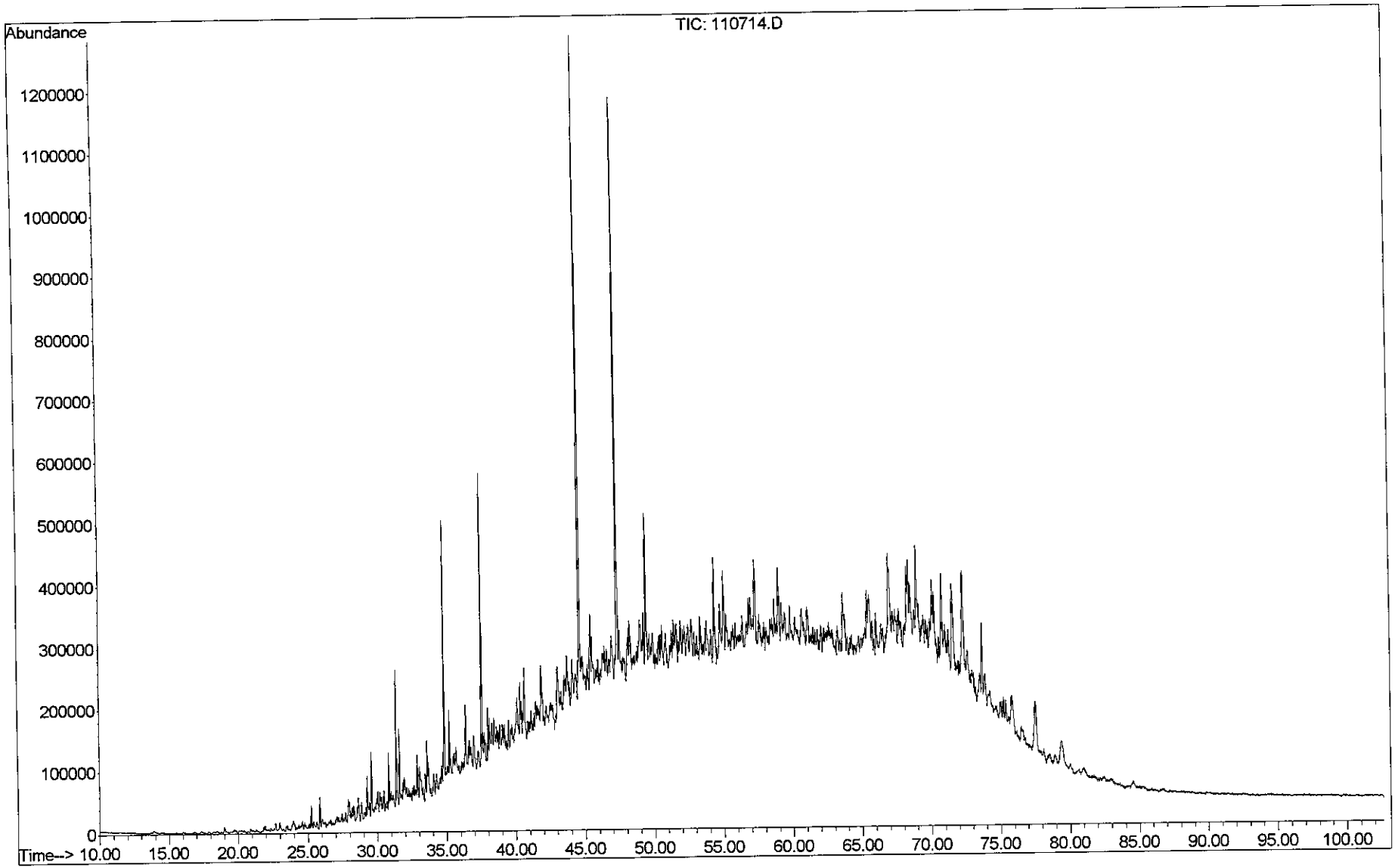
Sample Name: FTPH-FP-UT-QT (41362-6) product
Misc Info : Mare Island, CH2M HILL



Sample Name: FTPH-FP-SB-C (41362-7) product
Misc Info : Mare Island, CH2M HILL



Sample Name: FTPH-FP-SB-VV (41362-8) product
Misc Info : Mare Island, CH2M HILL

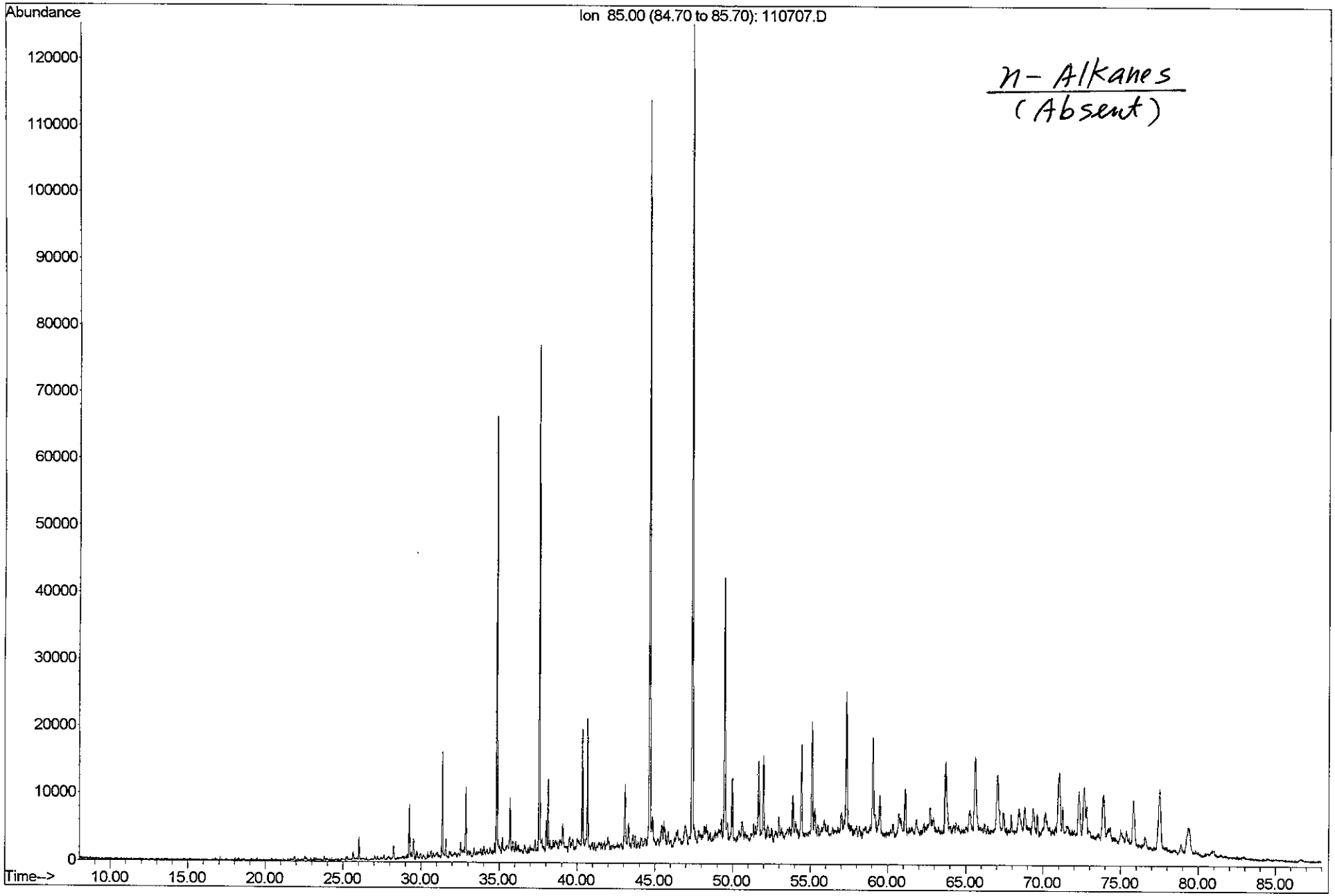


Table

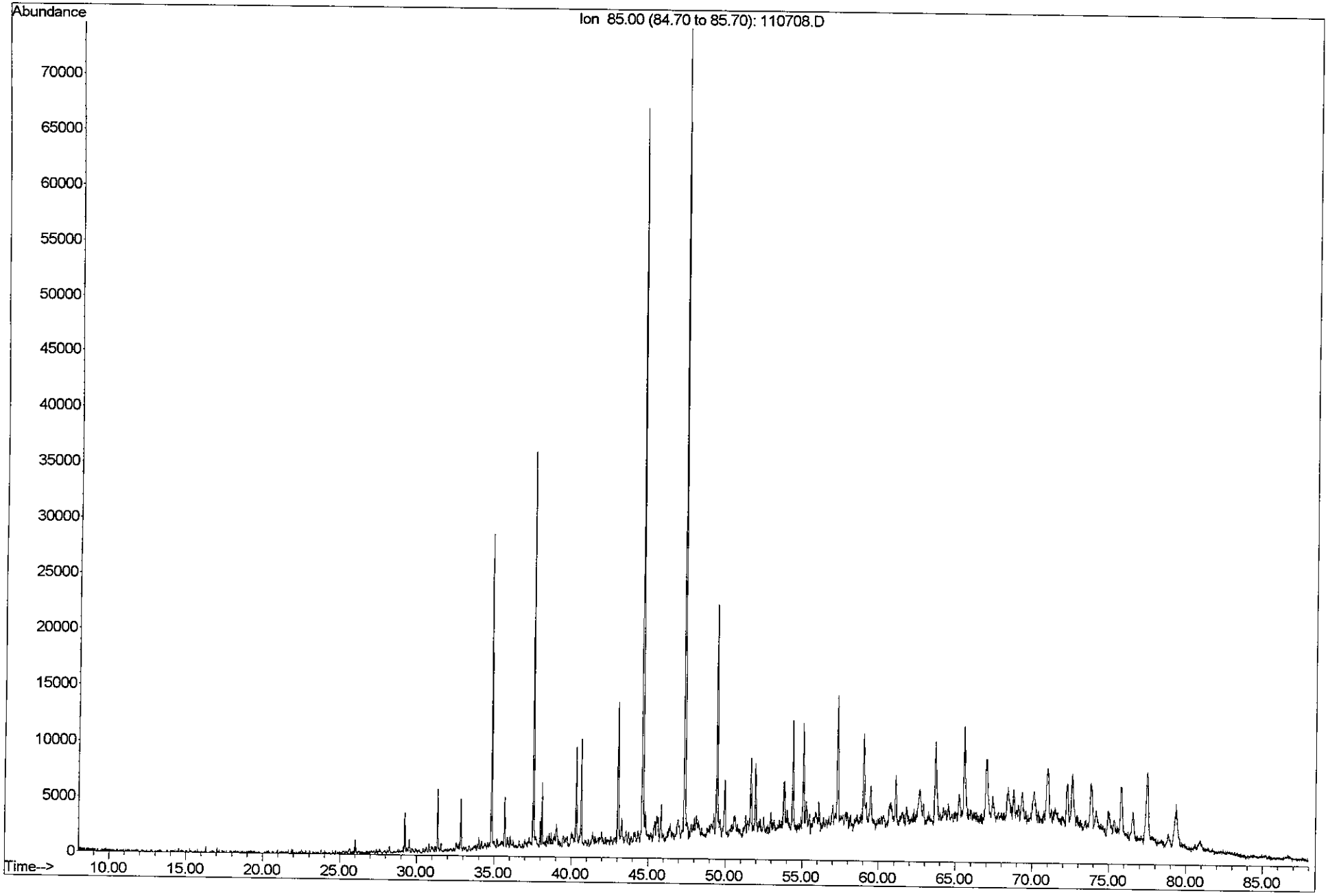
Key to Chromatogram Symbol Identification for m/z 85 and m/z 113 Paraffins and Isoparaffins

Symbol	Detail
i-10	Iso-alkane with 10 carbon atoms
i-15	Farnesane (isoprenoid with 15 carbon atoms)
i-16	Isoprenoid with 16 carbon atoms
Pr	Pristane (isoprenoid with 19 carbon atoms)
Ph	Phytane (isoprenoid with 20 carbon atoms)
nC_8	n-C_8 normal alkane
nC_{15}	n-C_{15} normal alkane
i-8	2,5-(2,4)-Dimethylhexane
i-8'	2,3,4-Trimethylpentane
i-8"	2,3-Dimethylhexane
CH-*n*	Alkylcyclohexane (where *n* indicates number of carbon atoms in the side chain)

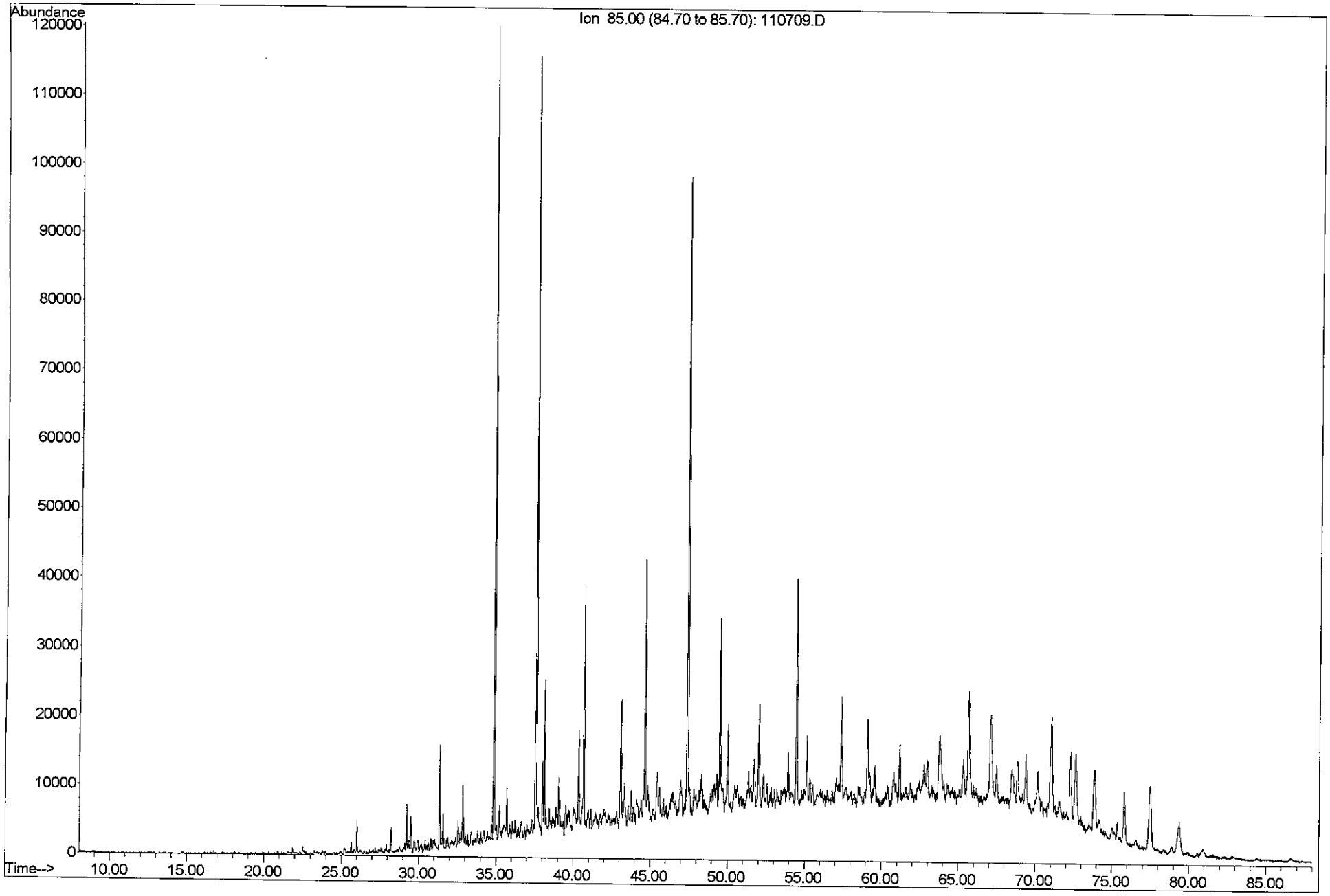
FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



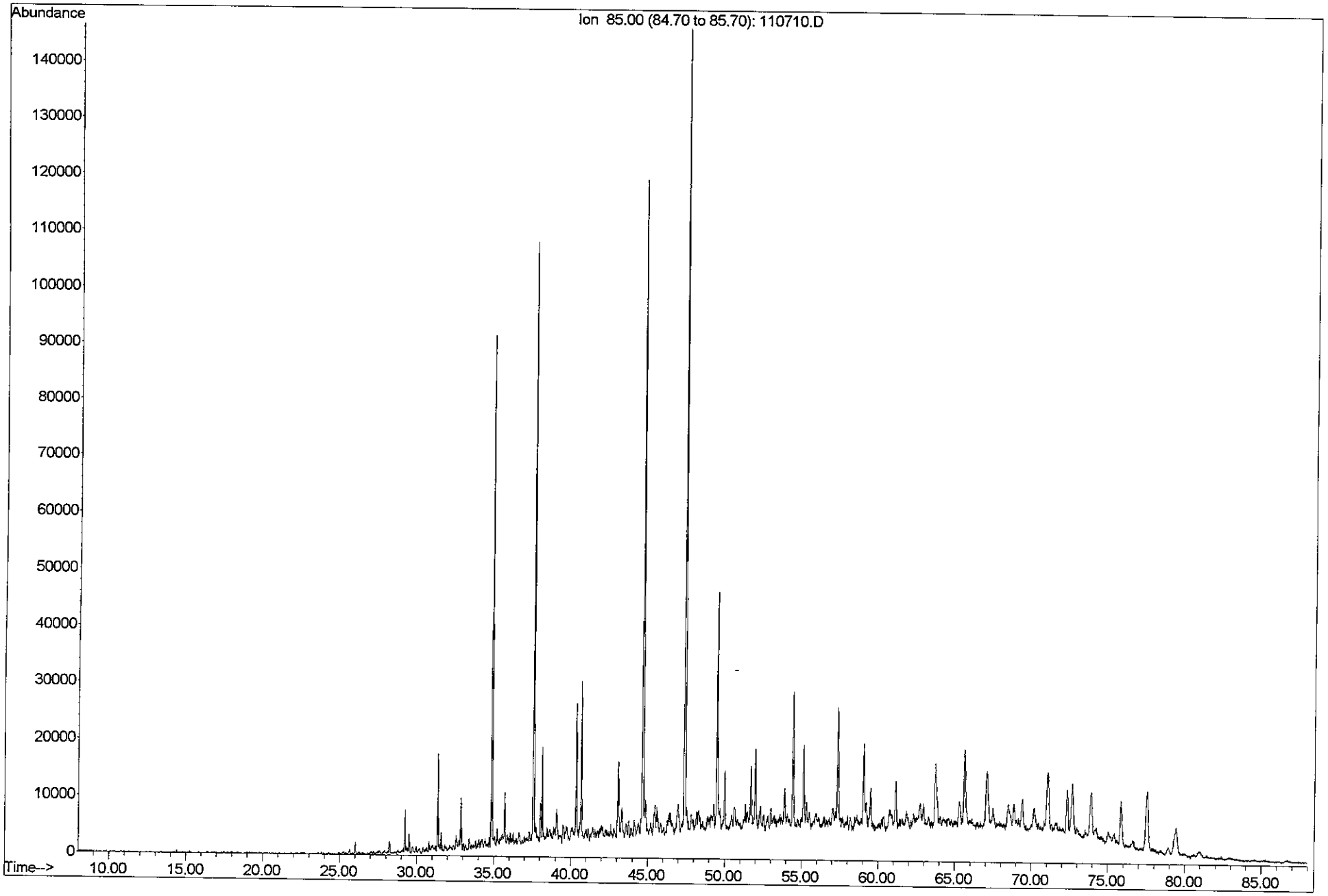
FTPH-FP-SB-MM (41362-2) product
Mare Island, CH2M HILL



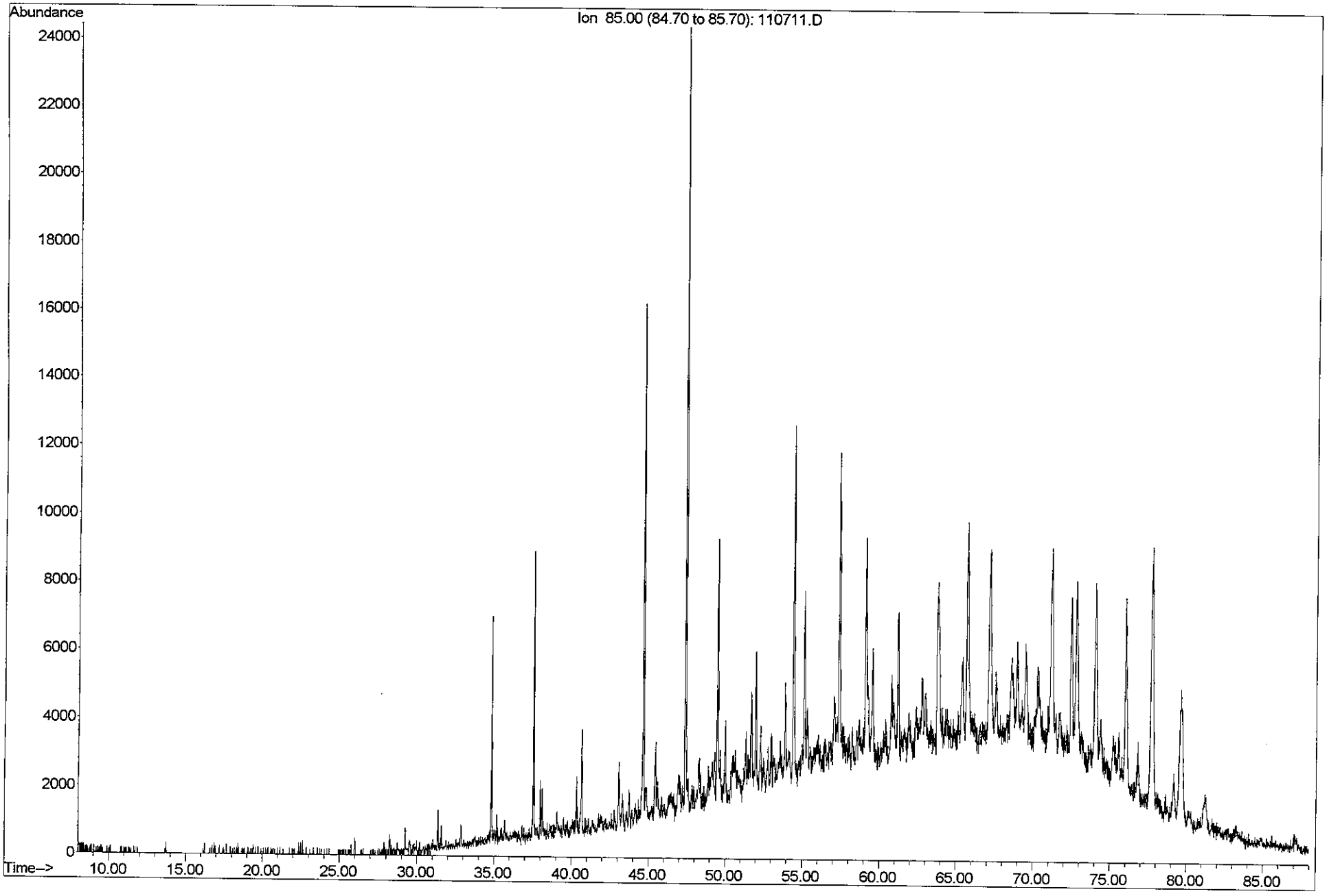
FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



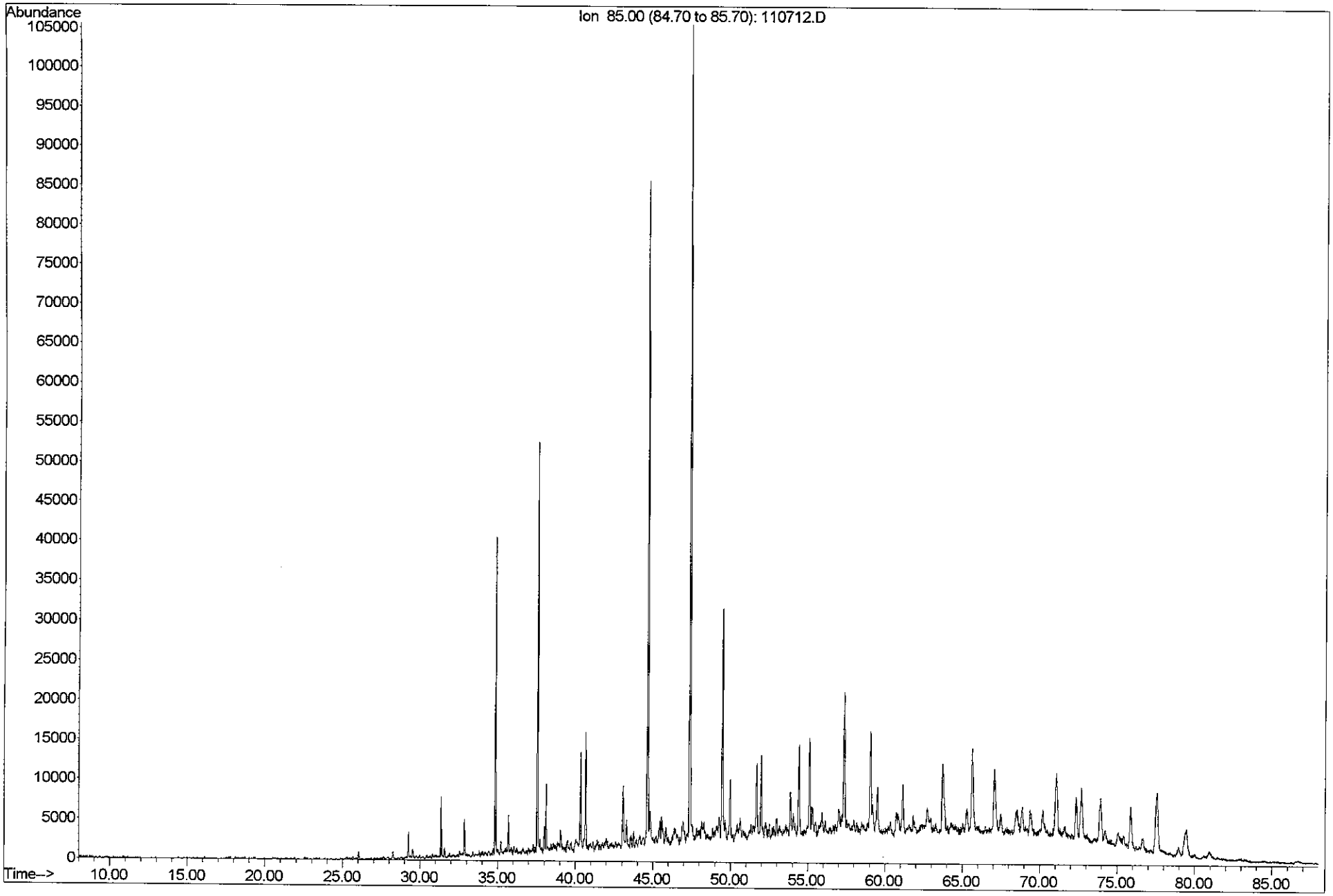
FTPH-FP-SB-PP (41362-4) product
Mare Island, CH2M HILL



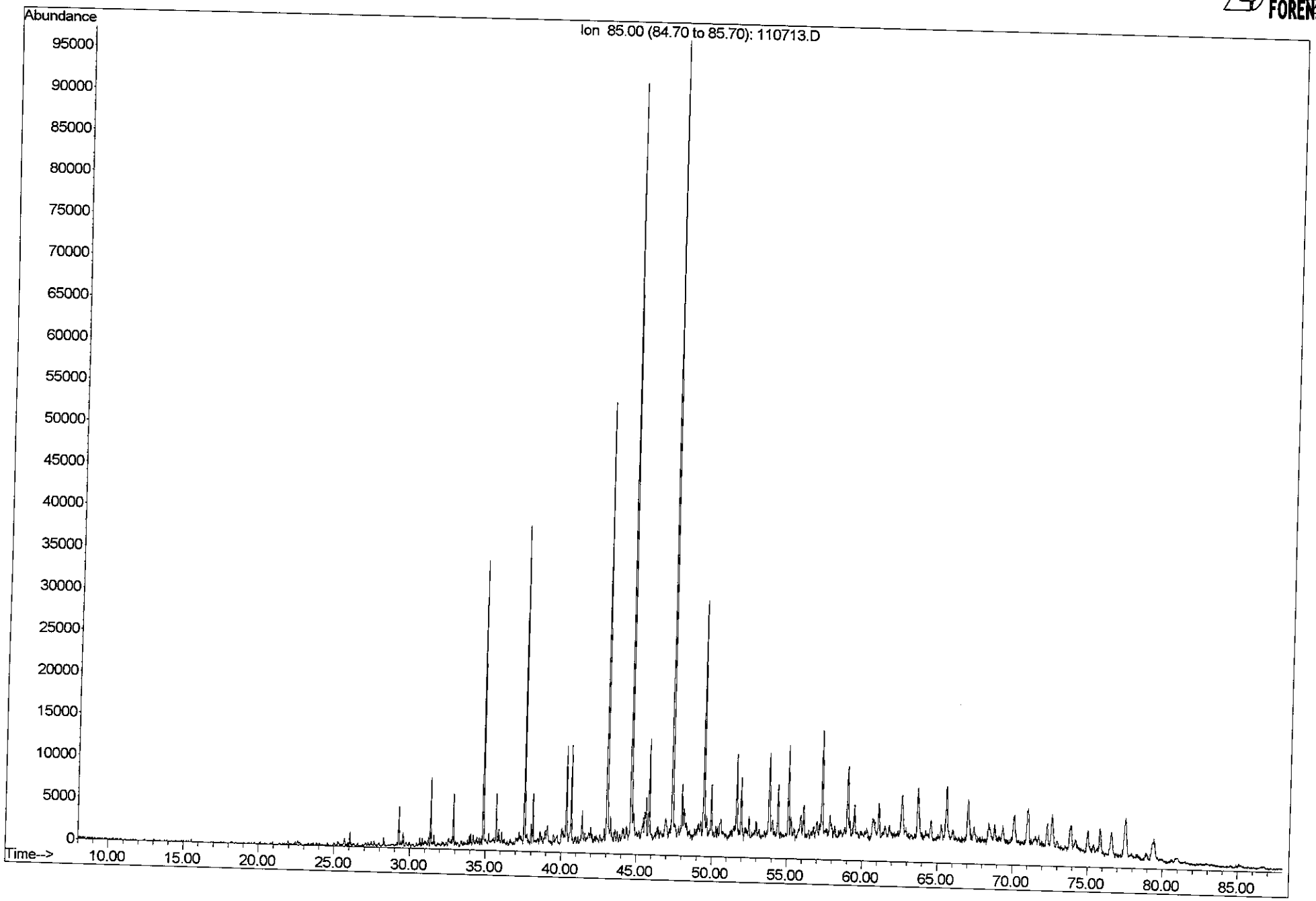
FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



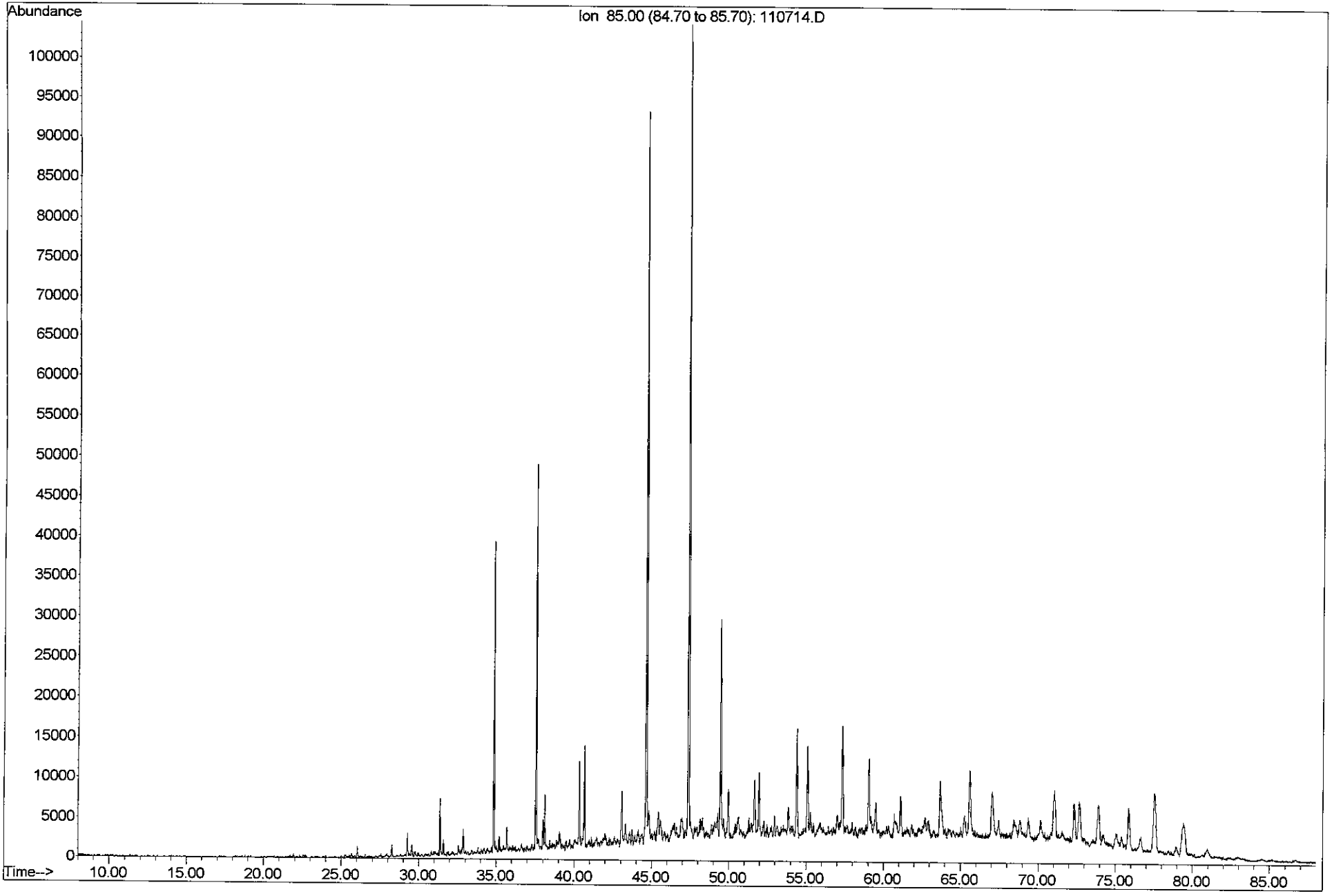
FTPH-FP-UT-QT (41362-6) product
Mare Island, CH2M HILL



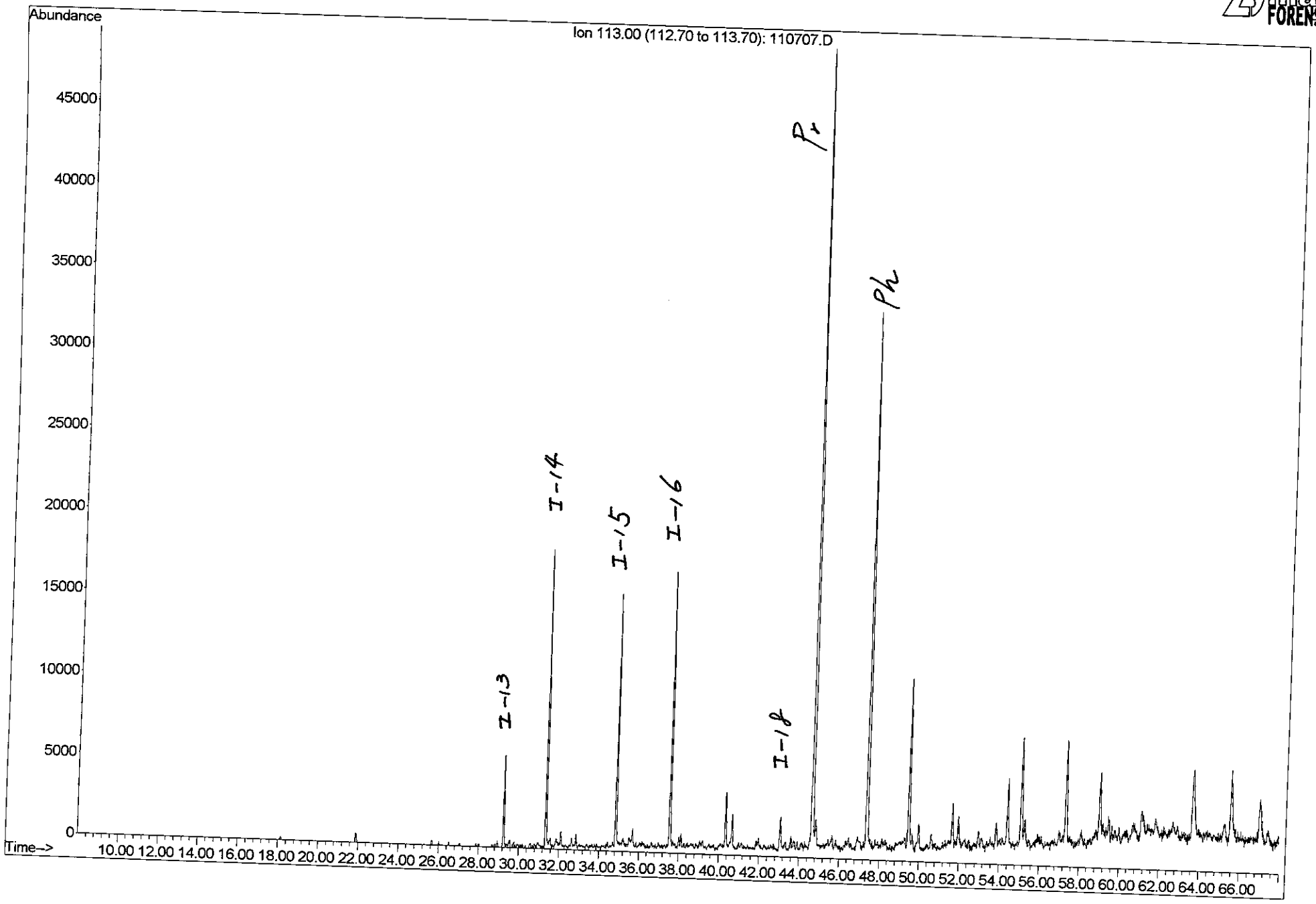
FTPH-FP-SB-C (41362-7) product
Mare Island, CH2M HILL



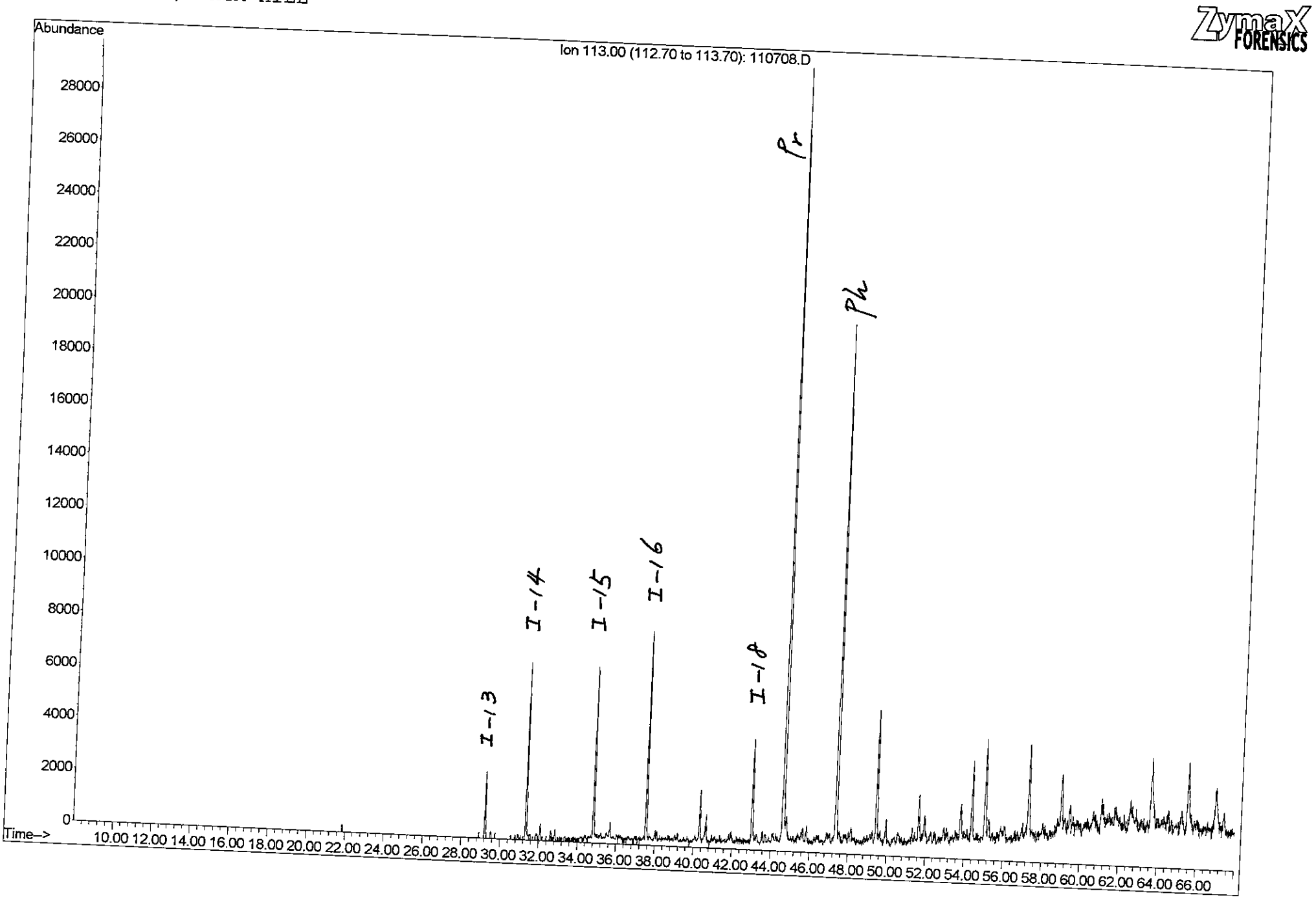
FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL



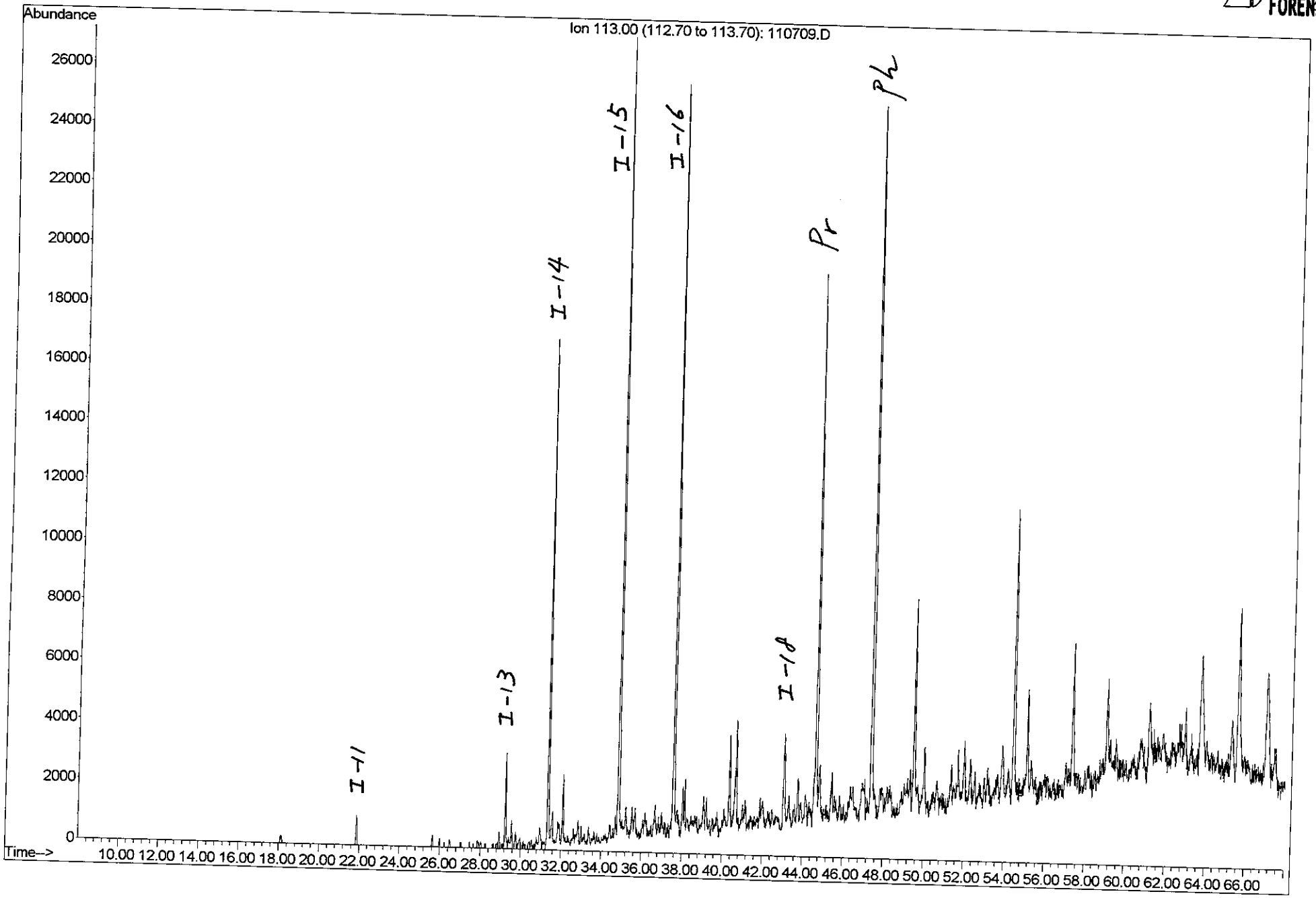
FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



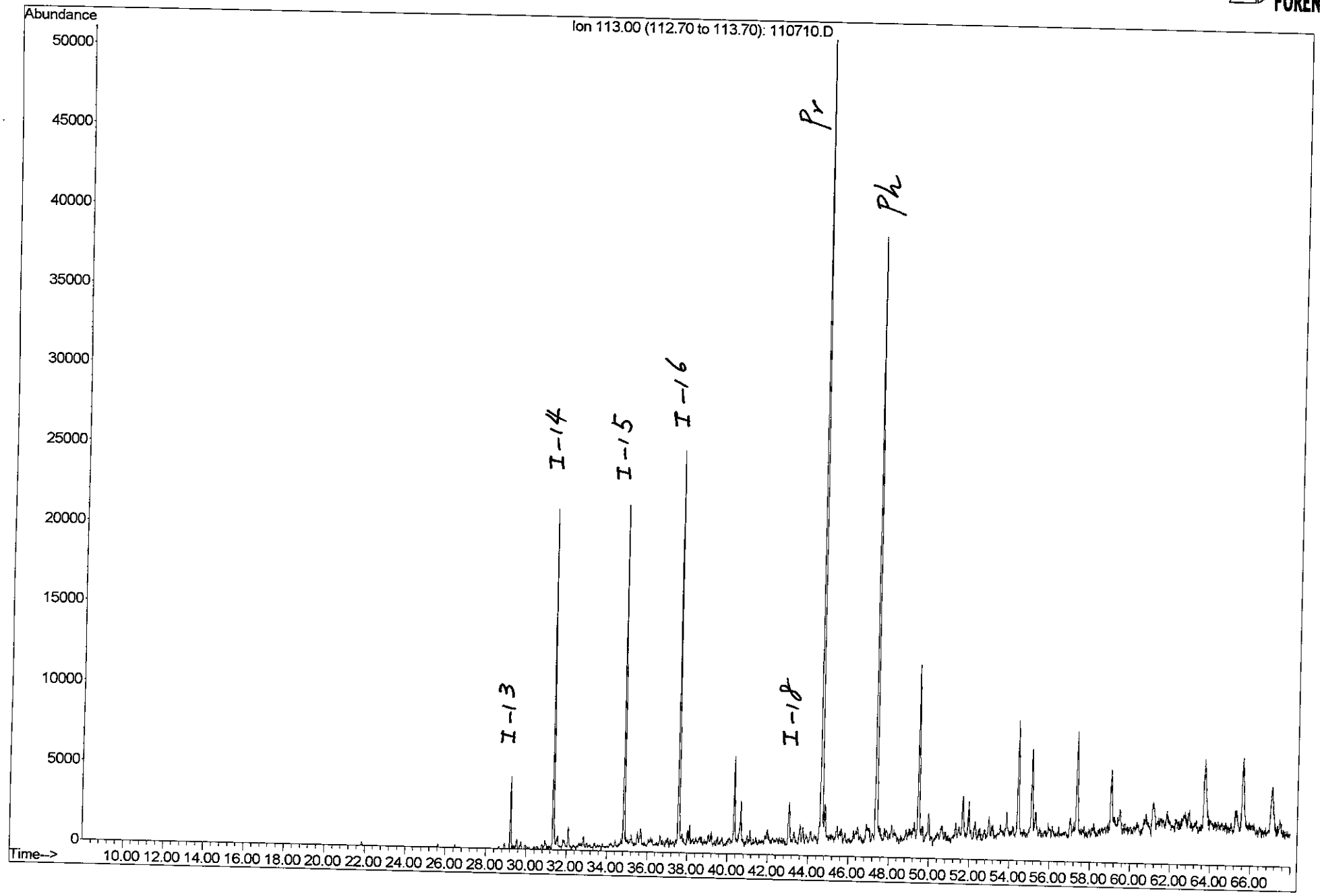
FTPH-FP-SB-MM (41362-2) product
Mare Island, CH2M HILL



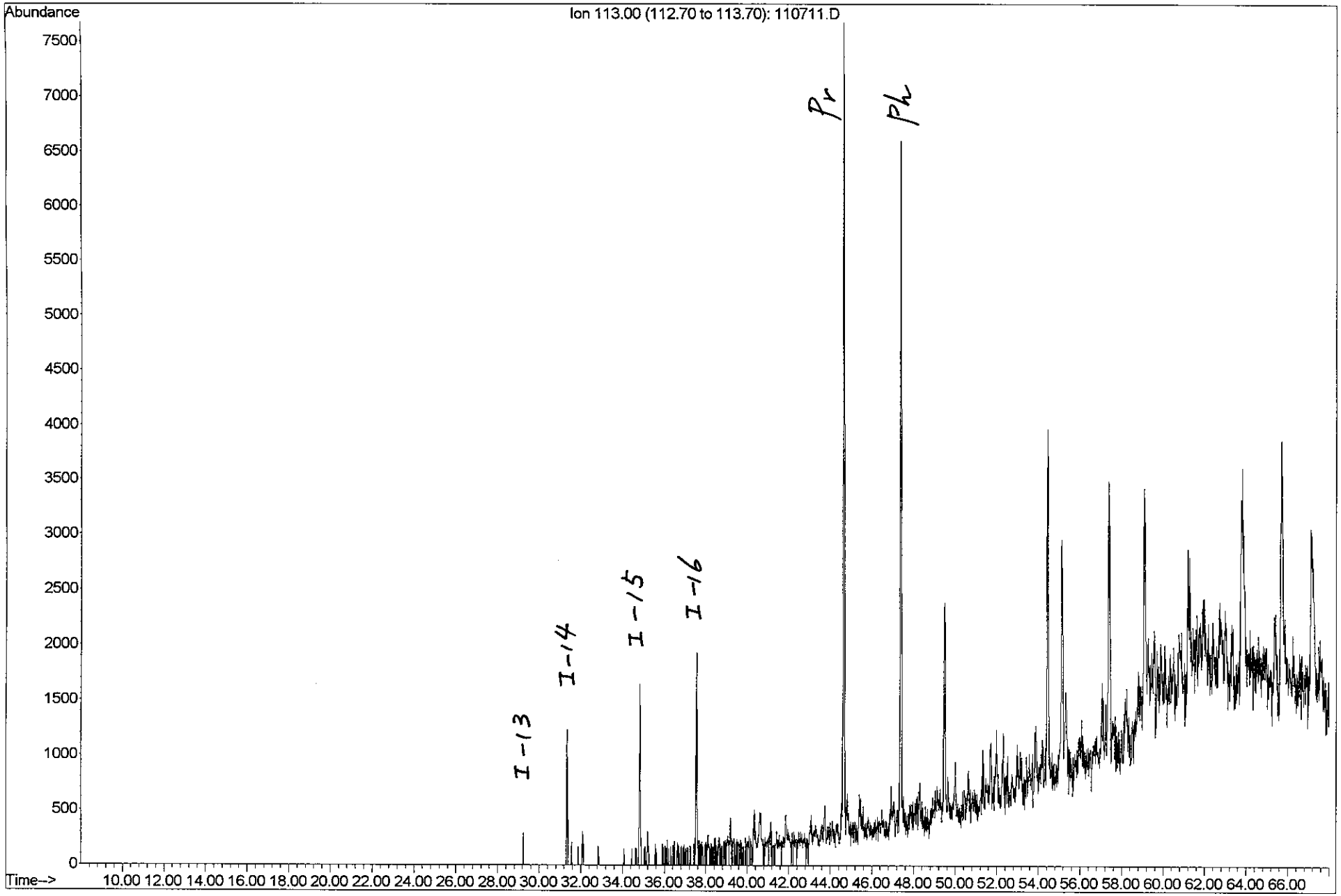
FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



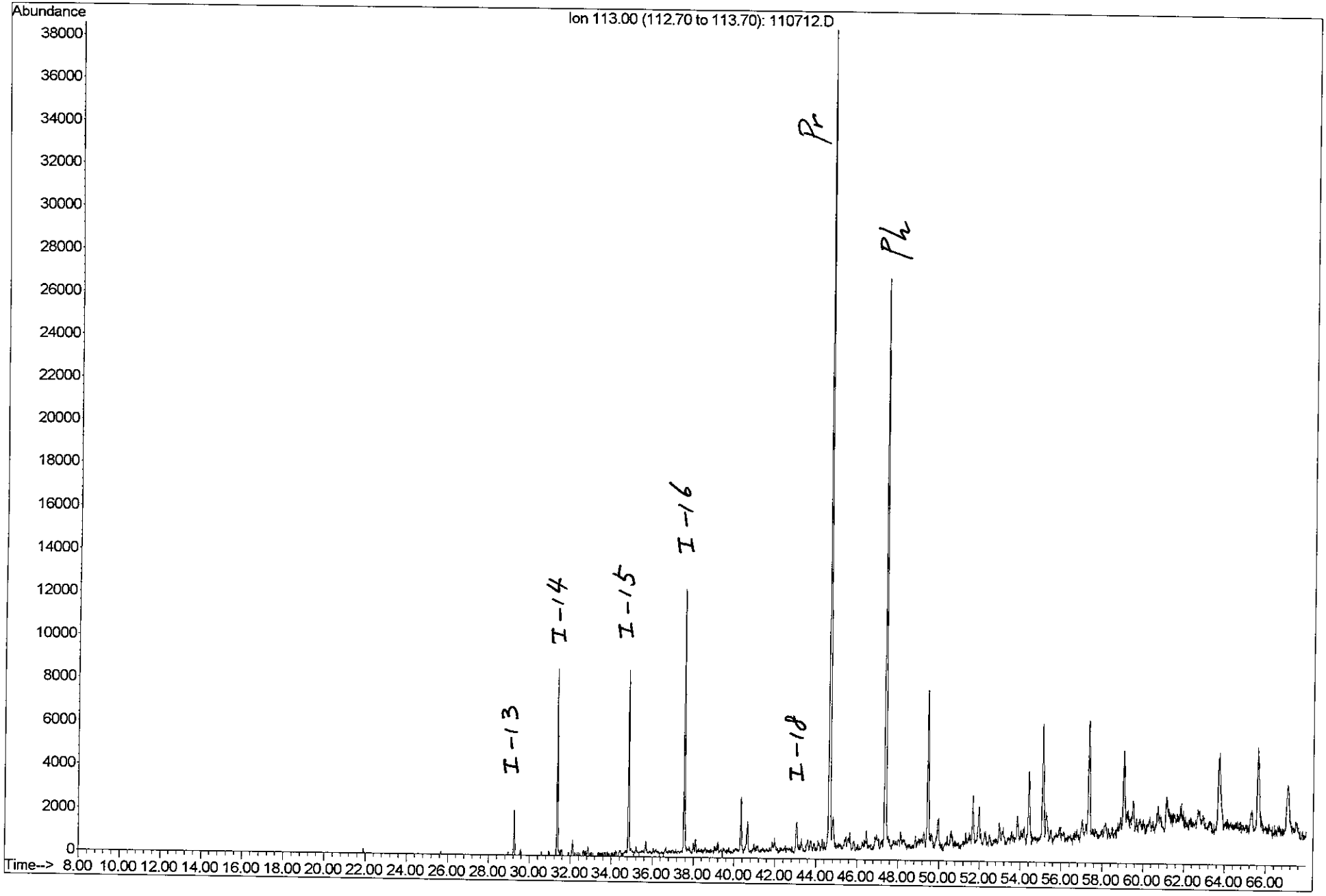
FTPH-FP-SB-PP (41362-4) product
Mare Island, CH2M HILL



FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



FTPH-FP-UT-QT (41362-6) product
Mare Island, CH2M HILL



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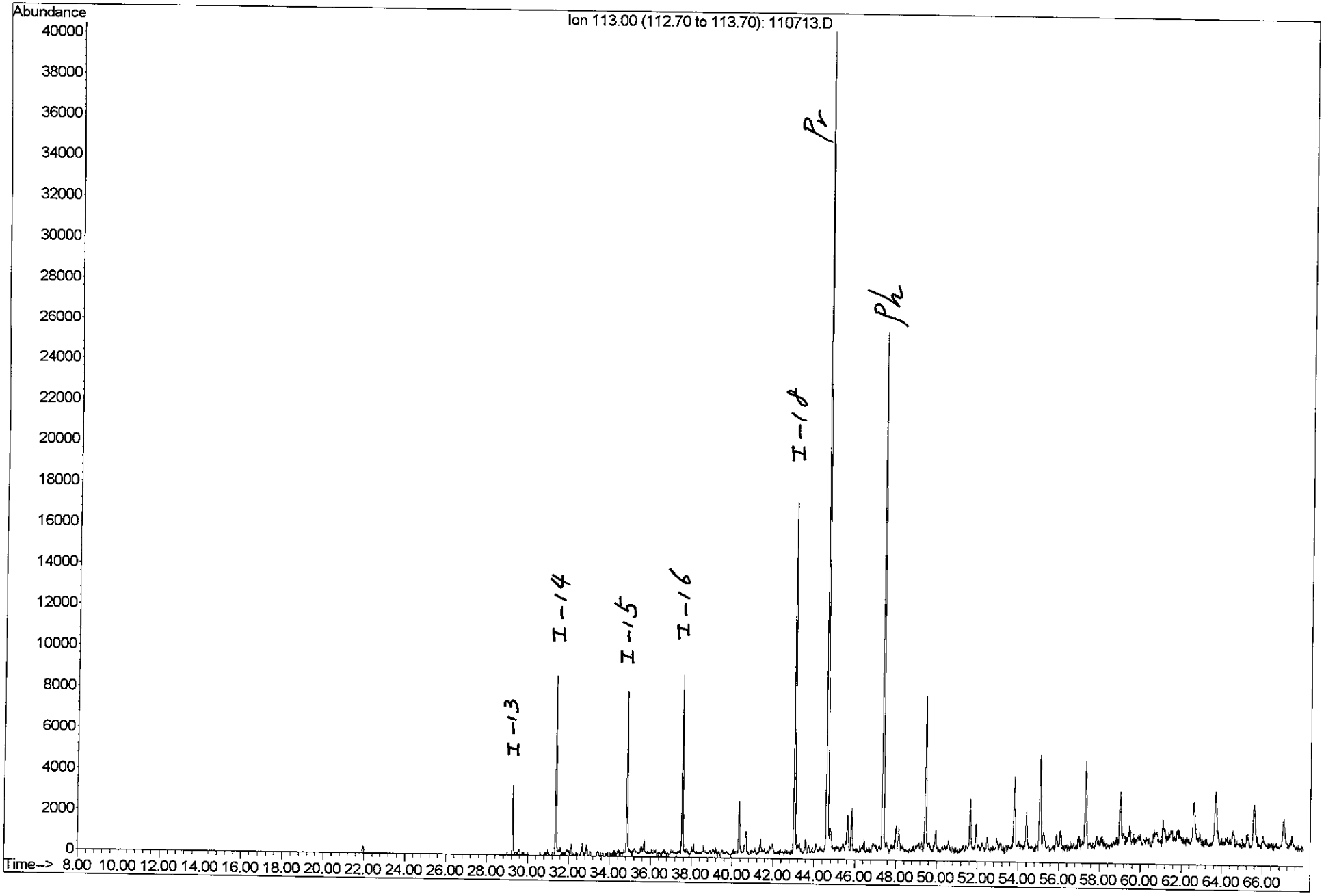

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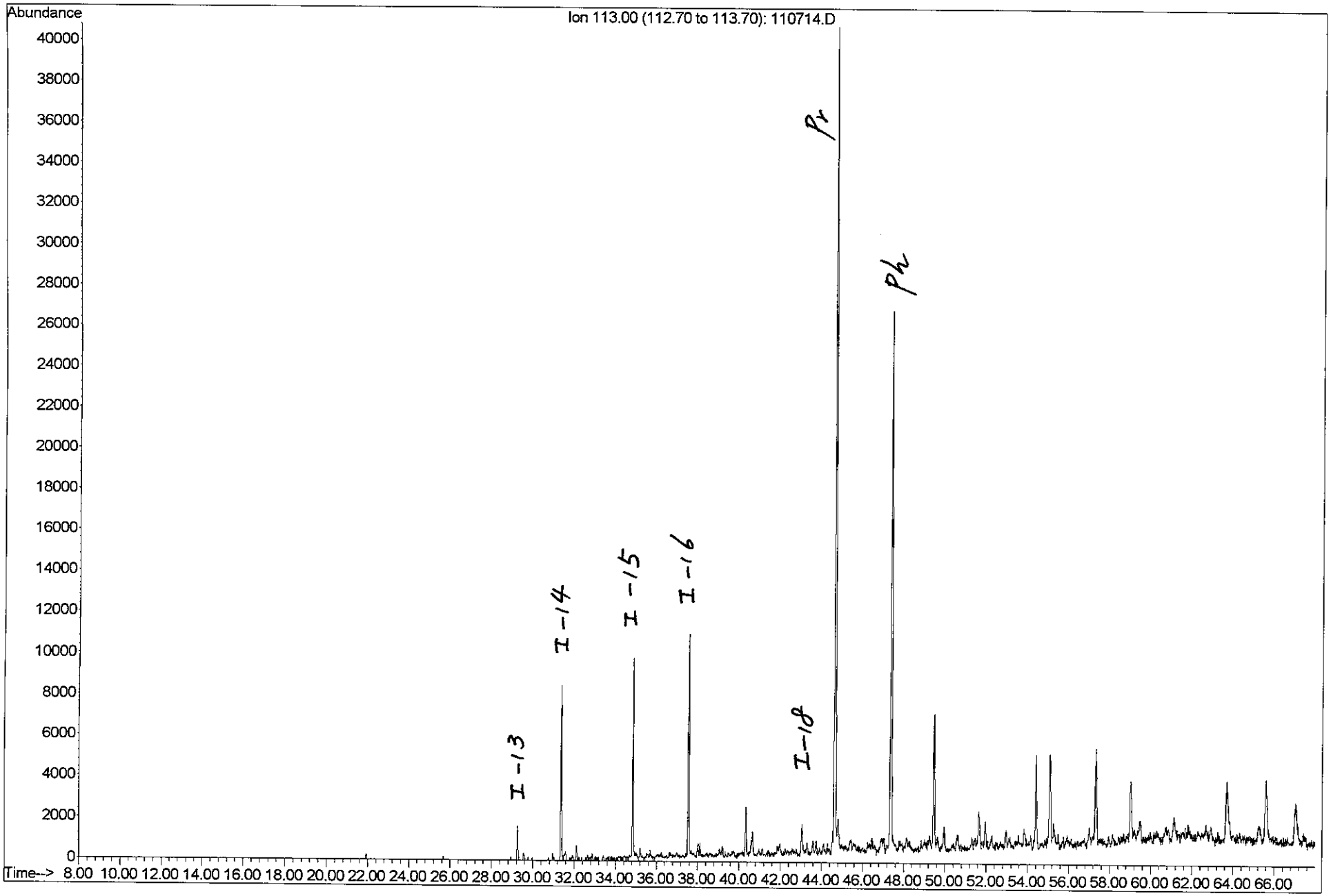
Mare Island, CH2M HILL

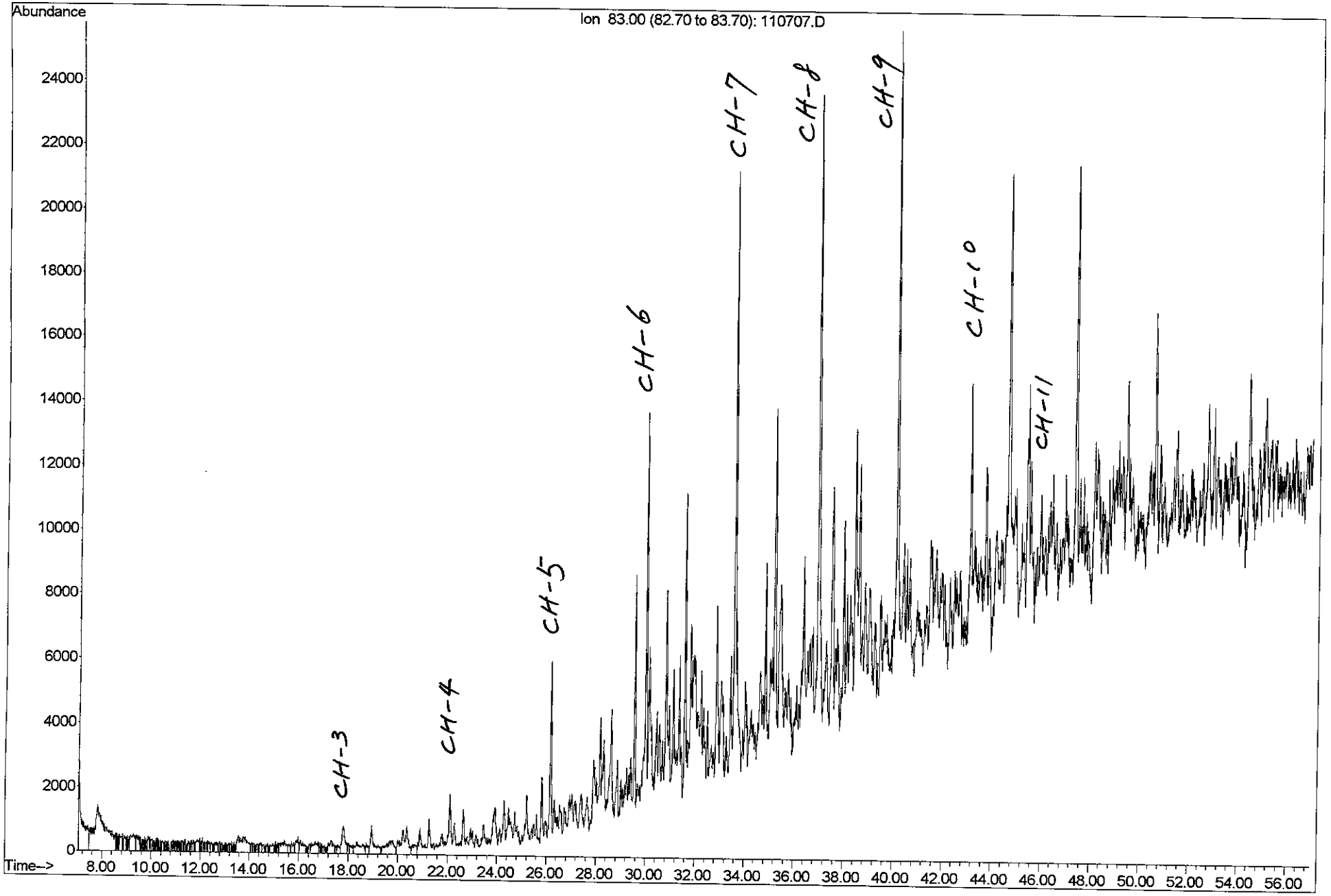


Table

Key for Alkylcyclohexanes at m/z 83

Symbol	Detail
CH-1:	Methylcyclohexane
CH-2:	Ethylcyclohexane
CH-3:	Propylcylohexane
CH-4:	Butylcyclohexane
CH-5:	Pentylcyclohexane
CH-6:	Hexylcyclohexane
CH-7:	Heptylcyclohexane
CH-8:	Octylcyclohexane
CH-9:	Nonylcyclohexane
CH-10:	Decylcyclohexane
CH-11:	Undecylcyclohexane
CH-12:	Dodecylcyclohexane
CH-13:	Tridecylcyclohexane
CH-14:	Tetradecylcyclohexane

FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



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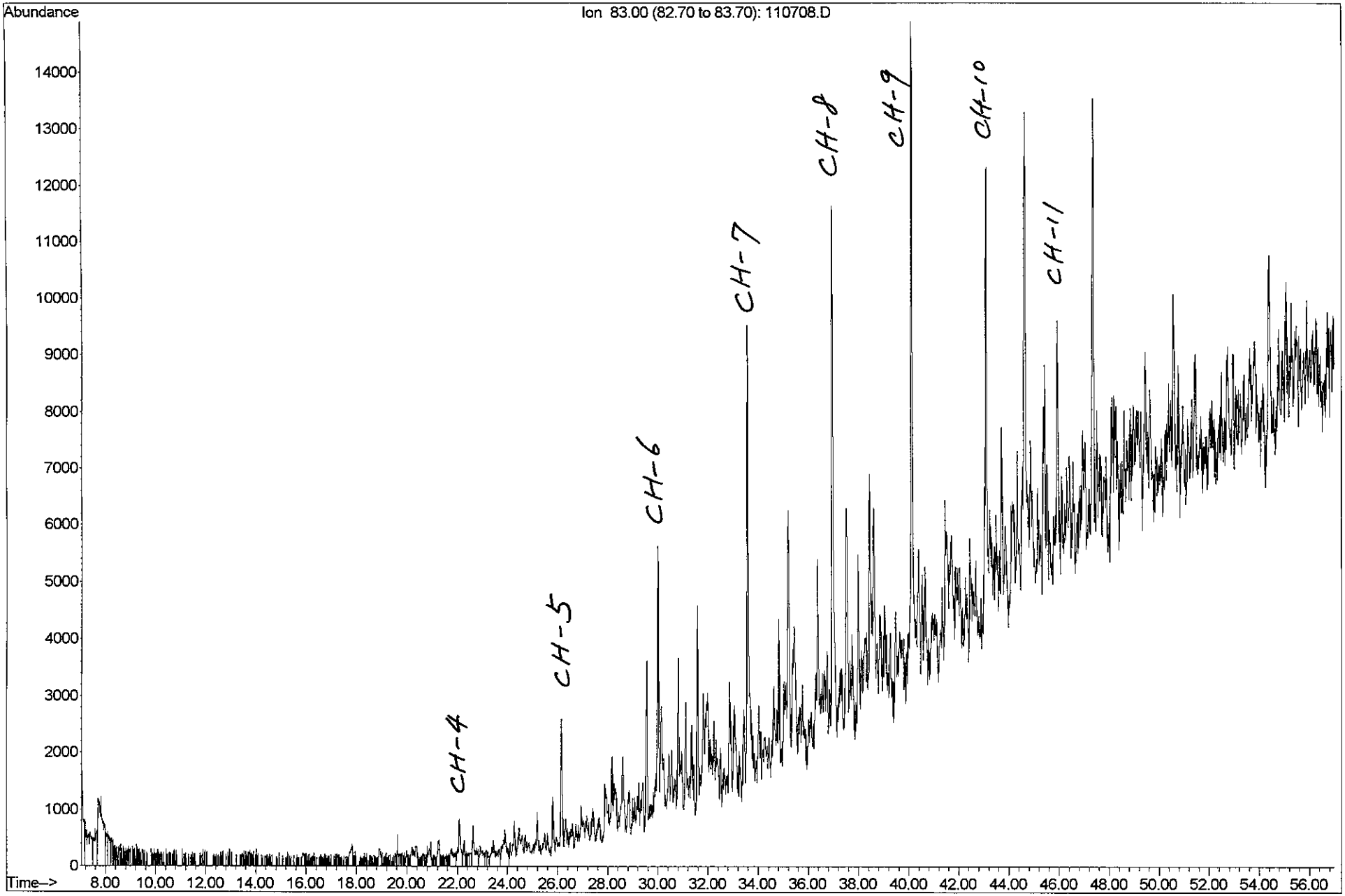
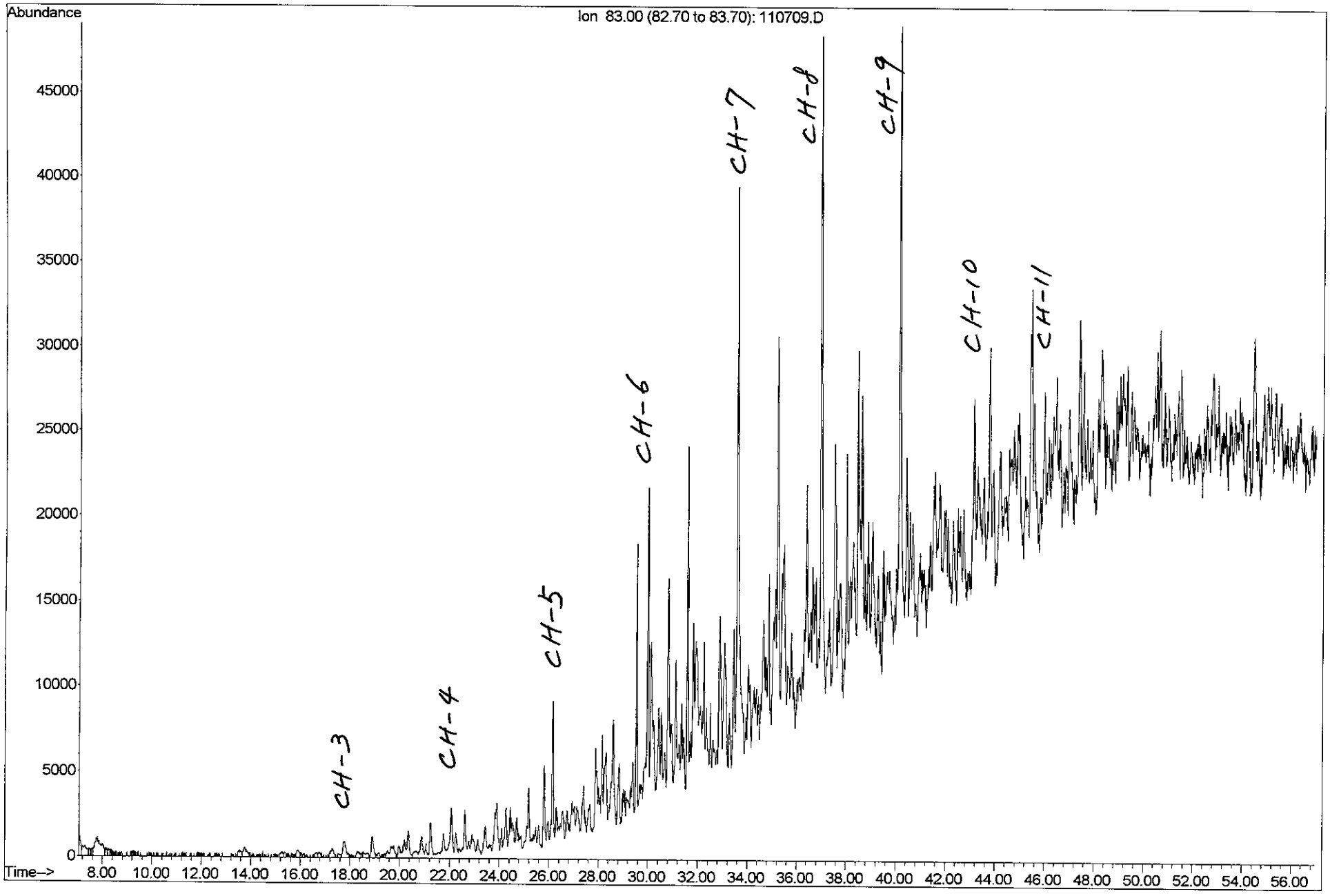
Mare Island, CH2M HILL



FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



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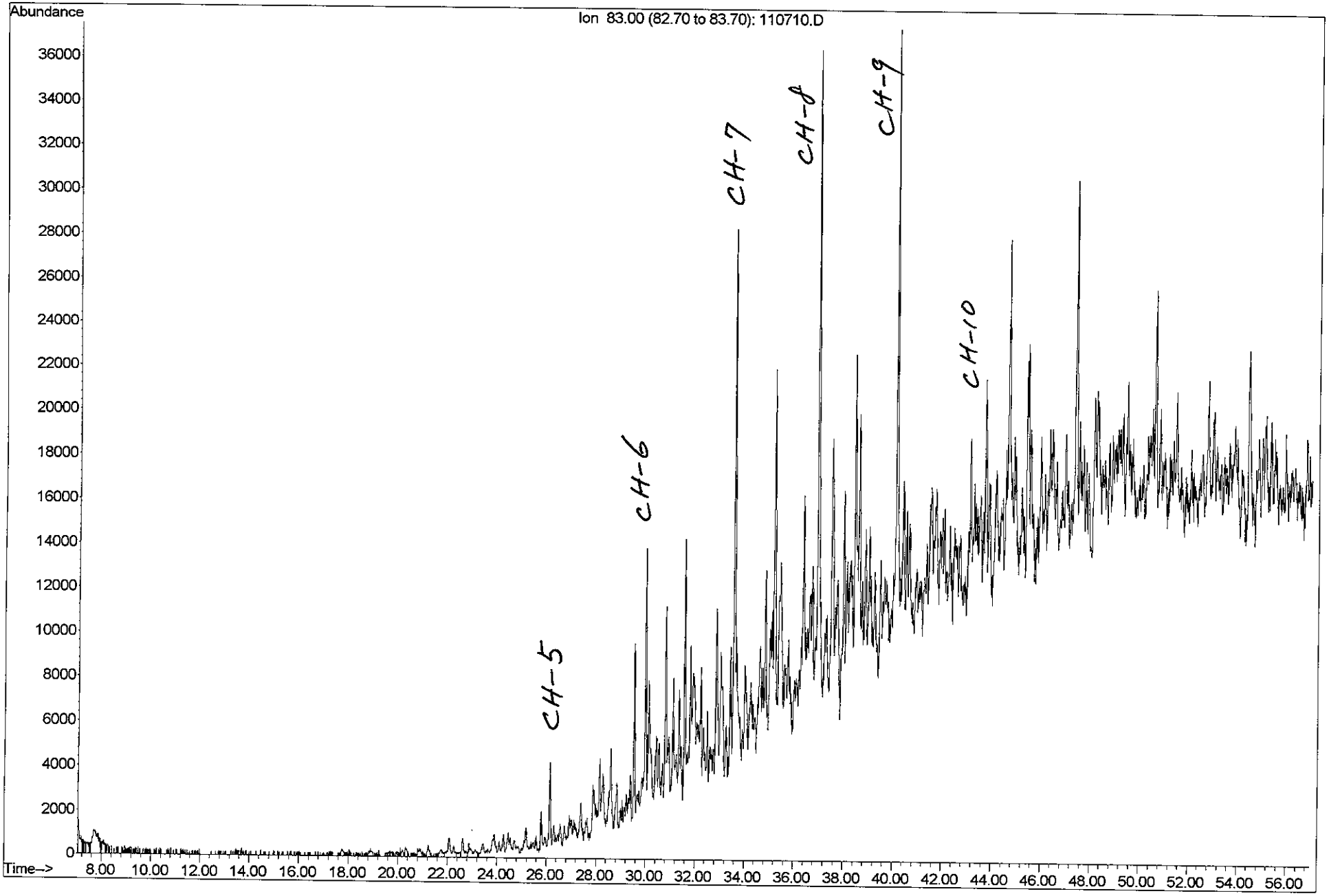
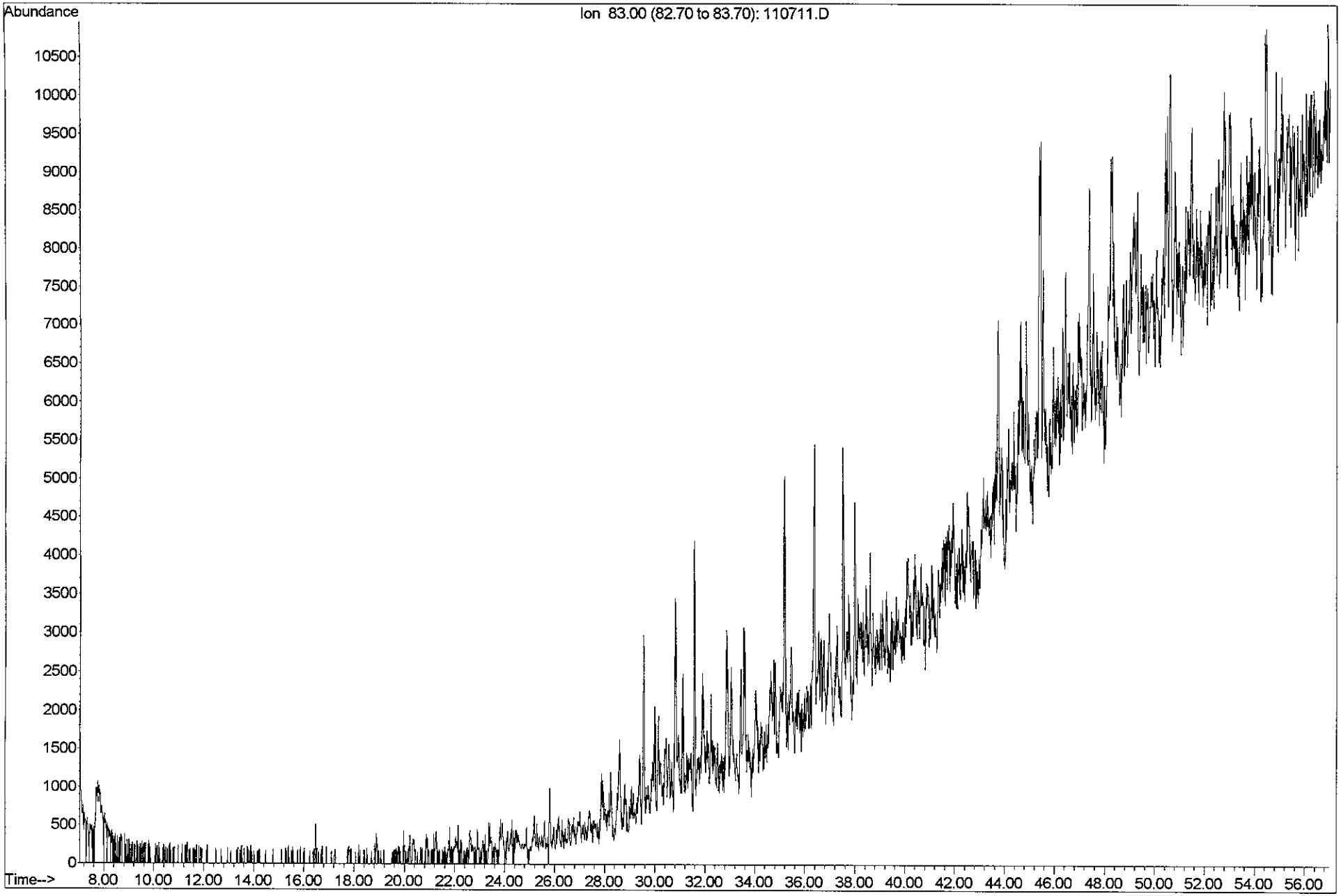
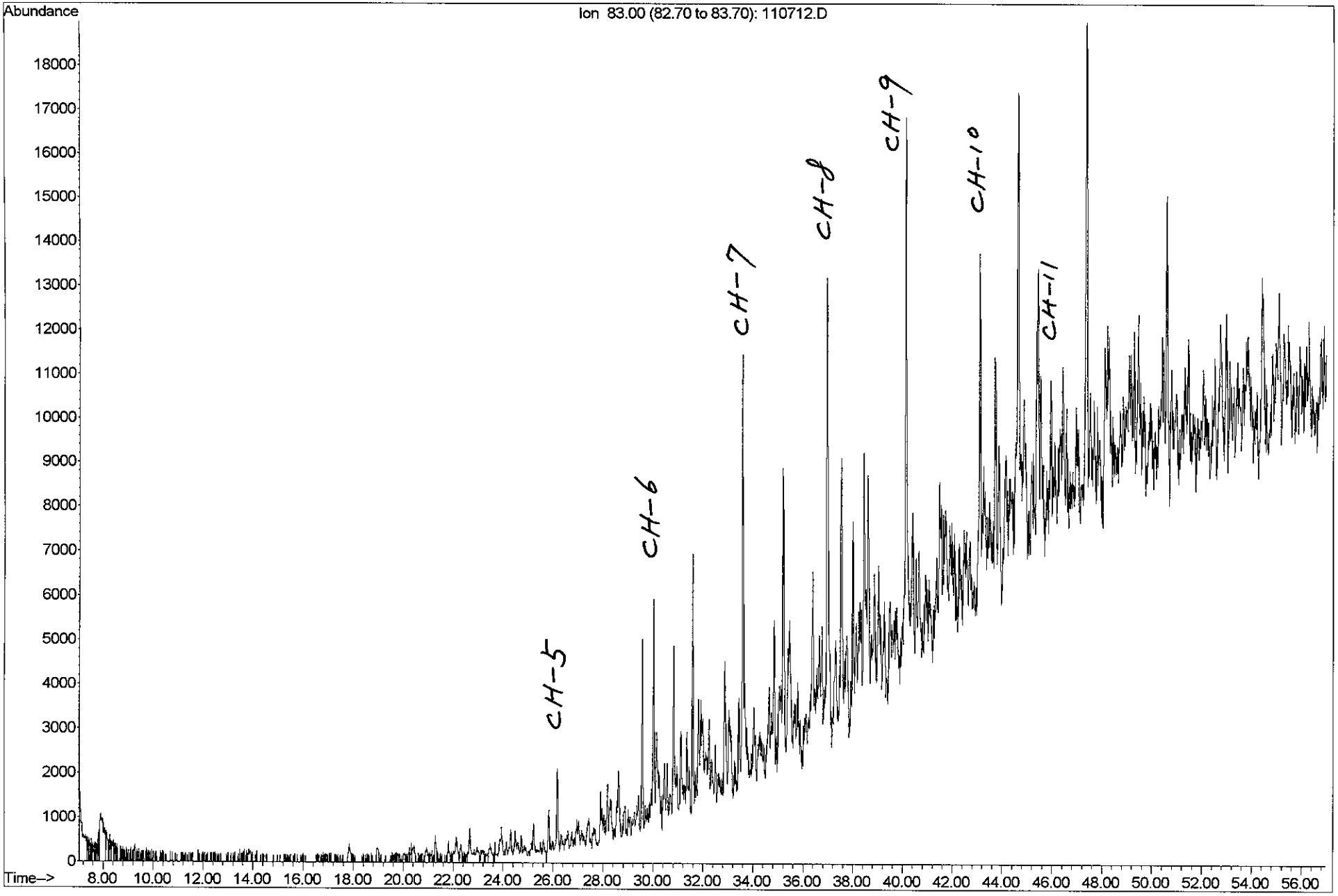
Mare Island, CH2M HILL



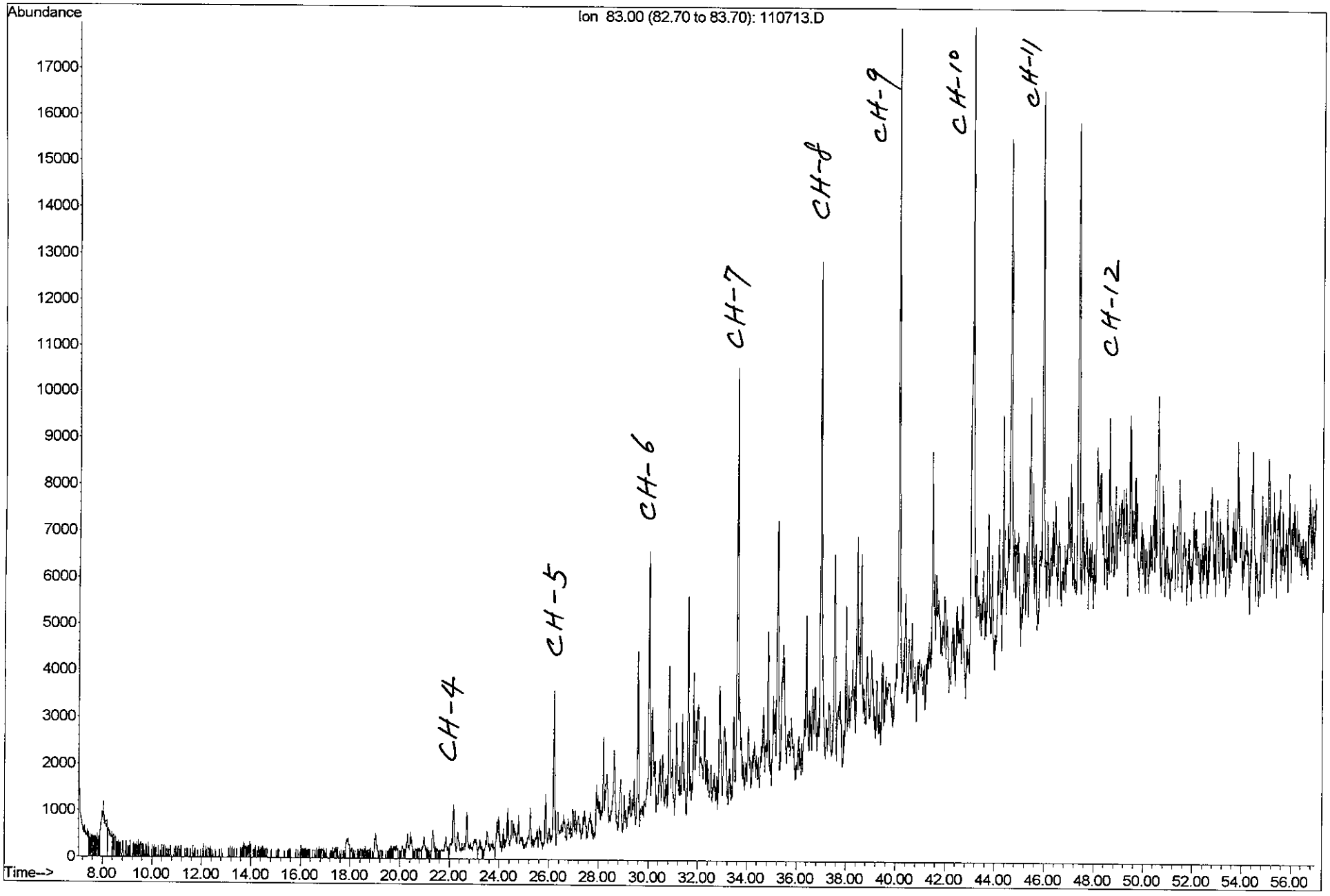
FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



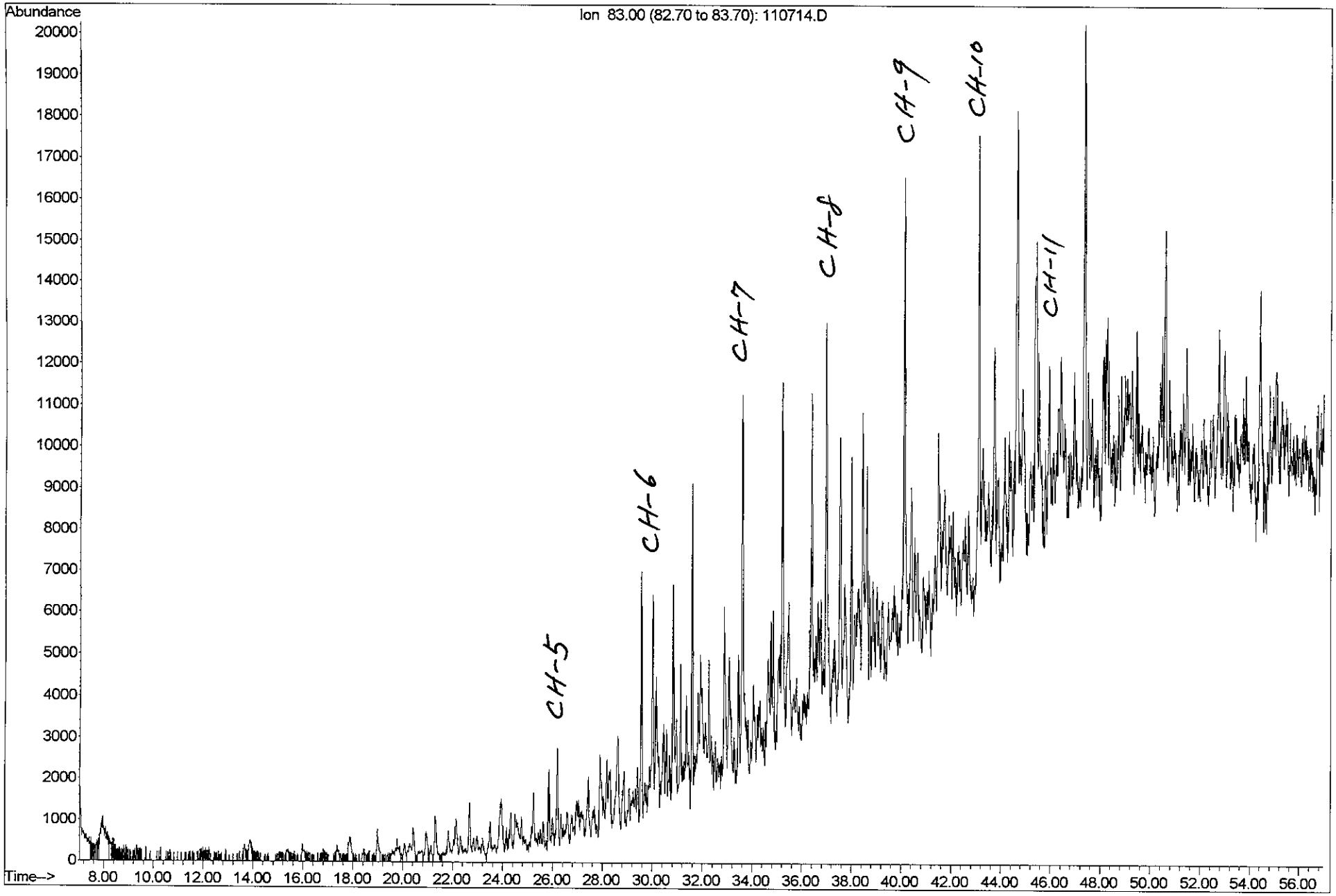
FTPH-FP-UT-QT (41362-6) product
Mare Island, CH2M HILL



FTPH-FP-SB-C (41362-7) product
Mare Island, CH2M HILL



FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL

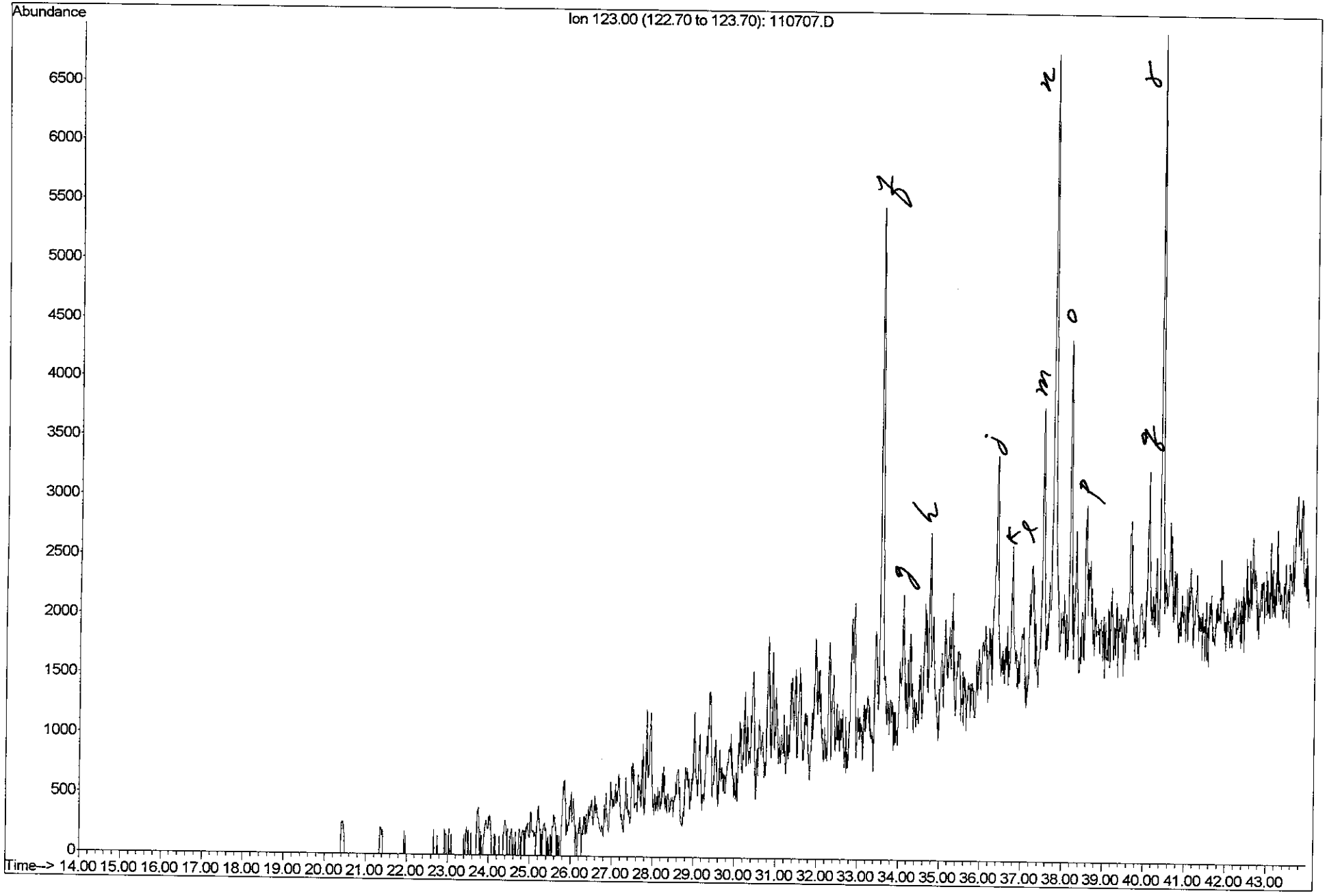


Table

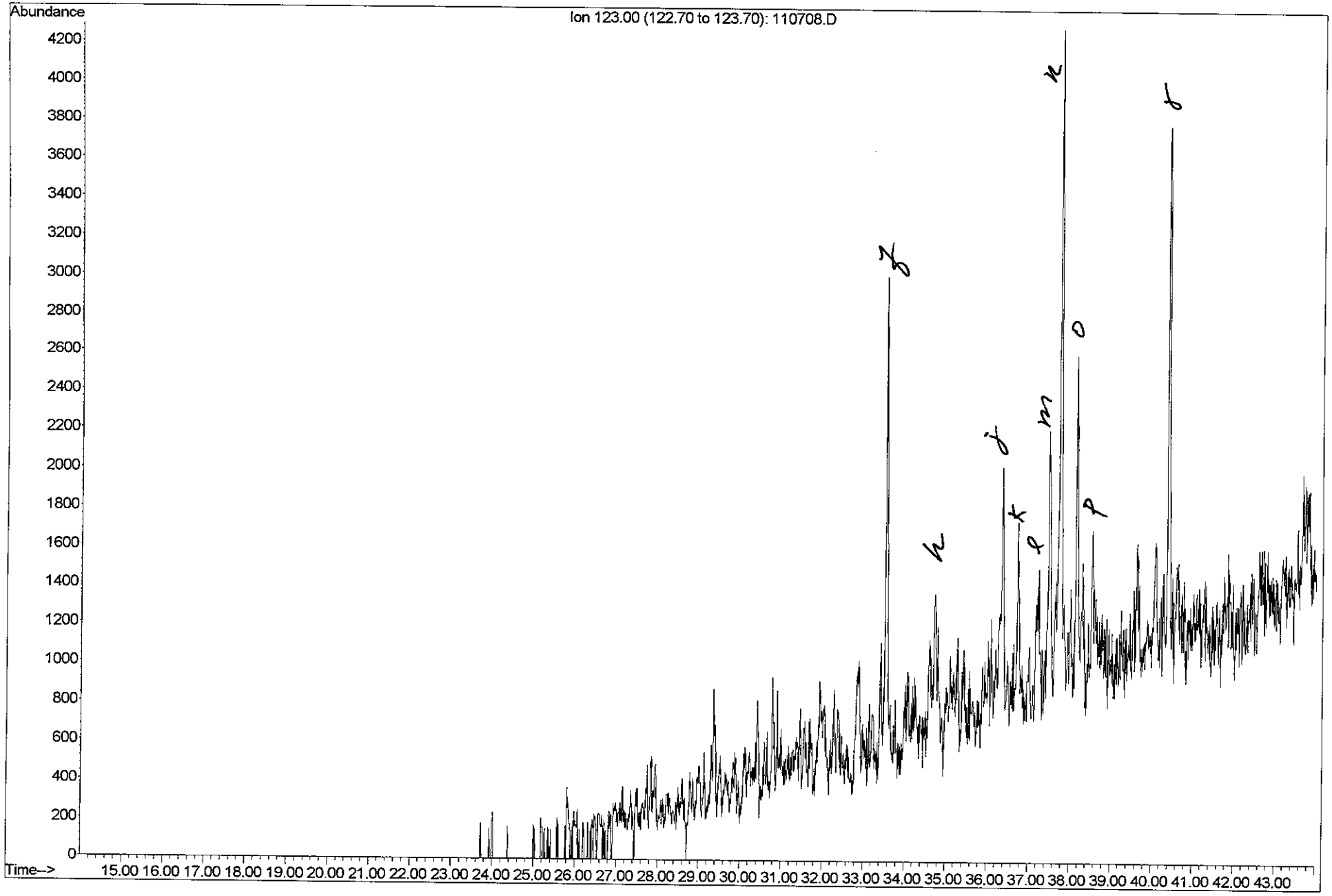
Key for identification of the Bicyclanes (m/z 123 mass chromatograms)

Peak No.	Identity	Formula	M.W.
a	2,2,3-Trimethylbicyloheptane	$C_{10}H_{18}$	138
b	C_{10} bicycloalkane	$C_{10}H_{18}$	138
c	3,3,7-Trimethylbicycloheptane	$C_{10}H_{18}$	138
d	C_{11} decalin	$C_{11}H_{20}$	152
f	Nordrimane	$C_{14}H_{26}$	194
g	Nordrimane	$C_{14}H_{26}$	194
h	Rearranged drimane	$C_{15}H_{28}$	208
j	Rearranged drimane	$C_{15}H_{28}$	208
k	Isomer of eudesmane	$C_{15}H_{28}$	208
l	4β(H) Eudesmane	$C_{15}H_{28}$	208
m	C_{15} bicyclic sesquiterpane	$C_{15}H_{28}$	208
n	8β(H) Drimane	$C_{15}H_{28}$	208
o	C_{15} bicyclic sesquiterpane	$C_{15}H_{28}$	208
p	C_{16} bicyclic sesquiterpane	$C_{16}H_{30}$	222
q	C_{16} bicyclic sesquiterpane	$C_{16}H_{30}$	222
r	8β(H) Homodrimane	$C_{16}H_{30}$	222

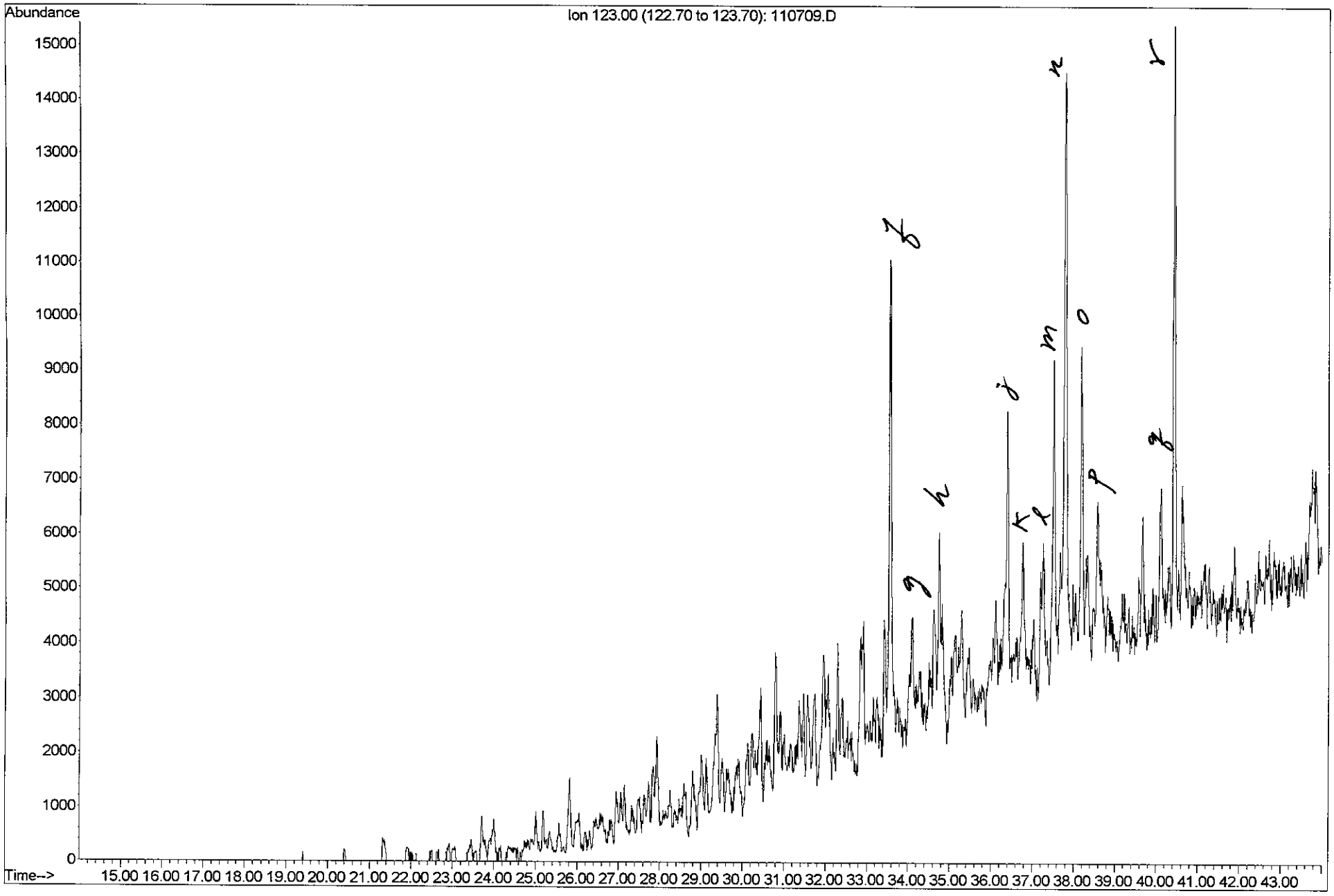
FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



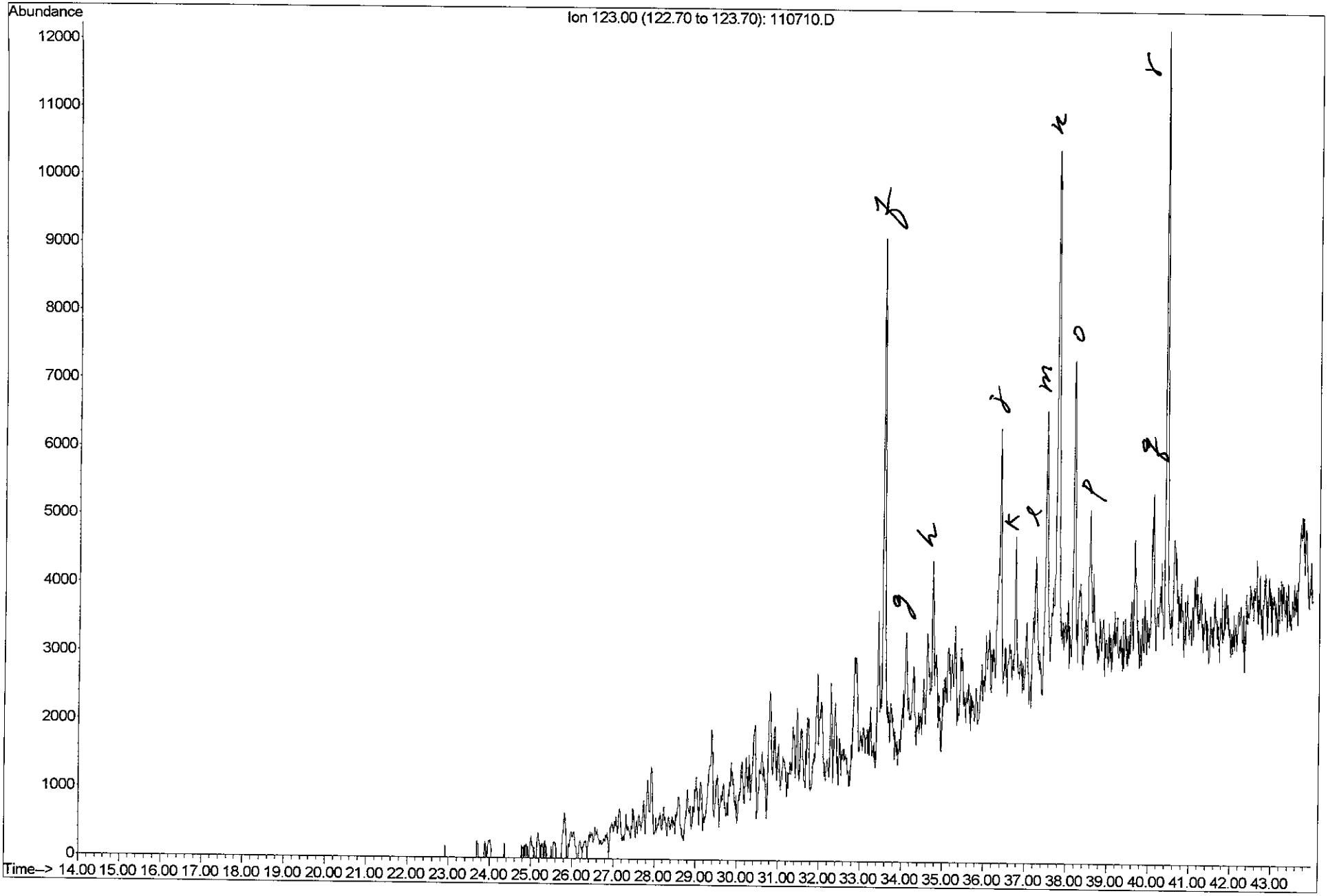
FTPH-FP-SB-MM (41362-2) product
Mare Island, CH2M HILL



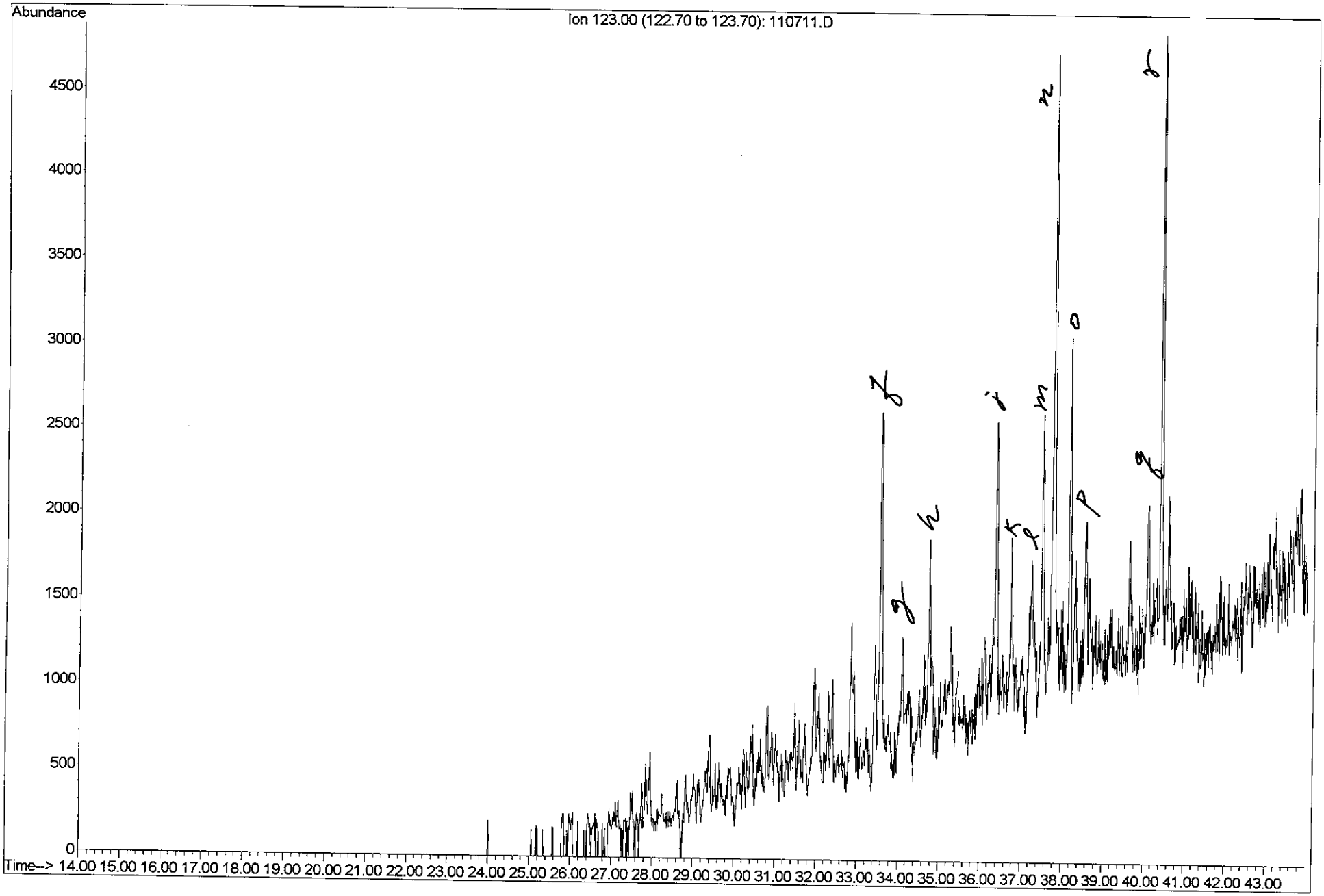
FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



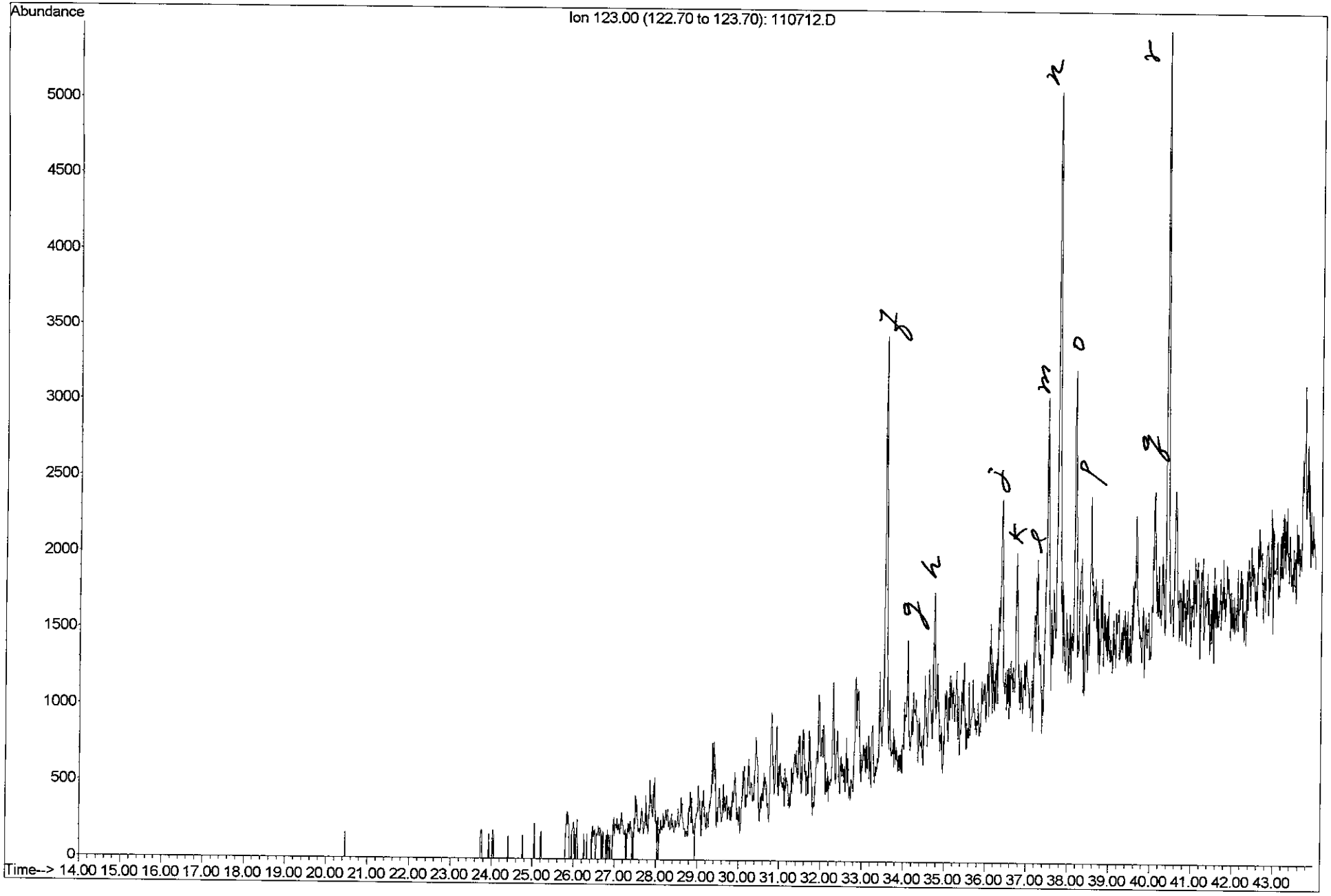
FTPH-FP-SB-PP (41362-4) product
Mare Island, CH2M HILL



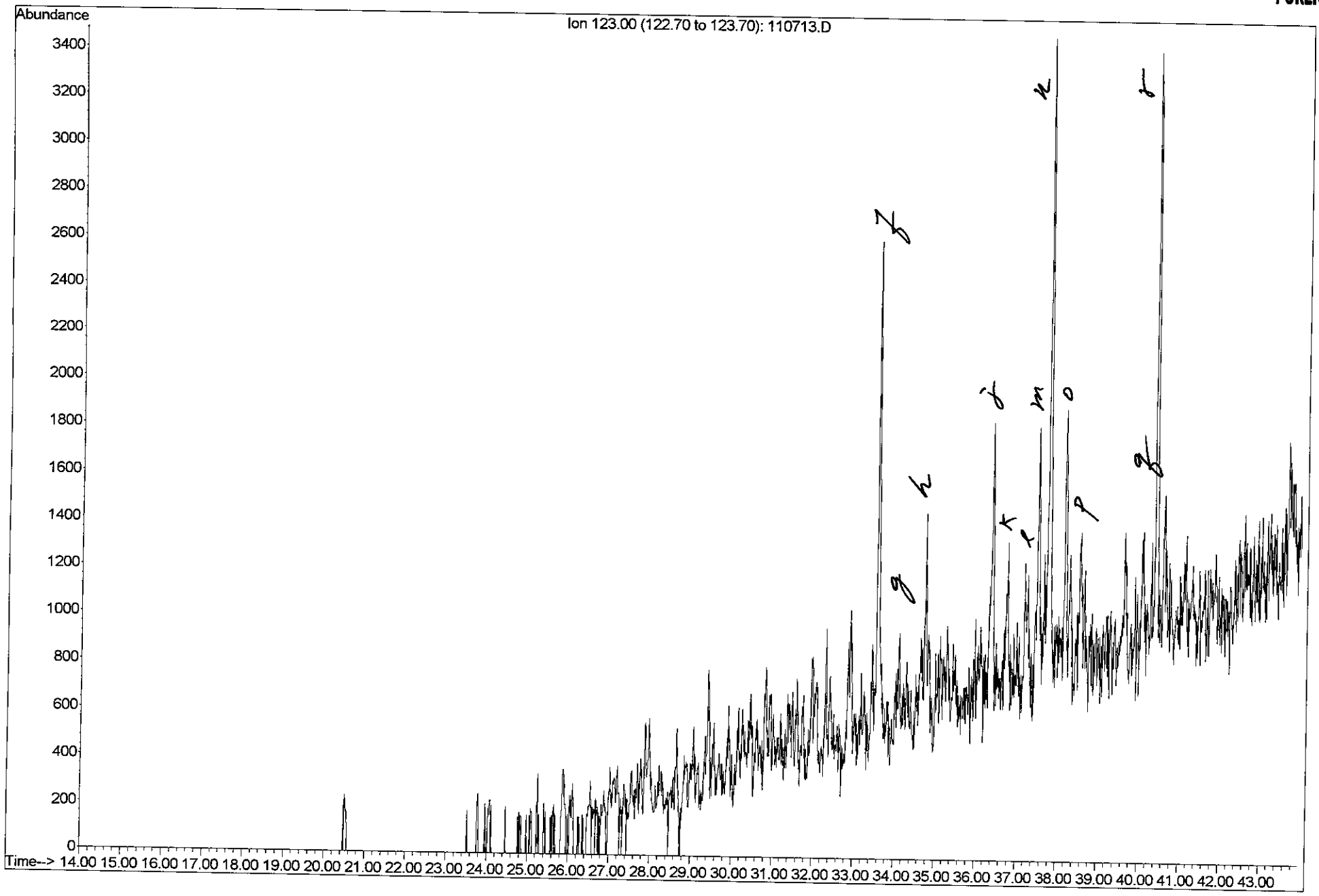
FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



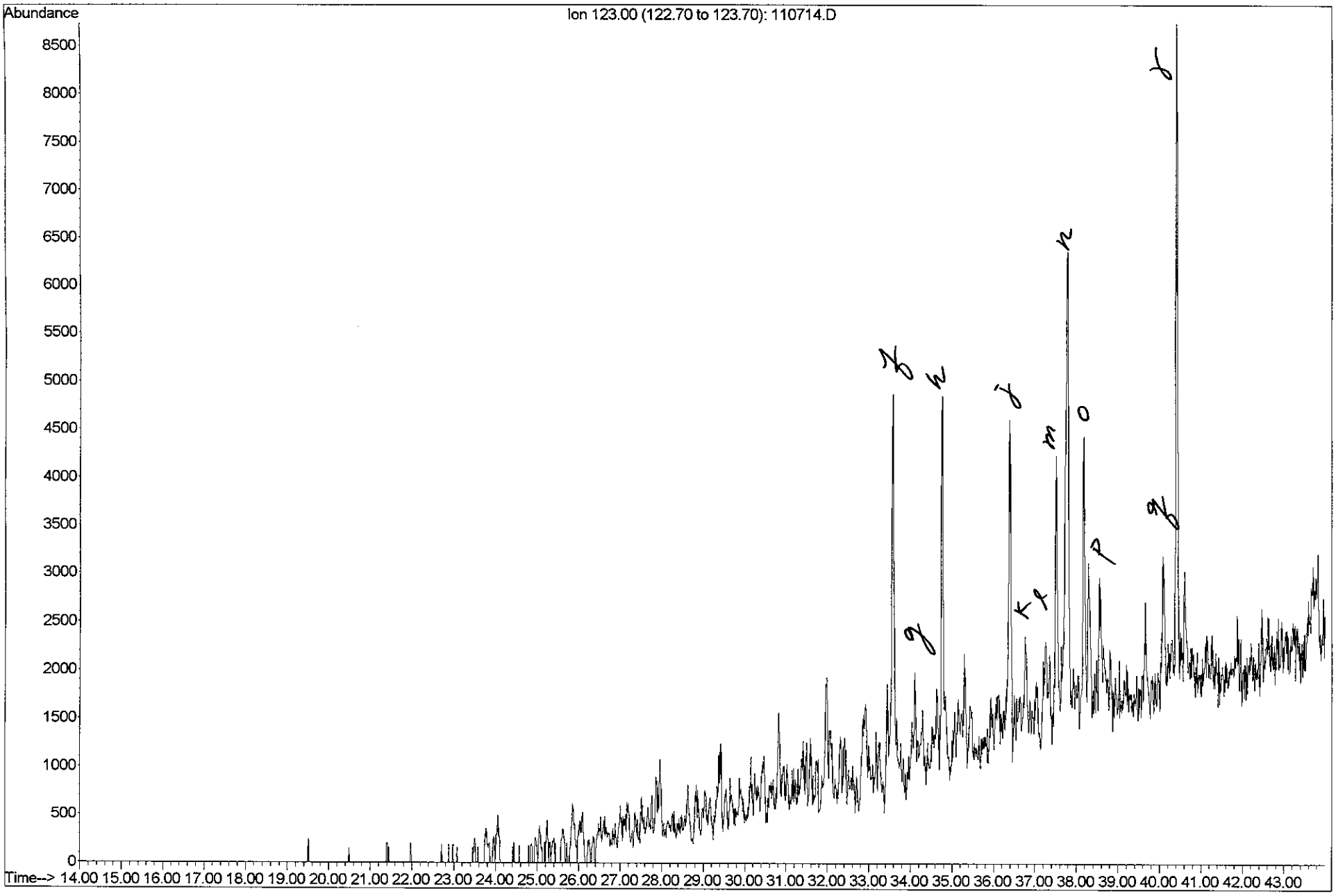
FTPH-FP-UT-QT (41362-6) product
Mare Island, CH2M HILL

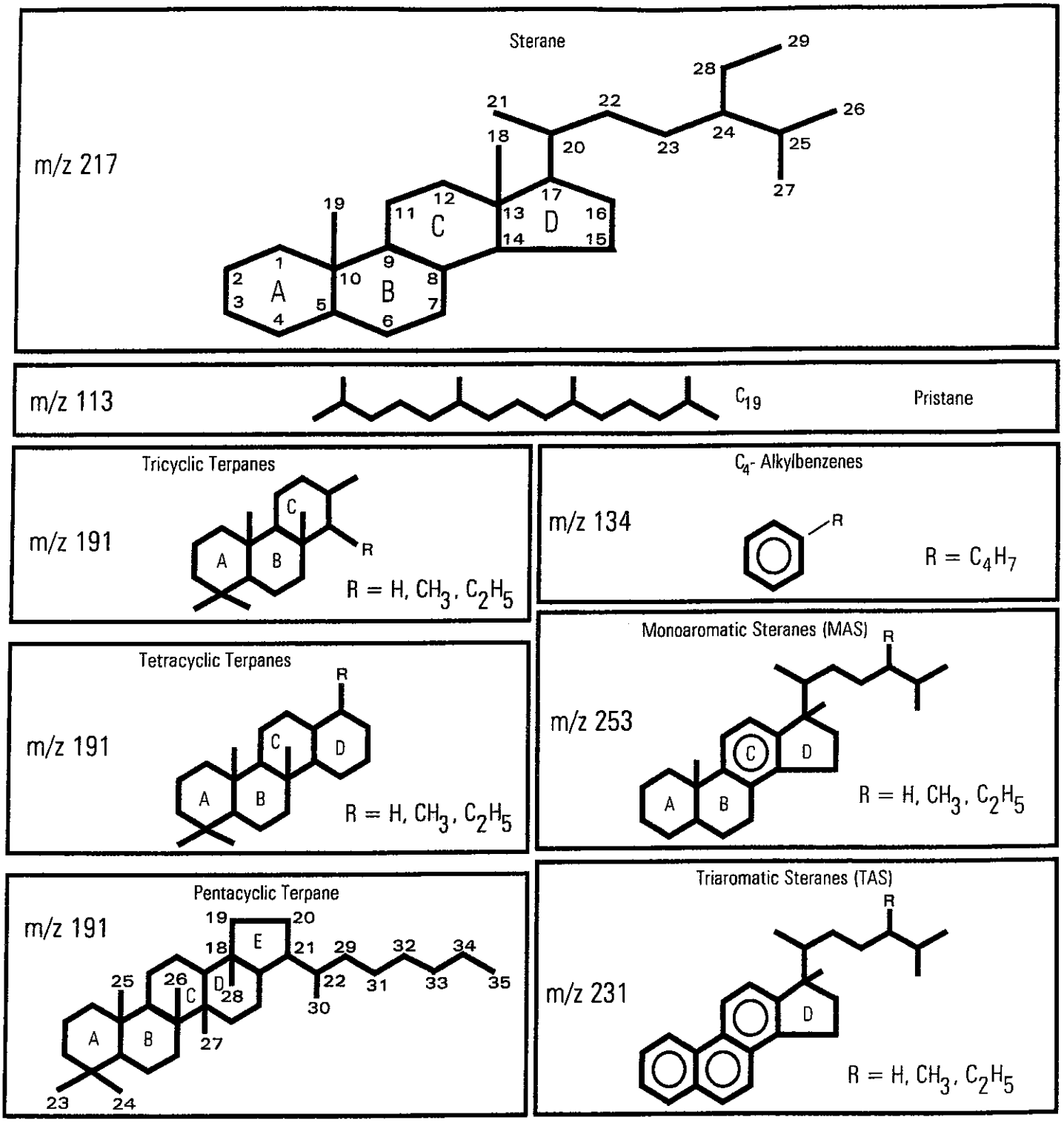


FTPH-FP-SB-C (41362-7) product
Mare Island, CH2M HILL



FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL





The compound structures of pristane, C_4-alkylbenzenes, sterane; terpanes; monoaromatic and triaromatic steranes

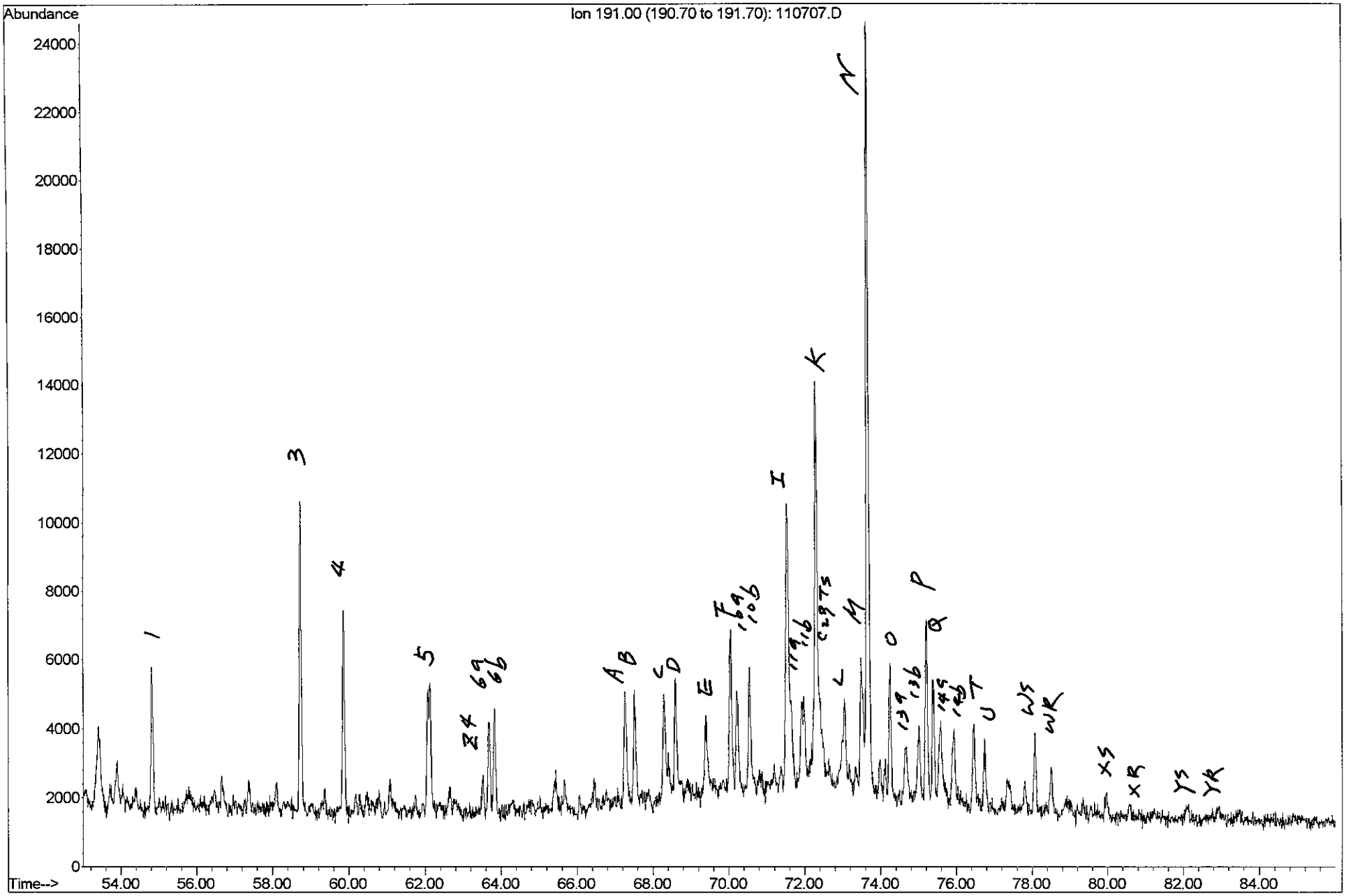
Table

ZymaX FORENSICS

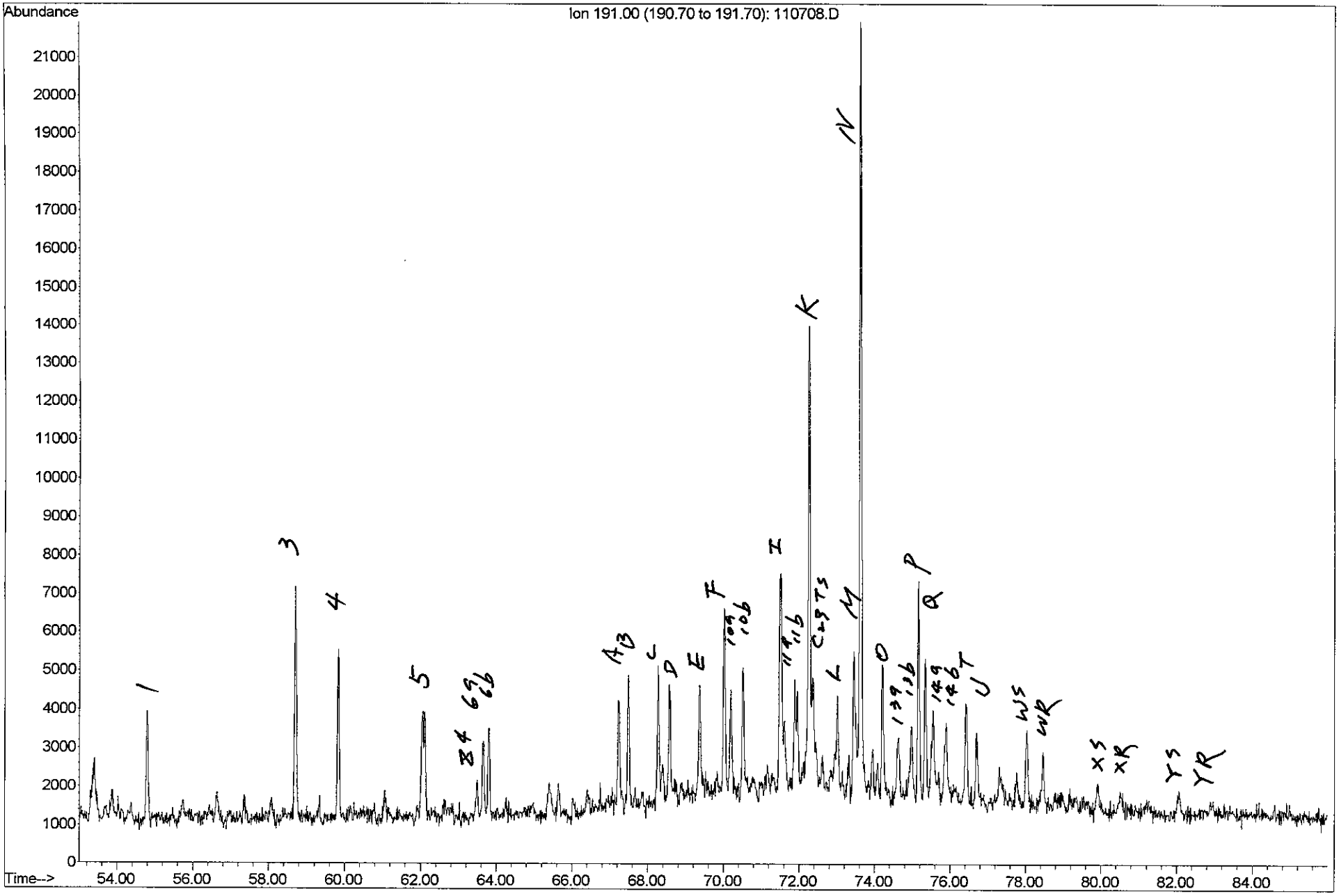
Key for Tricyclic, Tetracyclic, and Pentacyclic Terpanes Identification (m/z 191 mass chromatograms)

Code	Identity	Carbon #
0	C_{20}-Tricyclic Terpane	20
1	C_{21}-Tricyclic Terpane	21
2	C_{22}-Tricyclic Terpane	22
3	C_{23}-Tricyclic Terpane	23
4	C_{24}-Tricyclic Terpane	24
5	C_{25}-Tricyclic Terpane	25
Z4	C_{24}-Tetracyclic Terpane	24
6a	C_{26}-Tricyclic Terpane	26
6b	C_{26}-Tricyclic Terpane	26
7	C_{27}-Tricyclic Terpane	27
A	C_{28}-Tricyclic Terpane #1	28
B	C_{28}-Tricyclic Terpane #2	28
C	C_{29}-Tricyclic Terpane #1	29
D	C_{29}-Tricyclic Terpane #2	29
E	18α-22,29,30-Trisnorneohopane (Ts)	27
F	17α-22,29,30-Trisnorhopane (Tm)	27
G	17ß-22,29-30-Trisnorhopane	27
H	17α-23,28-Bisnorlupane	28
10a	C_{30}-Tricyclic Terpane #1	30
10b	C_{30}-Tricyclic Terpane #2	30
I	17α-28,30-Bisnorhopane	28
11a	C_{31}-Tricyclic Terpane #1	31
J	17α-25-Norhopane	29
11b	C_{31}-Tricyclic Terpane #2	31
K	17α,21ß-30-Norhopane	29
C_{29}Ts	18α-30-Norneohopane	29
C_{30}*	17α-Diahopane	30
L	17ß-21α-30-Normoretane	29
Ma	18α-Oleanane	30
Mb	18ß-Oleanane	30
N	17α,21ß-Hopane	30
O	17ß,21α-Moretane	30
13a	C_{33}-Tricyclic Terpane #1	33
13b	C_{33}-Tricyclic Terpane #2	33
P	22S-17α,21ß-30-Homohopane	31
Q	22R-17α,21ß-30-Homohopane	31
R	Gammacerane	30
14a	C_{34}-Tricyclic Terpane #1	34
S	17ß,21α-Homomoretane	31
14b	C_{34}-Tricyclic Terpane #2	34
T	22S-17α,21ß-30-Bishomohopane	32
U	22R-17α,21ß-30-Bishomohopane	32
15a	C_{35}-Tricyclic Terpane #1	35
15b	C_{35}-Tricyclic Terpane #2	35
V	17ß,21α-C_{32}-Bishomomoretane	32
WS	22S-17α,21ß-30,31,32-Trishomohopane	33
WR	22R-17α,21ß-30,31,32-Trishomohopane	33
16a	C_{36}-Tricyclic Terpane #1	36
16b	C_{36}-Tricyclic Terpane #2	36
XS	22S-17α,21ß-30,31,32,33-Tetrahomohopane	34
XR	22R-17α,21ß-30,31,32,33-Tetrahomohopane	34
YS	22S-17α,21ß-30,31,32,33,34-Pentahomohopane	35
YR	22R-17α,21ß-30,31,32,33,34-Pentahomohopane	35

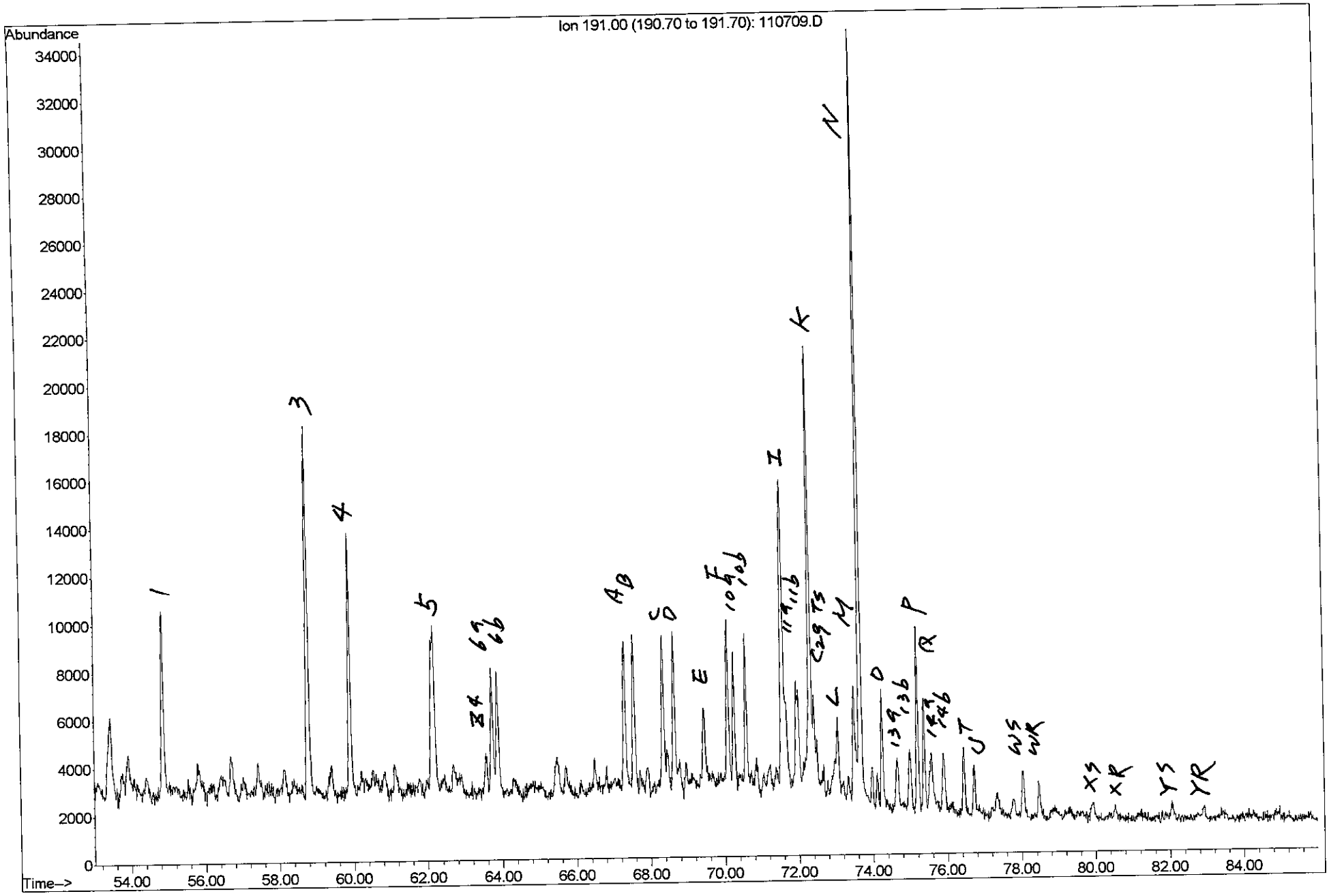
FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



FTPH-FP-SB-MM (41362-2) product
Mare Island, CH2M HILL



FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



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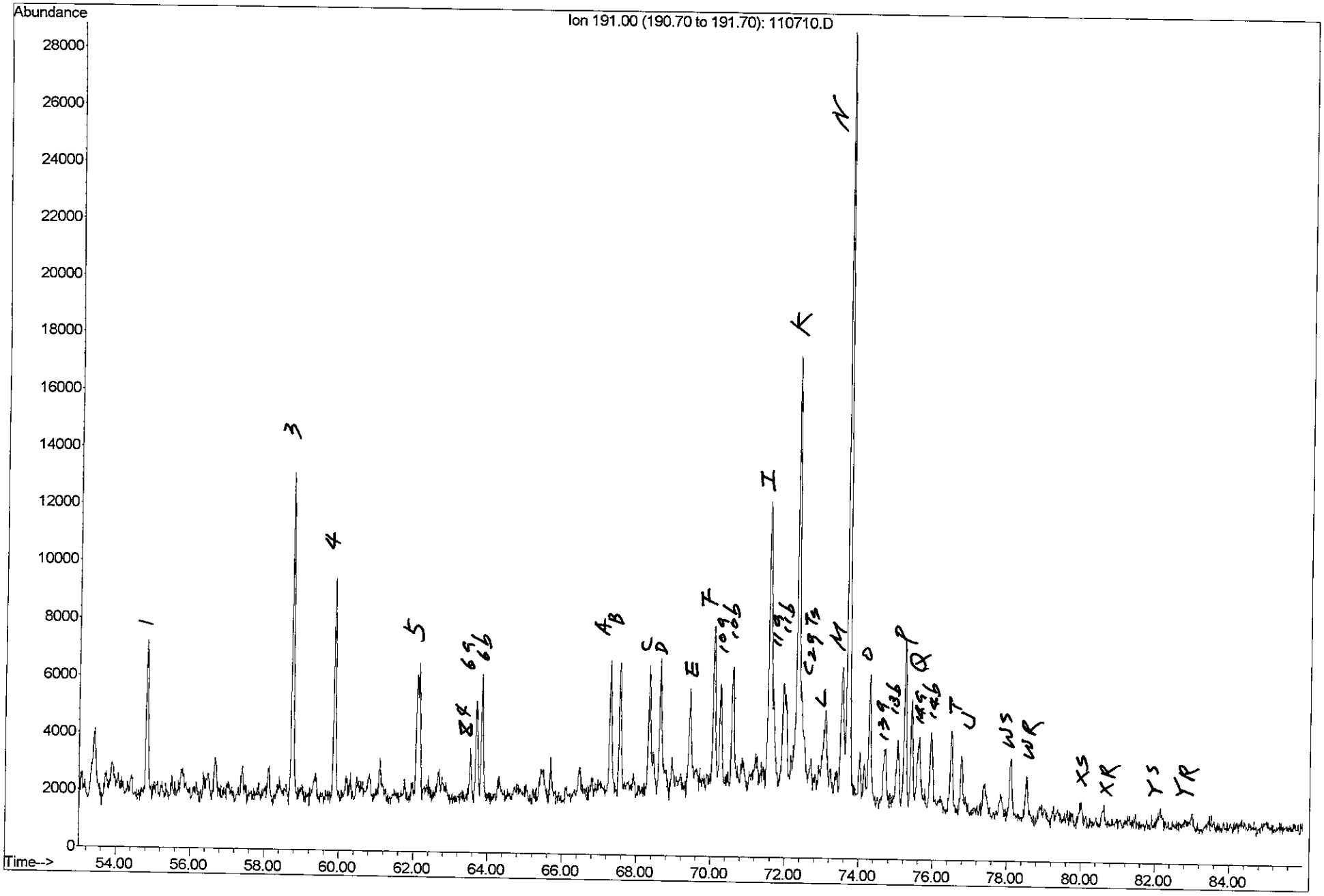
Mare Island, CH2M HILL



FTPH-FP-UT-QE (41362-5) product
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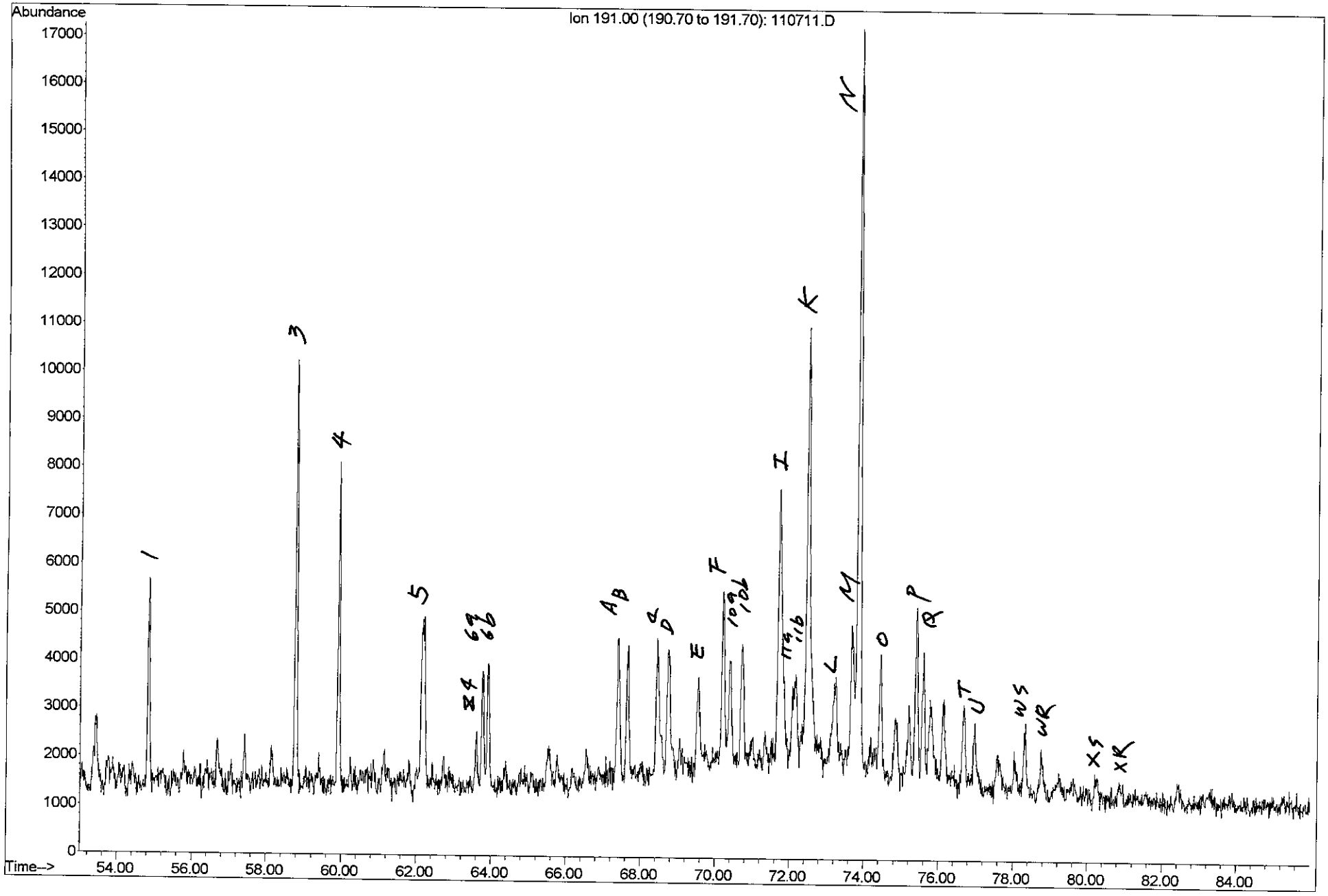

FTPH-FP-UT-QT (41362-6) product
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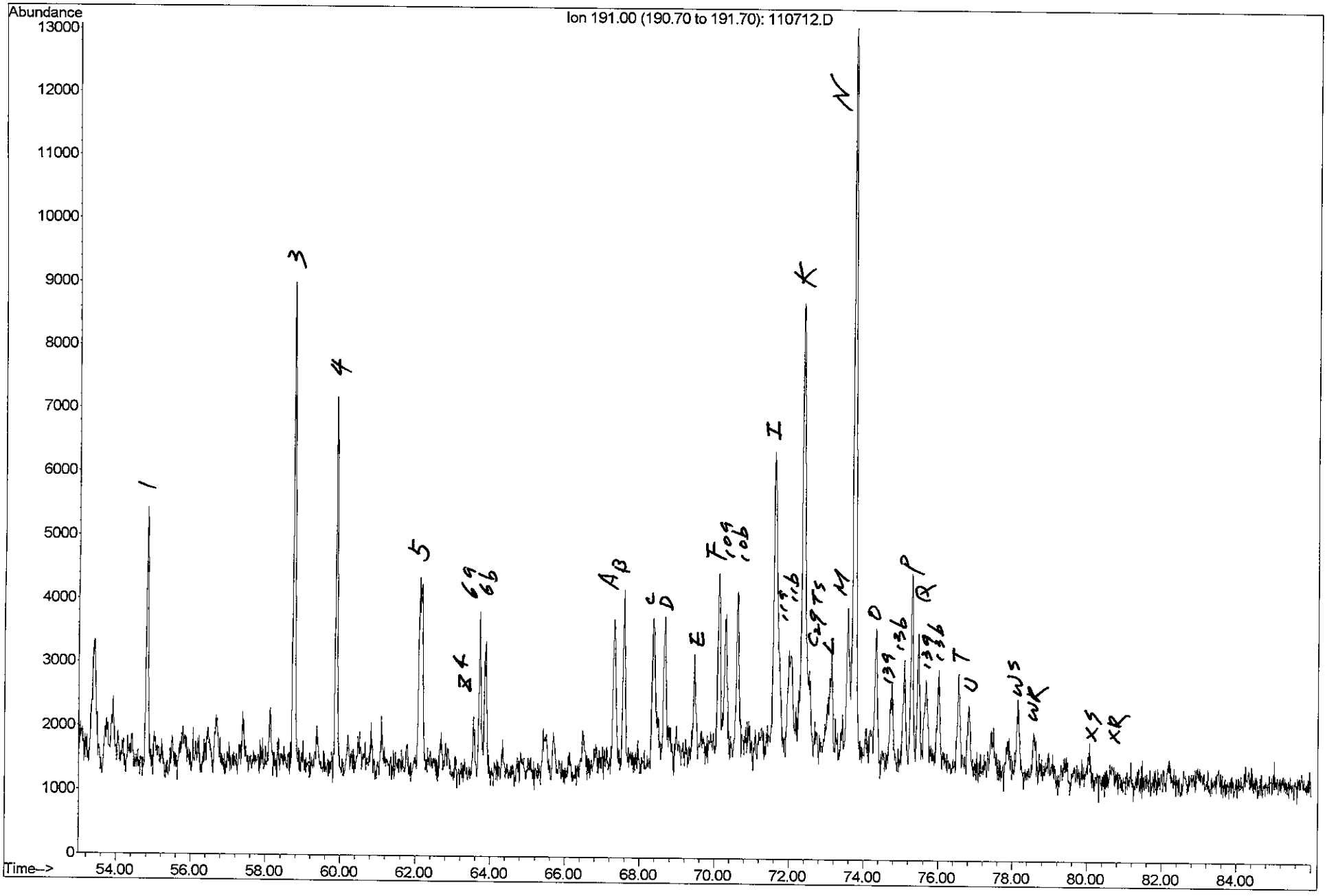

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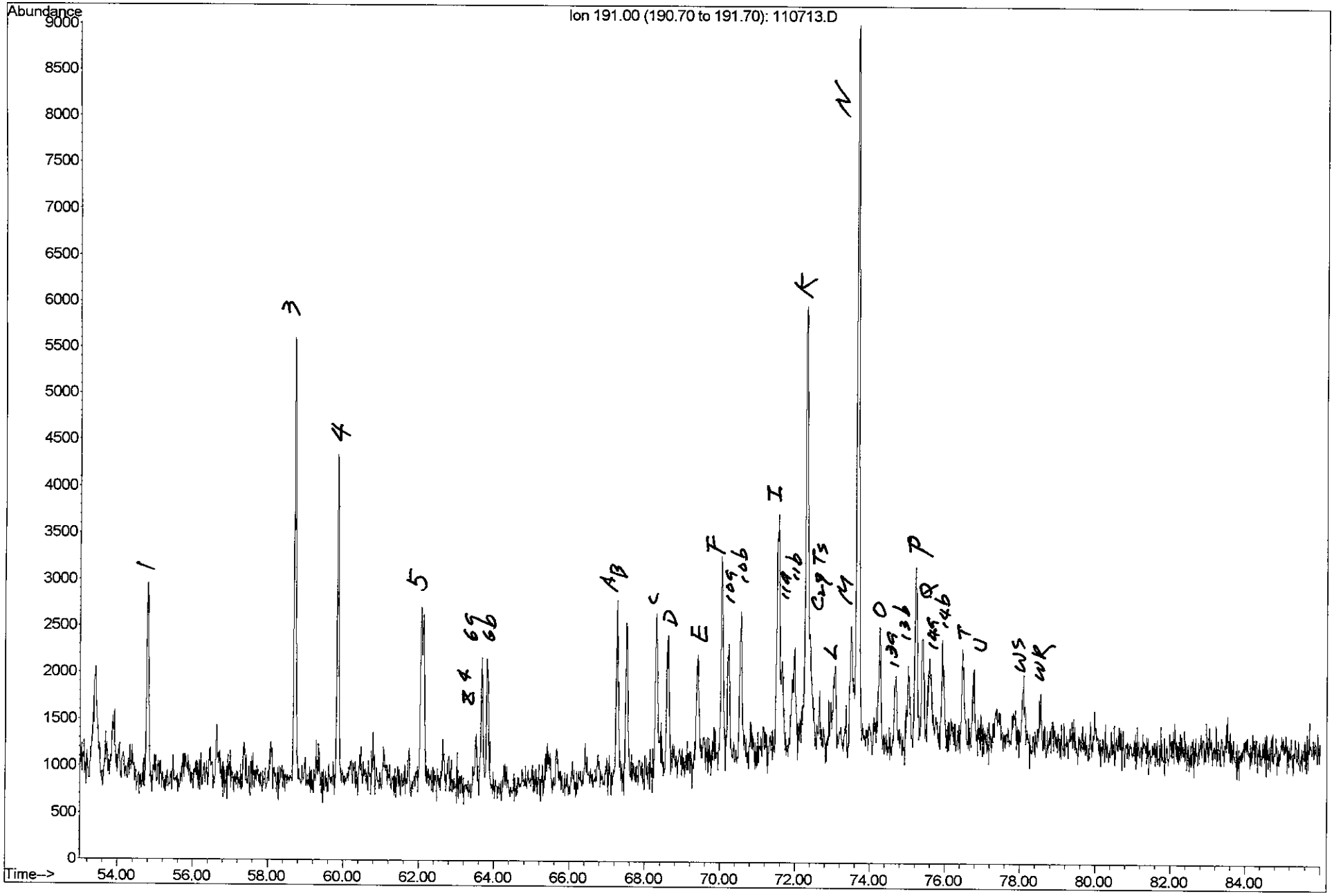
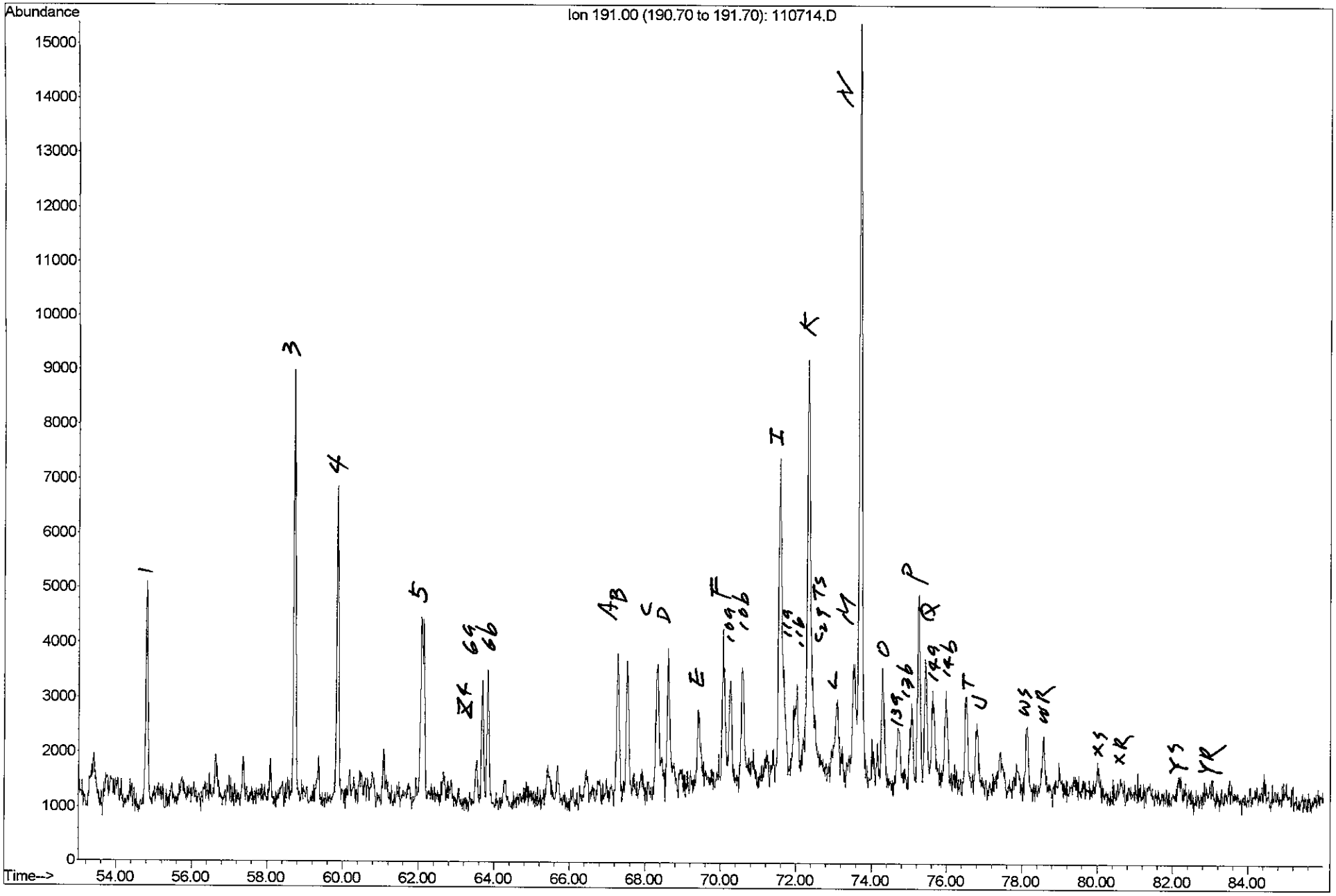


FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL

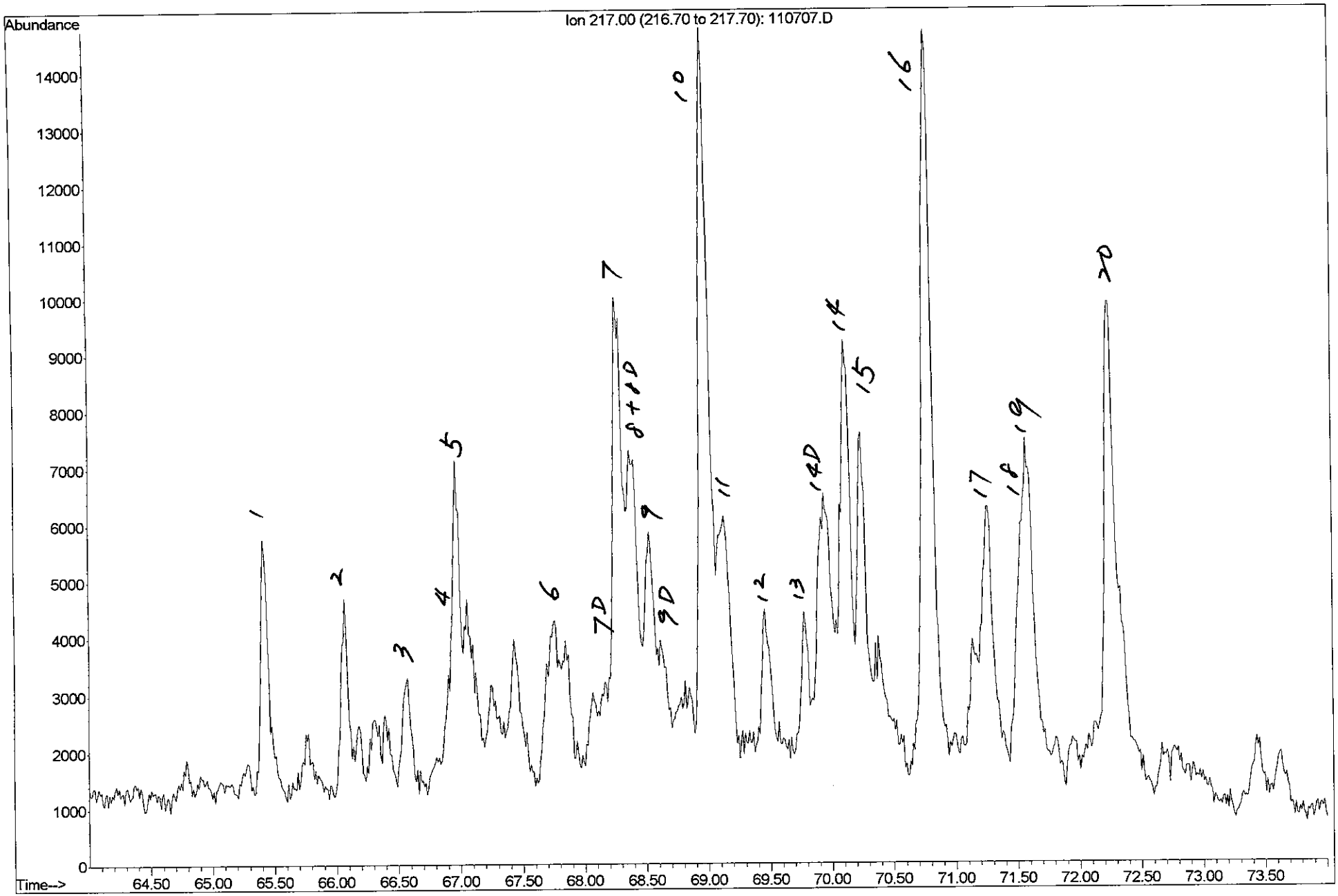


Table

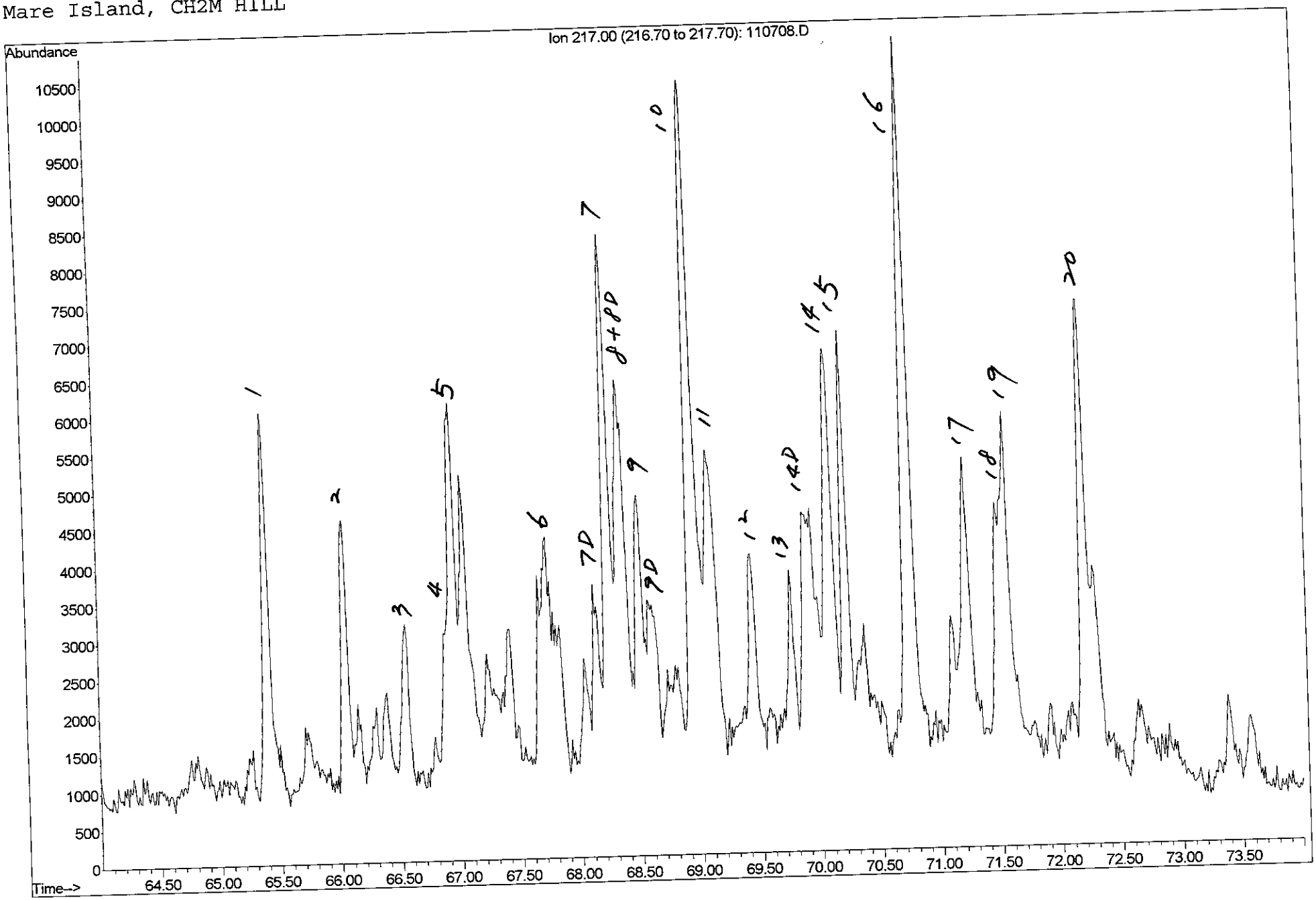
Key for Steranes Identification (m/z 217 Mass Chromatogram)

Code	Identity	Carbon #
1	13ß,17α-diacholestane (20S)	27
2	13ß,17α-diacholestane (20R)	27
3	13α,17ß-diacholestane (20S)	27
4	13α,17ß-diacholestane (20R)	27
5	24-methyl-13ß,17α-diacholestane (20S)	28
6	24-methyl-13ß,17α-diacholestane (20R)	28
7D	24-methyl-13α,17ß-diacholestane (20S)	28
7	14α,17α-cholestane (20S)	27
8D	24-ethyl-13ß,17α-diacholestane (20S)	29
8	14ß,17ß-cholestane (20R)	27
9	14ß,17ß-cholestane (20S)	27
9D	24-methyl-13α,17ß-diacholestane (20R)	28
10	14α,17α-cholestane (20R)	27
11	24-ethyl-13ß,17α-diacholestane (20R)	29
12	24-ethyl-13α,17ß-diacholestane (20S)	29
13	24-methyl-14α,17α-cholestane (20S)	28
14D	24-ethyl-13α,17ß-diacholestane (20R)	29
14	24-methyl-14ß,17ß-cholestane (20R)	28
15	24-methyl-14ß,17ß-cholestane (20S)	28
16	24-methyl-14α,17α-cholestane (20R)	28
17	24-ethyl-14α-cholestane (20S)	29
18	24-ethyl-14ß,17ß-cholestane (20R)	29
19	24-ethyl-14ß,17ß-cholestane (20S)	29
20	24-ethyl-14α,17α-cholestane (20R)	29
21A	24-n-Propylcholestane (20S)	30
21B	4-methyl-24-ethylcholestane (20S)	30
22A	4α-methyl-24-ethyl-14β,17β-cholestane(20S)	30
22B	24-n-propyl-14β,17β-cholestane (20S)	30
23A	4α-methyl-24-ethyl-14β,17β-cholestane(20R)	30
23B	24-n-propyl-14β,17β-cholestane (20R)	30
24A	4α-methyl-24-ethylcholestane(20R)	30
24B	24-n-propylcholestane (20R)	30

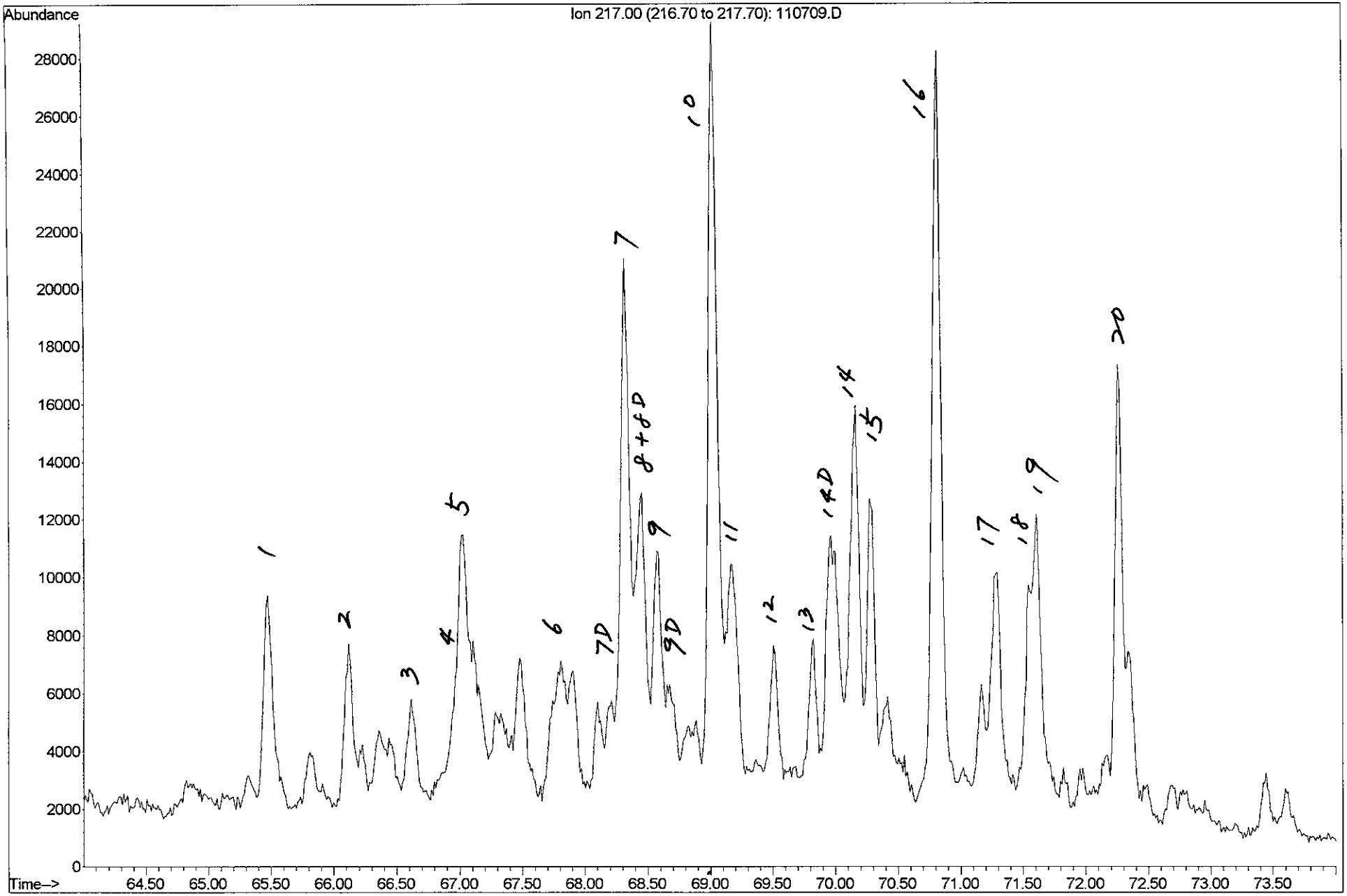
FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



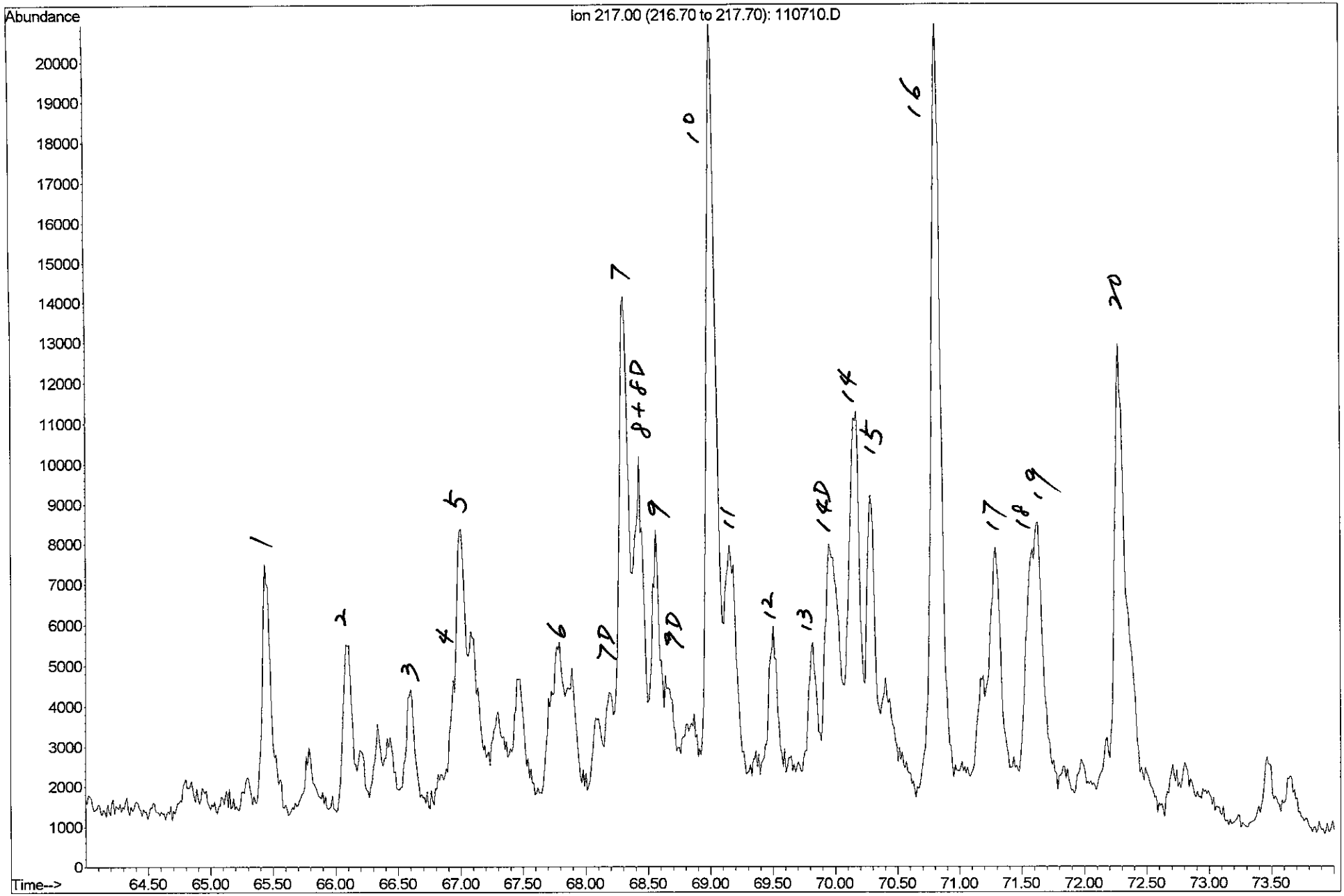
FTPH-FP-SB-MM (41362-2) product
Mare Island, CH2M HILL



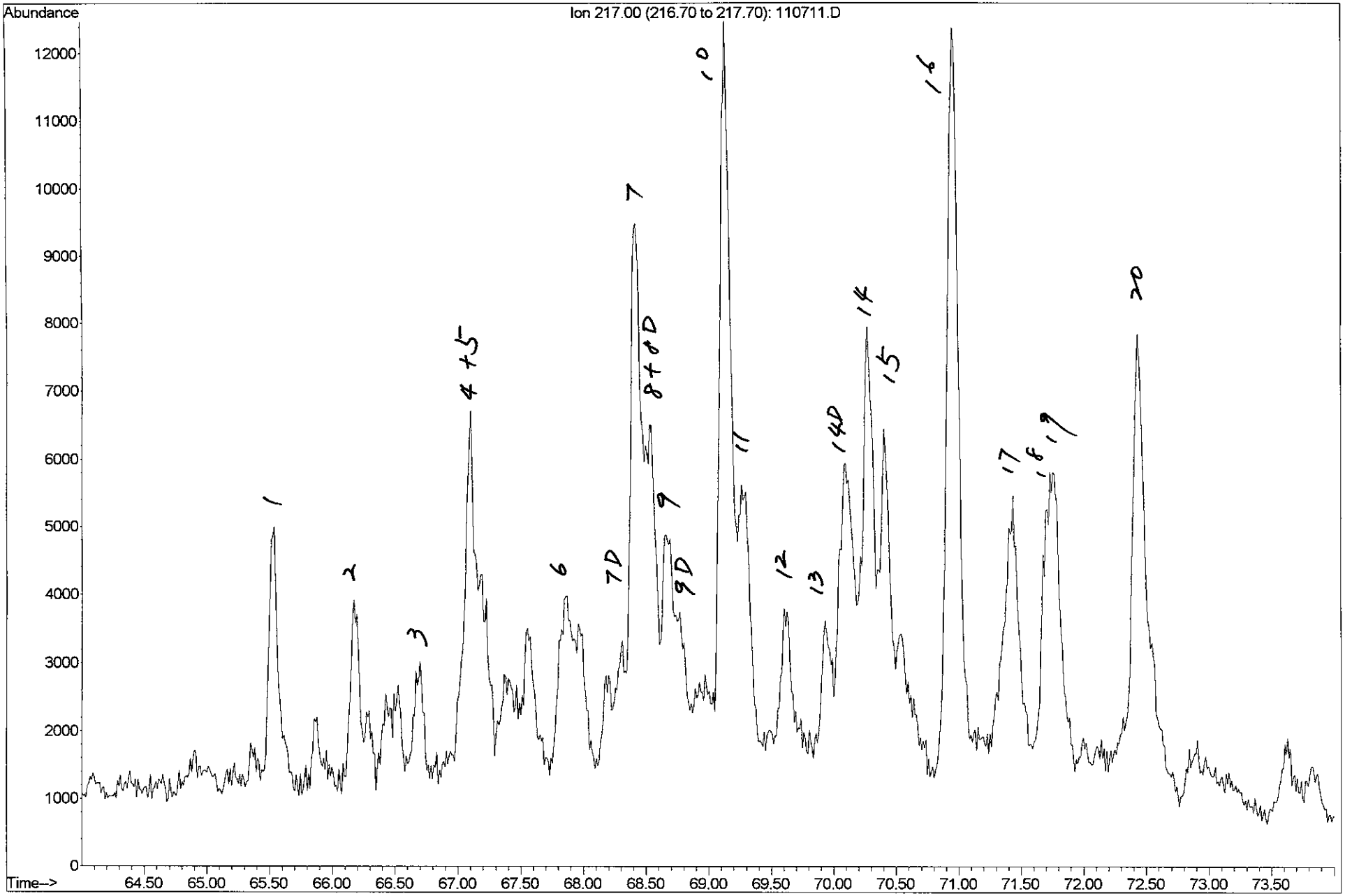
FTPH-FP-SB-NN (41362-3) product
Mare Island, CH2M HILL



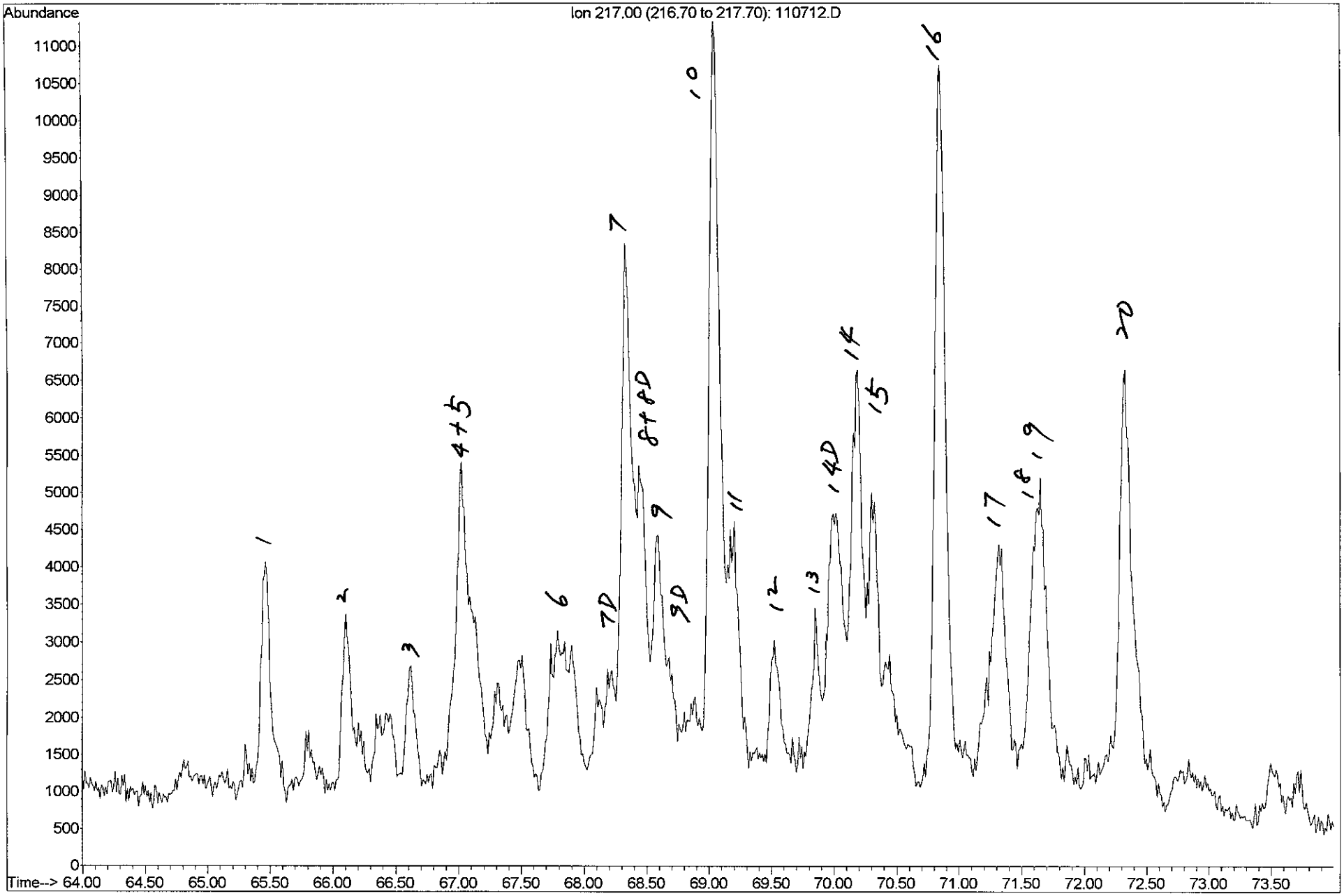
FTPH-FP-SB-PP (41362-4) product
Mare Island, CH2M HILL



FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



FTPH-FP-UT-QT (41362-6) product
Mare Island, CH2M HILL



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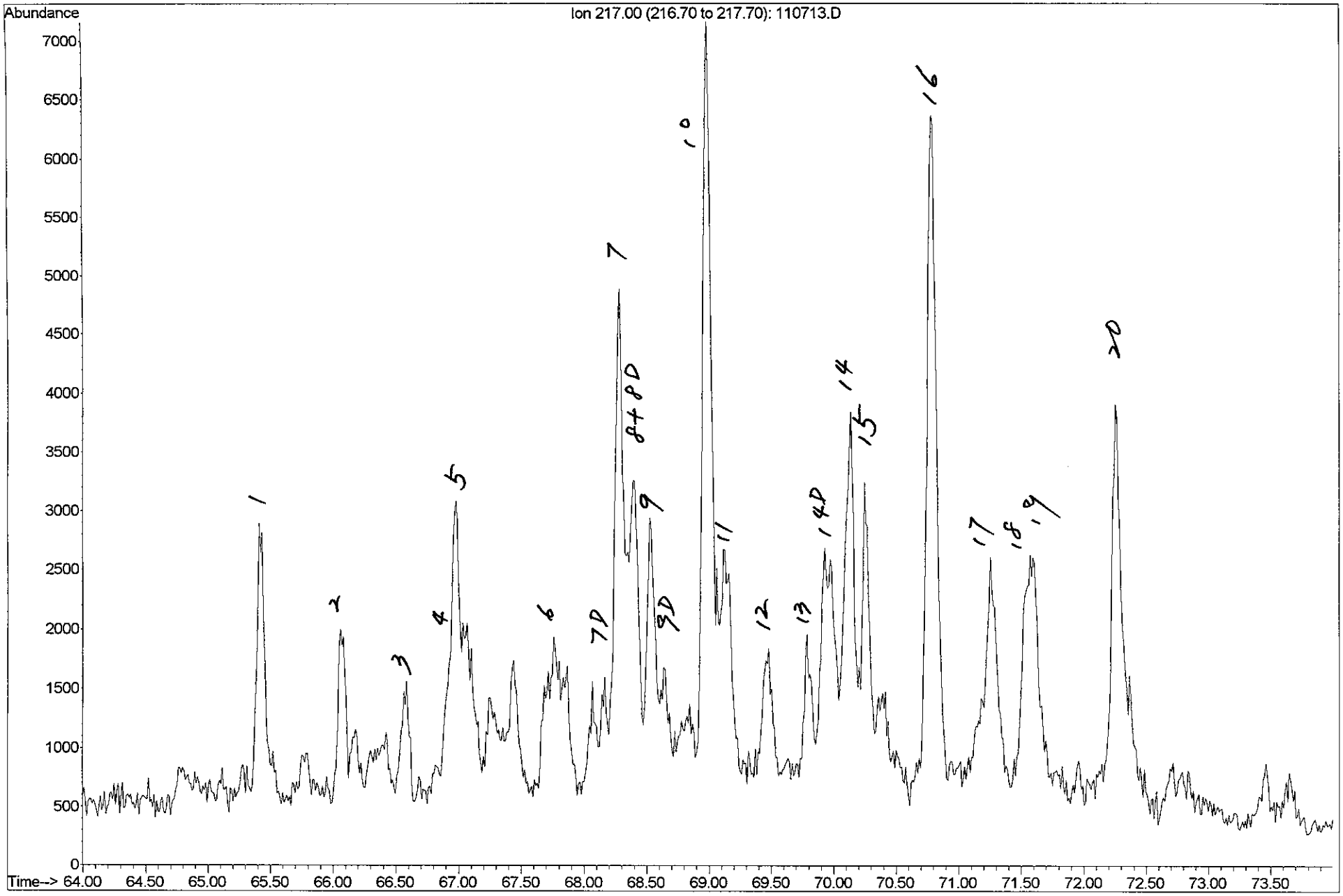
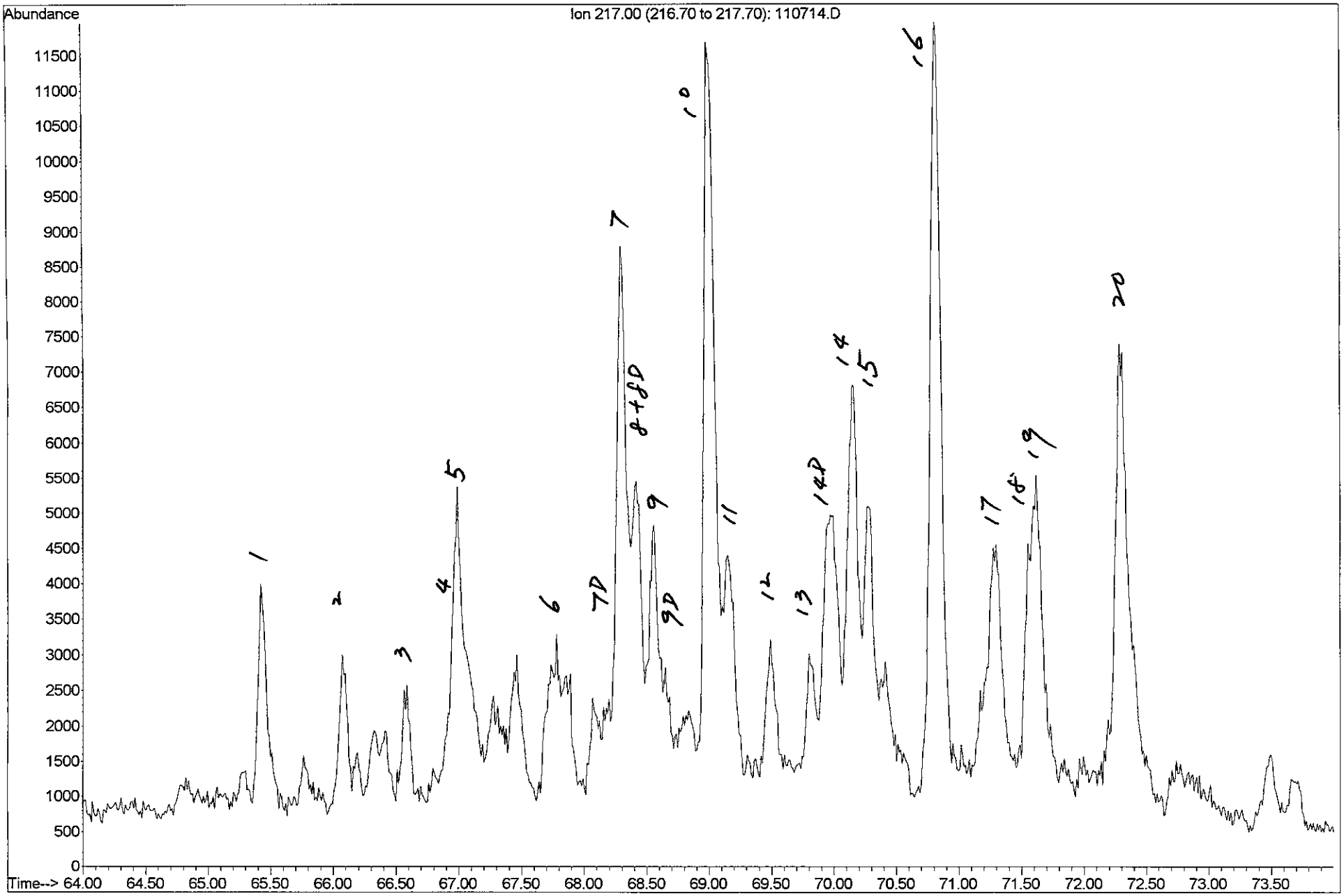


FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL

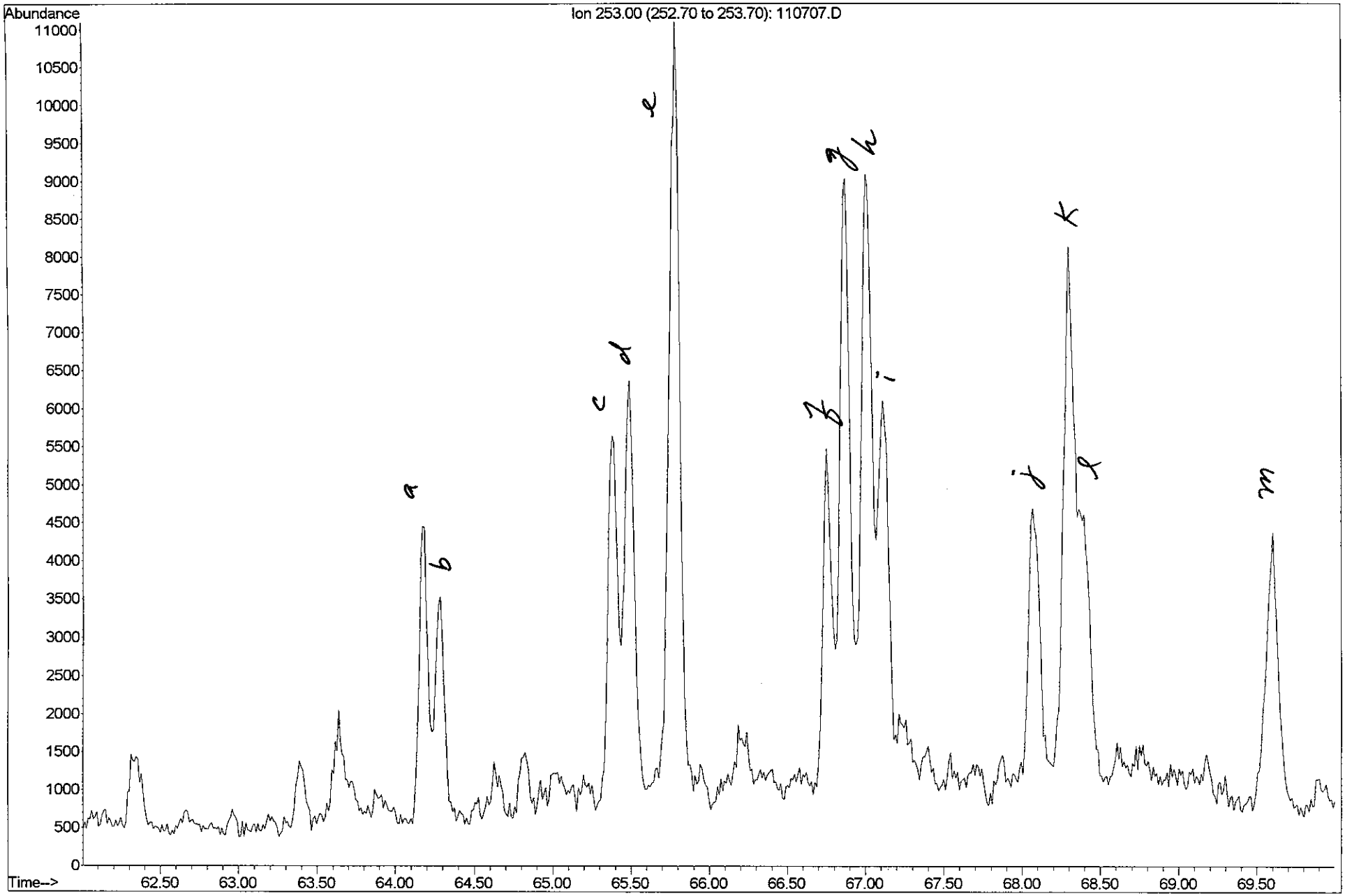


Table

Key for Monoaromatic Steranes Identification (m/z 253 mass chromatogram)

Code	Identity	Elemental Composition
a	20S, 5ß C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
b	20S, dia C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
c	20R, 5ß C_{27}-Monoaromatic sterane + 20R C_{27} dia MAS	$C_{27}H_{42}$
d	20S, 5α C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
e	20S, 5ß C_{28}-Monoaromatic sterane + 20S C_{28} dia MAS	$C_{28}H_{44}$
f	20R, 5α C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
g	20S, 5α C_{28}-Monoaromatic sterane	$C_{28}H4_4$
h	20R, 5ß C_{28}-Monoaromatic sterane + 20R C_{28} dia MAS	$C_{28}H_{44}$
i	20S, 5ß C_{29}-Monoaromatic sterane + 20S C_{29} dia MAS	$C_{29}H_{46}$
j	20S, 5α C_{29}-Monoaromatic sterane	$C_{29}H_{46}$
k	20R, 5α C_{28}-Monoaromatic sterane	$C_{28}H_{44}$
l	20R, 5ß C_{29}-Monoaromatic sterane + 20R C_{29} dia MAS	$C_{29}H_{46}$
m	20R, 5α C_{29}-Monoaromatic sterane	$C_{29}H_{46}$

FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



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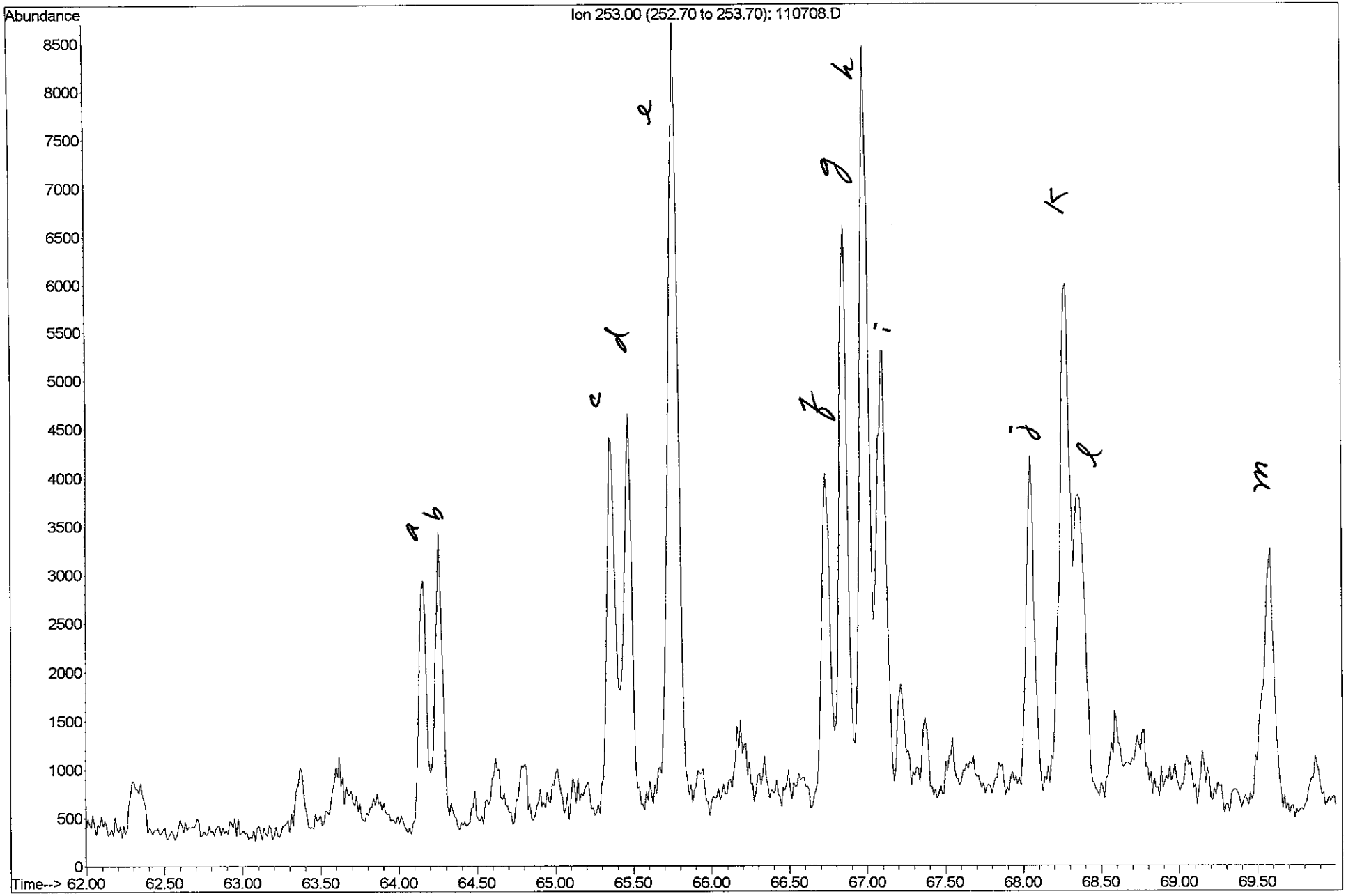
Mare Island, CH2M HILL



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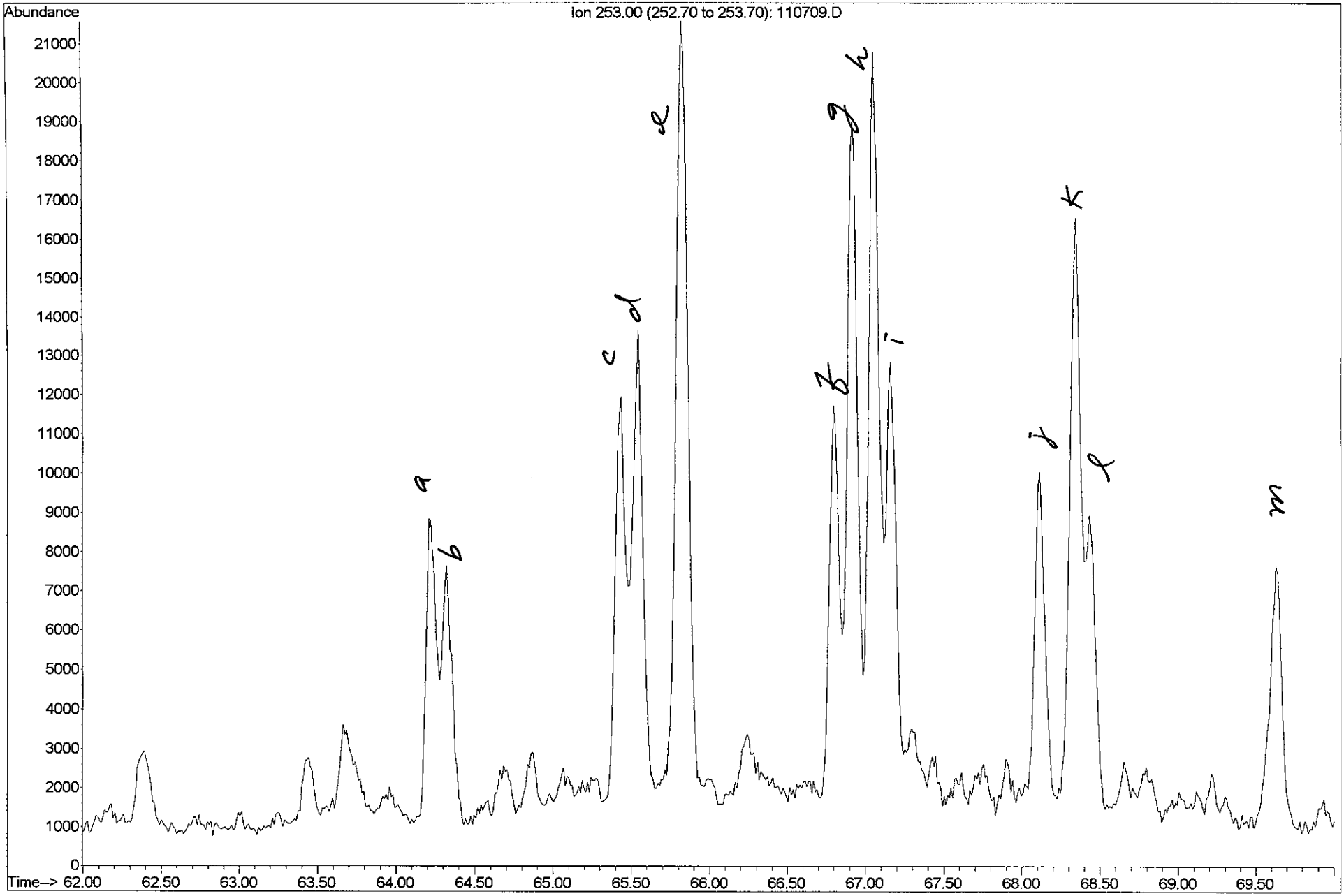
Mare Island, CH2M HILL



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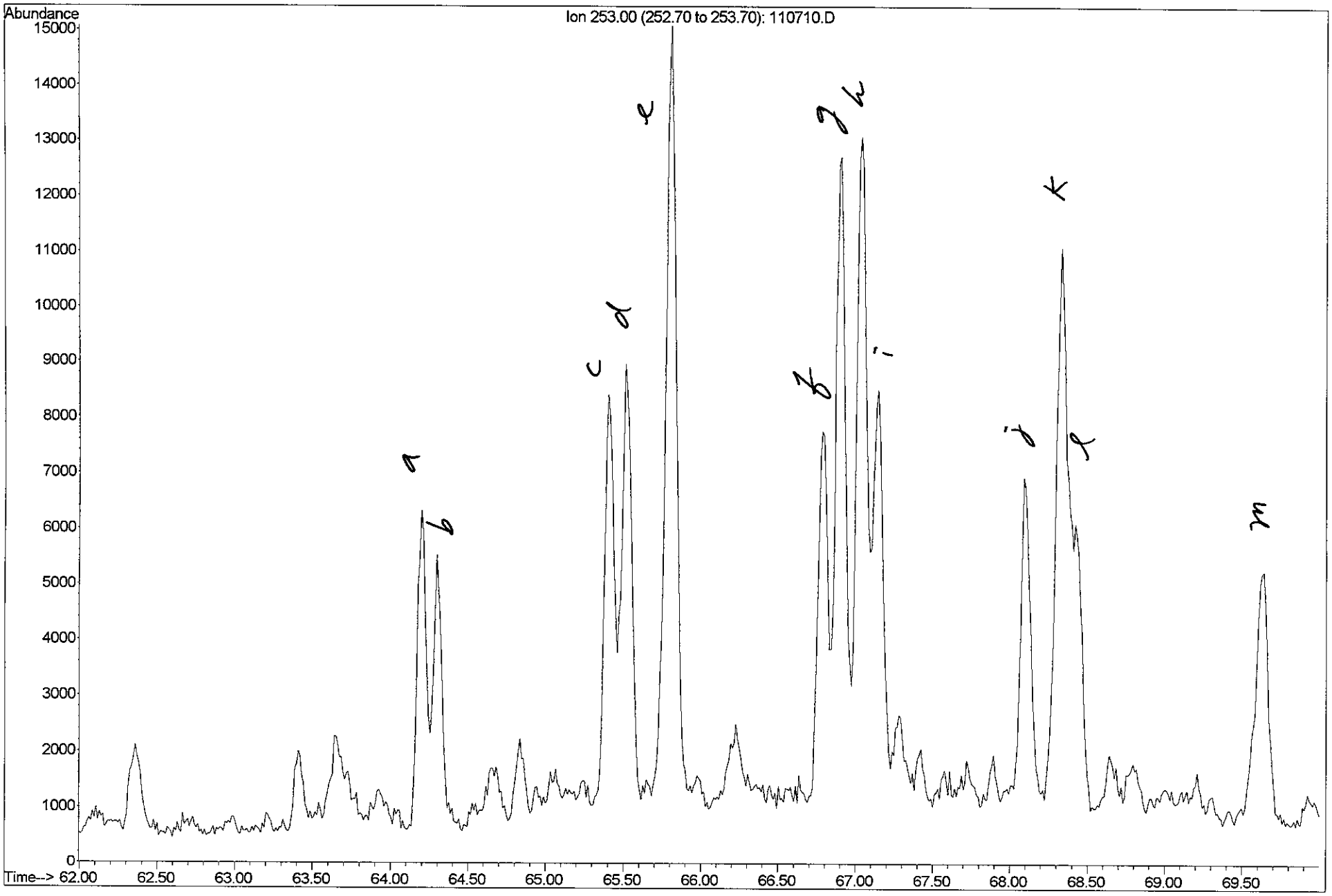
Mare Island, CH2M HILL



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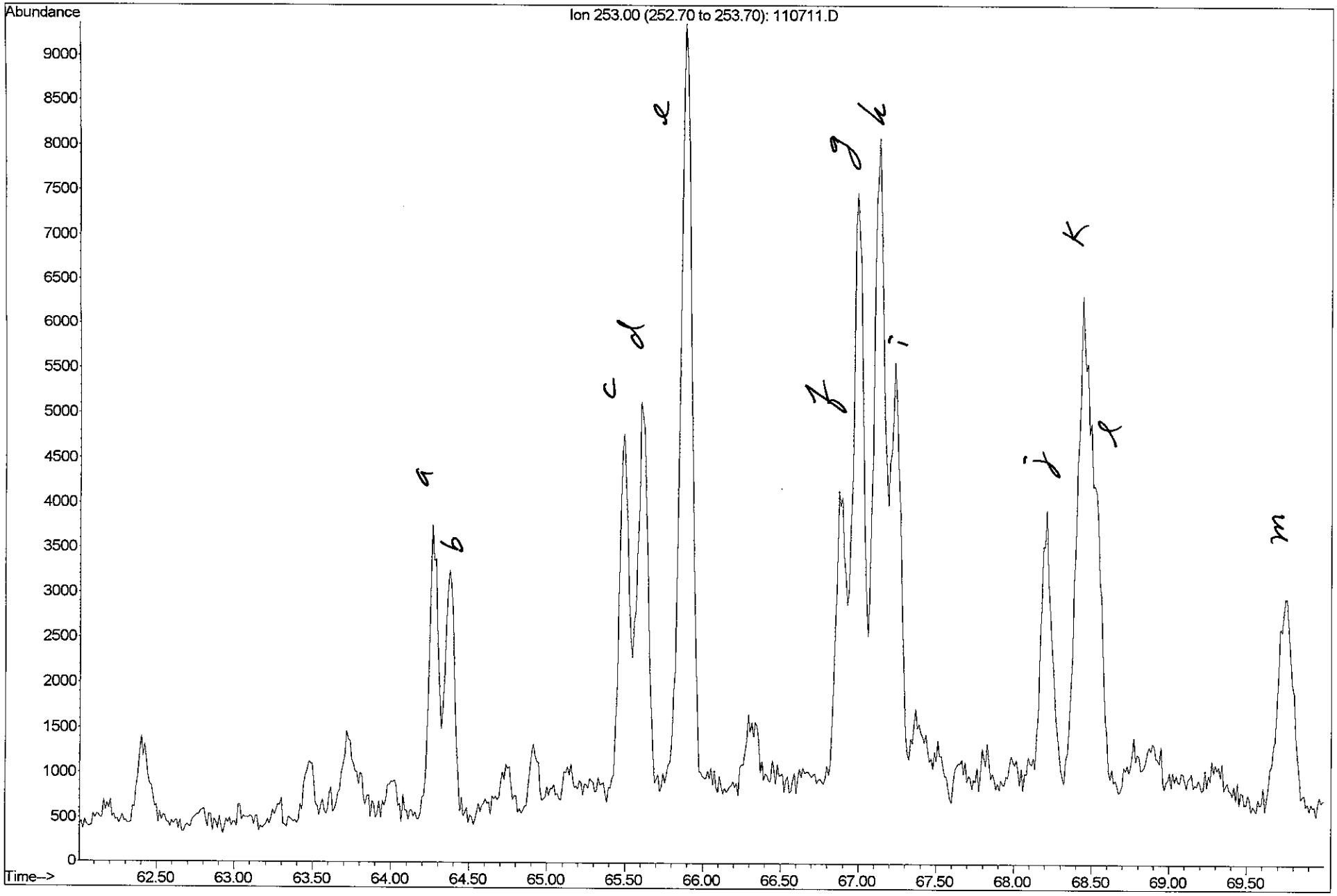
Mare Island, CH2M HILL



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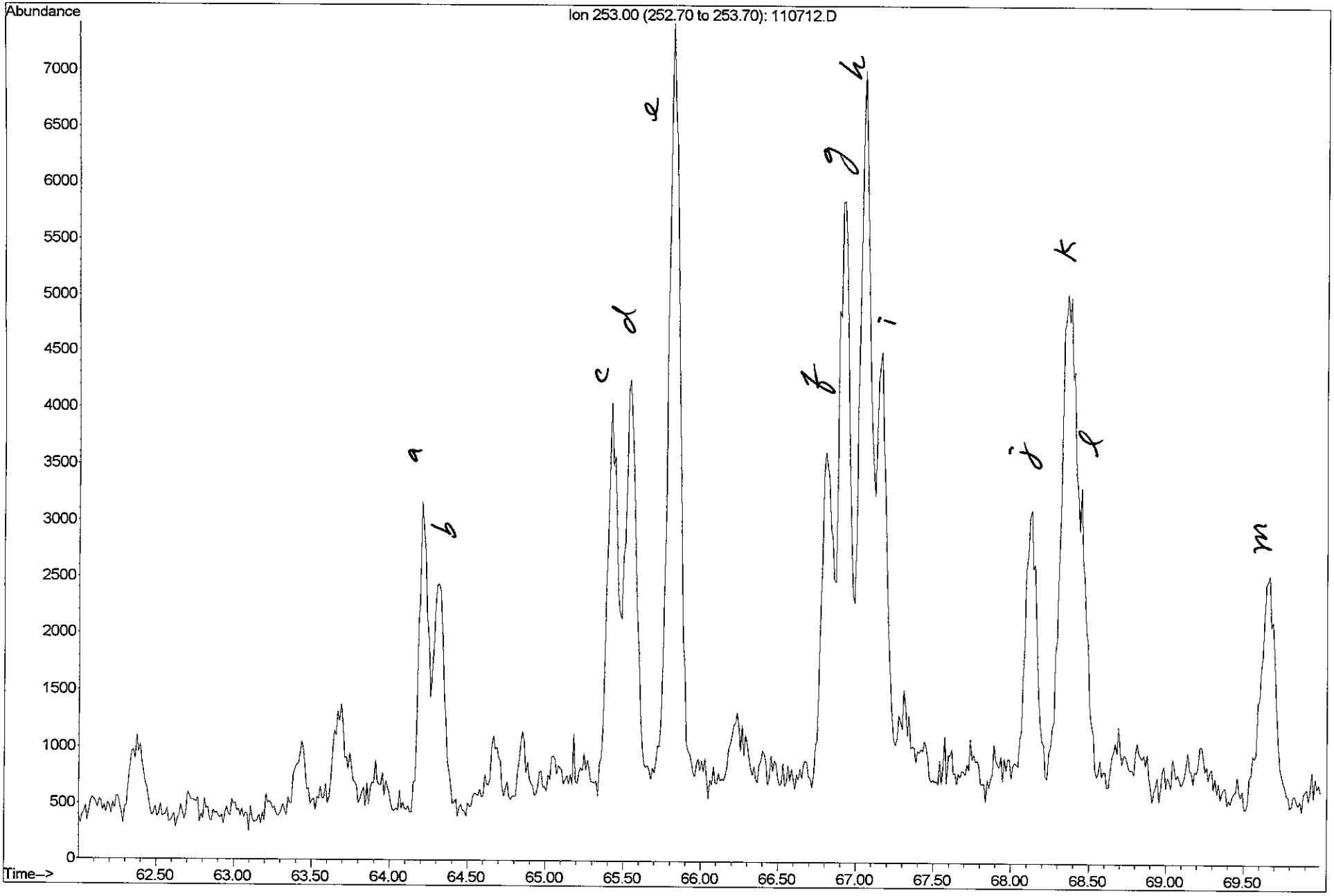
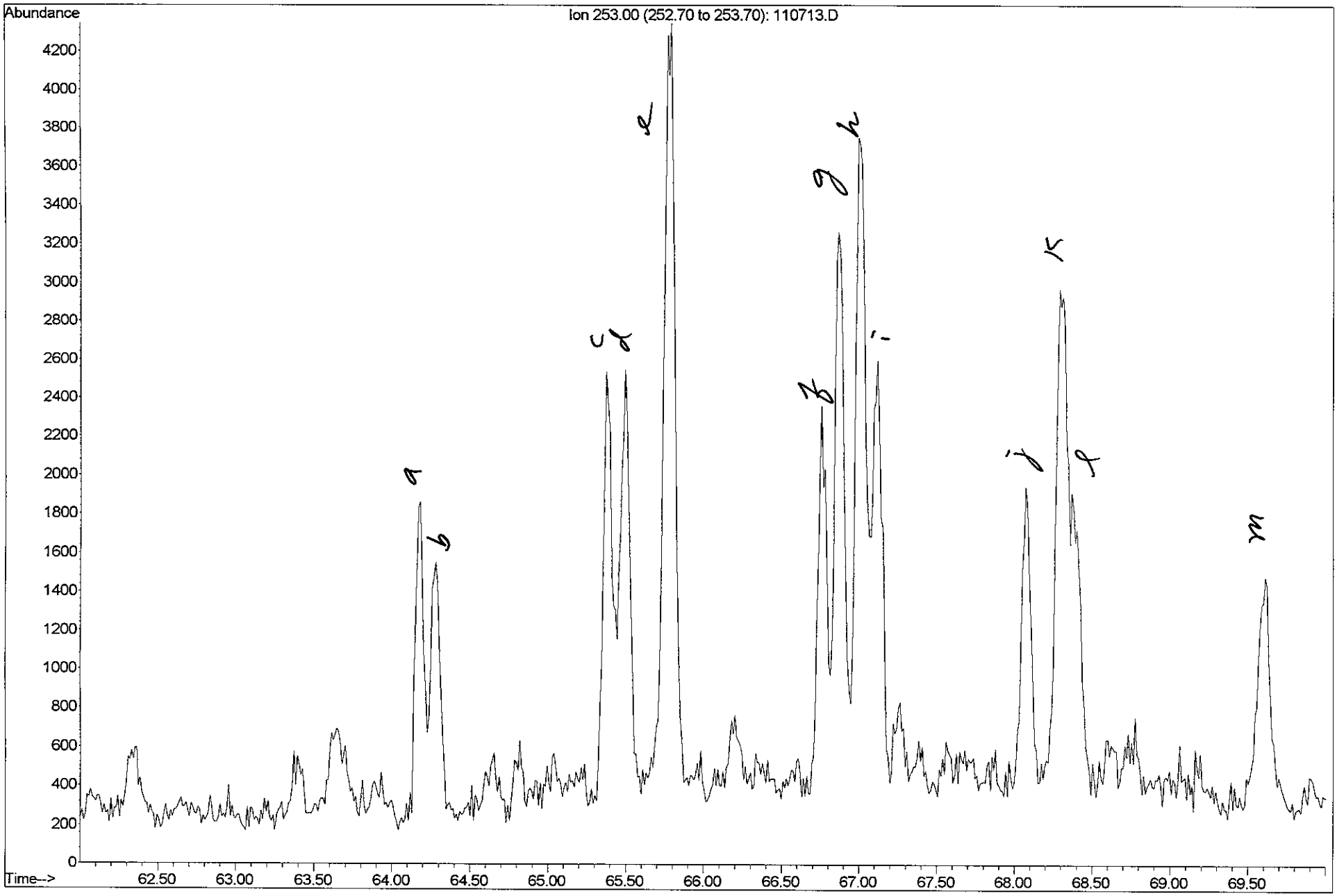
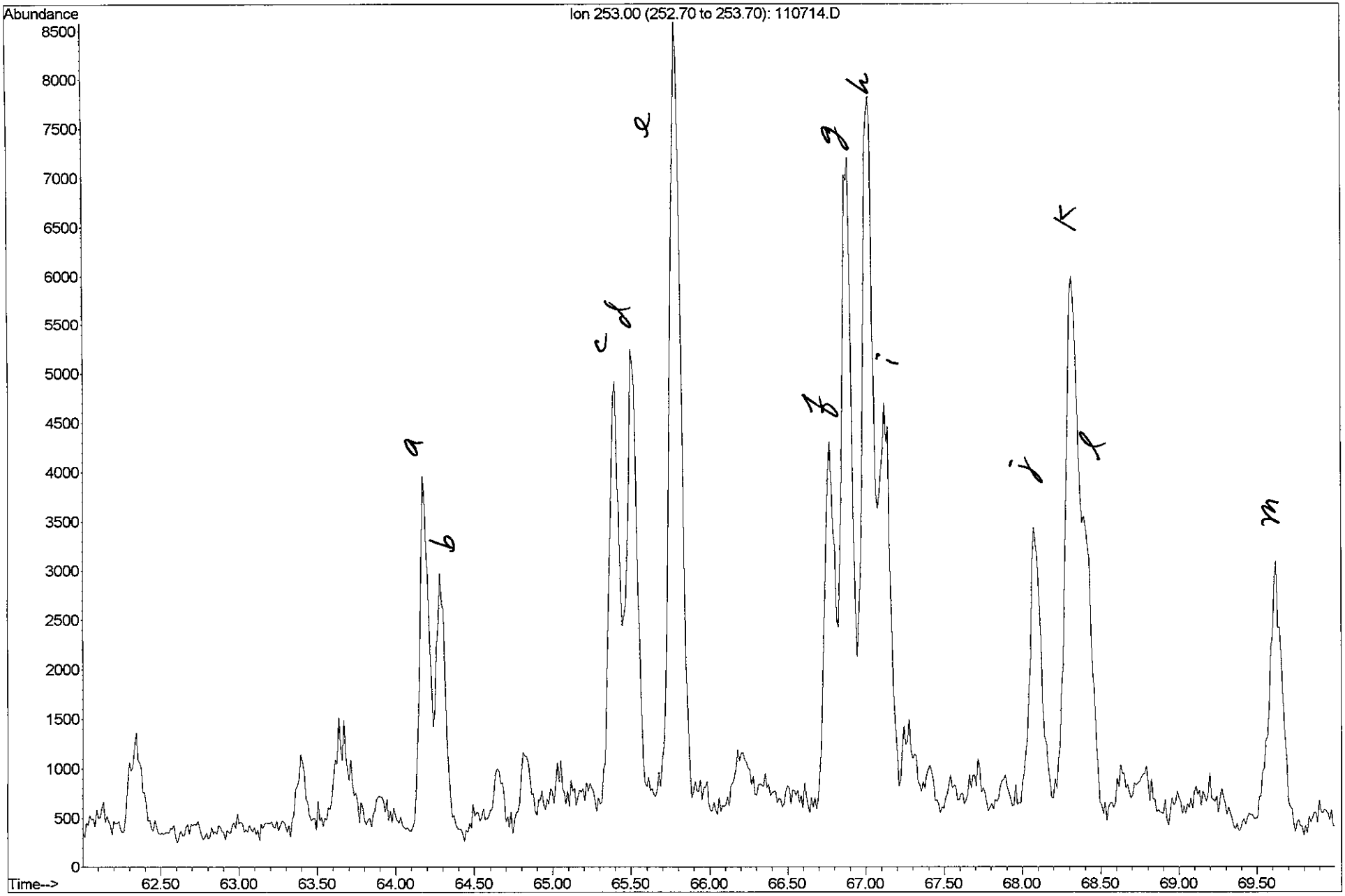
Mare Island, CH2M HILL



FTPH-FP-SB-C (41362-7) product
Mare Island, CH2M HILL



FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL

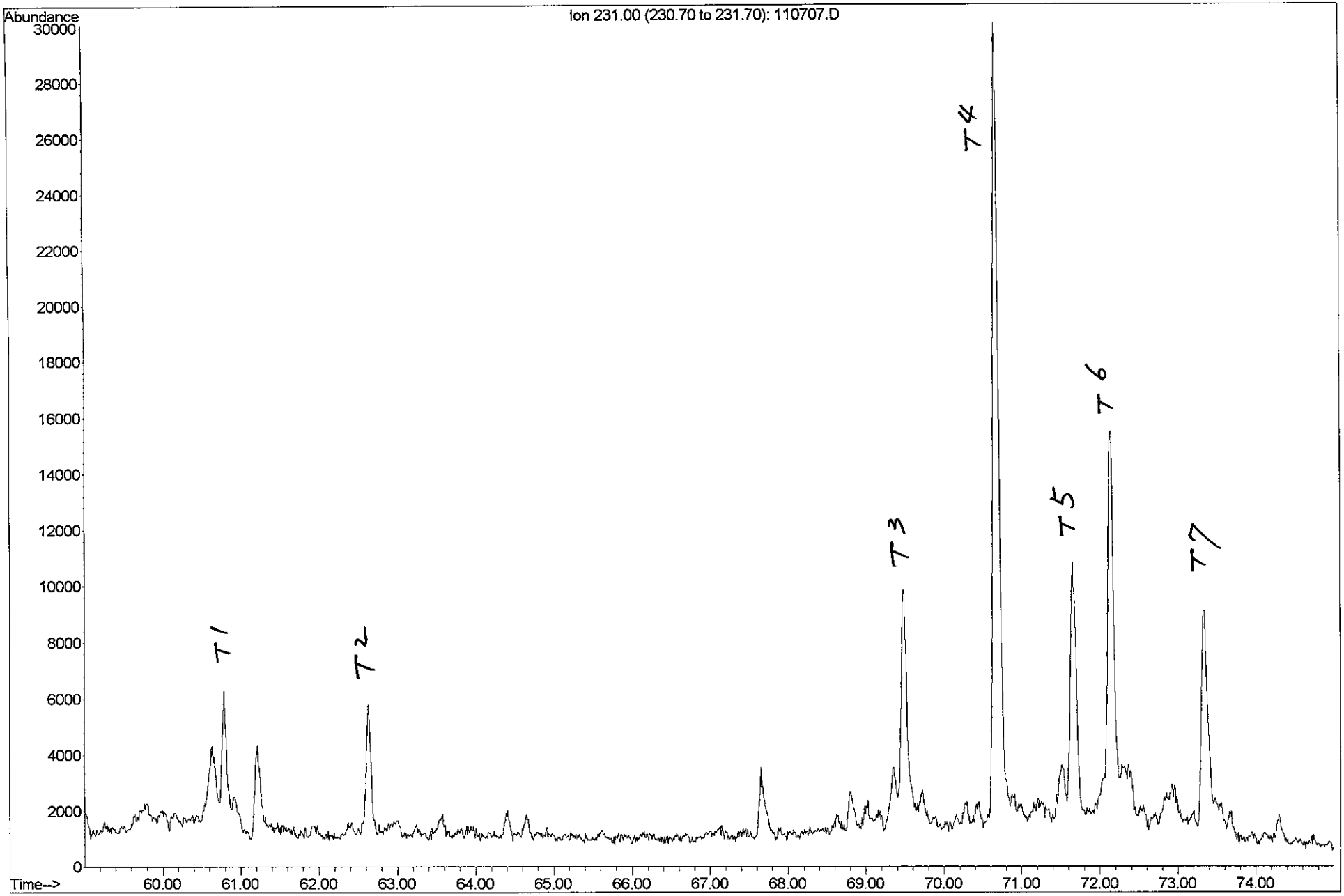


Table

Key for Triaromatic Steranes Identification (m/z 231 chromatogram)

Code	Identity	Elemental Composition
T1	C_{20} Triaromatic sterane	$C_{20}H_{20}$
T2	C_{21} Triaromatic sterane	$C_{21}H_{22}$
T3	20S C_{26} Triaromatic sterane	$C_{26}H_{32}$
T4	20R C_{26} + 20S C_{27}-Triaromatic steranes	$C_{26}H_{32}$ + $C_{27}H_{34}$
T5	20S C_{28}-Triaromatic sterane	$C_{28}H_{36}$
T6	20R C_{27}-Triaromatic sterane	$C_{27}H_{34}$
T7	20R C_{28}-Triaromatic sterane	$C_{28}H_{36}$

FTPH-FP-SB-GG (41362-1) product
Mare Island, CH2M HILL



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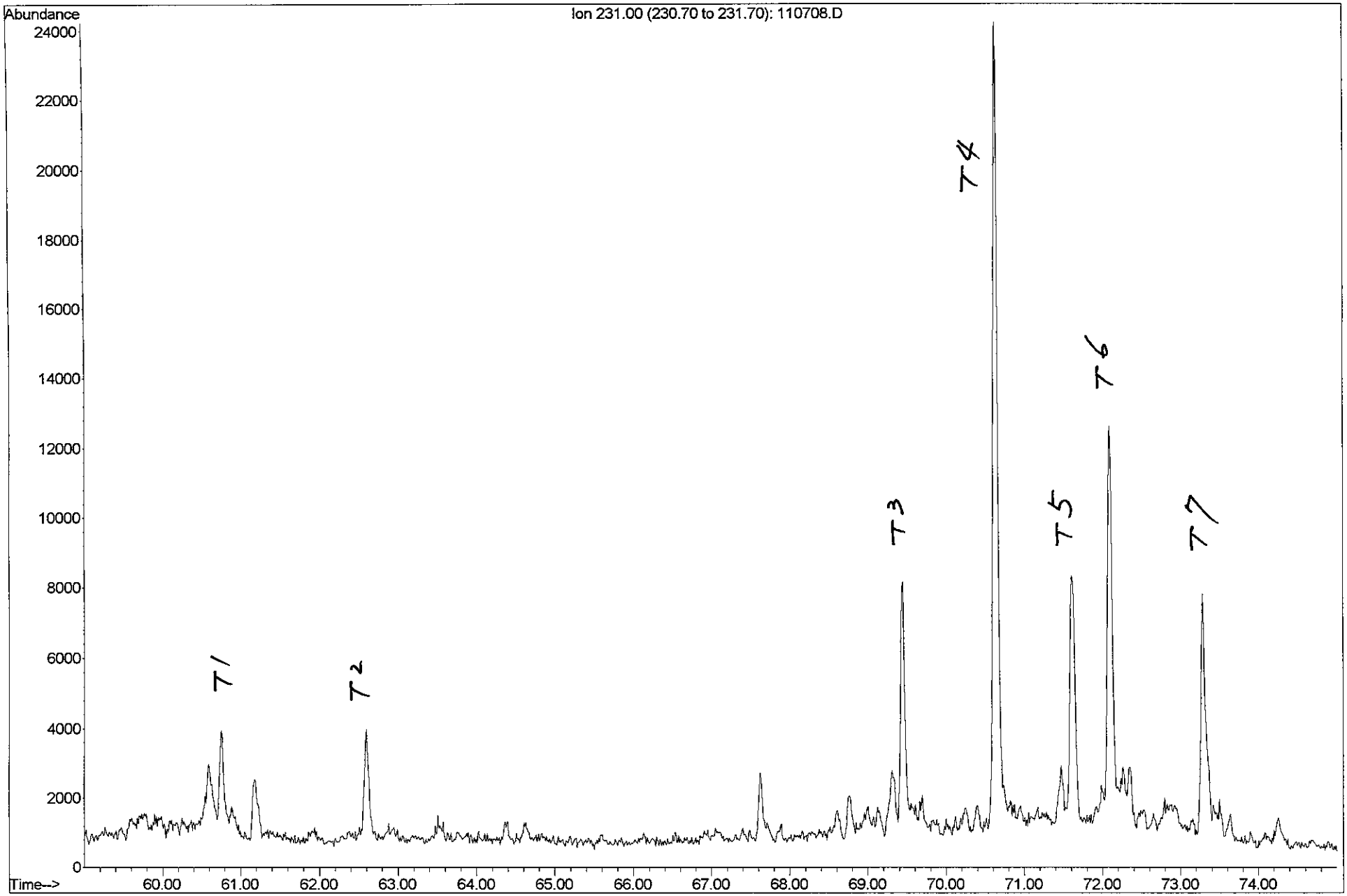
Mare Island, CH2M HILL



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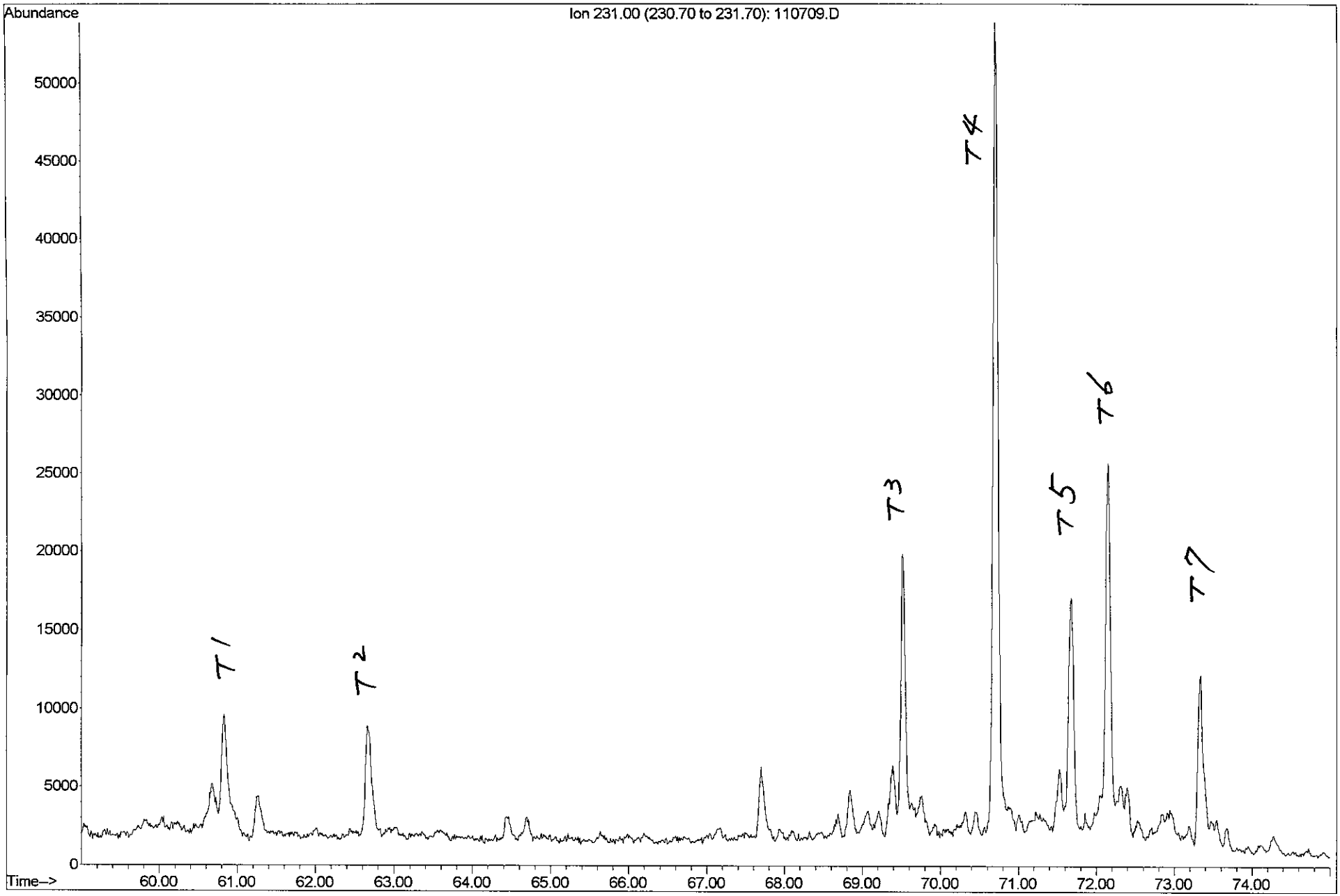
Mare Island, CH2M HILL



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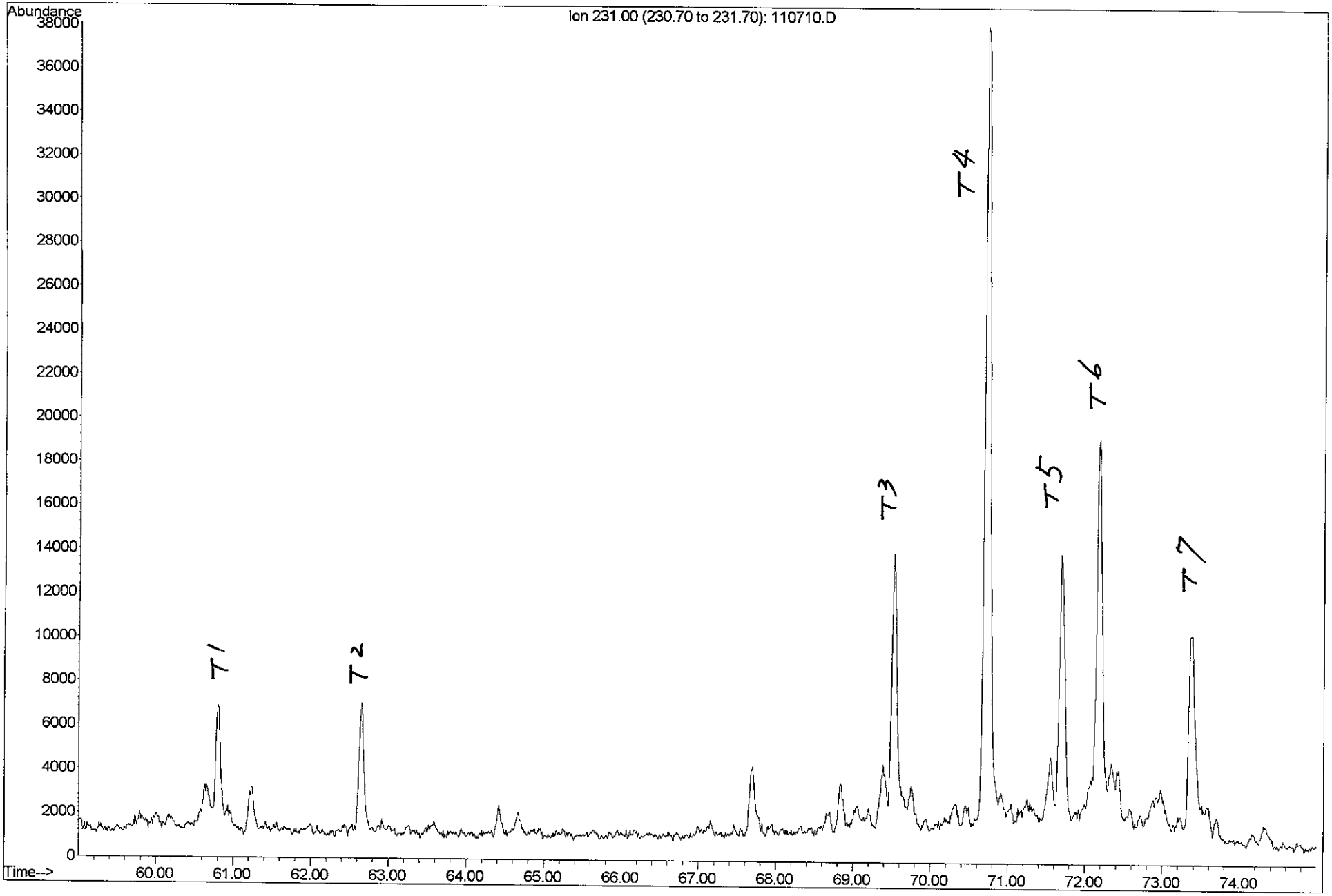
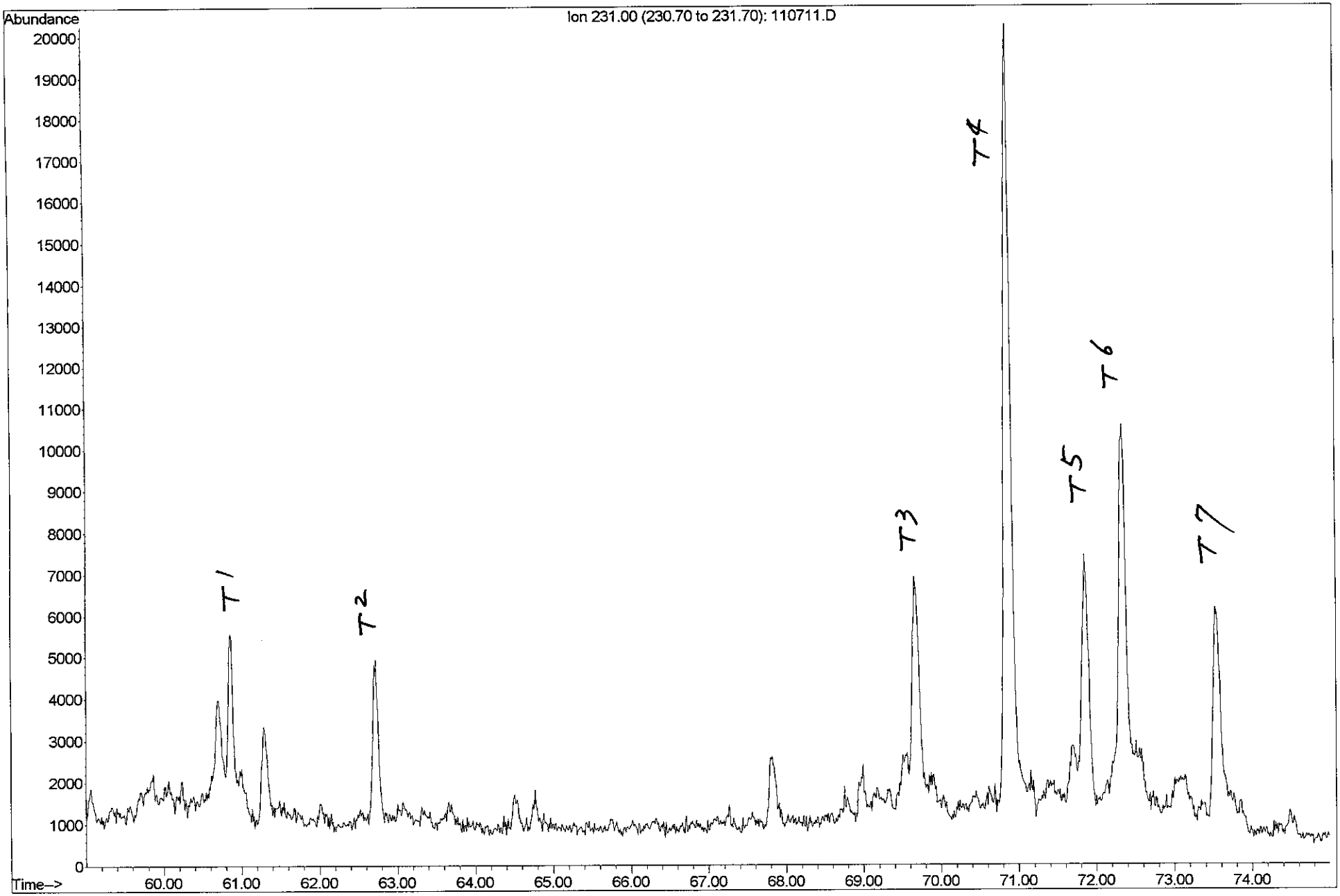
Mare Island, CH2M HILL



FTPH-FP-UT-QE (41362-5) product
Mare Island, CH2M HILL



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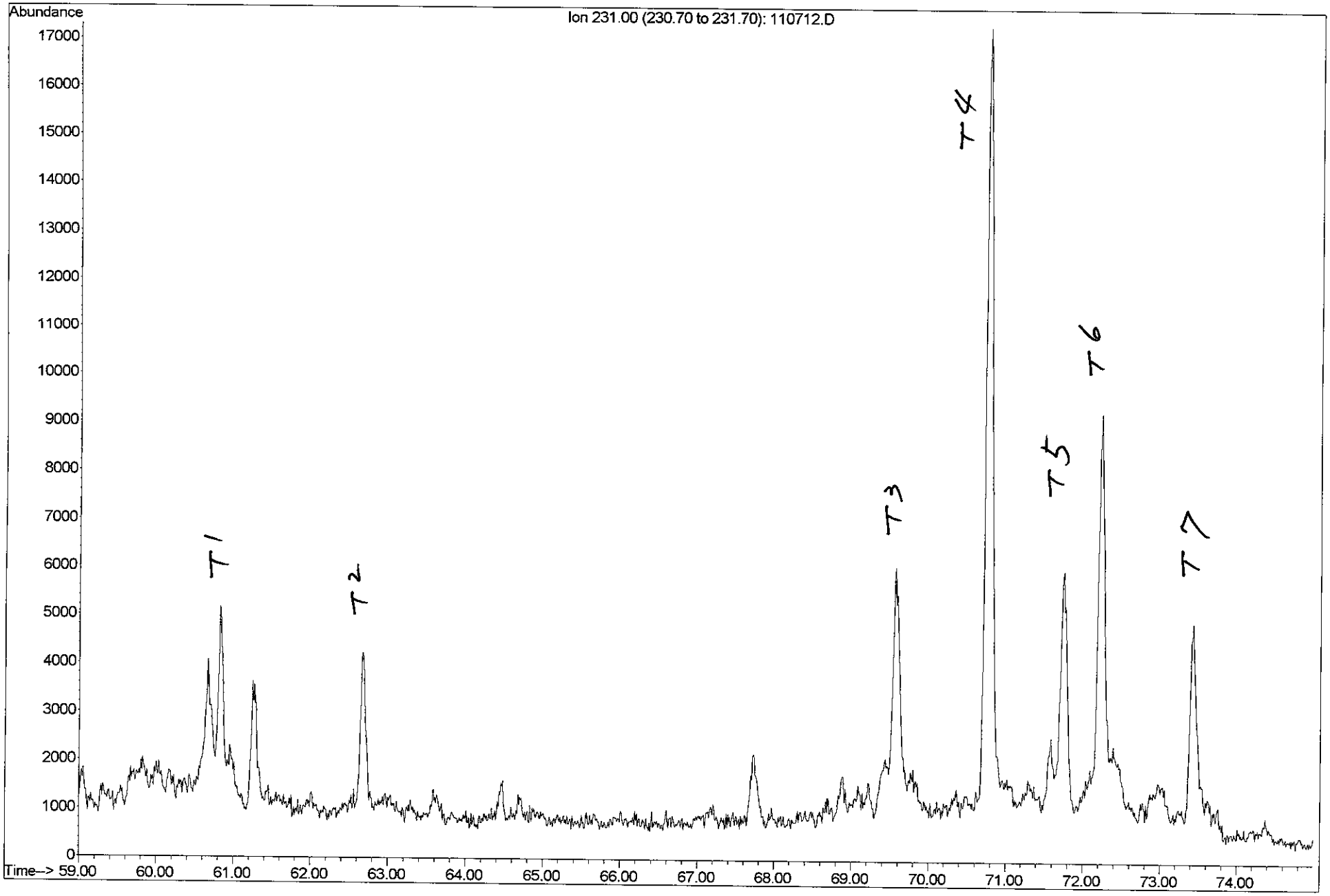
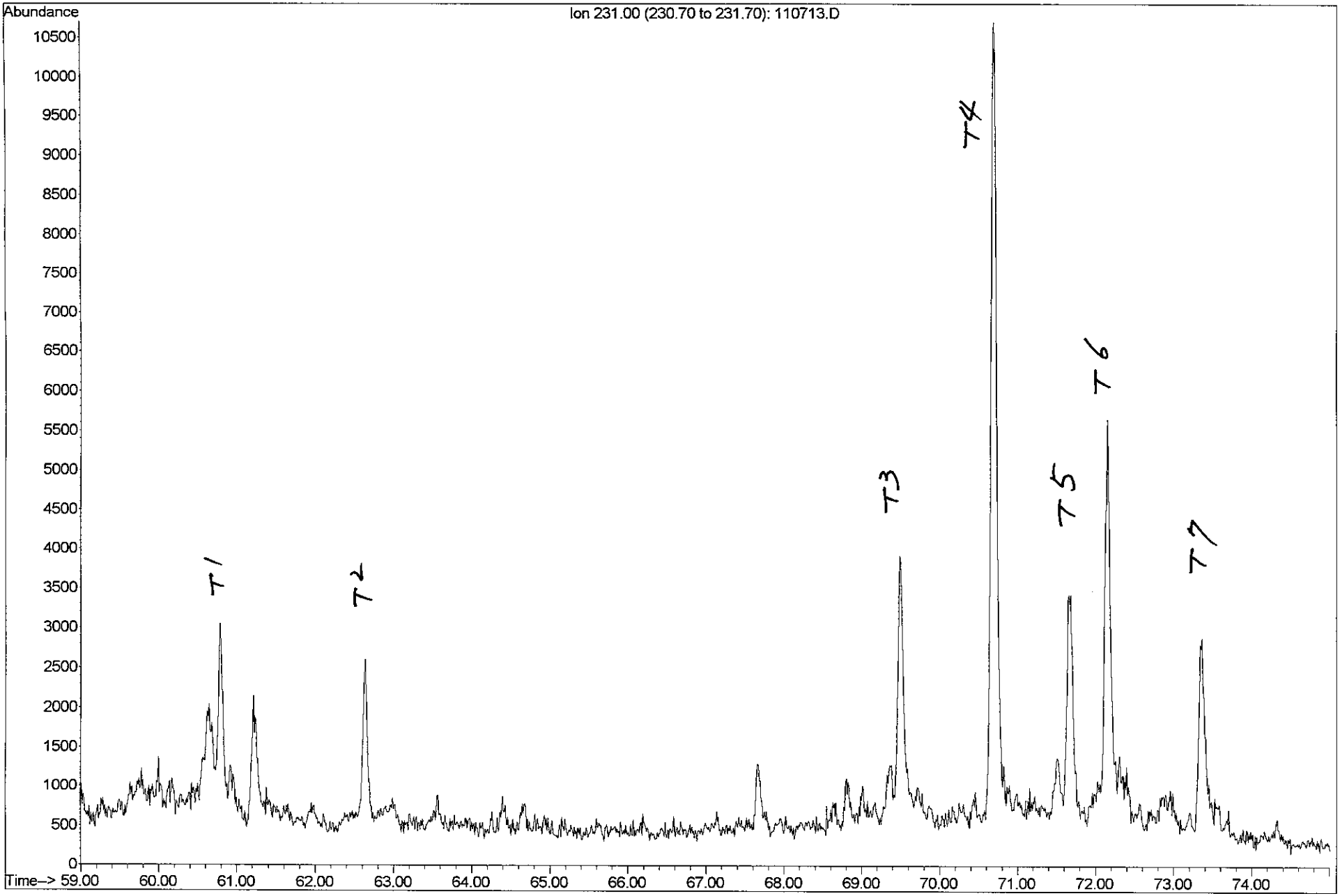
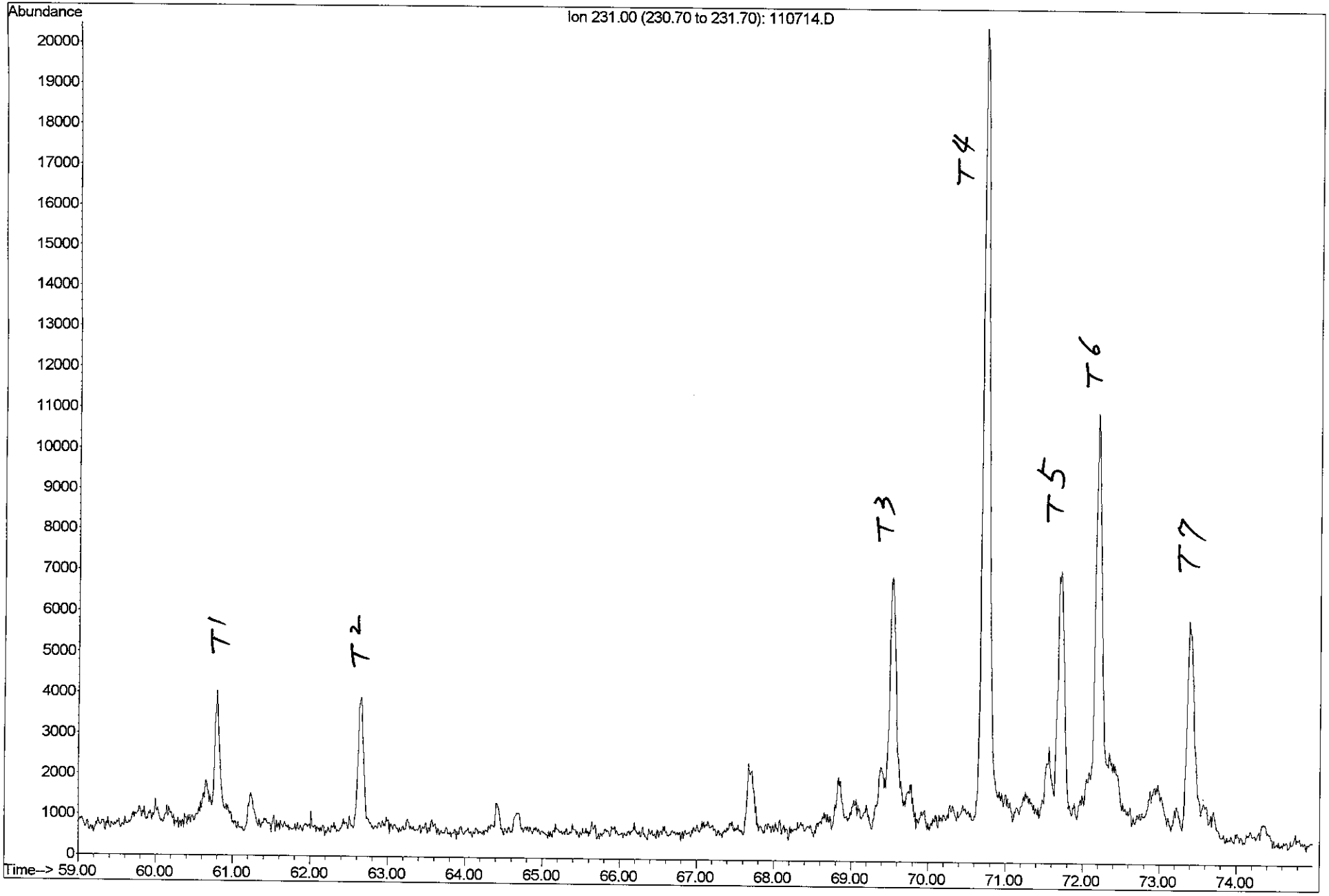


FTPH-FP-SB-C (41362-7) product
Mare Island, CH2M HILL



FTPH-FP-SB-VV (41362-8) product
Mare Island, CH2M HILL



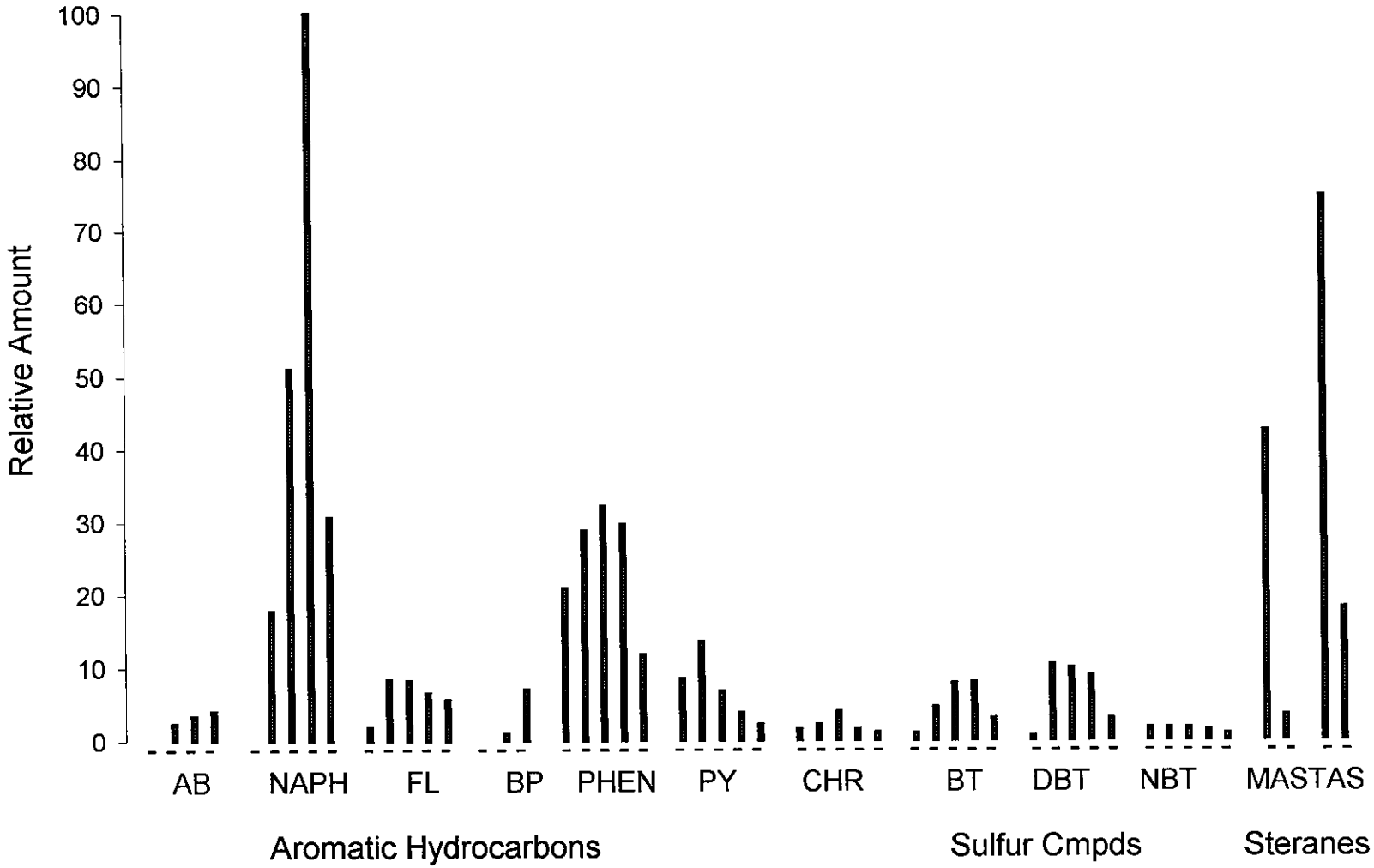
Table

Key for Identifying Aromatic Hydrocarbons

No.	m/z	Abbreviation	Compound
1	120	AB	C_3-alkylbenzenes
2	134		C_4-alkylbenzenes
3	148		C_5-alkylbenzenes
4	162		C_6-alkylbenzenes
5	128	NAPH	C_0-naphthalene
6	142		C_1-naphthalenes
7	156		C_2-naphthalenes
8	170		C_3-naphthalenes
9	184		C_4-naphthalenes
10	166	FL	C_0-fluorene
11	180		C_1-fluorenes
12	194		C_2-fluorenes
13	208		C_3-fluorenes
14	222		C_4-fluorenes
15	154	BP	C_0-biphenyl
16	168		C_1-biphenyls + dibenzofuran
17	182		C_2-biphenyls + C_1-dibenzofuran
18	178	PHEN	C_0-phenanthrene
19	192		C_1-phenanthrenes
20	206		C_2-phenanthrenes
21	220		C_3-phenanthrenes
22	234		C_4-phenanthrenes
23	202	PY	C_0-pyrene/fluoranthene
24	216		C_1-pyrenes/fluoranthenes
25	230		C_2-pyrenes/fluoranthenes
26	244		C_3-pyrenes/fluoranthenes
27	258		C_4-pyrenes/fluoranthenes
28	228	CHR	C_0-chrysene
29	242		C_1-chrysenes
30	256		C_2-chrysenes
31	270		C_3-chrysenes
32	284		C_4-chrysenes
33	148	BT	C_1-benzothiophenes
34	162		C_2-benzothiophenes
35	176		C_3-benzothiophenes
36	190		C_4-benzothiophenes
37	204		C_5-benzothiophenes
28	184	DBT	C_0-dibenzothiophene
39	198		C_1-dibenzothiophenes
40	212		C_2-dibenzothiophenes
41	226		C_3-dibenzothiophenes
42	240		C_4-dibenzothiophenes
43	234	NBT	C_0-naphthobenzothiophene
44	248		C_1-naphthobenzothiophenes
45	262		C_2-naphthobenzothiophenes
46	276		C_3-naphthobenzothiophenes
47	290		C_4-naphthobenzothiophenes
48	253	MAS	Monoaromatic steranes
49	267		Monoaromatic steranes
50	239		Monoaromatic steranes
51	231	TAS	Triaromatic steranes
52	245		Triaromatic steranes

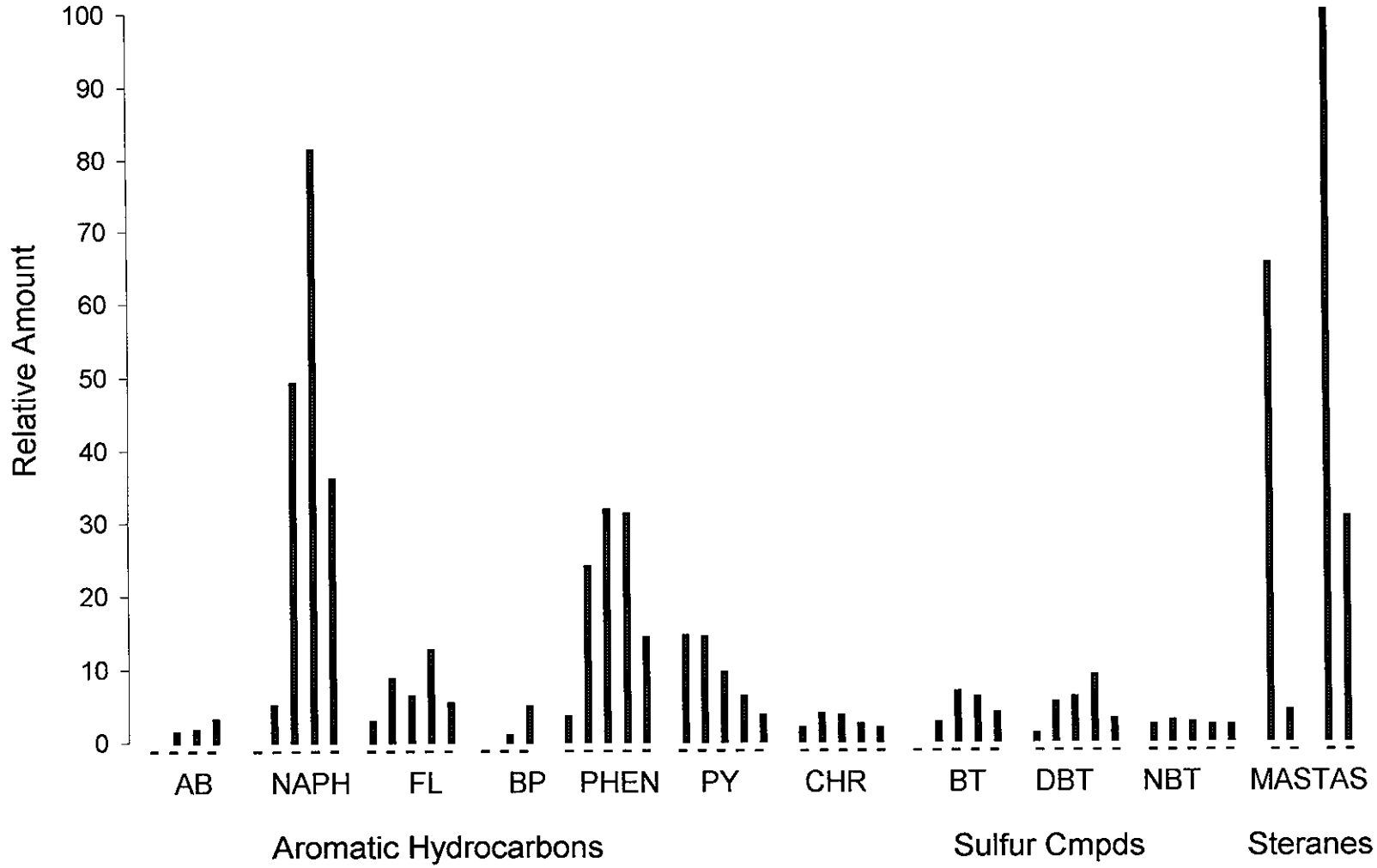
Aromatic Hydrocarbon Distribution

FTPH-FP-SB-GG



Aromatic Hydrocarbon Distribution

FTPH-FP-SB-MM



Aromatic Hydrocarbon Distribution

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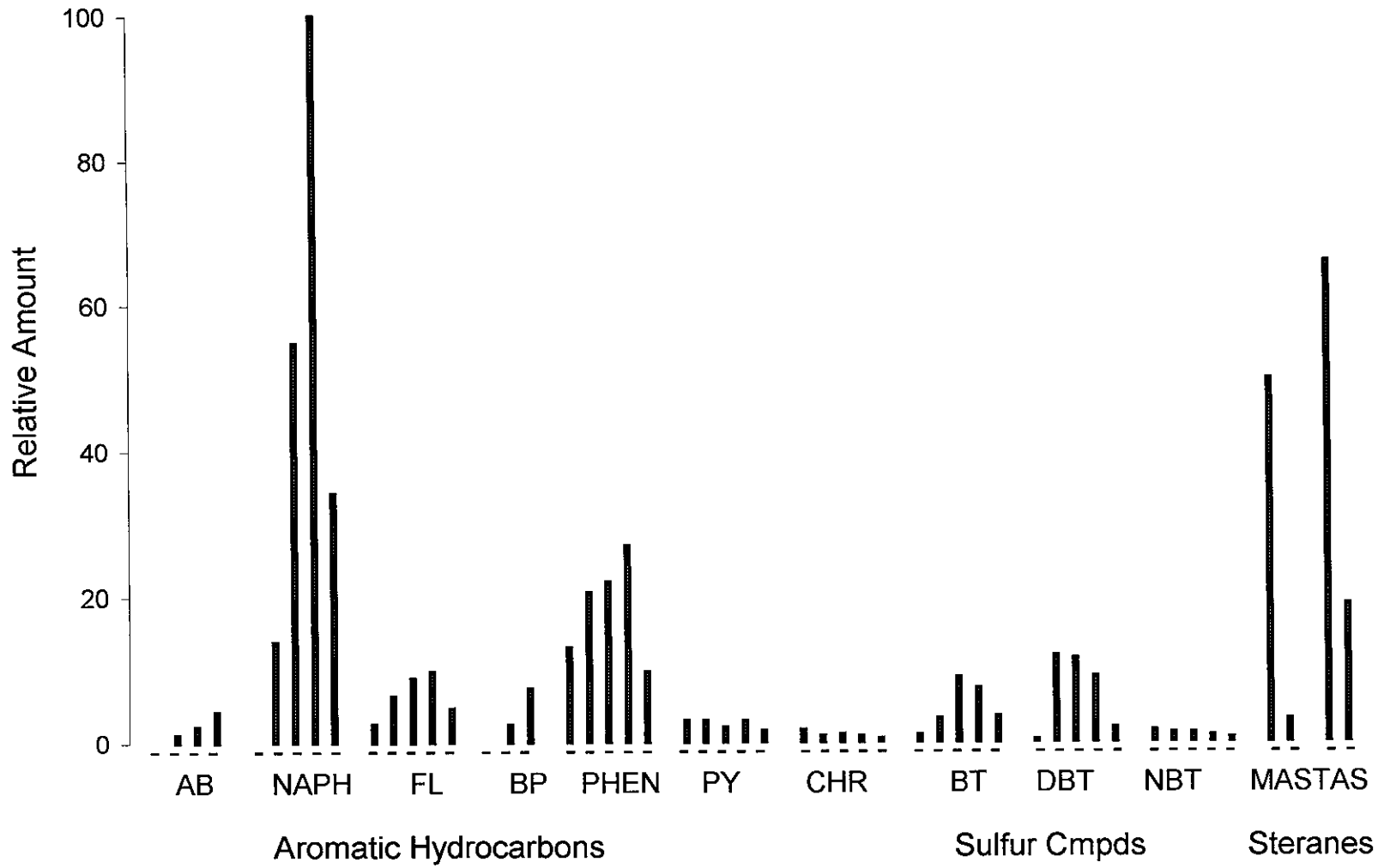
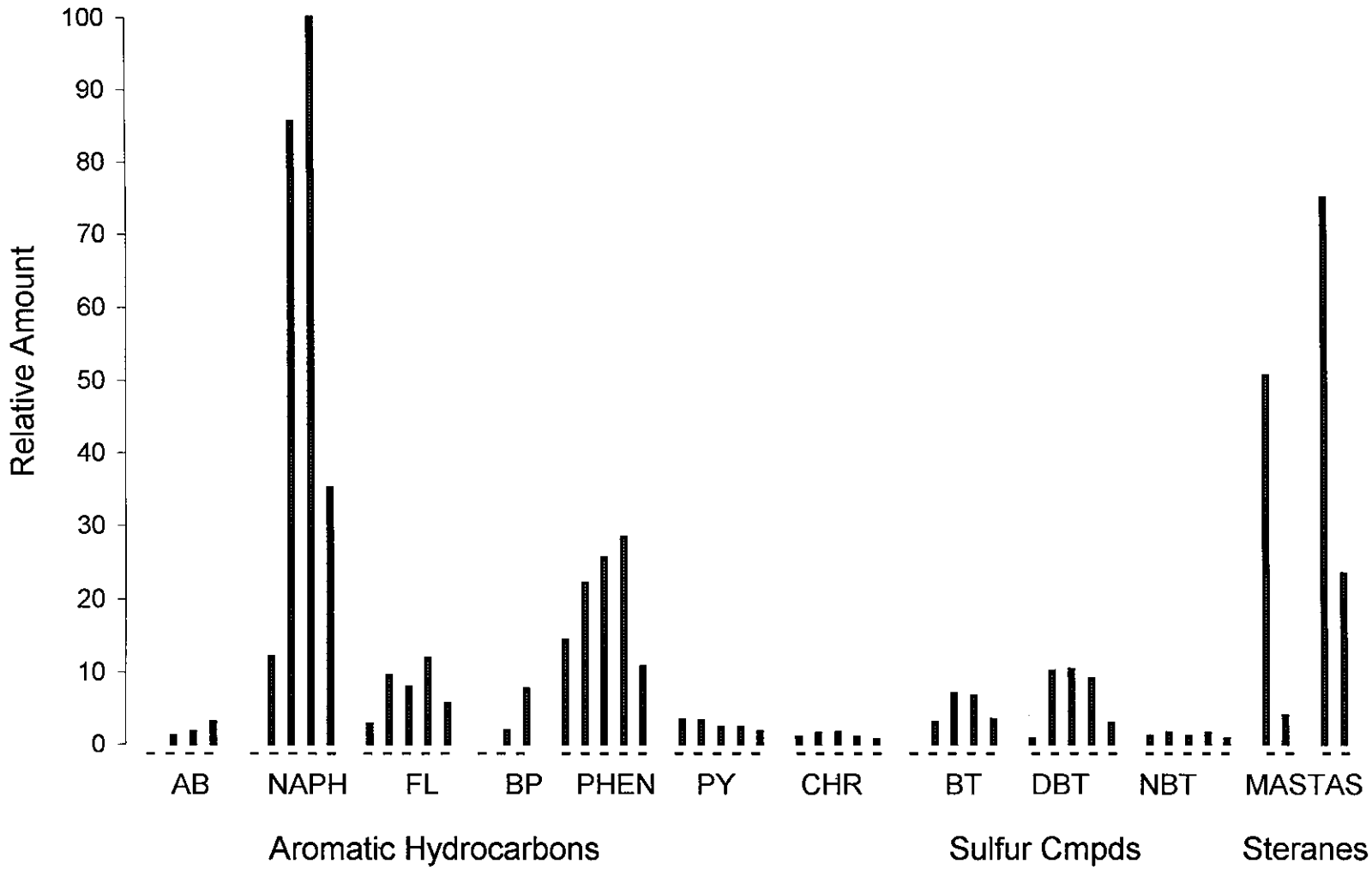


Aromatic Hydrocarbon Distribution

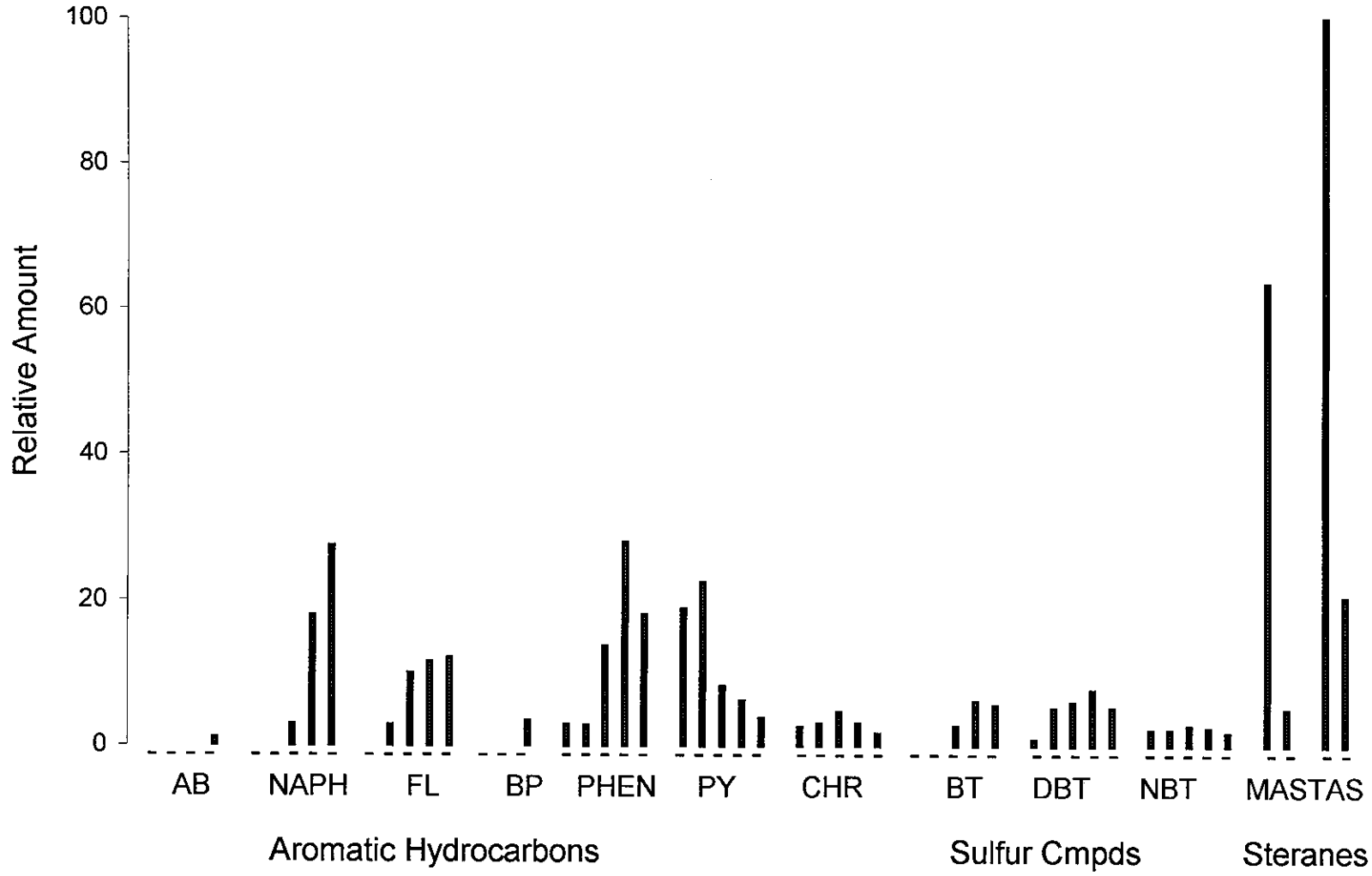
FTPH-FP-SB-PP



ZymaX FORENSICS

Aromatic Hydrocarbon Distribution

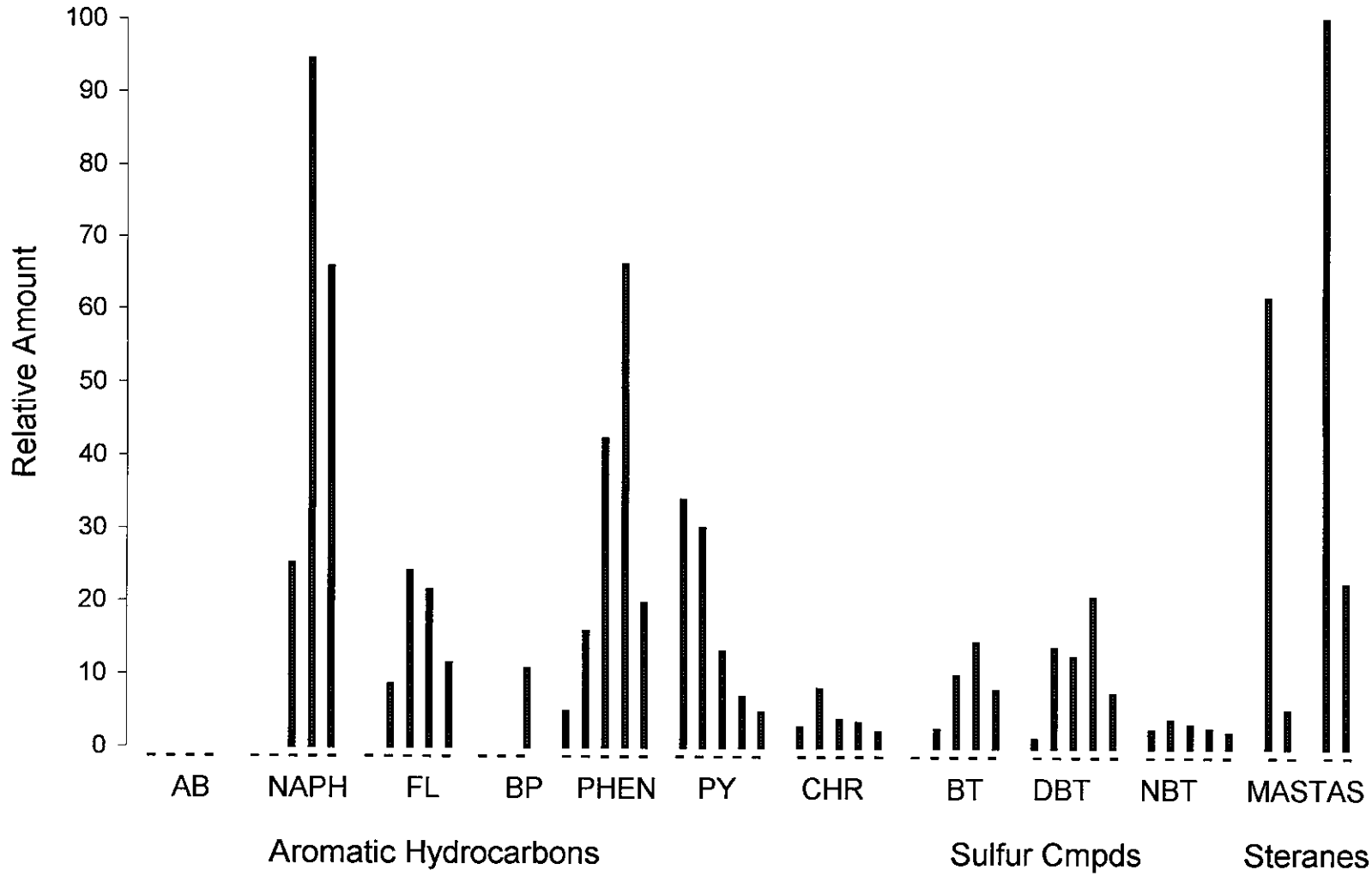
FTPH-FP-UT-QE



ZymaX FORENSICS

Aromatic Hydrocarbon Distribution

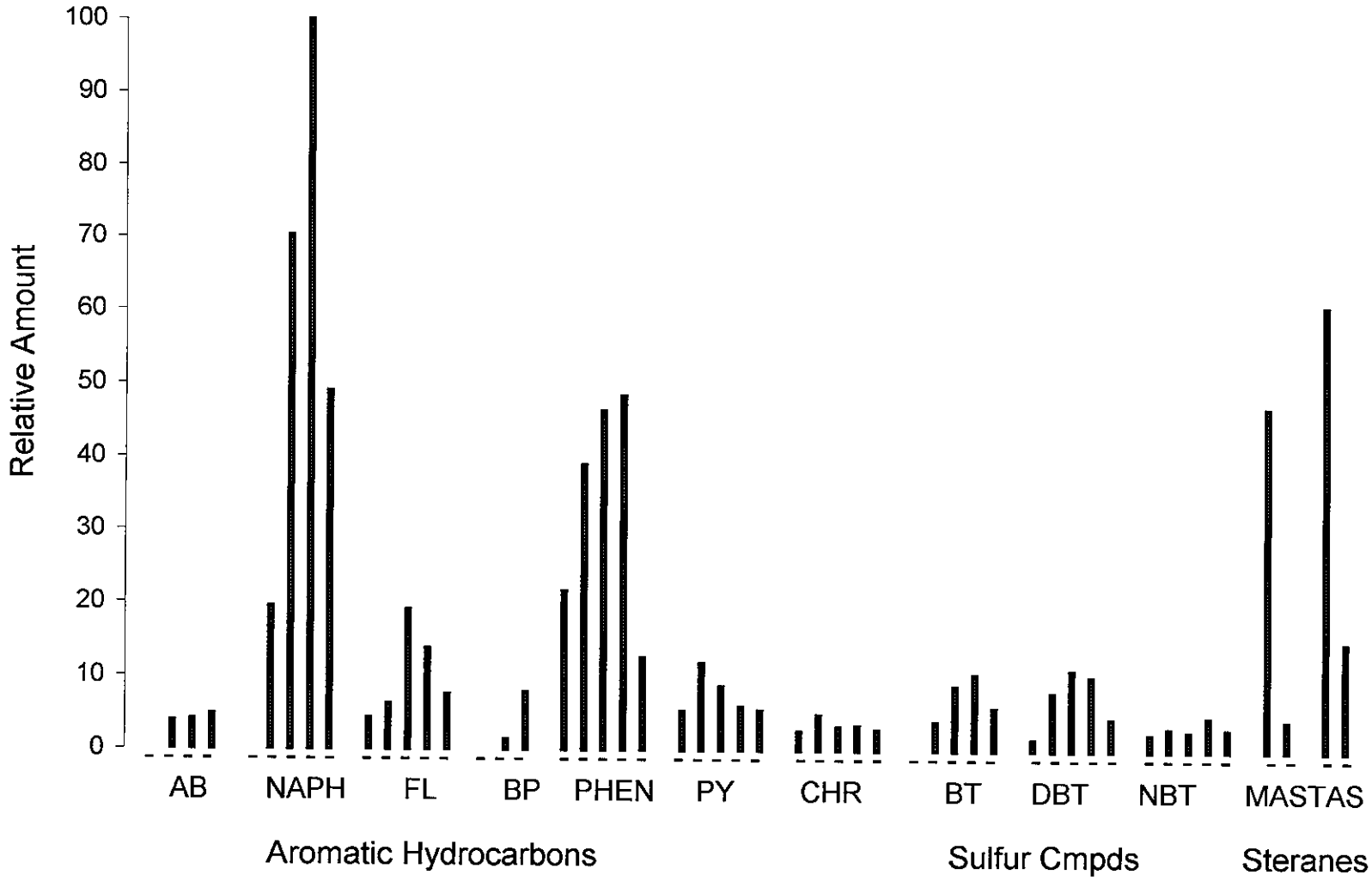
FTPH-FP-UT-QT



ZymaX FORENSICS

Aromatic Hydrocarbon Distribution

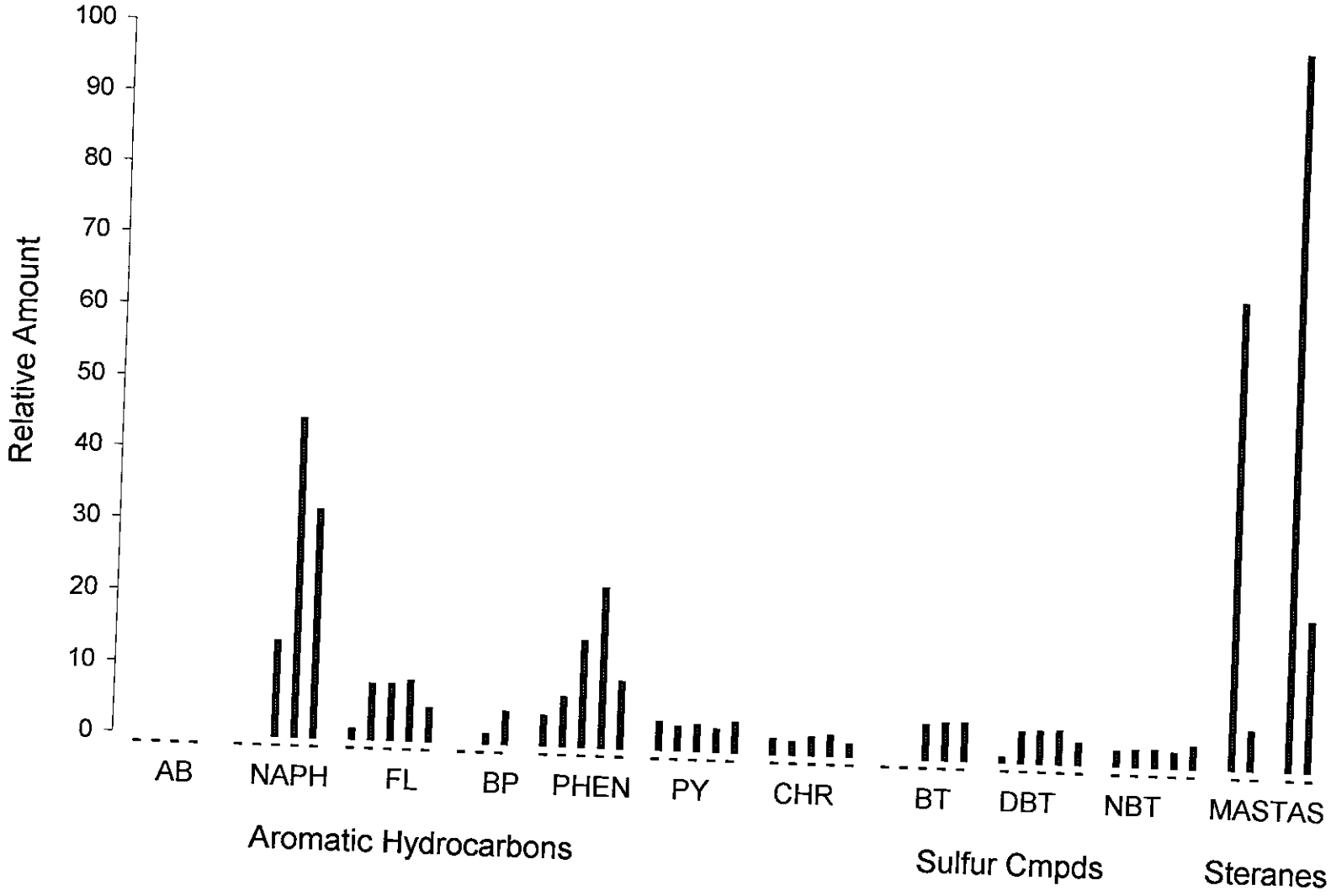
FTPH-FP-SB-C



ZymaX FORENSICS

Aromatic Hydrocarbon Distribution

FTPH-FP-SB-VV



Chain of Custody Record   COC Number: ZYMA-04   CH2MHILL   11/13/2008 5:51:32 PM   Page 1 of 1

Project Name Mare Island   **Location** Mare Island
Task Order 14.01   **Project:** Followon TPH Investigation DRMO Site
Project Number 273939.14.01
Project Manager ~~Ellen Hedfield~~ SBG Jim Boone
Sample Manager Mike Godwin   (707) 246-5781
Turnaround Time 21 Days
PO Number 273939.14.01

Analyses columns: FORENSIC ANALYSES; GC/MS Full Scan; Extended PAHs; Extraction; C&H isotope ratio

Sample ID	Sample Date/Time		Type	Matrix	# Containers	Preserv	FORENSIC ANALYSES							GC/MS Full Scan	Extended PAHs	Extraction	C&H isotope ratio
FTPH-FP-SB-RR	12-Nov-08	17:00	N	Water	SBG				41370-1					x	x		x
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered: ☐	~~1~~ 2	HCl, pH<2, 4'C SBG	☑										
				Total Containers:	~~1~~ 2												
FTPH-FP-TR-DDD2	13-Nov-08	14:15	N	Water							-2			x	x	x	x
GCMS ASTM5739, extended PAH 8270-SMI, stable isotopes C&H IRMS				Field Filtered: ☐	1	HCl, pH<2, 4'C	☑										
				Total Containers:	1												

MS = Matrix Spike   SD = Matrix Spike Duplicate

	Signatures	Date/Time
Approved by		
Sampled by	[signature]	11-13-08
Relinquished by		1800
Received by	[signature]	10:15 11/14
Relinquished by		
Received by		

Shipping Details
Method of Shipment: FedEx
On Ice: (yes) / no
Airbill No: 790624799429
Lab Name: Zymax Forensics
Lab Phone: (805) 544-4696

ATTN:
Sample Custody
and
Alan Jeffrey

Special Instructions:

Report Copy to
Artemis Antipas
(425) 453-5005

Isotech Data

Job 10650
Project 41370

Isotech Lab No.	Sample Name	$\delta^{13}C$ ‰	$\delta^{2}H$ ‰
149782	41370-1	-24.0	-140
149783	41370-2	-24.9	-136

ZymaX FORENSICS

Client:	**Jim Boone** **CH2M HILL** **690 Walnut Ave., Ste. 230** **Vallejo, CA 94592**

Lab Number:	**41370-1**
Collected:	**11/12/08**
Received:	**11/14/08**
Matrix:	**Product**

Project:	**Mare Island**
Project Number:	**273939.14.01**
Collected by:	**Mike Godwin**

Sample Description:	**FTPH-FP-SB-RR**
Analyzed:	**11/24/08**
Method:	**8270M**

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	2.5	ND
C1 Benzothiophenes	2.5	16.9
C2 Benzothiophenes	2.5	33.6
C3 Benzothiophenes	2.5	48.7
C4 Benzothiophenes	2.5	67.6
Naphthalene	2.5	3.8
1-Methylnaphthalene	2.5	194.5
2-Methylnaphthalene	2.5	204.5
C2 Naphthalenes	2.5	822.0
C3 Naphthalenes	2.5	732.7
C4 Naphthalenes	2.5	615.6
Biphenyl	2.5	ND
Acenaphthylene	2.5	ND
Dibenzofuran	2.5	13.4
Acenaphthene	2.5	9.9
Fluorene	2.5	45.3
C1 Fluorenes	2.5	68.9
C2 Fluorenes	2.5	31.6
C3 Fluorenes	2.5	55.4
Anthracene	2.5	5.7
Phenanthrene	2.5	103.2
C1 Phenanthrenes/Anthracenes	2.5	207.0
C2 Phenanthrenes/Anthracenes	2.5	286.6
C3 Phenanthrenes/Anthracenes	2.5	233.4
C4 Phenanthrenes/Anthracenes	2.5	85.7

***PQL - Practical Quantitation Limit**
****Results listed as ND would have been reported if present at or above the listed PQL.**

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41370-1pna.xls
STL/th

Client:	**Jim Boone** **CH2M HILL** **690 Walnut Ave., Ste. 230** **Vallejo, CA 94592**	**Lab Number:** **Collected:** **Received:** **Matrix:**	**41370-1** **11/12/08** **11/14/08** **Product**
Project: **Project Number:** **Collected by:**	**Mare Island** **273939.14.01** **Mike Godwin**	**Sample Description:** **Analyzed:** **Method:**	**FTPH-FP-SB-RR** **11/24/08** **8270M**

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	2.5	26.0
C1 Dibenzothiophenes	2.5	98.5
C2 Dibenzothiophenes	2.5	145.7
C3 Dibenzothiophenes	2.5	93.1
C4 Dibenzothiophenes	2.5	87.6
Fluoranthene	2.5	8.1
Pyrene	2.5	16.6
C1 Pyrenes/Fluoranthenes	2.5	76.0
C2 Pyrenes/Fluoranthenes	2.5	130.4
C3 Pyrenes/Fluoranthenes	2.5	59.8
Benz(a)anthracene	2.5	4.4
Chrysene	2.5	18.6
C1 Chrysenes	2.5	84.6
C2 Chrysenes	2.5	70.2
C3 Chrysenes	2.5	35.6
C4 Chrysenes	2.5	16.5
Benzo(b)fluroanthene	2.5	ND
Benzo(k)fluoranthene	2.5	ND
Benzo(e)pyrene	2.5	ND
Benzo(a)pyrene	2.5	ND
Perylene	2.5	19.4
Indeno(1,2,3-c,d)pyrene	2.5	ND
Dibenz(a,h)anthracene	2.5	ND
Benzo(g,h,i)perylene	2.5	ND

***PQL - Practical Quantitation Limit**
****Results listed as ND would have been reported if present at or above the listed PQL.**

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41370-1pna.xls
STL/th

ZymaX FORENSICS

Client:	**Jim Boone**
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	**41370-2**
Collected:	**11/13/08**
Received:	**11/14/08**
Matrix:	**Soil**

Project:	**Mare Island**
Project Number:	**273939.14.01**
Collected by:	**Mike Godwin**

Sample Description:	**FTPH-FP-TR-DDD2**
Analyzed:	**11/24/08**
Method:	**8270M**

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Benzothiophene	0.075	ND
C1 Benzothiophenes	0.075	ND
C2 Benzothiophenes	0.075	ND
C3 Benzothiophenes	0.075	0.237
C4 Benzothiophenes	0.075	0.263
Naphthalene	0.075	ND
1-Methylnaphthalene	0.075	0.152
2-Methylnaphthalene	0.075	ND
C2 Naphthalenes	0.075	2.338
C3 Naphthalenes	0.075	3.264
C4 Naphthalenes	0.075	2.832
Biphenyl	0.075	ND
Acenaphthylene	0.075	ND
Dibenzofuran	0.075	ND
Acenaphthene	0.075	ND
Fluorene	0.075	0.233
C1 Fluorenes	0.075	0.387
C2 Fluorenes	0.075	0.160
C3 Fluorenes	0.075	0.258
Anthracene	0.075	ND
Phenanthrene	0.075	0.156
C1 Phenanthrenes/Anthracenes	0.075	0.804
C2 Phenanthrenes/Anthracenes	0.075	1.302
C3 Phenanthrenes/Anthracenes	0.075	0.941
C4 Phenanthrenes/Anthracenes	0.075	0.314

***PQL - Practical Quantitation Limit**
****Results listed as ND would have been reported if present at or above the listed PQL.**

Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

MSD 10
41370-2pna.xls
STL/th

Client:	**Jim Boone**
	CH2M HILL
	690 Walnut Ave., Ste. 230
	Vallejo, CA 94592

Lab Number:	**41370-2**
Collected:	**11/13/08**
Received:	**11/14/08**
Matrix:	**Soil**

Project:	**Mare Island**
Project Number:	**273939.14.01**
Collected by:	**Mike Godwin**

Sample Description:	**FTPH-FP-TR-DDD2**
Analyzed:	**11/24/08**
Method:	**8270M**

CONSTITUENT	PQL* mg/kg	RESULT** mg/kg
Dibenzothiophene	0.075	0.114
C1 Dibenzothiophenes	0.075	0.390
C2 Dibenzothiophenes	0.075	0.469
C3 Dibenzothiophenes	0.075	0.307
C4 Dibenzothiophenes	0.075	0.234
Fluoranthene	0.075	ND
Pyrene	0.075	0.123
C1 Pyrenes/Fluoranthenes	0.075	0.489
C2 Pyrenes/Fluoranthenes	0.075	0.625
C3 Pyrenes/Fluoranthenes	0.075	0.274
Benz(a)anthracene	0.075	ND
Chrysene	0.075	0.101
C1 Chrysenes	0.075	0.425
C2 Chrysenes	0.075	0.325
C3 Chrysenes	0.075	0.139
C4 Chrysenes	0.075	ND
Benzo(b)fluroanthene	0.075	ND
Benzo(k)fluoranthene	0.075	ND
Benzo(e)pyrene	0.075	ND
Benzo(a)pyrene	0.075	ND
Perylene	0.075	ND
Indeno(1,2,3-c,d)pyrene	0.075	ND
Dibenz(a,h)anthracene	0.075	ND
Benzo(g,h,i)perylene	0.075	ND

***PQL - Practical Quantitation Limit**
****Results listed as ND would have been reported if present at or above the listed PQL.**

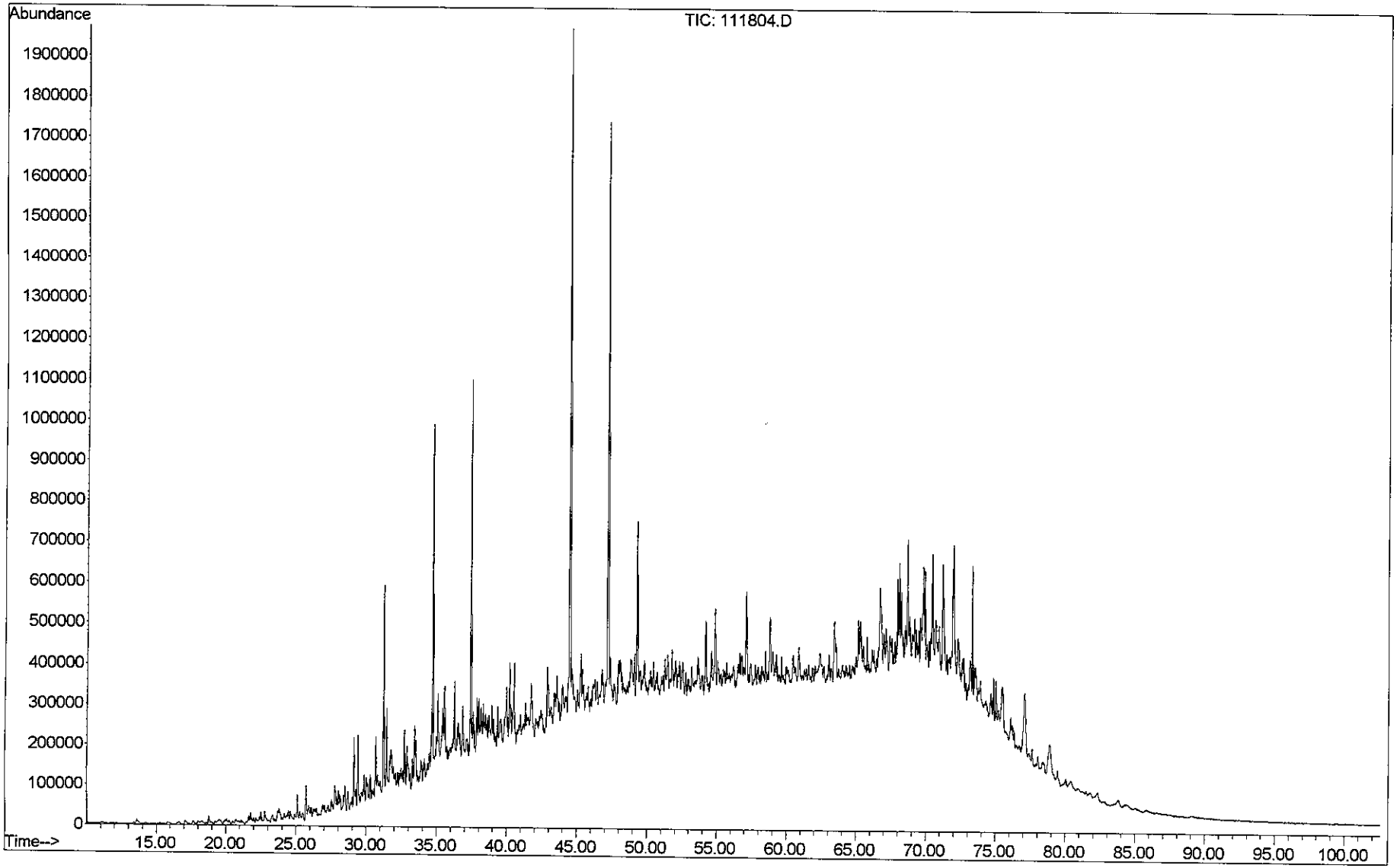
Note: Analyzed in the Selected Ion Monitoring (SIM) mode.

Submitted by,
Zymax Forensics, a DPRA Company

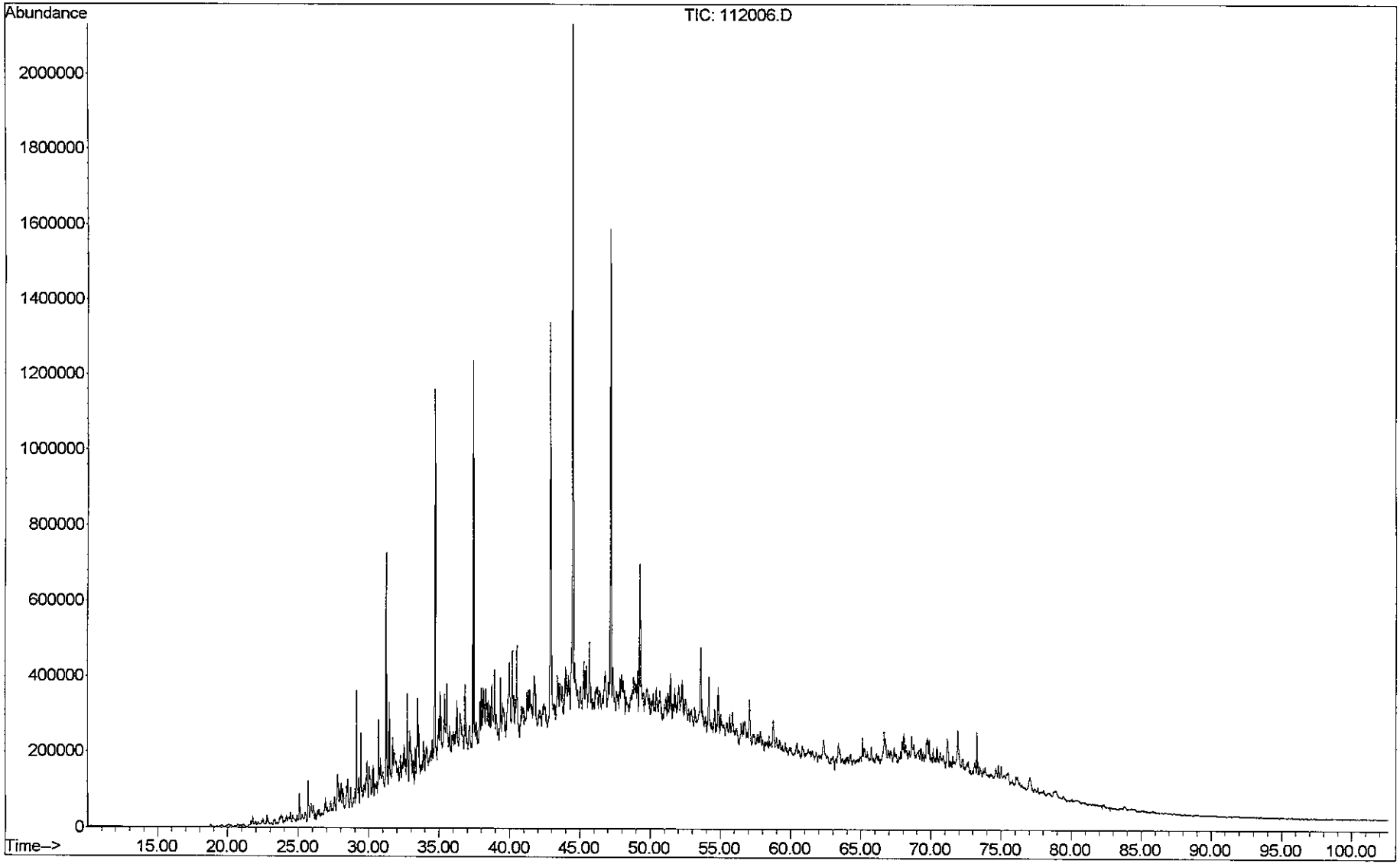
Shan-Tan Lu, Ph.D.
Director, Forensic Geochemistry

MSD 10
41370-2pna.xls
STL/th

Sample Name: FTPH-FP-SB-RR (41370-1) product
Misc Info : Mare Island, CH2M HILL



Sample Name: FTPH-FP-TR-DDD2 (41370-2) soil extract
Misc Info : Vf=4ml, 25g, Mare Island, CH2M HILL

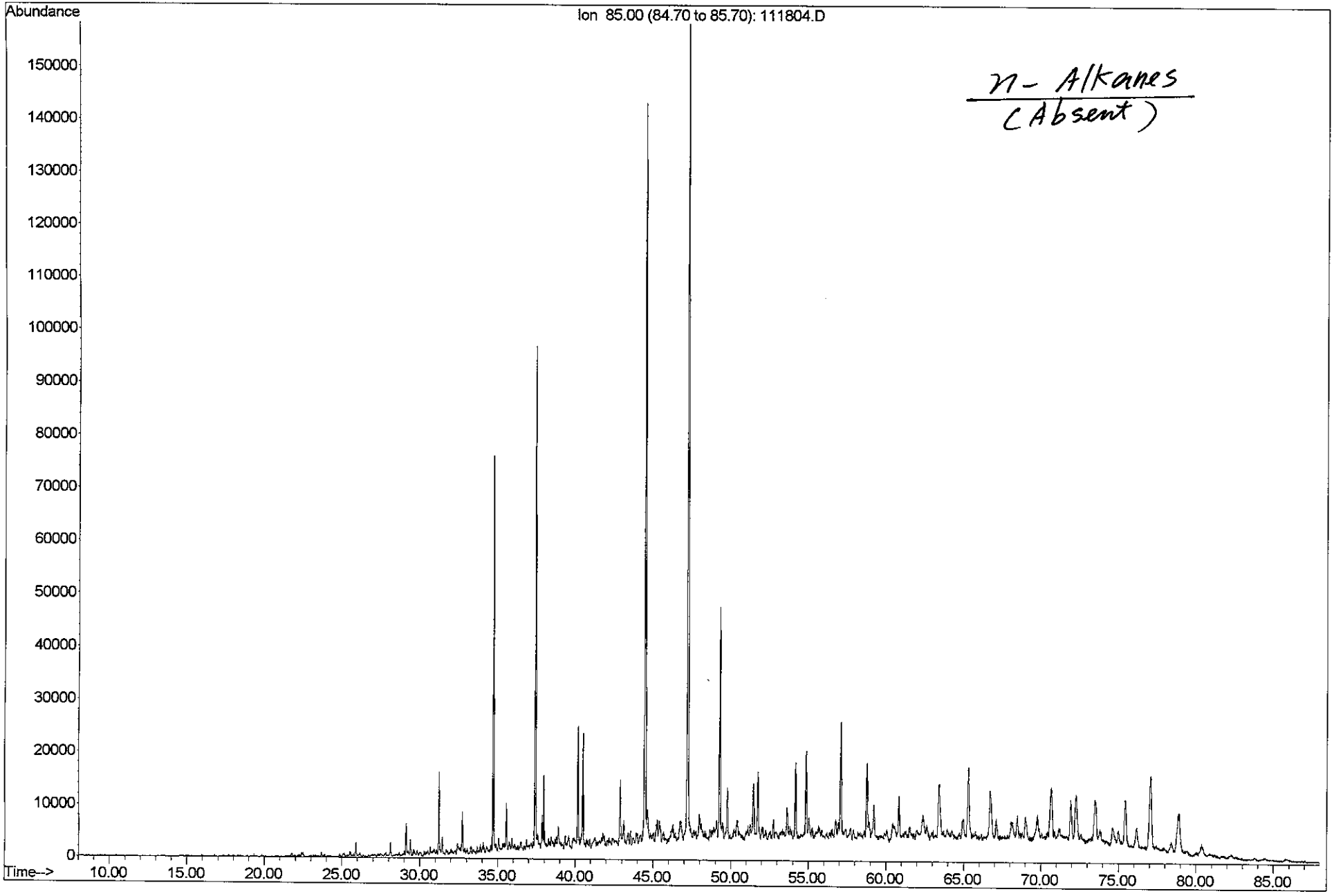


Table

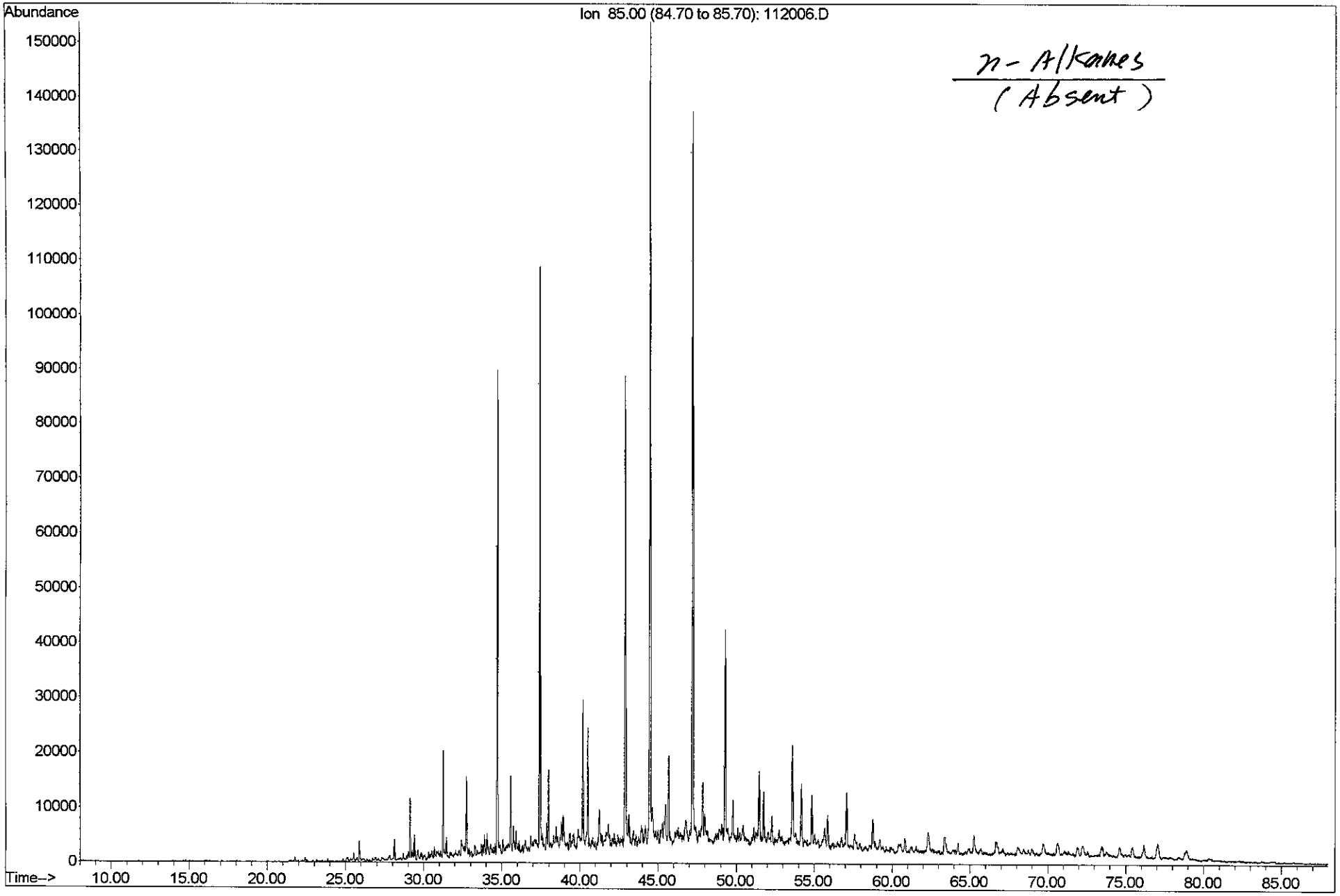
Key to Chromatogram Symbol Identification for m/z 85 and m/z 113 Paraffins and Isoparaffins

Symbol	Detail
i-10	Iso-alkane with 10 carbon atoms
i-15	Farnesane (isoprenoid with 15 carbon atoms)
i-16	Isoprenoid with 16 carbon atoms
Pr	Pristane (isoprenoid with 19 carbon atoms)
Ph	Phytane (isoprenoid with 20 carbon atoms)
nC_8	n-C_8 normal alkane
nC_{15}	n-C_{15} normal alkane
i-8	2,5-(2,4)-Dimethylhexane
i-8'	2,3,4-Trimethylpentane
i-8"	2,3-Dimethylhexane
CH-*n*	Alkylcyclohexane (where *n* indicates number of carbon atoms in the side chain)

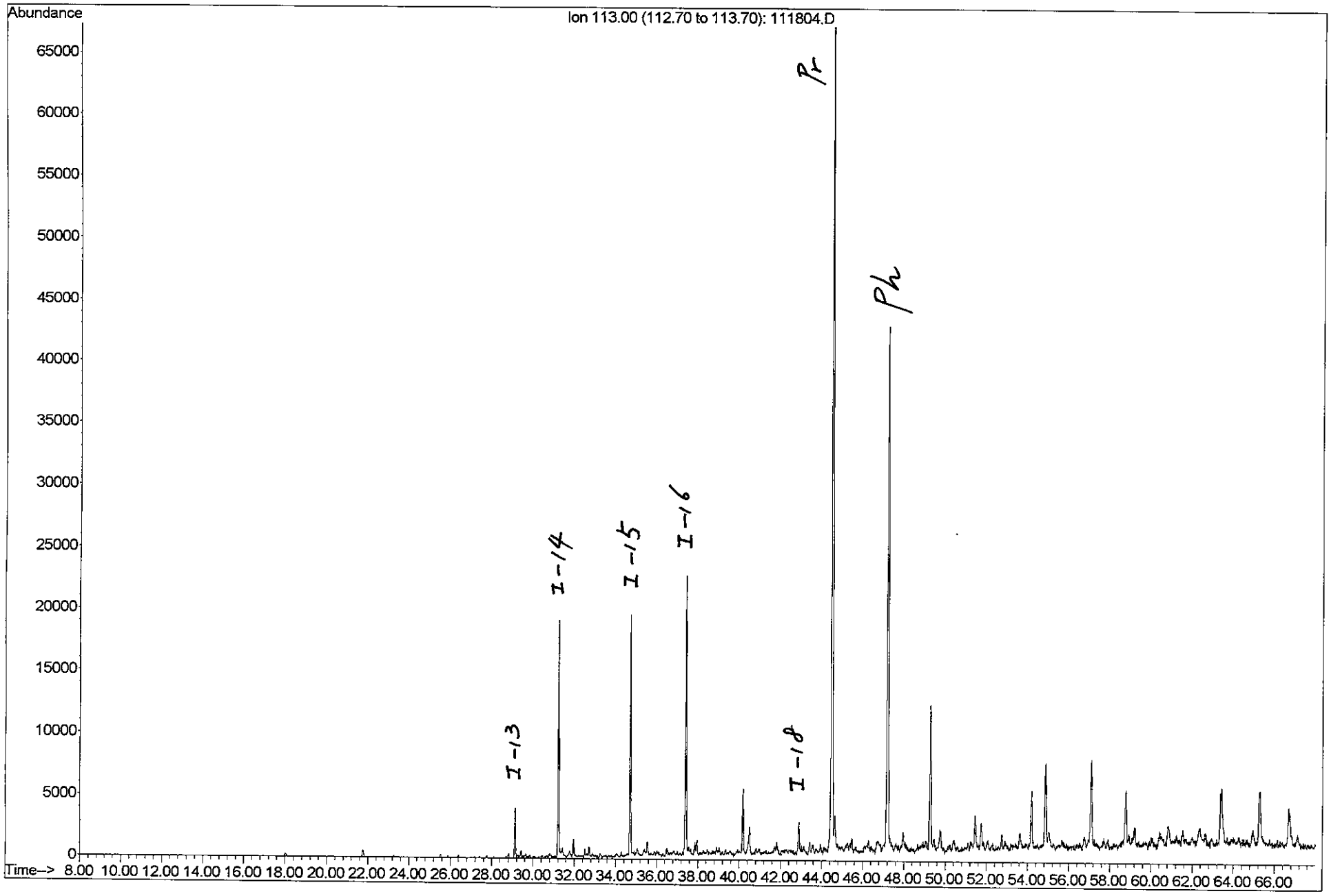
FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



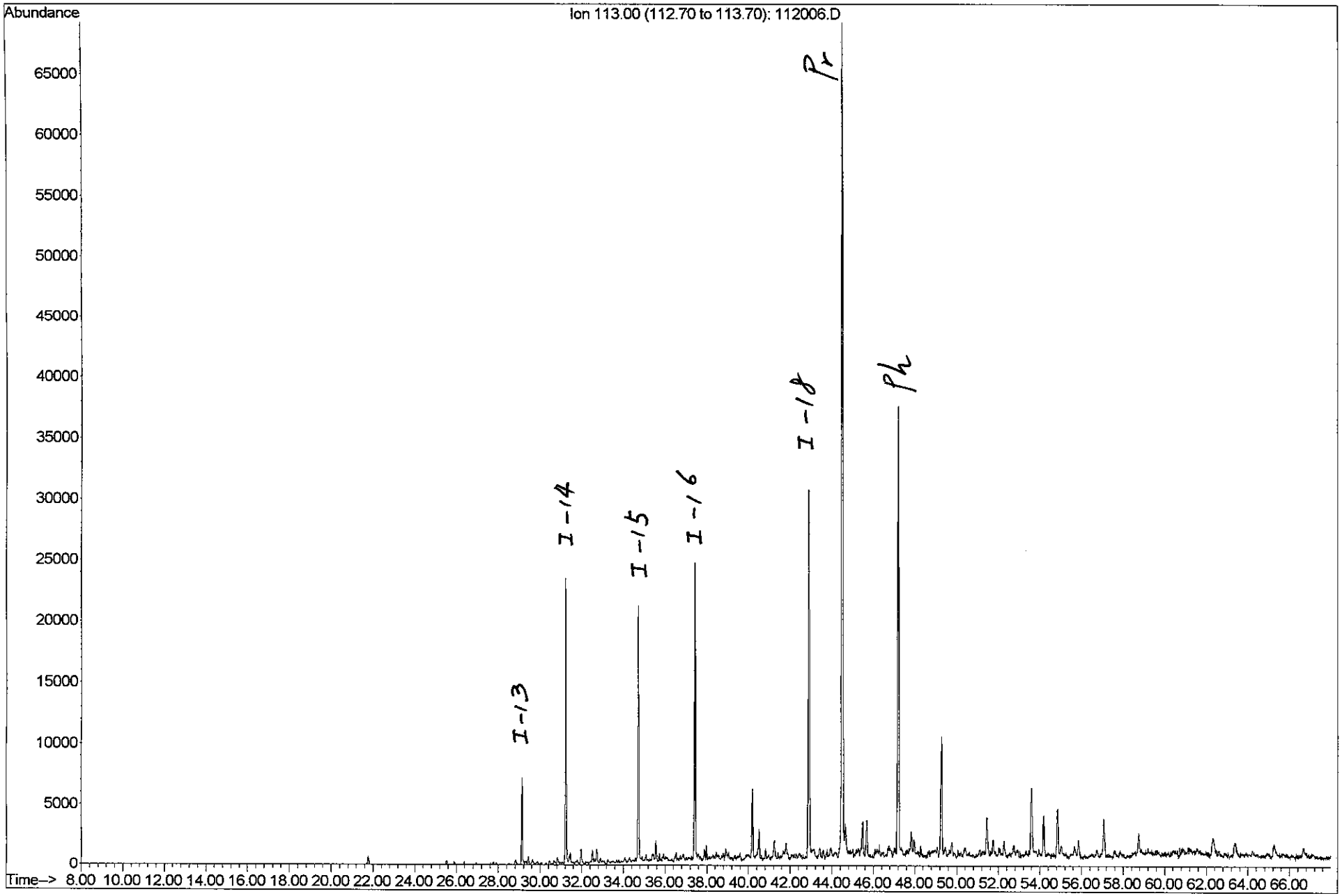
FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL



FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL

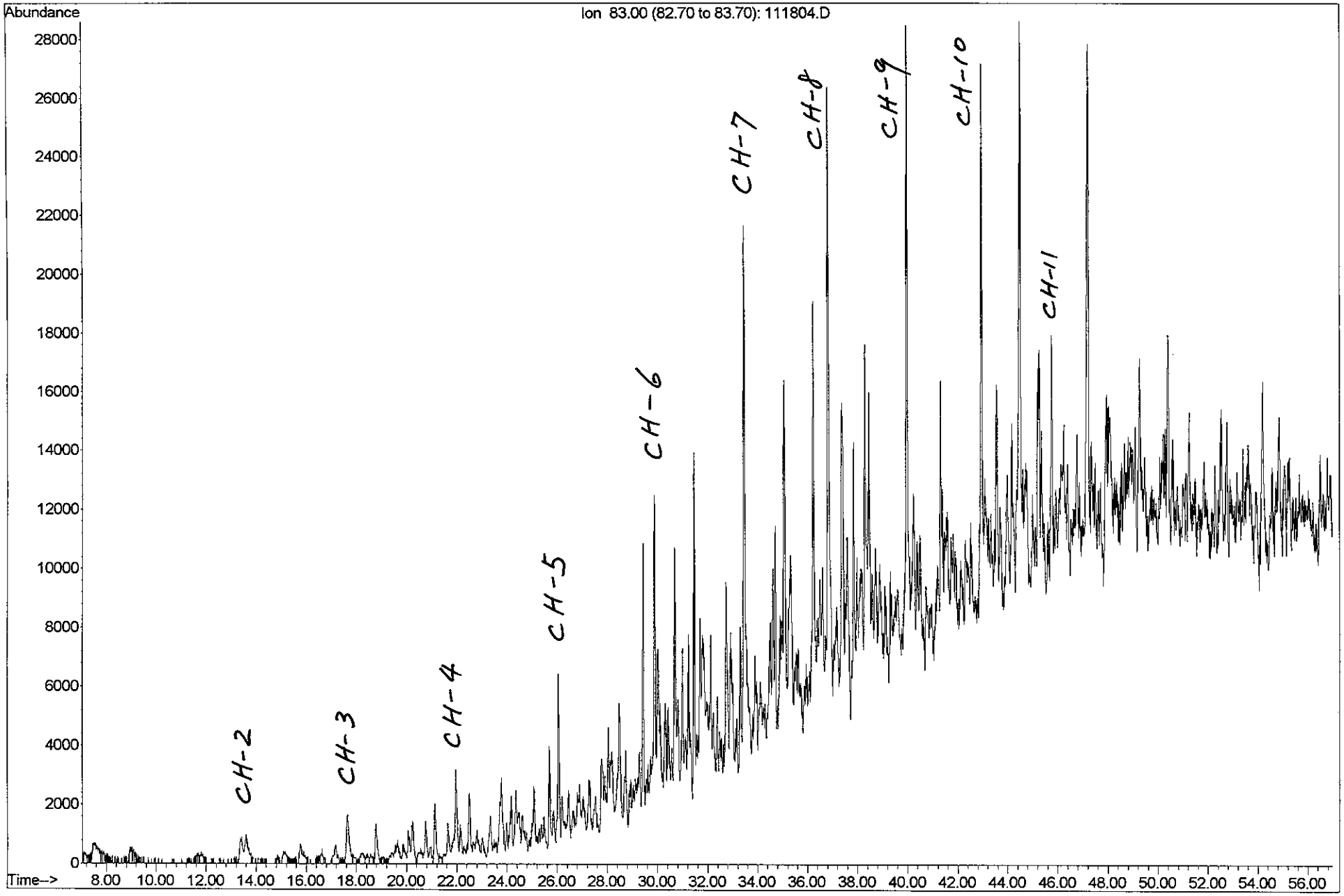


Table

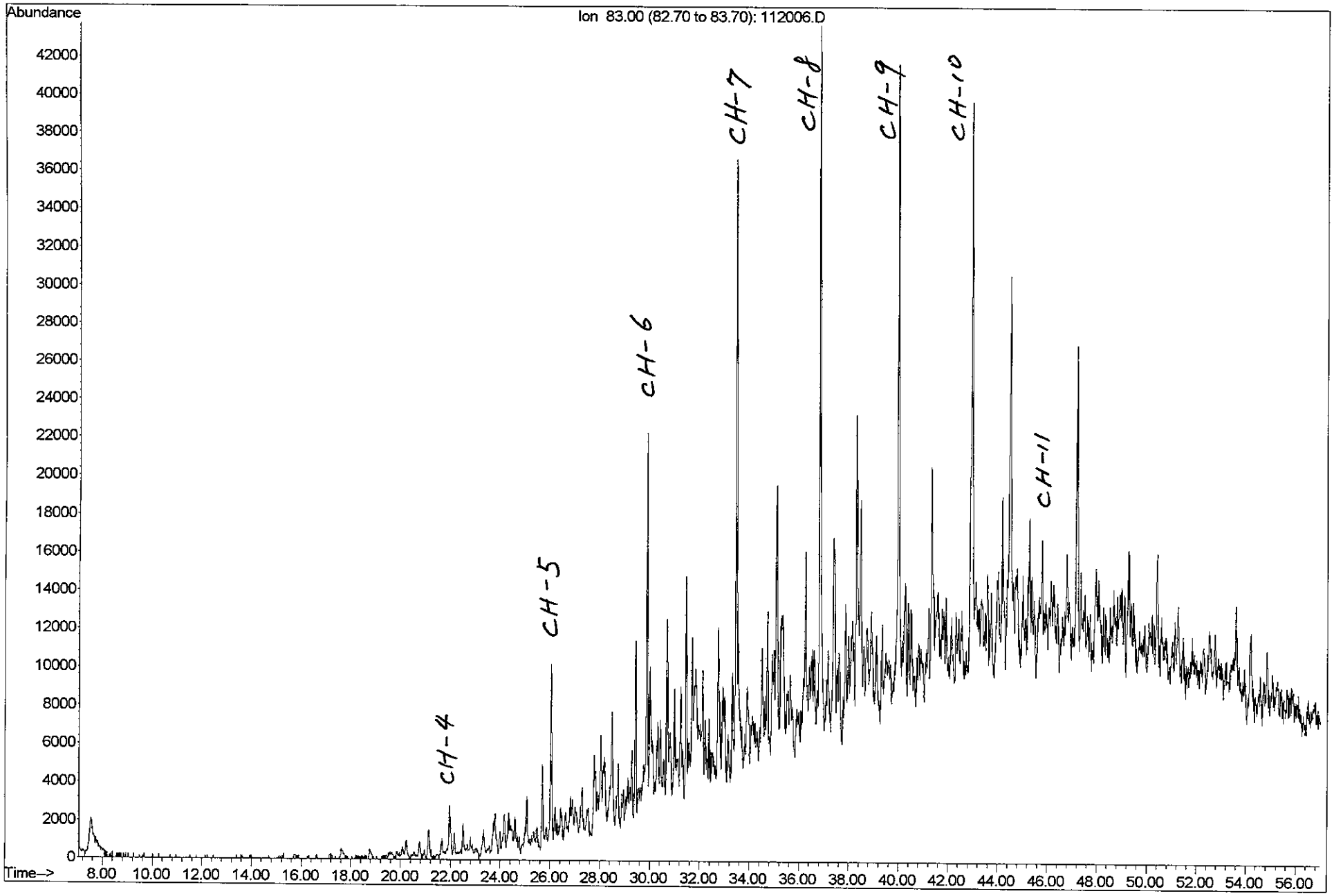
Key for Alkylcyclohexanes at m/z 83

Symbol	Detail
CH-1:	Methylcyclohexane
CH-2:	Ethylcyclohexane
CH-3:	Propylcylohexane
CH-4:	Butylcyclohexane
CH-5:	Pentylcyclohexane
CH-6:	Hexylcyclohexane
CH-7:	Heptylcyclohexane
CH-8:	Octylcyclohexane
CH-9:	Nonylcyclohexane
CH-10:	Decylcyclohexane
CH-11:	Undecylcyclohexane
CH-12:	Dodecylcyclohexane
CH-13:	Tridecylcyclohexane
CH-14:	Tetradecylcyclohexane

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL

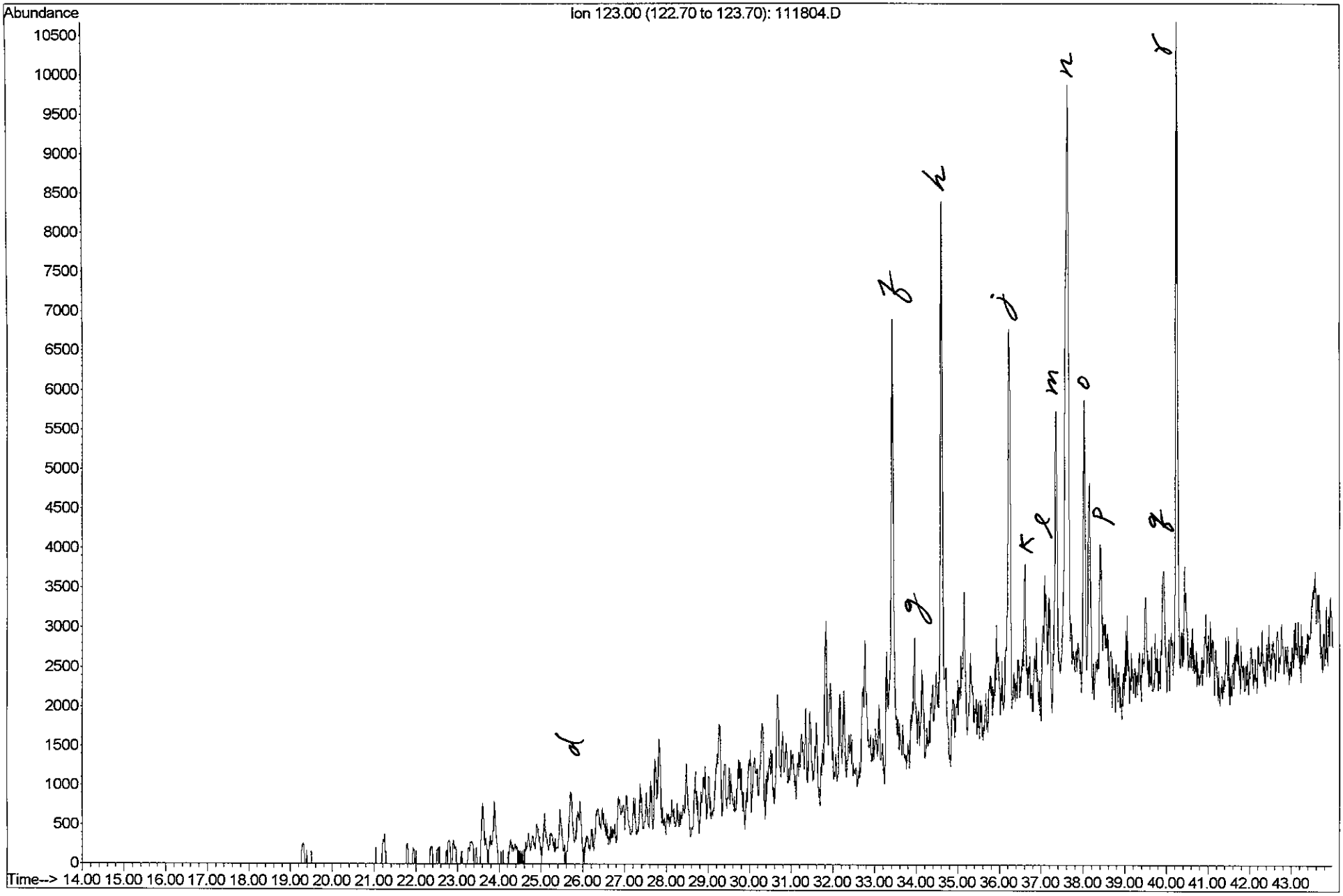


Table

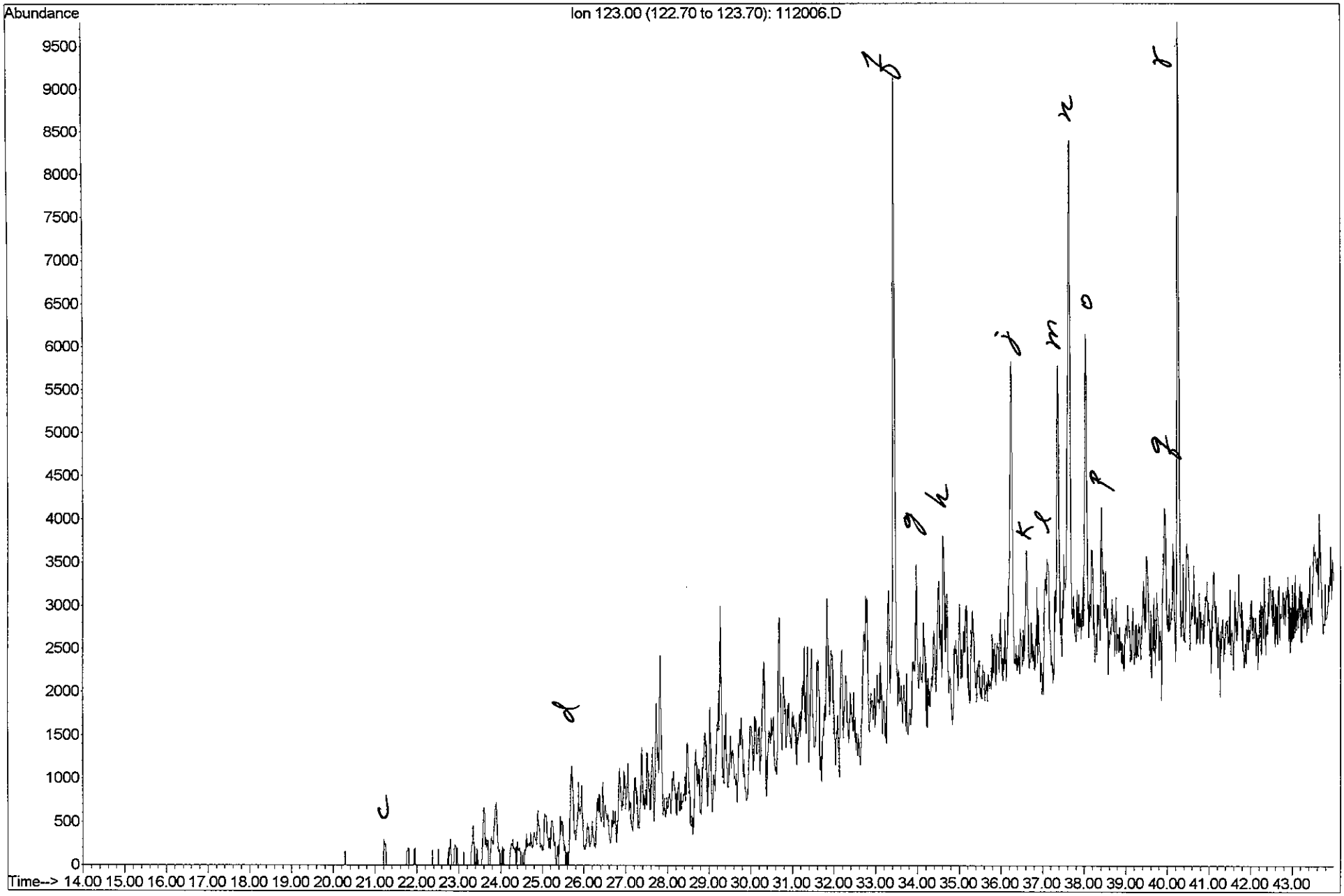
Key for identification of the Bicyclanes (m/z 123 mass chromatograms)

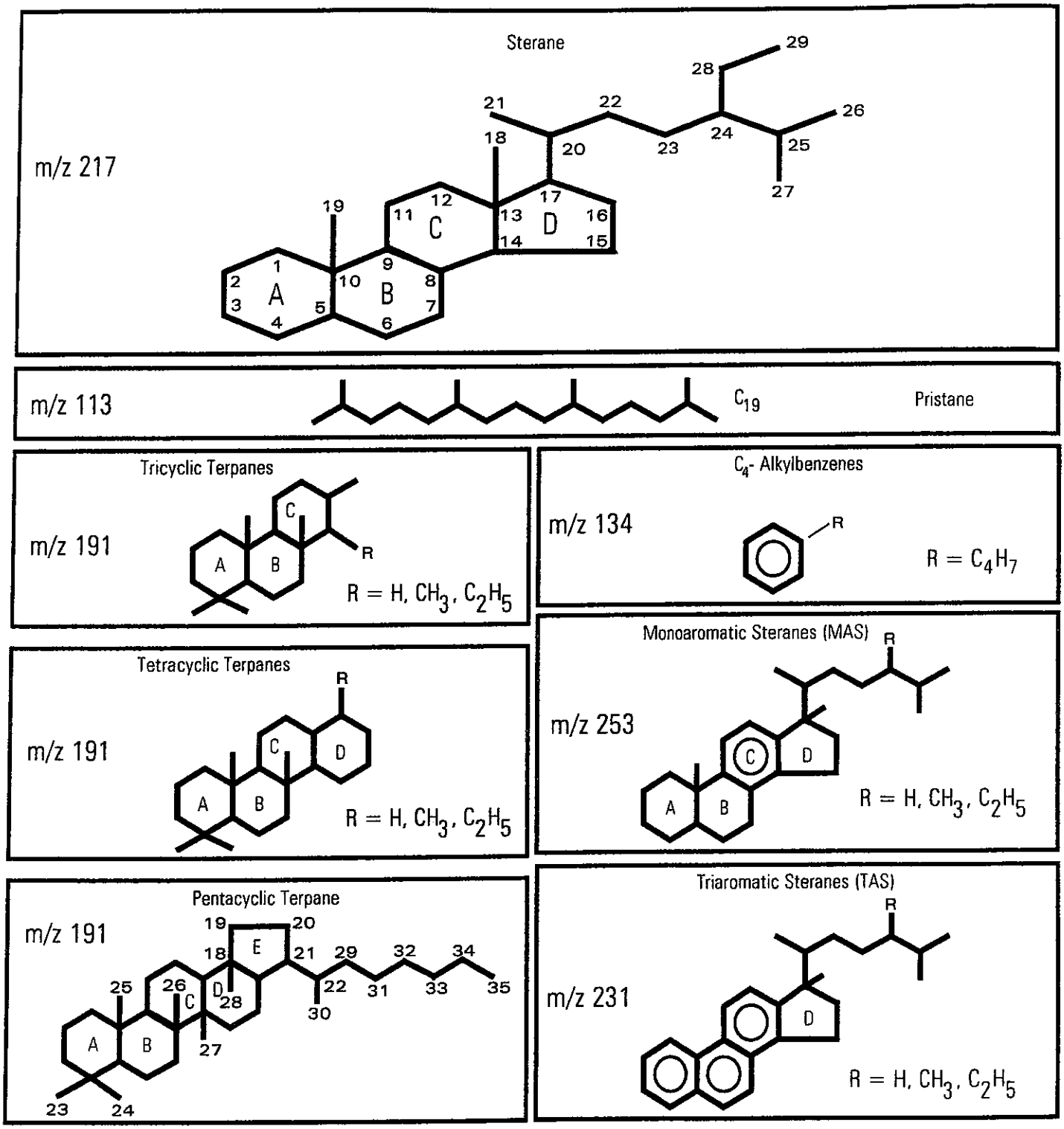
Peak No.	Identity	Formula	M.W.
a	2,2,3-Trimethylbicyloheptane	$C_{10}H_{18}$	138
b	C_{10} bicycloalkane	$C_{10}H_{18}$	138
c	3,3,7-Trimethylbicycloheptane	$C_{10}H_{18}$	138
d	C_{11} decalin	$C_{11}H_{20}$	152
f	Nordrimane	$C_{14}H_{26}$	194
g	Nordrimane	$C_{14}H_{26}$	194
h	Rearranged drimane	$C_{15}H_{28}$	208
j	Rearranged drimane	$C_{15}H_{28}$	208
k	Isomer of eudesmane	$C_{15}H_{28}$	208
l	4β(H) Eudesmane	$C_{15}H_{28}$	208
m	C_{15} bicyclic sesquiterpane	$C_{15}H_{28}$	208
n	8β(H) Drimane	$C_{15}H_{28}$	208
o	C_{15} bicyclic sesquiterpane	$C_{15}H_{28}$	208
p	C_{16} bicyclic sesquiterpane	$C_{16}H_{30}$	222
q	C_{16} bicyclic sesquiterpane	$C_{16}H_{30}$	222
r	8β(H) Homodrimane	$C_{16}H_{30}$	222

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL





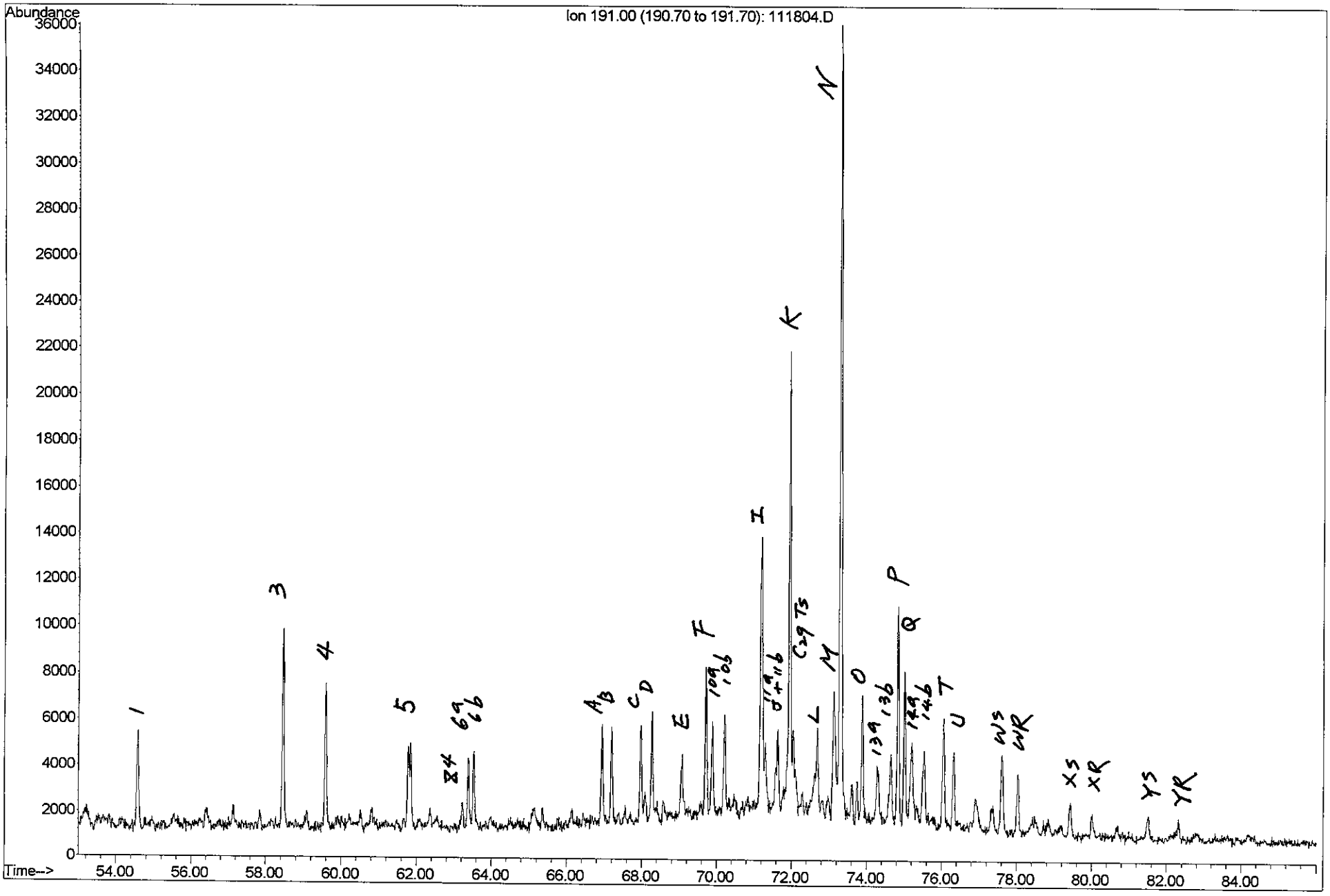
The compound structures of pristane, C_4-alkylbenzenes, sterane; terpanes; monoaromatic and triaromatic steranes

ZymaX FORENSICS

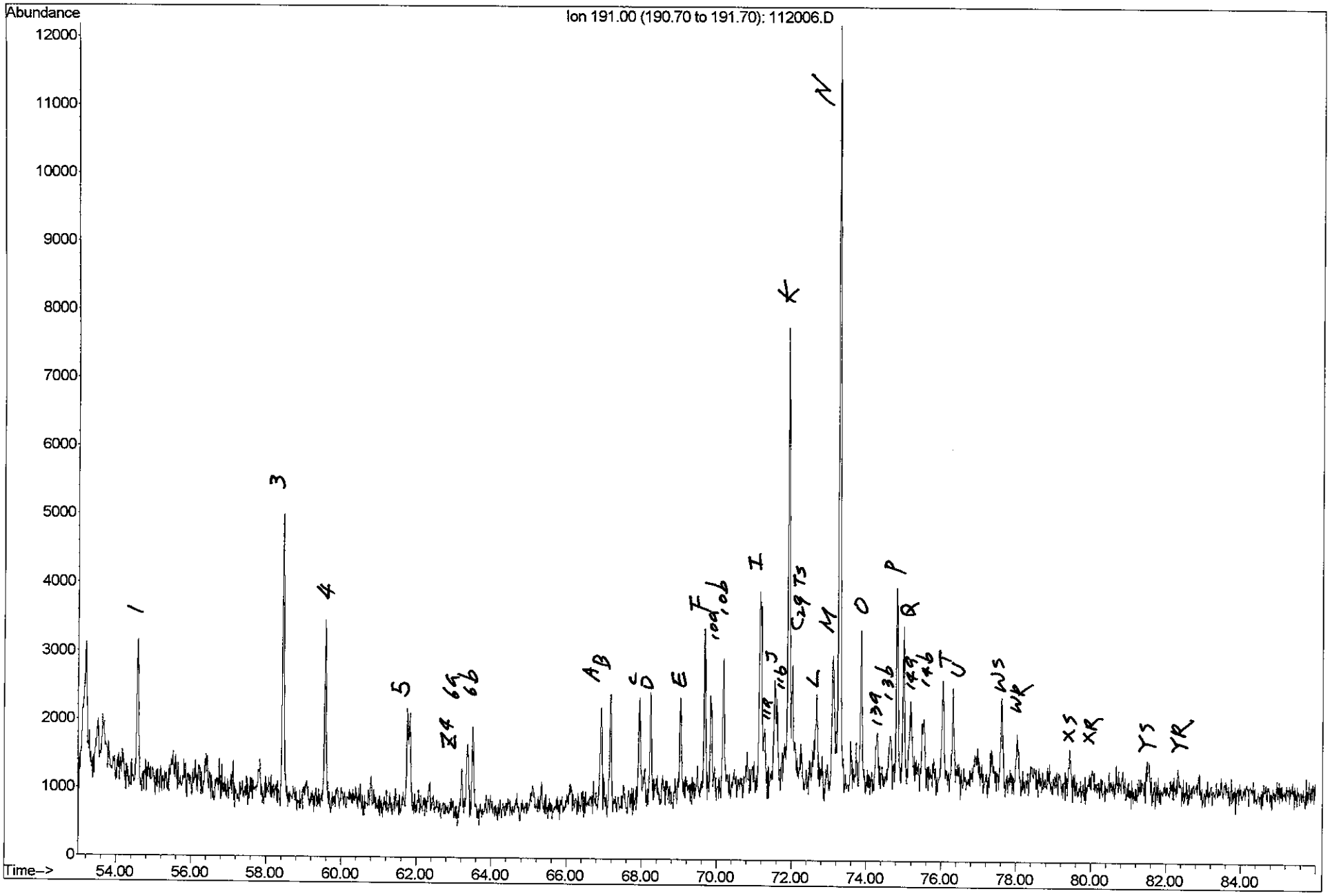
Key for Tricyclic, Tetracyclic, and Pentacyclic Terpanes Identification (m/z 191 mass chromatograms)

Code	Identity	Carbon #
0	C_{20}-Tricyclic Terpane	20
1	C_{21}-Tricyclic Terpane	21
2	C_{22}-Tricyclic Terpane	22
3	C_{23}-Tricyclic Terpane	23
4	C_{24}-Tricyclic Terpane	24
5	C_{25}-Tricyclic Terpane	25
Z4	C_{24}-Tetracyclic Terpane	24
6a	C_{26}-Tricyclic Terpane	26
6b	C_{26}-Tricyclic Terpane	26
7	C_{27}-Tricyclic Terpane	27
A	C_{28}-Tricyclic Terpane #1	28
B	C_{28}-Tricyclic Terpane #2	28
C	C_{29}-Tricyclic Terpane #1	29
D	C_{29}-Tricyclic Terpane #2	29
E	18α-22,29,30-Trisnorneohopane (Ts)	27
F	17α-22,29,30-Trisnorhopane (Tm)	27
G	17ß-22,29-30-Trisnorhopane	27
H	17α-23,28-Bisnorlupane	28
10a	C_{30}-Tricyclic Terpane #1	30
10b	C_{30}-Tricyclic Terpane #2	30
I	17α-28,30-Bisnorhopane	28
11a	C_{31}-Tricyclic Terpane #1	31
J	17α-25-Norhopane	29
11b	C_{31}-Tricyclic Terpane #2	31
K	17α,21ß-30-Norhopane	29
C_{29}Ts	18α-30-Norneohopane	29
C_{30}*	17α-Diahopane	30
L	17ß-21α-30-Normoretane	29
Ma	18α-Oleanane	30
Mb	18ß-Oleanane	30
N	17α,21ß-Hopane	30
O	17ß,21α-Moretane	30
13a	C_{33}-Tricyclic Terpane #1	33
13b	C_{33}-Tricyclic Terpane #2	33
P	22S-17α,21ß-30-Homohopane	31
Q	22R-17α,21ß-30-Homohopane	31
R	Gammacerane	30
14a	C_{34}-Tricyclic Terpane #1	34
S	17ß,21α-Homomoretane	31
14b	C_{34}-Tricyclic Terpane #2	34
T	22S-17α,21ß-30-Bishomohopane	32
U	22R-17α,21ß-30-Bishomohopane	32
15a	C_{35}-Tricyclic Terpane #1	35
15b	C_{35}-Tricyclic Terpane #2	35
V	17ß,21α-C_{32}-Bishomomoretane	32
WS	22S-17α,21ß-30,31,32-Trishomohopane	33
WR	22R-17α,21ß-30,31,32-Trishomohopane	33
16a	C_{36}-Tricyclic Terpane #1	36
16b	C_{36}-Tricyclic Terpane #2	36
XS	22S-17α,21ß-30,31,32,33-Tetrahomohopane	34
XR	22R-17α,21ß-30,31,32,33-Tetrahomohopane	34
YS	22S-17α,21ß-30,31,32,33,34-Pentahomohopane	35
YR	22R-17α,21ß-30,31,32,33,34-Pentahomohopane	35

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL

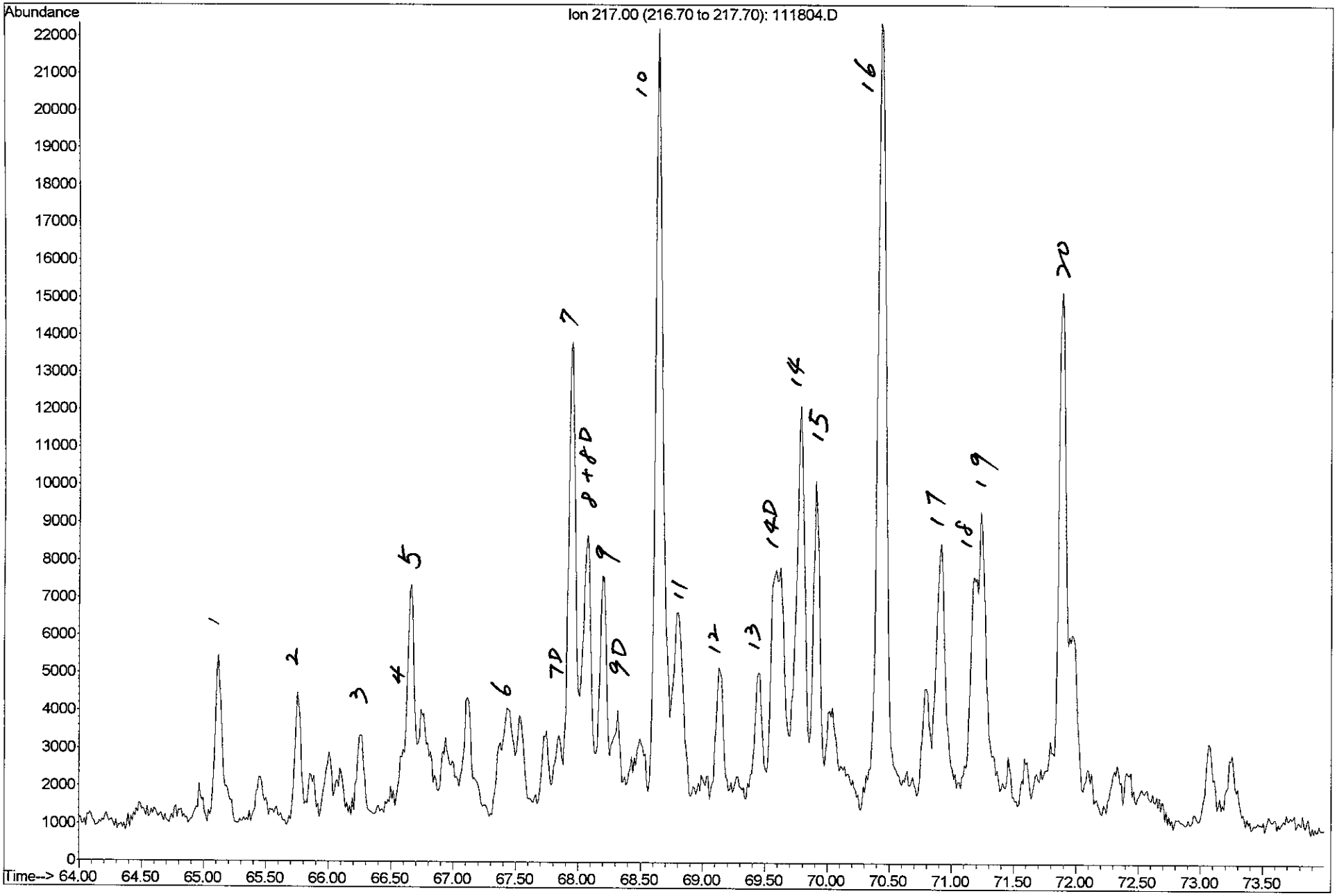


Table

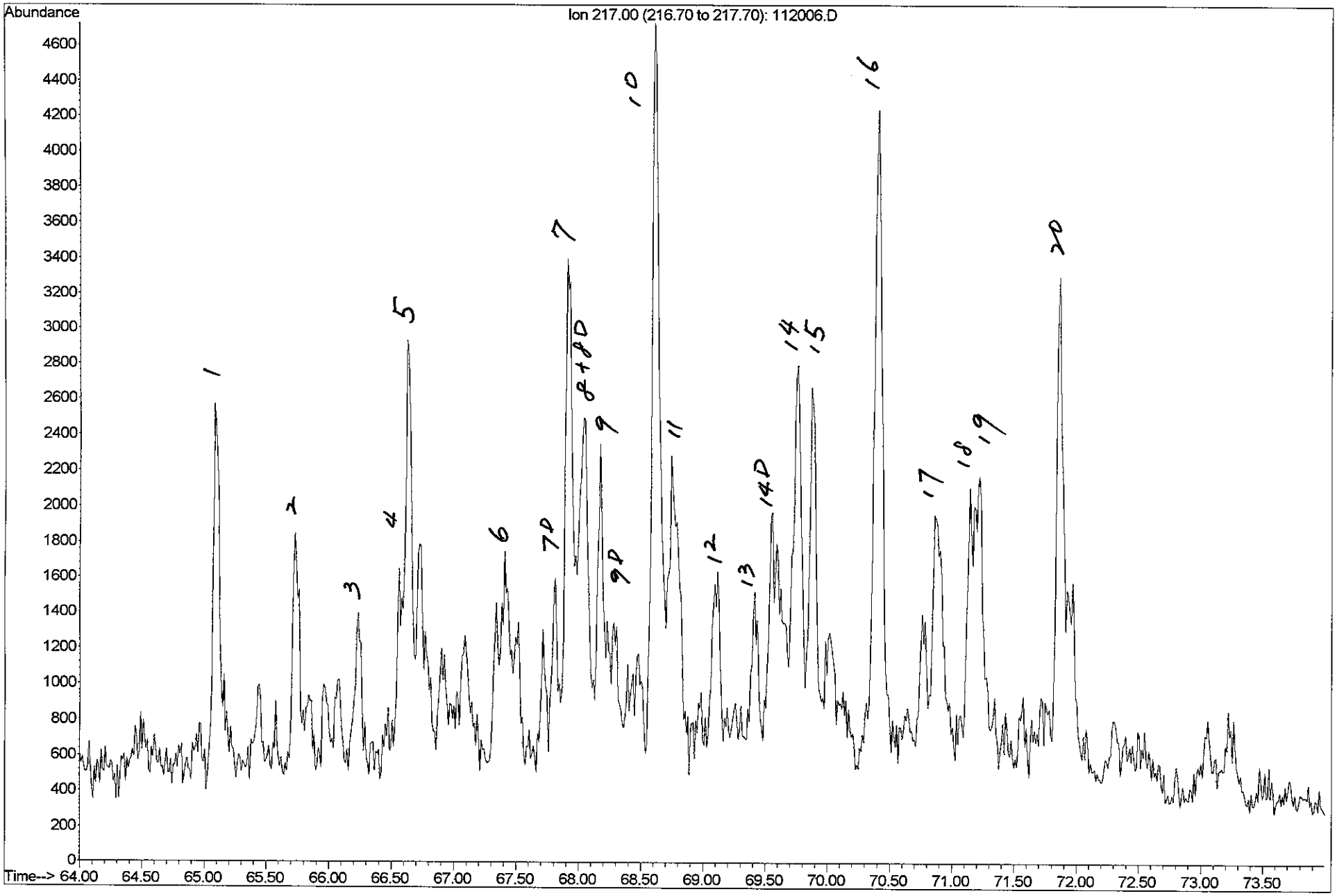
Key for Steranes Identification (m/z 217 Mass Chromatogram)

Code	Identity	Carbon #
1	13ß,17α-diacholestane (20S)	27
2	13ß,17α-diacholestane (20R)	27
3	13α,17ß-diacholestane (20S)	27
4	13α,17ß-diacholestane (20R)	27
5	24-methyl-13ß,17α-diacholestane (20S)	28
6	24-methyl-13ß,17α-diacholestane (20R)	28
7D	24-methyl-13α,17ß-diacholestane (20S)	28
7	14α,17α-cholestane (20S)	27
8D	24-ethyl-13ß,17α-diacholestane (20S)	29
8	14ß,17ß-cholestane (20R)	27
9	14ß,17ß-cholestane (20S)	27
9D	24-methyl-13α,17ß-diacholestane (20R)	28
10	14α,17α-cholestane (20R)	27
11	24-ethyl-13ß,17α-diacholestane (20R)	29
12	24-ethyl-13α,17ß-diacholestane (20S)	29
13	24-methyl-14α,17α-cholestane (20S)	28
14D	24-ethyl-13α,17ß-diacholestane (20R)	29
14	24-methyl-14ß,17ß-cholestane (20R)	28
15	24-methyl-14ß,17ß-cholestane (20S)	28
16	24-methyl-14α,17α-cholestane (20R)	28
17	24-ethyl-14α-cholestane (20S)	29
18	24-ethyl-14ß,17ß-cholestane (20R)	29
19	24-ethyl-14ß,17ß-cholestane (20S)	29
20	24-ethyl-14α,17α-cholestane (20R)	29
21A	24-n-Propylcholestane (20S)	30
21B	4-methyl-24-ethylcholestane (20S)	30
22A	4α-methyl-24-ethyl-14β,17β-cholestane(20S)	30
22B	24-n-propyl-14β,17β-cholestane (20S)	30
23A	4α-methyl-24-ethyl-14β,17β-cholestane(20R)	30
23B	24-n-propyl-14β,17β-cholestane (20R)	30
24A	4α-methyl-24-ethylcholestane(20R)	30
24B	24-n-propylcholestane (20R)	30

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL

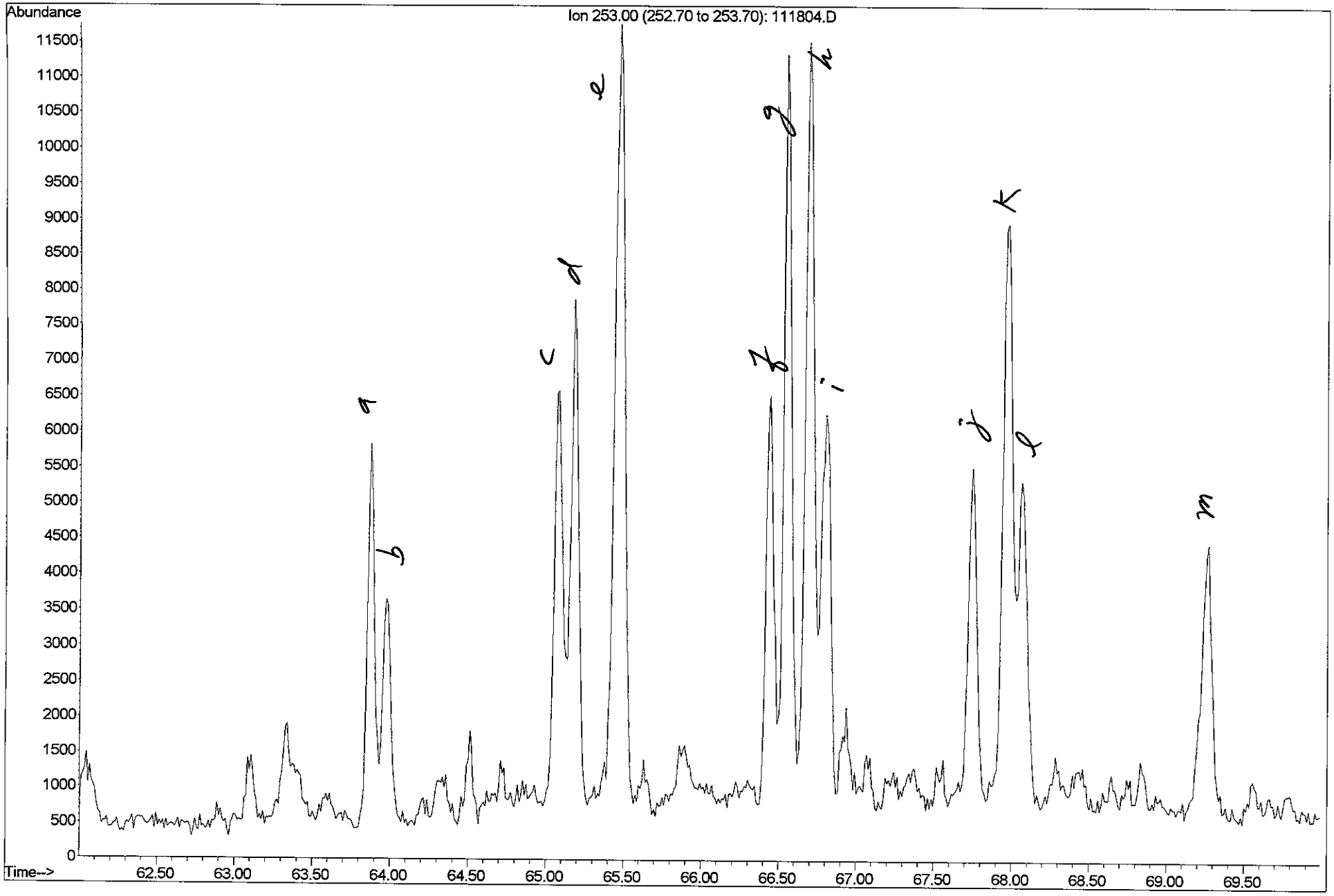


Table

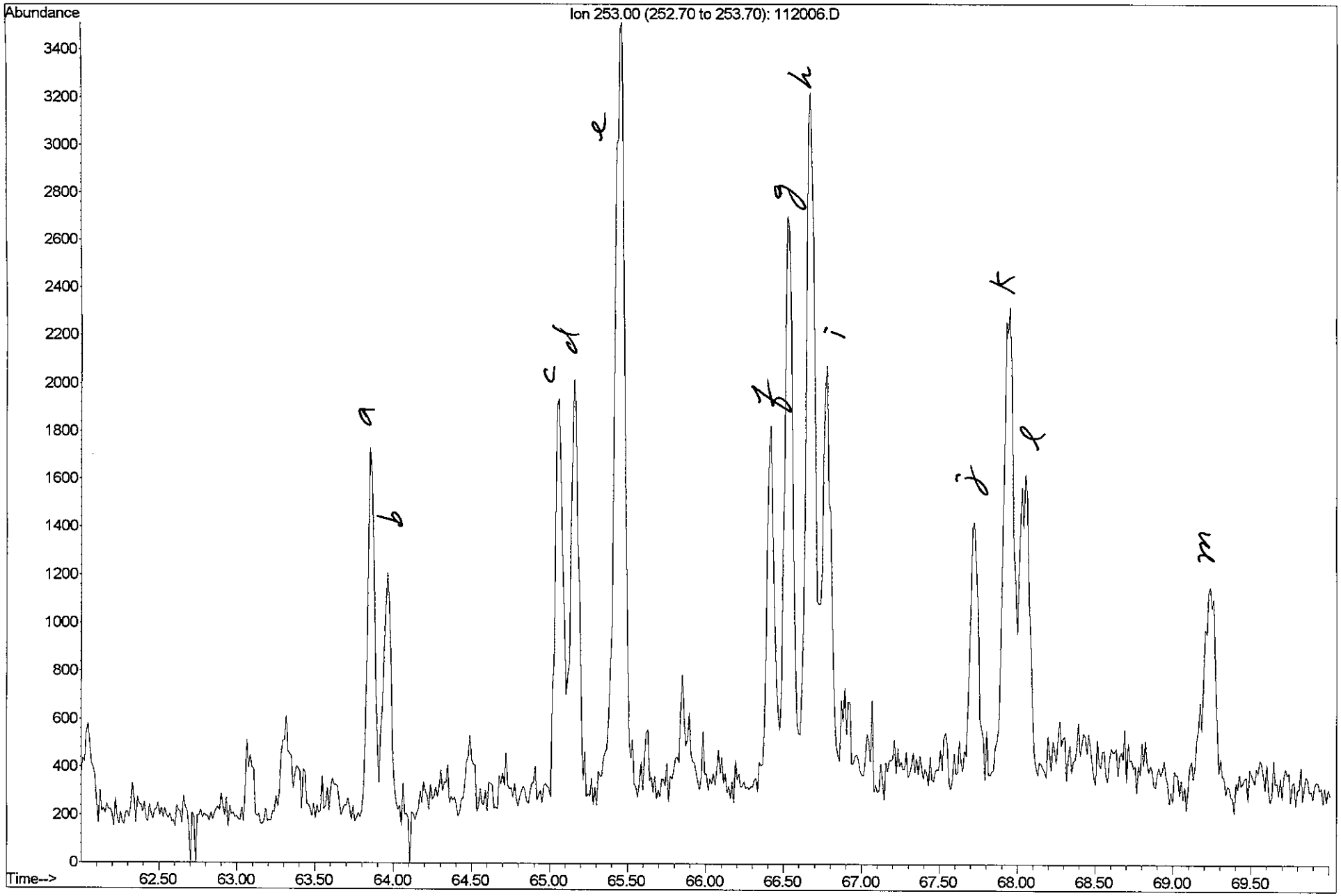
Key for Monoaromatic Steranes Identification (m/z 253 mass chromatogram)

Code	Identity	Elemental Composition
a	20S, 5ß C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
b	20S, dia C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
c	20R, 5ß C_{27}-Monoaromatic sterane + 20R C_{27} dia MAS	$C_{27}H_{42}$
d	20S, 5α C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
e	20S, 5ß C_{28}-Monoaromatic sterane + 20S C_{28} dia MAS	$C_{28}H_{44}$
f	20R, 5α C_{27}-Monoaromatic sterane	$C_{27}H_{42}$
g	20S, 5α C_{28}-Monoaromatic sterane	$C_{28}H4_4$
h	20R, 5ß C_{28}-Monoaromatic sterane + 20R C_{28} dia MAS	$C_{28}H_{44}$
i	20S, 5ß C_{29}-Monoaromatic sterane + 20S C_{29} dia MAS	$C_{29}H_{46}$
j	20S, 5α C_{29}-Monoaromatic sterane	$C_{29}H_{46}$
k	20R, 5α C_{28}-Monoaromatic sterane	$C_{28}H_{44}$
l	20R, 5ß C_{29}-Monoaromatic sterane + 20R C_{29} dia MAS	$C_{29}H_{46}$
m	20R, 5α C_{29}-Monoaromatic sterane	$C_{29}H_{46}$

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL

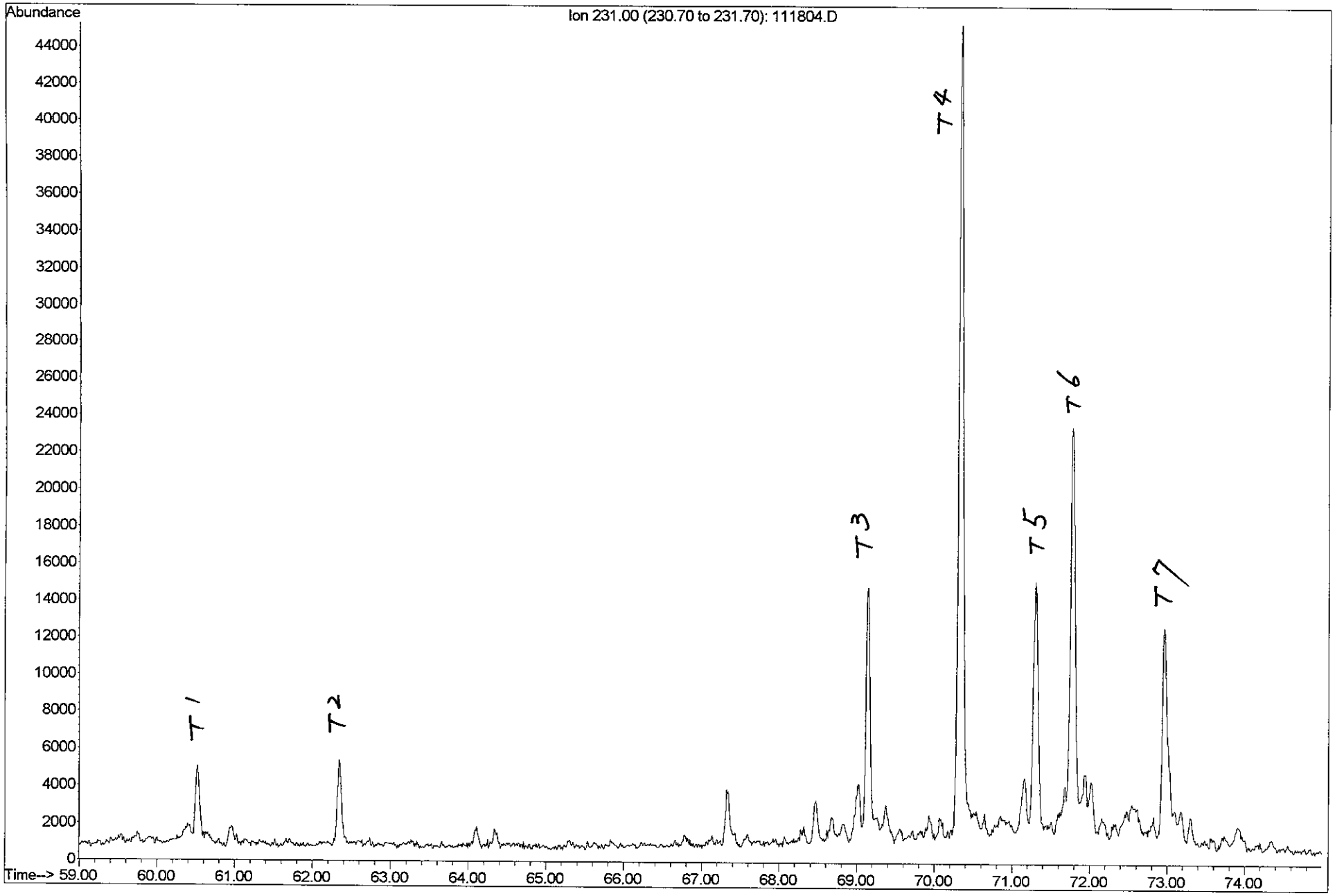


Table

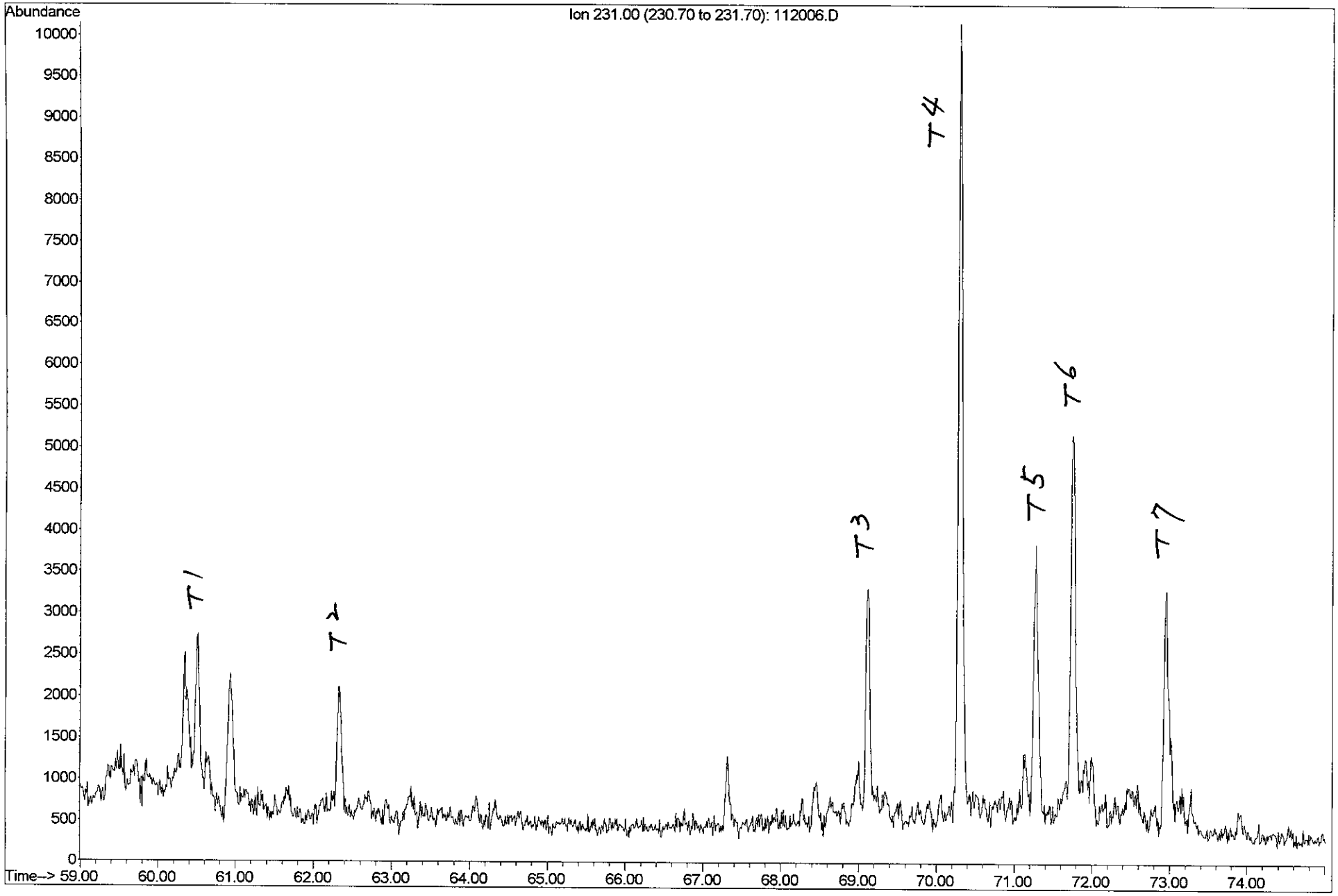
Key for Triaromatic Steranes Identification (m/z 231 chromatogram)

Code	Identity	Elemental Composition
T1	C_{20} Triaromatic sterane	$C_{20}H_{20}$
T2	C_{21} Triaromatic sterane	$C_{21}H_{22}$
T3	20S C_{26} Triaromatic sterane	$C_{26}H_{32}$
T4	20R C_{26} + 20S C_{27}-Triaromatic steranes	$C_{26}H_{32}$ + $C_{27}H_{34}$
T5	20S C_{28}-Triaromatic sterane	$C_{28}H_{36}$
T6	20R C_{27}-Triaromatic sterane	$C_{27}H_{34}$
T7	20R C_{28}-Triaromatic sterane	$C_{28}H_{36}$

FTPH-FP-SB-RR (41370-1) product
Mare Island, CH2M HILL



FTPH-FP-TR-DDD2 (41370-2) soil extract
Vf=4ml, 25g, Mare Island, CH2M HILL



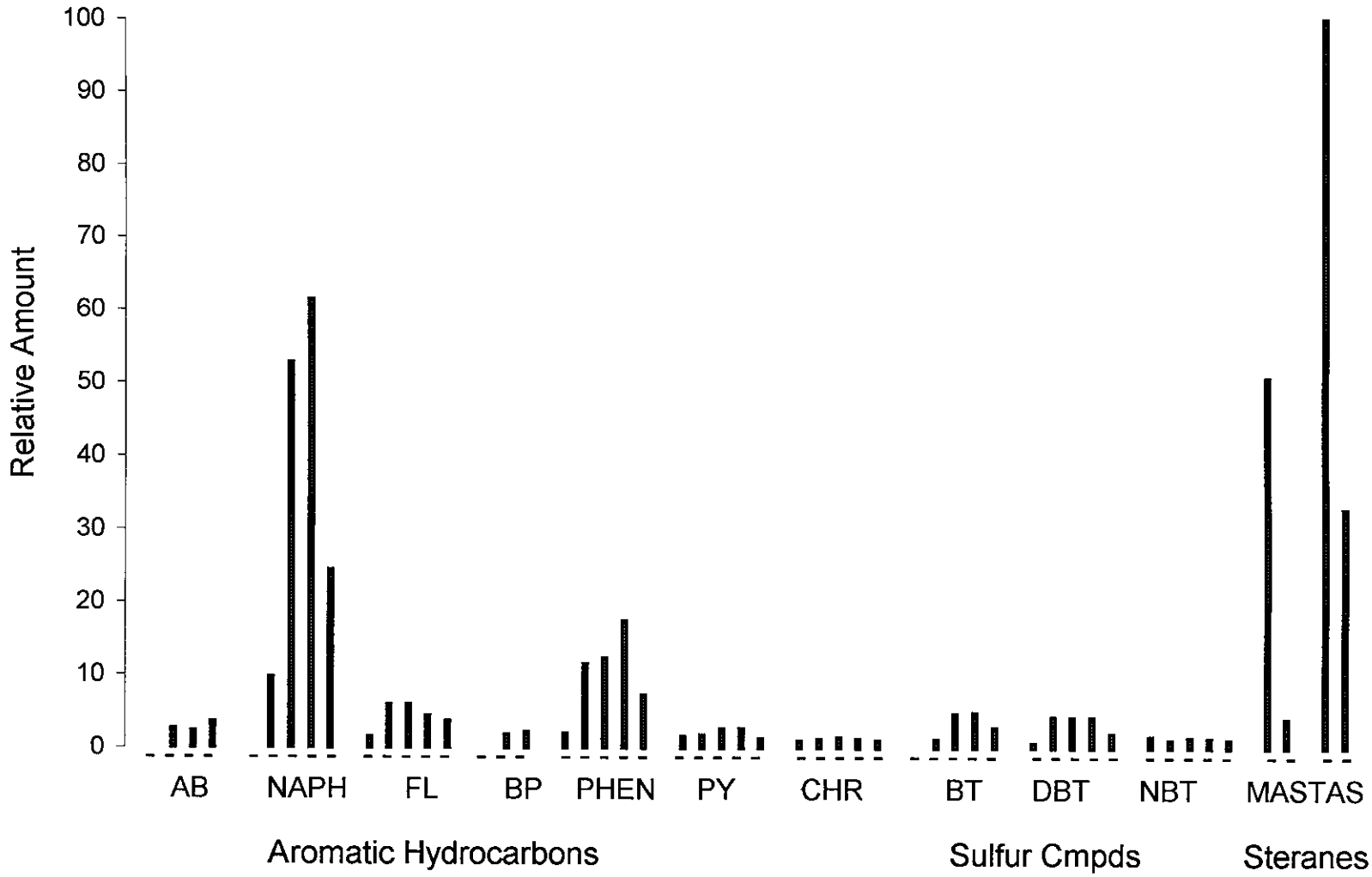
Table

Key for Identifying Aromatic Hydrocarbons

No.	m/z	Abbreviation	Compound
1	120	AB	C_3-alkylbenzenes
2	134		C_4-alkylbenzenes
3	148		C_5-alkylbenzenes
4	162		C_6-alkylbenzenes
5	128	NAPH	C_0-naphthalene
6	142		C_1-naphthalenes
7	156		C_2-naphthalenes
8	170		C_3-naphthalenes
9	184		C_4-naphthalenes
10	166	FL	C_0-fluorene
11	180		C_1-fluorenes
12	194		C_2-fluorenes
13	208		C_3-fluorenes
14	222		C_4-fluorenes
15	154	BP	C_0-biphenyl
16	168		C_1-biphenyls + dibenzofuran
17	182		C_2-biphenyls + C_1-dibenzofuran
18	178	PHEN	C_0-phenanthrene
19	192		C_1-phenanthrenes
20	206		C_2-phenanthrenes
21	220		C_3-phenanthrenes
22	234		C_4-phenanthrenes
23	202	PY	C_0-pyrene/fluoranthene
24	216		C_1-pyrenes/fluoranthenes
25	230		C_2-pyrenes/fluoranthenes
26	244		C_3-pyrenes/fluoranthenes
27	258		C_4-pyrenes/fluoranthenes
28	228	CHR	C_0-chrysene
29	242		C_1-chrysenes
30	256		C_2-chrysenes
31	270		C_3-chrysenes
32	284		C_4-chrysenes
33	148	BT	C_1-benzothiophenes
34	162		C_2-benzothiophenes
35	176		C_3-benzothiophenes
36	190		C_4-benzothiophenes
37	204		C_5-benzothiophenes
28	184	DBT	C_0-dibenzothiophene
39	198		C_1-dibenzothiophenes
40	212		C_2-dibenzothiophenes
41	226		C_3-dibenzothiophenes
42	240		C_4-dibenzothiophenes
43	234	NBT	C_0-naphthobenzothiophene
44	248		C_1-naphthobenzothiophenes
45	262		C_2-naphthobenzothiophenes
46	276		C_3-naphthobenzothiophenes
47	290		C_4-naphthobenzothiophenes
48	253	MAS	Monoaromatic steranes
49	267		Monoaromatic steranes
50	239		Monoaromatic steranes
51	231	TAS	Triaromatic steranes
52	245		Triaromatic steranes

Aromatic Hydrocarbon Distribution

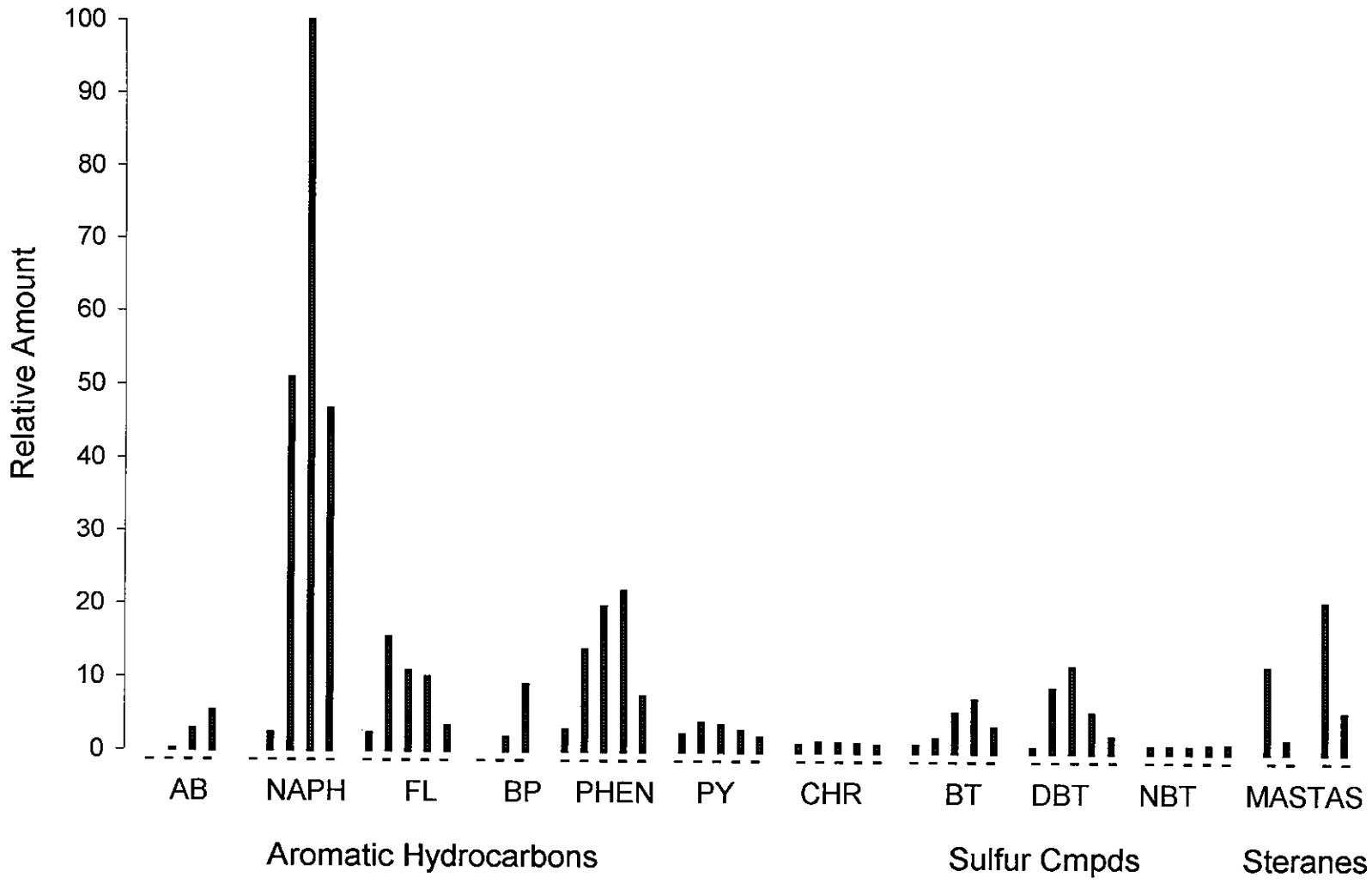
FTPH-FP-SB-RR



ZymaX FORENSICS

Aromatic Hydrocarbon Distribution

FTPH-FP-TR-DDD2



APPENDIX K

Stakeholder Review Comments on the Draft Final Technical Memorandum (March 2009) and Navy Responses

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Regional Water Quality Control Board, San Francisco Bay Region, April 23, 2009

Comment	Response
General Comment 1. Based on the available data and evidence presented in this Technical Memorandum, the Water Board concurs with the finding that the Dump Road and Azuar Drive free-phase hydrocarbon plumes resulted from separate sources. The Dump Road plume appears to be the result of land disposal practices; however, identifying the source of the Azuar Drive plume is not straight forward. This Technical Memorandum concludes that the oil sump box (OSB) is the source of the free-phase hydrocarbons on the Navy side of Azuar Drive, but not the source of the free-phase hydrocarbons on the Lennar Mare Island (LMI) side of Azuar Drive. The Water Board is unable to firmly concur with this conclusion based on the following reasoning: • The OSB is only identified source of free-phase hydrocarbons in the Azuar Drive plume area. • The OSB was a disposal feature. There is a high probability that many different types of petroleum hydrocarbons were disposed of in the OSB. Unless there is an inventory or evidence that only the heavy fuel oil identified in the forensic analysis was disposed of in the OSB, then the conclusion that certain free-phase hydrocarbons are not	The comment has been respectfully noted. While no specific revisions have been made to the document, the Navy is providing the background information below about the comment. The Navy's intent was to garner a significant additional body of information within funding and time constraints. The Navy believes this objective was fulfilled. As further useful information about source methodologies may be gathered during the future removal action, the approach taken was to simply test the existing hypothesis that the former Oil Sump Box (OSB) was the source of all heavy fuel oil (HFO) at the DRMO Site and in the vicinity, and to report the results of that exercise. Visual observations, geophysical data, and forensic evaluation are reliable and appropriate sources of information for this setting. Concluding text in the first paragraph of Section 6.4 of the Technical Memorandum (TM) states: "Findings indicate that the former OSB was a source of HFO contamination on the Navy side of Azuar Drive. The former OSB was not found to be the origin of HFO at two locations on the LMI side of Azuar Drive southwest of the OSB. Findings were inconclusive as to the former OSB being the origin of HFO found at third point to the southwest." The lines of reasoning from forensic and preferential pathway evaluations leading to these conclusions are documented in Section 6.3.2. We agree that the OSB is the only identified source in the area; however, this is not the same as saying the OSB is conclusively known to be the source of all HFO in the area. Railroad tracks, former tanks, buildings, and other surface features along Azuar Drive may have had a historical role in

Comment	Response
associated with the OSB is not valid. • Extensive areas east of Azuar Drive were not included in the geophysical survey coverage. While a few trenches revealed the absence, or limited amounts, of metal debris east of Azuar Drive, the data presented does not prove that potential migration pathways do not exist between the OSB and areas east of Azuar Drive.	past releases and disposal practices in the area. There is no identified source of the Dump Road HFO, thus it is assumed that HFO in that vicinity was the result of land disposal practices. No information reviewed by the Navy precludes the possibility of historical releases and land disposal practices along and just east of Azuar Drive. Furthermore, the forensic and pathway evaluations in the TM indicate that other sources were present. We also agree that it is highly probable that different types of products were disposed of through the OSB. However, if the OSB were the source of all the HFO found east of Azuar Drive, then it would follow that the forensic properties would be within the range of variability of those on the west side, as it is difficult to conceive of a mechanism that would selectively distribute some HFO products only to the west side, and only some others to the east side. The Navy was clear that the product found at one forensic point was similar (see the response to Specific Comment 2 below), different at another, and indeterminate at a third. We similarly agree that the data do not prove conclusively that there are no preferential pathways to the forensic points east of Azuar Drive. The intent of the document was to take what factual information is known and compare it to the existing source hypothesis. Again, the Navy believes it appropriate to state in clear language what the data indicated with respect to the hypothesis test. The gap in geophysical survey coverage along the east side of Azuar Drive has been reported as resulting from (a) access restrictions from partially fenced areas, and (b) the widespread presence of metallic materials and debris in the area.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Regional Water Quality Control Board, San Francisco Bay Region, April 23, 2009

Comment	Response
General Comment 2. The lateral extent of free-phase hydrocarbons is extrapolated in areas between borings or trenches where free-phase hydrocarbons was and was not observed (i.e. between sample location A3 and Trench A, between sample locations I3 and H3, and the area north and west of the end of the Weston V-Trench). The interpreted extent is biased towards the locations where free-phase hydrocarbons were observed. The upcoming Petroleum Corrective Action Plan shall address these areas. Special attention shall be given to the area of free-phase hydrocarbons that underlies the sensitive habitat at the northwestern edge of the Dump Road plume.	Figure 12 in the TM has been revised after the exchange of further information among Navy consultants. The extent of the Dump Road HFO has been revised to reflect recently available surveying information for the Weston V-Trench and the Investigation Area H1 boundary. The resulting northern extent of HFO in the Dump Road area no longer comes into contact with the northwestern non-tidal wetland area (as referenced in the comment). Visual observations made during the excavation of a series of test pits in 2007 have been incorporated into Figure 12 along with information from the Non-Time-Critical Removal Action conducted by Weston Solutions, Inc., also in 2007. While formal documentation of the test pits is not available (they were preliminary in nature), photographs provided by Weston are included in a new Appendix F4 in the TM, along with Figure 2-5 from the *Final Non-Time Critical Removal Action Completion Report, Defense Reutilization and Marketing Office* (Weston, 2007). The lateral extent of HFO in the above areas has been re-extrapolated along the western and southern portions of Dump Road on the revised Figure 12. In the appropriate areas, the limited presence of HFO at investigation points relative to others was used to bias the estimated horizontal extent boundary closer to points where HFO was observed rather than towards locations where it was not, to provide a more accurate estimate of the extent. In addition, the presence or absence of scrap metal was used to extrapolate extent. For instance, no scrap metal was found at location I, so the estimated extent was biased toward location I. The comment has been noted and incorporated into the methodology for the Petroleum Corrective Action Plan (PCAP), and the Navy looks forward to the agency's comments on the draft document.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
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Comments Submitted by the California Regional Water Quality Control Board, San Francisco Bay Region, April 23, 2009

Comment	Response
General Comment 3. Regardless of the source of free-phase hydrocarbons on the Eastern Early Transfer Parcel-side of Azuar Drive (specifically the area between sample location YY and DDD, and southeast of sample location DDD), the lateral and vertical extent of free-phase hydrocarbons in this area must be delineated and addressed.	The comment has been respectfully noted. While no specific revisions have been made to the document, the Navy is providing the background information below about the comment. The material found at location DDD is different from all the HFO found beneath Azuar Drive, as stated in the third paragraph of Section 6.1. Based on an evaluation of fuel types provided in the Chemical Forensic Evaluation Report for the 2007-2008 Follow-on Investigation (included in the TM as Appendix J), the material is a different fuel type than all of the HFO found beneath and on both sides of Azuar Drive. As the material is not the material under study and is not on Navy property, the delineation of this area does not appear to be within the scope of the TM.
Specific Comment 1. Section 6.2, Page 6-3 – The first paragraphs indicates the thickness of heavy fuel oil (HFO) is 375 feet. This is clearly an error; please correct.	In the sentence referenced by the reviewer, “thickness” has been changed to “width”.
Specific Comment 2. Section 6.3.2, Page 6-4 – The last sentence of the second paragraphs identifies the free-phase hydrocarbons observed at boring location VV as “not dissimilar” from the free-phase hydrocarbons observed near the OSB. The use of the double negative is confusing and obfuscates the finding that the HFO observed at the two locations is similar.	The Navy regrets any confusion caused by the use of this term, which was quoted directly from the Chemical Forensic Evaluation Report. The sentence in question has been revised as follows: “HFO product types found at a still more distant location (VV) to the southwest were similar to those found near the OSB; however, observations of record do not show a clear preferential pathway to this point.”

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
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Comments Submitted by the California Regional Water Quality Control Board, San Francisco Bay Region, April 23, 2009

Comment	Response
Specific Comment 3. Section 6.3.2, Page 6-7 – The first bulleted item under the discussion of the forensic chemistry at sample location VV identifies sample location PP as having a chemical signature similar to those found on the Navy side of Azuar Drive. This statement is contradictory to the data presented earlier in the section, that the chemical signature at sample location PP is not similar to those found on the Navy side of Azuar Drive.	In the paragraph referenced by the reviewer, "PP" has been changed to "VV".
Specific Comment 4. Figures 1, 2, 4, 5, 10, and 12 – Areas on these figures are identified as "vegetation". These areas are considered by the Water Board to be sensitive receptors (non-tidal wetlands) and should be labeled as such.	The figures noted have been updated as requested to be consistent with the Draft PCAP. In the legends of the figures, "Vegetation" has been changed to "Non-Tidal Wetlands", and the boundaries of these areas have been updated. The estimated extent of pickleweed identified in March 2009 has also been added based on further site reconnaissance by Weston Solutions.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
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Comments Submitted by the California Regional Water Quality Control Board, San Francisco Bay Region, April 23, 2009

Comment	Response
Specific Comment 5. Figure 12 – Free-phase hydrocarbons were observed in Trenches T-3, DDD-1, and DDD-2, but were not identified as locations were free-phase hydrocarbons was observed. Please correct the figure to indicated that free-phase hydrocarbons were observed in Trenches T-3, DDD-1, and DDD-2.	The changes to Figure 12 requested by the reviewer have been made by revising the symbols involved and the legend. The symbol for Trench T-3 has been revised to represent "2006-2008 Free Product Observed in Trench". A note has been added to Figure 12 that reads: "Based on field observations, the free-phase hydrocarbons observed at trenches DDD-1 and DDD-2 were a lighter fuel oil than the heavier fuel oil observed at the surrounding boring and trench locations. The presence of the lighter fuel oil was confirmed by forensic analysis of a sample collected at DDD-2. Therefore, trench locations DDD-1 and DDD-2 are not included within the 'Azuar Drive Free-Phase and Soil Fracture/Vegetation-Bound Hydrocarbons' boundary." Similar notes have been added to Tables 4, 9, 10, and 12.
Specific Comment 6. Figures A-4, A-5, A-6, and A-11 – On Figure A-4, two tanks are visible east of the Future DRMO Site, along the future alignment of Azuar Drive. In figures A-5, A-6, and A-11, the area where the tanks are/were located has been hidden with a text box. Please move the text box on these three figures.	The figure changes requested by the reviewer have been addressed by revising Figures A-5, A-6, and A-11. In the same Appendix A, Figures A-4B and A-4C have been added to show oblique aerial views from the time period represented by Figure A-4A, which corresponds to the former Figure A-4. Text in the final bullet of Section 6.3.2 has been updated to include references to the information shown in these revised and new figures.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR), April 29, 2009

Comment	Response
Specific Comment 1. Page ES-ii Executive Summary; Page 3-9, Section 3.3.3.1; and Figure 12. DFG-OSPR does not concur with the Navy's statement "The findings of an ecological risk assessment (ERA) were that the DRMO site is paved, covered with gravel, and contains buildings, and therefore does not provide habitat for ecological receptors." Salt marsh or other wetland areas are not the only ecological settings at this site that can provide habitat for wildlife. Species that are adapted to human disturbance can live in and adjacent to ruderal vegetation, landscaping, and developed areas containing buildings and pavement. Sparrows, gulls, ravens, raptors, rodents, opossums, raccoons, and skunks are a few examples of animals adapted to living in developed areas. Raptors such as Peregrine Falcon and Red-tailed Hawk have been documented to nest on office buildings. A Ring-necked Pheasant was observed crossing Dump Road during a site visit with the Navy on March 26, 2009. The Navy also states on page 6-3 that the Fenced Scrapyard Area within the DRMO "is currently an earthen field covered to varying degrees with grasses and small shrubs" and "some areas are prone to flooding during periods of heavy precipitation." This field, with vegetation and	The Navy's purpose in preparing the Technical Memorandum (TM) is to describe the nature, extent, and mobility of free-phase petroleum hydrocarbons at the DRMO Site and in the vicinity. The TM is not intended to identify or analyze ecological risks, habitat, or fish and wildlife resources in general. To the extent that the TM includes statements about these issues, it is in the context of summarizing previous studies of the area that may have addressed these issues. The referenced sections of the TM have been revised to clarify that such statements are based on historical documentation of the site. A Petroleum Corrective Action Plan (PCAP) is currently being prepared for the DRMO Site. The purpose of the PCAP is to develop a plan to remediate petroleum at the site. The Navy's remediation of the site will result in an improved environment for all species. Nevertheless, where appropriate the Navy will take into account impacts to habitat or wildlife during the preparation of the PCAP and its associated Environmental Protection Plan. However, while the policy of the Navy is to be protective of species that are endangered, threatened, rare, or fully protected under state/federal law, it is not obligated to be protective of other ordinary species when it undertakes cleanup actions on federal property.

Comment	Response
seasonal ponds can provide habitat for ecological receptors. Therefore, the Navy's determination that the DRMO “does not provide habitat for ecological receptors” is inaccurate and should be removed or corrected in the document.	

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
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Comments Submitted by the California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR), April 29, 2009

Comment	Response
Specific Comment 2. The Navy's ERA should cover the entire investigation area for the petroleum hydrocarbons, not just the area within the boundaries of the DRMO. Figure 12 shows locations of the free-phase petroleum hydrocarbons, which fall outside the boundaries of the DRMO. Therefore, the Navy should conduct an ERA for the areas of free-product that are outside the DRMO. During a site visit with the Navy on March 26, 2009, DFG-OSPR staff noted the area north of Dump Road around the Weston V-trench contained wetland habitat, due to the presence of wetland hydrology (i.e. surface water, saturation, surface soil cracks, aquatic invertebrates), hydric soils, and hydrophytic vegetation (i.e. pickleweed, cattails, sedges). Department of Fish and Game (DFG) utilizes the U.S. Fish and Wildlife Service (USFWS) definition of a wetland which requires the presence of at least one of these criteria, in order to classify the area as a wetland [Fish and Game Commission Wetlands Policy (adopted 1987) included in Fish and Game Code Addenda (CDFG Commission, 2009)].	The extent of grassy vegetation and pickleweed near the northwestern extent of the planned excavation was located by visual observations and hand-held GPS equipment on March 30, 2009. These areas were determined to be outside the expected extent of excavation, and the pickleweed habitat was determined to be just over 100 feet at the closest point from the potential extent of the excavation. A qualified biologist will monitor the area during the cutting of vegetation and the installation of a silt fence barrier, which are the same avoidance measures that have been used on Mare Island for habitat improvement purposes. Although it is unlikely that the excavation will extend into the area classified as non-tidal wetlands, the planned avoidance measures will be protective of the Salt Marsh Harvest Mouse (SMHM) (*Reithrodontomys raviventris*) and other protected species.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR), April 29, 2009

Comment	Response
Specific Comment 3. Federal and state wetlands policies require No Net Loss of wetlands [Fish and Game Commission Wetlands Policy (adopted 1987) included in Fish and Game Code Addenda; 660 FW1, Wetlands Policy and Action Plan]. These policies state that unavoidable impacts to wetlands must be mitigated, which includes compensatory mitigation. If the destruction of wetlands is unavoidable, DFG's Wetland Policy identifies acceptable compensation as the creation of new wetlands at an appropriate mitigation ratio. The compensatory mitigation alternatives, in descending order of general acceptability are: in-kind, on-site; in-kind, off-site; out of-kind, on-site; or out-of-kind, off-site [Fish and Game Commission Wetlands Policy (adopted 1987) included in Fish and Game Code Addenda]. Therefore, the Navy should mitigate for any impacts to wetlands at the DRMO site and surrounding contaminated areas that result from remedial actions.	No loss of wetlands is anticipated as a result of the petroleum corrective action. In the unlikely event that excavation within jurisdictional wetlands is required, final grading will be set to maintain the same function and values as existed prior to the site activities. This issue will be addressed in the final version of the PCAP.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR), April 29, 2009

Comment	Response
Specific Comment 4. During the site visit, wildlife species observed in the wetland area include Red-tailed Hawk, Red-winged Blackbird, and Pacific tree frog. Coyote scat and small mammal burrows were also observed. The salt marsh adjacent to the wetland provides habitat for the salt marsh harvest mouse *(Reithrodontomys raviventris)*, California Clapper Rail *(Rallus longirostris obsoletus)*, and California Black Rail *(Laterallus jamaicensis coturniculus)*, which are State listed species as well as Fully Protected by DFG. Other than collection for scientific purposes, Fully Protected species may not be "taken" or possessed at any time and no permits may be issued for their "take" including trapping. As a result, appropriate avoidance and minimization measures should be implemented when work is conducted within habitat areas. Avoidance and mitigation measures may include conducting pre-construction surveys, use of a biological monitor, installation of silt fencing, and restricting work within 200 feet of nesting raptors or within 500 feet of nesting rails. The Navy should consult DFG-OSPR and USFWS on appropriate avoidance, minimization, and mitigation measures to use.	Impacts to wildlife habitat located in the vicinity of the site will be minimized by limiting the area of actual removal action activity at the site and controlling runoff from the site. The SMHM is present at the former MINS; it is fully protected and listed as endangered under the California Endangered Species Act, and listed as endangered under the federal ESA. The SMHM requires special protection against disturbance and destruction. Pickleweed- *(salicomia virginica-*) dominated non-tidal wetlands and pickleweed-dominated upland areas adjacent to non-tidal wetlands serve as habitat to the SMHM. The SMHM is known to be highly cover-dependent, i.e., it will not frequent areas devoid of cover from raptors and other predators. Existing wetland vegetation is present near the northwest extent of the work area. An informal field survey of this area on April 6, 2009, attended by Paisha Jorgenson, Allen Tsao, Tami Nakahara, Marie Dreyer, Michael Bloom, and Dwight Gemar, indicated that the grassy vegetation near the planned extent of the excavation area does not include pickleweed. Since pickleweed is not present in the work areas associated with the corrective action, the project is not expected to impact the SMHM. Nevertheless, a project orientation given to the field crew will include a discussion of the special protection requirements for the SMHM and its habitat by a qualified biologist. Existing vegetation along the wetland/work area boundary will be mowed as part of the mobilization task, and the wetland/work area boundary will be delineated using silt fencing. Silt fencing will be installed as a barrier to the SMHM in accordance with the Stormwater Pollution Prevention Plan (Appendix E of the PCAP).

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR), April 29, 2009

Comment	Response
Specific Comment 5. *Figures 1, 2, 4, 5, 10, and 12*. Vegetation areas depicted in these figures are inaccurate and the boundaries should be re-mapped to include ruderal, grassland, salt marsh, freshwater wetland, and landscaped areas, or a separate map should be provided with these vegetation types delineated in and around the project site.	The figures noted have been updated to be more consistent with the Draft PCAP. In the legends of the figures, "Vegetation" has been changed to "Non-Tidal Wetlands" as requested by the California Regional Water Quality Control Board, San Francisco Bay Region, and the boundaries of these areas have been updated. Pickleweed location information has also been included. The boundaries of the non-tidal wetlands were visually confirmed and mapped using GPS by Weston Solutions on March 30, 2009. These boundaries are also used in the production of figures for the PCAP and will be monitored during the removal action. See the planned avoidance measures described in the response to Specific Comment 4.
Specific Comment 6. *Page 6-8, Section 6.3.4 and Figure 11*. The Navy states that the preferential pathways for migration of the heavy fuel oil (HFO) are void spaces in bulk metal debris. However, the Conceptual Site Model in Figure 11 depicts the presence of HFO outside of the bulk metal debris fields. Please explain the migration pathway for the HFO outside the debris fields and whether there is potential for this pathway to allow the HFO to migrate further.	As a conceptual depiction, Figure 11 contains generalized graphic elements and is not intended to provide a detailed scaled representation of subsurface conditions. One of the main purposes of the TM is to characterize potential migration pathways for HFO. Information about this topic is reviewed below. Page 6-8, Section 6.3.4, paragraph 1 contains information about other pathways that were evaluated: "Two additional potential HFO migration pathways were initially considered: migration through fractures in clayey/silty soil, and migration through vegetative structures (i.e., roots and mats). However, neither of these additional pathways was considered significant, and the pathways were removed from further consideration because of the limited occurrence of HFO in these features in the absence

Comment	Response
	of an overlying HFO-saturated debris or fill layer; the lack of lateral continuity between fractured or vegetation horizons; and the relatively small volume of potentially mobile HFO observed in these features." Further conclusions relevant to this comment are provided in the fourth paragraph of the same section, where it is stated that: "HFO is unlikely to migrate laterally or vertically given its viscosity, its current state, the lack of a continuing source, and the absence of contiguous metal layers beyond those already delineated." In addition, the possibility of a utility corridor backfill preferential pathway was investigated and discussed in paragraphs 7 and 8 of Section 6.3.4. Observations did not support this pathway as viable. An alternative hypothesis involving localized disposal in the form of incidental dumping or other releases in various places with little or no migration is also plausible due to the history of the area as a landfill. Conclusions about this topic are provided in the final paragraph and bullets of Section 6.3.2.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by the United States Environmental Protection Agency (EPA), June 5, 2009

Comment	Response
EPA concurs that there is adequate characterization to recommend excavation and removal of the estimated 200,000 cubic yards of soils contaminated with an estimated 1 to 3 million gallons of petroleum hydrocarbons. The site is similar to the 9th and Tisdale petroleum removal site previously excavated by Lennar and CH2M Hill. If the Navy intends to further investigate this site, EPA recommends that the vapor intrusion pathway be evaluated. The presence of odors as reported in the technical memorandum indicates that there are volatile constituents present that could migrate along utility corridors and enter buildings.	Extensive analysis has shown the contaminant at the site to be heavy fuel oil which, though deficient in volatiles, does have an odor. The odors noted in the Technical Memorandum are consistent with those of heavy fuel oil (in the form of Bunker C), and are not an indication that volatile constituents (such as those found in gasoline) are present. The objective of the DRMO Site Petroleum Corrective Action Plan is to remove free petroleum product and petroleum-impacted soil to meet Tier II screening levels. After the corrective action has been completed, the Navy expects that evaluation of vapor intrusion pathways will be unnecessary.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by Lennar Mare Island, LLC, April 27, 2009

Comment	Response
General Comment 1. **The Navy is the Only Known Entity to Dispose of Oil on Mare Island -** The Navy is the only entity that every disposed of oil on Mare Island as part of its historical shipyard practices. Neither LMI nor the City of Vallejo, have ever disposed of oil on Mare Island. Thus, a discussion of differences between Navy-owned and LMI-owned property must focus on depositional history and disposal practices of the Navy itself.	The intent of the Technical Memorandum (TM) is not to suggest that LMI or the City of Vallejo disposed of oil on Mare Island. The terms are used for simplicity's sake in differentiating areas with heavy fuel oil (HFO) contamination. The Navy agrees that depositional history and disposal practices are relevant to the TM and believes that they were discussed adequately. Depositional history is discussed in the Introduction. Sections 2.0 and 3.0 are devoted to historical investigation reports, and Appendices A through C are devoted to site historical records, historical investigation records, and other background materials. Appendix A contains numerous historical figures, and has been updated per California Regional Water Quality Control Board comments to clarify information presented in Figures A-4, A-5, A-6, and A-11.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
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Comments Submitted by Lennar Mare Island, LLC, April 27, 2009

Comment	Response
General Comment 2. **Petroleum Hydrocarbon Sources -** The DRMO is the only area in the immediate vicinity of the DRMO/Crane Test Area (CTA)/Dump Road/Azuar Drive Area to have a reported use of "...handling of petroleum and waste oils." In addition, the Oil Sump Box (OSB) and the wooden sump box near the eastern boundary of the DRMO (on Navy property), appear to be structures where oil was disposed. To the east, the IR02 waste oil disposal sumps also used to dispose of large volumes of waste oil, not all of which was recovered or for which there is an accurate accounting. Neither the CTA (Investigation Area [IA] 8.1) nor portions of IA B.2 have ever had a reported use of "...handling of petroleum and waste oils…" or the disposal of such materials.	The comment has been respectfully noted. While no specific revisions have been made to the document, the Navy is providing the following information about the comment. The Navy agrees that the OSB is a known source in the Azuar Drive area; however, this is not the same as saying that the OSB is conclusively known to be the source of all HFO in the vicinity of the DRMO Site. Railroad tracks, former tanks, buildings, and other undocumented surface features along Azuar Drive may have had a historical role in past releases and disposal practices in the area. There is no identified source for the Dump Road HFO. The horizontal extent investigation and analysis of information from geophysical surveys and subsurface explorations (borings, test pits, and excavations) did not show any evidence of possible preferential pathways connecting the Dump Road HFO to the IR02 waste oil disposal sumps; thus, it is assumed that HFO in the vicinity was the result of land disposal practices. It is also probable (considering the original Mare Island land boundary) that historical releases and land disposal practices occurred along and just east of Azuar Drive. Releases may have been related to the railroad tracks located in the area, possible above-ground tanks shown on Cedar Avenue/Azuar Drive in Figure A-4A (formerly A-4), activities in the area shown in other historical figures (see new Figures A-4B and A-4C), or to incidental disposal as Mare Island was expanded from the 1852 limits shown in Figures A-5, A-6, and A-11 to its current configuration. Furthermore, the forensic and preferential pathway evaluations in the TM indicate at least two other locations in the vicinity (PP and VV, on the LMI side of Azuar Drive southeast of the OSB) where releases from the OSB did not appear to be the source of TPH. Findings were inconclusive as to releases from the OSB being the origin of HFO found at a third point to the southeast (location RR).

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
Comments Submitted by Lennar Mare Island, LLC, April 27, 2009

Comment	Response
General Comment 3. **Nature of the FPPH -** The nature of the free-phase petroleum hydrocarbons (FPPH) is characterized and described (a black, viscous liquid with a chemical signature of a heavy fuel-oil [HFO] such a Bunker C). However, the forensic analysis indicates that there is substantial variation in the makeup of the HFO. We therefore believe it is reasonable to assume that the Navy used and disposed of varying types of petroleum hydrocarbon products at the DRMO as evidenced in the immediate area and east of the OSB.	The Navy agrees that it is highly probable that different types of products were disposed of through the OSB. However, if the OSB were the source of all the HFO found east of Azuar Drive, then it would follow that the forensic properties would be within the range of variability of those on the west side, as it is difficult to conceive of a mechanism that would selectively distribute some HFO products only to the west side, and only some others to the east side. The Navy was clear that the product found at one forensic point was similar (location VV), different at another (location PP), and indeterminate at a third (location RR). In addition, forensics was not the only factor used in the Navy's evaluation; the absence of preferential pathways for subsurface migration is also a factor (see the response to General Comment 2).

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Comment	Response
General Comment 4. **Mobility of Free-Phase Petroleum Hydrocarbons** - The DRMO TPH TM concludes that the HFO's high viscosity (five orders of magnitude greater than water), lack of driving pressure and the fine-grained nature of geologic materials at depth indicate that it is immobile, unless it encounters a preferential pathway (i.e., metal debris or an underground utility). Please describe the mechanism(s) that would allow for the observed extent of free product, if the HFO is immobile. Clarify the depth of HFO, versus the depths of utilities, to support the conclusion that the corridors essentially cut off contaminant flow to the east.	In Section 6.1, the TM states that HFO presents a <u>low</u> potential for future mobility in the soil found at the DRMO Site and in the vicinity. The term "relatively immobile" is also referenced in findings presented in the following historical documents: • Section 3.4 in the Addendum to the Remedial Investigation (RI) Report for Investigation Area (IA) H2 (Tetra Tech EM Inc., 2001) • Section 3.5.2 in the RI Report for IA B, discussion of the IR16-B4/Building 455 Area (CH2M HILL, 2004) The two areas of concern (AOCs) identified in the TM (see Figures 9 and 12) are not uniform, contiguous areas of HFO or metal debris. Forensics show that the HFO found on Dump Road and Azuar Drive are chemically distinct (see Figure 8). The geophysical survey shows that the two AOCs are not connected via a preferential pathway (see Figure 9). The only source identified was the OSB on Azuar Drive. It was concluded that HFO contamination on or near Dump Road and at the farther, eastern extents of Azuar Drive are possibly a result of intermittent and separate disposal, spills, or releases.

STAKEHOLDER REVIEW COMMENTS AND NAVY RESPONSES
Draft Final Technical Memorandum, Total Petroleum Hydrocarbons at the Defense Reutilization and Marketing Office (DRMO) Site and Vicinity, Former Mare Island Naval Shipyard, Vallejo, California, dated March 2009:
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Comment	Response
General Comment 5. **Metal-Debris Layer and Mobility of Free-Phase Petroleum Hydrocarbons -** The DRMO TPH TM concludes that the FPPH is strongly correlated with the presence of the metal debris, which is encountered in the subsurface at the DRMO, the CTA, Dump Road, Azuar Drive and IA B.2 (LMI property across Azuar Drive from the DRMO). However, the report concludes that FPPH could not have migrated across the Navy/LMI property boundary, even though the metal debris layer extends all the way across that boundary. If the metal debris layer is present, please describe what prevents the FPPH from migrating from the Navy OSB disposal area, across the boundary and onto the LMI property through that metal debris layer.	Conclusions about specific locations were drawn in Section 6.3.2 from investigation data regarding HFO forensic profiles and potential pathway observations. On page 6-6 of the TM, the text states that forensic chemistry and preferential migration pathway findings indicate that the OSB was not the source of contamination at sampling location PP, as the points were chemically different and preferential pathway indicators were not observed. Text continuing to page 6-7 in the TM states an inconclusive nature of both preferential pathway and forensic findings pursuant to sampling location RR. Multiple possible conclusions were noted with respect to sampling location VV as forensic chemistry findings were of similar product to the Navy side, but a continuous preferential pathway was not observed. Observations of subsurface soil for indications of preferential pathways between the OSB and the forensic points discussed above are presented throughout Section 6.3.2 and in Table 12.
General Comment 6. **Forensic Analysis -** LMI believes the forensic analysis, while useful, is not extensive enough, spatially or temporally, to reach the unequivocal conclusions made in the report. These issues are related to the limited data set used, the implied assumption that data collected today are representative of years of potential FPPH migration, gaps in the data and a focus on sample dissimilarities with no evaluation of	Limitations to individual methodologies are discussed where they arose in the Chemical Forensic Evaluation Report (Appendix J in the TM). There are limitations to any methodology; multiple analytical methods and types of evaluations were performed based on peer-reviewed research and under industry approved standard practices. Furthermore, evaluations were performed by a trained and experienced Professional Geologist and Certified Engineering Geologist who has served as an expert witness and authored and reviewed numerous technical papers on this subject matter. The Navy's intent was to garner a significant additional body of information within funding and time constraints. The Navy believes that

Comment	Response
similarities.	this objective was fulfilled. The approach taken was to simply test the existing hypothesis that the OSB was the source of all HFO at the DRMO Site and the vicinity, and to report the results of the Navy's investigation. Further useful source information may be gathered during the future petroleum corrective action. It should be noted that a change has been made to the last sentence of the second paragraph in Section 6.3.2, Page 6-4 to clarify the meaning of the sentence. Originally, the sentence was written with a double negative ("not dissimilar"). The sentence now reads: "HFO product types found at a still more distant location (VV) to the southwest were similar to those found near the OSB; however, observations of record do not show a clear preferential pathway to this point." The Navy acknowledges that the former sentence may have been confusing to the reader.
Specific Comment 1. **Page 5-3, Section 5.13, First bullet on page -** Change "SSL-4 station 99 to 10" to "SSL-4 station 99 to 110."	This change has been made.
Specific Comment 2. **Page 5-6, Section 5.3.1 -** In the first paragraph in the section it is written that "Nineteen free product samples ..." were collected. However, in the bullets directly below this paragraph it is written that 5 + 3 + 3 + 4 + 1 + 5 = 21 free product samples were collected. One of	The count of 20 total forensic samples is correct; 19 samples were of free product, and one sample (at trench DDD-2) was of product in soil. The sample at trench DDD-2 was discussed twice to provide additional information about its location. The counts appear to be correct, and no revisions have been made.

Comment	Response
those samples is counted twice in the bullets (FTPH-TR-DDD2); leaving 20 samples, please explain this discrepancy.	
Specific Comment 3. **Page 6-3, Section 6.2 -** In the first paragraph at the top of the page, last sentence, it is written that "The thickness of the HFO was 375 feet at its widest just northwest of the former OSB location, and approximately 50 feet at the southeastern end." This should be changed to "The width of the HFO was 375 feet at its widest just northwest of the former OSB location, and approximately 50 feet at the southeastern end."	In the sentence referenced by the reviewer, "thickness" has been changed to "width".
Specific Comment 4. **Page 6-7, Section 6.3.2 -** In the second to last bullet at the bottom of the page, last sentence it is written that "...or undocumented HFO contaminated backfill HFO that was placed within the EETP itself." This should be changed to "...or undocumented HFO contaminated backfill that was placed within the EETP itself."	This change has been made.