Proposal for an Active LNAPL Recovery System

Volume 1 of 2: Text, Figures, Tables, Appendices A through D

1190505040 -- Madison County -- ILR000128249
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

February 2, 2006
Clayton Project No. 15-03095.18.002

Prepared for:
The Hartford Working Group
Hartford, Illinois

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Volume 2 of 2: Appendix E

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ACRONYM LIST

AOC	Administrative Order on Consent
API	American Petroleum Institute
AST	Aboveground Storage Tank
Atlantic Richfield	Atlantic Richfield Company
ASTM	American Society for Testing and Materials
bgs	below ground surface
cm/s	centimeters per second
CERCLA	Comprehensive Environmental Responsibility Compensation and Liability Act
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
D_o	Actual LNAPL Thickness
DOLR	Dual Optimal Response Model
DPE	Dual Phase Extraction
DPR	Dual Pump Recovery
DRO	Diesel Range Organics
gpd	gallons per day
GRO	Gasoline Range Organics
H_2A Environmental, Ltd.	H_2A
HWG	Hartford Working Group
HVR	high vacuum recovery
Illinois EPA	Illinois Environmental Protection Agency
ICE	Internal Combustion Engine
LNAPL	Light Non-Aqueous Phase Liquid
LRP	Liquid Ring Pump
μm	micrometers
MPE	Multi-Phase Extraction
MSL	mean sea level
NAPL	Non-Aqueous Phase Liquid
O&M	operation and maintenance
PESC	Philip Environmental Services Corporation
PMPE	Periodic Multi-Phase Extraction
PMR	Periodic Manual Removal
PTS	PTS Laboratories Inc.
PVC	polyvinyl chloride
The Premcor Refining Group Inc.	Premcor
RCRA	Resource Conservation and Recovery Act
RETEC	The RETEC Group, Inc.
ROI	Radius of Influence
ROST™	Rapid Optical Scanning Technique
scfm	standard cubic feet per minute
Shell	Shell Oil Products US
Sinclair	Sinclair Oil Corporation
SPR	Skimmer Pump Recovery
SVE	Soil Vapor Extractions
SVOC	Semi-Volatile Organic Compounds

ACRONYM LIST
(Continued)

TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
Torkelson	Torkelson Geochemistry, Inc.
USEPA	United States Environmental Protection Agency
VCS	Vapor Control System
VES	Vacuum Enhances Skimmer Pump Recovery
VOC	Volatile Organic Compounds
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

This *Proposal for an Active Light Non-Aqueous Phase Liquid (LNAPL) Recovery System* (Proposal), prepared for The Hartford Area Hydrocarbon Plume Site (Site) in Hartford, Illinois, addresses the area exhibiting LNAPL at the Site. The presence of LNAPL underlying northern Hartford has been documented since 1978. Previous recovery efforts included operation of LNAPL recovery wells and a soil vapor extraction (SVE) system. This Proposal presents the Hartford Working Group (HWG) proposal for active recovery systems to remove mobile LNAPL, as required under paragraph 53 of the Administrative Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA).

The objectives for the work conducted at the Site are to:

- Control the threat, if any, to human health via ingestion of constituents in groundwater which could result from subsurface oil identified in northern Hartford reaching the Hartford Municipal Wells or its five-year recharge area; and
- Control the threat, if any, to human health via inhalation of vapors above designated levels that arise from subsurface oil identified in northern Hartford; and
- Control the threat, if any, of potential oil releases to the Mississippi River that arises from subsurface oil identified in northern Hartford; and
- Actively recover, as appropriate, subsurface oil in the form of either LNAPL (mobile or residual), or vapors to mitigate the threat of vapor inhalation, discharge to the Mississippi Rover and impact on the Hartford Municipal Wells.

This Proposal evaluates eight technologies as potential alternatives for active LNAPL recovery at three areas representing different degrees of mobile LNAPL. Selection of the technologies was based on the conceptual site model (CSM), current knowledge of the LNAPL composition, baildown and pilot testing results, recovery modeling, and experience in applications of LNAPL recovery technology. Selection of technologies to be evaluated was also based on USEPA correspondence dated May 9, 2005, which requested the evaluation of skimming, dual pump recovery (DPR), vacuum enhanced recovery, and multi-phase extraction (MPE). The following technologies were evaluated:

- Dual phase extraction (DPE)
- DPR
- MPE

- Skimmer pump recovery (SPR)
- Vacuum-enhanced skimmer pump recovery (VES)
- Soil vapor extraction (SVE)
- Periodic manual removal (PMR)
- Periodic MPE (PMPE)

An understanding of the geology, hydrogeology and LNAPL distribution was necessary to select a LNAPL recovery system. The geologic units underlying northern Hartford can be generally described as consisting of alternating alluvial deposits of clay and silt, which overlie the regionally extensive Main Sand Stratum (American Bottoms Aquifer). Current groundwater flow in the Main Sand Stratum is to the north and northwest.

The LNAPL in northern Hartford is not present as a continuous layer, but is disseminated in the strata in more or less discrete globules or ganglia in the pores. The LNAPL does not fully saturate, or fill, the soil pores; and therefore, LNAPL saturations are relatively low. However, mobile LNAPL (sufficient saturation and volume to flow into a well) is primarily restricted to the Main Sand Stratum and two isolated areas in the overlying permeable strata. If LNAPL is present below a minimum saturation, called the irreducible oil saturation, permeability to oil is zero and there will be no flow of liquid LNAPL. LNAPL recovery testing revealed recoveries were progressively slower after LNAPL had been removed from the wells multiple times, indicating lower permeability as LNAPL saturation decreased.

Multiple pilot tests were conducted in northern Hartford to assess the effectiveness and efficiency of various technologies in removing LNAPL. MPE, SVE, SPR and DPE pilot tests were conducted at the Site. MPE pilot testing was completed over a large aerial extent of the LNAPL plume in northern Hartford and indicated the following:

- LNAPL production and recharge potential across much of northern Hartford is relatively low.
- Much of the area containing mobile LNAPL will not sustain high levels of LNAPL recovery on a continuous basis based on observed seasonal variability.
- The primary recoverable phase is vapor for the majority of the LNAPL area.
- The location exhibiting the highest liquid-phase LNAPL production and sustainability, combined with limited water generation, is HMW-44C.
- Locations exhibiting moderate to high sustainable liquid-phase LNAPL production rates include

wells MP-55C, MP-53C, MP-51D, MP-47C, MP-50C, HMW-19, MP-29D, HMW-45C, and HMW-48D.

The DPE pilot testing was specifically designed to create a groundwater cone of depression in the formation surrounding an extraction well, while simultaneously applying vacuum to the formation via the extraction well. The DPE tests at RW-4A and RW-5 required pumping large quantities of water to recover very small amounts of LNAPL (i.e., water production 15 to 1,800 times greater than with MPE for the same volume of recovered LNAPL). Consequently, LNAPL removal via MPE was considerably more efficient than via DPE.

MPE, DPE, SVE and SPR pilot testing data from 2004 and 2005 were compared for the RW-3/RW-4A and RW-2/RW-5 areas to identify the most effective and efficient technology for the removal of LNAPL from the tested wells. Based on the data, MPE provided a better combination of both LNAPL removal effectiveness and remediation efficiency than SPR and DPE.

This Proposal includes a brief description of the Dual Optimal LNAPL Response (DOLR) model, which was developed using the 2005 pilot testing. DOLR can explain the seasonal variations in LNAPL thicknesses that occur due to changing aquifer levels. DOLR can also be used to predict the relative LNAPL production capacity of wells on the basis of the Site water table elevation and historical well production during MPE Pilot Testing in 2005. Basically, the DOLR model states that LNAPL thicknesses and production rates increase in response to two conditions:

- Confining conditions that create a hydrostatic head driving LNAPL into the wells, which act as pressure relief points for LNAPL accumulation.
- Unconfined conditions that allow drainage of LNAPL (above residual LNAPL concentrations) from the upper portion of the Main Sand as the water table falls and LNAPL accumulates at the Water/LNAPL/Air interface zone.

To evaluate various LNAPL recovery methods at the Site, predictive LNAPL recovery modeling was completed using American Petroleum Institute (API) models. The modeling was conducted using site-specific LNAPL and subsurface characterization data collected from five (5) soil core locations. The API model predicts both LNAPL distribution and recovery at a given soil core location. After predicting LNAPL recovery, the model results were validated against actual LNAPL recovery data from northern Hartford.

The model was also applied to generate LNAPL-specific thicknesses (feet^3/feet^2) (D_o) for given measured LNAPL well thicknesses based on the soil core characterization data, and to explain why measured LNAPL thicknesses in monitoring wells are often exaggerated due to density differences between LNAPL and water. D_o is the integral of LNAPL saturation over the entire length of the soil column, also known as the specific thickness of LNAPL (i.e., the true amount of LNAPL in the subsurface) over a given soil column area.

Results from the recovery modeling showed LNAPL recovery using either DPE or MPE was approximately 3 to 30 times greater than with SPR. Modeled recovery results were also evaluated by comparing predicted recovery volumes for MPE to actual recovery volumes from pilot testing at HMW-44C. The modeling results matched pilot test results that indicated the HMW-44 area was the highest production area. The model was not applied for quantitative purposes, rather to assess recovery potential and compare relative recovery rates for various remedial technologies.

For purposes of selecting a LNAPL recovery system(s), northern Hartford was divided into three (3) aerially separate areas, based on recovery/recharge rates and LNAPL characterization. These areas are conceptual, based on available information. The proposed active recovery system(s) will not necessarily be restricted to within defined areas. The eight LNAPL remediation technologies were evaluated separately for different areas. In summary:

- The area surrounding well HMW-44 exhibited high LNAPL recovery and recharge rates relative to other areas and was designated “Area A”.
- Localized areas outside Area A exhibiting moderate liquid recovery and recharge rates were designated “Area B”. Area B was then divided into subsections B1 through B4 based on further consideration of product type or recovery rates.
- The remaining area of northern Hartford where LNAPL has exhibited poor liquid recovery and recharge rates and higher vapor than LNAPL production was designated “Area C”.

The technologies were evaluated on the basis of the criteria identified in the AOC (Section VI. Paragraph 53), which are protectiveness, long-term effectiveness, implementability, and cost. Short-term effectiveness and community impact were also evaluated. MPE was chosen as the recovery technology for Area A, based on the high LNAPL recovery observed during pilot testing and consideration of the additional evaluation criteria. MPE was selected over DPE and DPR, for a number of reasons (e.g., no

substantial increase in LNAPL recovery by DPE over MPE, the siting difficulties within and outside Hartford, the long timetable involved in constructing a waste water treatment plant [WWTP], and the required permitting).

MPE was chosen as the primary recovery technology for Areas B1, B2 and B4. It was determined that MPE would more effectively remove LNAPL than SVE, because it has the capability to be optimized to varying fluid level elevations at different times and in different areas.

In addition for Area B4, MPE was chosen because a substantial portion of the LNAPL in this area is composed of diesel range organics, which are not conducive to removal via SVE.

Area B3 is unique, because it is a relatively small area where MPE pilot testing showed moderate LNAPL recovery, but limited LNAPL recovery sustainability potential. Based on these considerations, only the mobile technologies were considered for Area B3. PMPE was selected as the recovery technology for Area B3 over PMR based on long-term effectiveness considerations (e.g., flexibility, potentially greater radius of influence [ROI], and ability to address all phases of LNAPL).

Periodic mobile technologies were eliminated from consideration for Area C, because of the lack of long-term effectiveness over such a large area. DPE and DPR were also eliminated from consideration for Area C for implementability and other reasons. Of the remaining technologies (SVE, MPE, SPR and VES), SVE is the most efficient technology to implement since the non-sustainable liquid LNAPL production in Area C minimizes the advantages of any of the fluid withdrawal technologies. This is supported by MPE pilot testing that indicates the majority of LNAPL is removed in the vapor-phase throughout Area C.

The conceptual design of the proposed active recovery system for Areas A, B-1, B-2 and B-4 is a MPE system with a series of extraction wells spaced at approximately 60 to 100 feet. Wells will be equipped with a stinger pipe intended to withdraw primarily LNAPL. The MPE system will be designed to transfer LNAPL, water and vapors to a treatment area, where the LNAPL recovery, blower and vapor destruction systems will be located.

The proposed LNAPL recovery technology for B-3 consists of a mobile MPE unit operated periodically on a series of recovery wells located near well MP-79C.

The conceptual design for the SVE recovery technology in area C will include the existing and expanded VCS system, with additional SVE wells, as necessary, to provide coverage of the LNAPL plume in northern Hartford.

1.0 INTRODUCTION/PURPOSE

This report presents the Hartford Working Group's preferred Active Recovery alternative to the United States Environmental Protection Agency (USEPA), in accordance with Section 53 of the Administrative Order on Consent. Clayton Group Services, Inc., (Clayton), *a Bureau Veritas Company*, was retained by the Hartford Working Group (HWG) to prepare this Proposal for an Active Light Nonaqueous Phase Liquid (LNAPL) Recovery System (Proposal). The HWG consists of the Atlantic Richfield Company (Atlantic Richfield), The Premcor Refining Group Inc. (Premcor), Shell Oil Products US (Shell) and Sinclair Oil Corporation (Sinclair). The Village of Hartford, Illinois, and the surrounding area, is illustrated in Figure 1-1. Detailed characterization of the Site is presented in the LNAPL Active Recovery System Conceptual Site Model Report (CSM) dated December 15, 2005.

The Hartford Working Group is submitting this proposal for an Active Recovery System as required under paragraph 53 of the Administrative Order on Consent (AOC) with the USEPA in the matter of The Hartford Area Hydrocarbon Plume Site (Site) (Docket No. R7003-5-04-001) (USEPA, undated). To assess the effectiveness of this proposal, the Hartford Working Group established the following Active Recovery System Objectives.

- Control the threat, if any, to human health via ingestion of constituents in groundwater which result from subsurface oil identified in northern Hartford reaching the Hartford Municipal Wells or its five-year recharge area; and
- Control the threat, if any, to human health via inhalation of vapors above designated levels that arise from subsurface oil identified in northern Hartford; and
- Control the threat, if any, of potential oil releases to the Mississippi River that arise from subsurface oil identified in northern Hartford; and
- Actively recover, as appropriate, subsurface oil in the form of either LNAPL (mobile or residual), or vapors to mitigate the threat of vapor inhalation, discharge to the Mississippi River and impact on the Hartford Municipal Wells.

The selected technologies shall be used to their practical or effective limits to control the potential threats identified in the AOC as reflected in the Active Recovery System Objectives listed above.

Interim measures have been implemented to address potential imminent threats to human health. These

interim measures include completed and planned upgrades/expansions to the soil vapor extraction system, building-specific interim measures, and a contingency plan to assess potential vapor intrusion complaints. In addition, investigations demonstrate that there is no imminent threat to the Hartford Municipal Wells from either the oil or dissolved phase plumes. Further, the oil plume appears to have stabilized, and even decreased in magnitude, when compared to its 1990 depiction.

LNAPL is a term used to identify the presence of light non-aqueous phase liquid petroleum within the subsurface. This Proposal addresses the area exhibiting LNAPL at the Site and presents a proposal for active recovery systems to remove mobile LNAPL. Residual (non-mobile) LNAPL is found to some degree across the Site and is also present within the intervening clay strata. However, mobile LNAPL (defined as free product having sufficient saturation and volume to flow into a well) is primarily restricted to the Main Sand Stratum and two isolated areas in the overlying strata. Therefore, this Proposal is focused on those three areas.

This Proposal presents an evaluation of eight technologies used in the further evaluation of alternatives for active LNAPL recovery. Selection of the alternatives was based on the CSM, current knowledge of the LNAPL composition, pilot testing results, recovery modeling, and experience in applications of recovery technologies. Selection of technologies to be evaluated was also directed by USEPA's *"Comments to the Technical Memorandum Remedy Selection Process for The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois,"* (May 9, 2005), requesting the evaluation of skimming, dual pump recovery (DPR), vacuum enhanced recovery, and multi-phase extraction (MPE). The following LNAPL recovery technologies were evaluated: DPR, dual phase extraction (DPE), MPE, skimmer pump recovery (SPR), vacuum-enhanced skimmer pump recovery (VES), soil vapor extraction (SVE), periodic manual removal (PMR), and periodic MPE (PMPE). A description of these technologies, including an explanation of nomenclature, is provided in this Proposal. Each alternative was evaluated according to its protectiveness, long-term effectiveness, implementability, and cost. In addition, short-term effectiveness and community acceptance were evaluated.

SVE is currently being used to provide a break in the migration pathway for vapor intrusion into the homes and businesses throughout the northern portion of Hartford. Although the SVE system is not being evaluated for vapor intrusion mitigation as part of this document, the effect of its continued operation is considered when evaluating the effectiveness and efficiency of the potential alternatives.

An American Petroleum Institute (API) liquid product recovery model to determine the relative effectiveness of various mobile product recovery techniques. Input to the model included data from the CSM for LNAPL (LNAPL Active Recovery System Conceptual Site Model Report, December 15, 2005) and the following LNAPL characterization:

- LNAPL sampling and analysis for identification of product type (including gasoline and diesel range evaluation), density, viscosity and interfacial tension.
- LNAPL recharge evaluation via baildown testing and recovery measurements collected as part of pilot testing at the Site.
- Soil core sampling, photography and analysis for LNAPL saturation, capillary pressure, soil grain-size distribution and LNAPL mobility.
- MPE pilot testing by H_2A Environmental, Ltd. (H_2A) using a High Vacuum Recovery (HVR) system to extract LNAPL from wells.

This Proposal further includes a detailed description of the results of MPE pilot testing recently completed by H_2A using a high vacuum recovery (HVR) system to extract LNAPL from wells. H_2A's pilot testing, completed over an approximate 6-month period at 19 different wells in Hartford, experimented with various LNAPL recovery approaches, including low and high vacuum techniques, and drawdown pilot testing in a DPE mode. This data was compared to, and analyzed along with, previous pilot testing in Hartford to assist in evaluating various LNAPL recovery systems.

The proposed Active Recovery system reflects the Hartford Working Group's consensus on the alternative which best mitigates the threats identified in the AOC in a cost-effective manner and accommodates a phased approach to site response activities.

2.0 EXISTING SITE CONDITIONS

2.1 LOCATION AND SETTING

Hartford, Illinois is located in Madison County, approximately 3,000 feet east of the Mississippi River, upstream from St. Louis, Missouri. The Shell Oil Company Tannery property and the Premcor Terminal/Former Refinery facility are located directly east of Hartford, while the Shell Rand Avenue Site is to the northeast of Hartford. The Hartford Wood River Terminal is located directly north of Hartford across Rand Avenue. The BP Terminal (fka Amoco) Former Refinery Facility lies north-northeast of Hartford across Rand Avenue. The ConocoPhillips facility (former Shell facility) is located east of the Premcor Facility with a portion also abutting the north boundary of Premcor. Numerous underground petroleum pipelines are present in the area including three corridors located in northern Hartford. These corridors include the Elm Street and the Rand Avenue corridors, both installed in the 1940s, and the North Olive Street corridor, developed in the 1950s. The Elm Street and Rand Avenue corridors remain active.

Hartford is within a geographical region collectively known as the American Bottoms (Schict 1965). The American Bottoms consists of unconsolidated valley fill deposits ranging up to 170 feet thick. The uppermost geologic unit is the Cahokia Alluvium, which consists of sands, silts, and clays of channel, floodplain, and modern river origin. The Mackinaw Member of the Henry Formation, a sandy glacial outwash deposit, underlies the Cahokia Alluvium. The Cahokia sands and Henry Formation outwash deposits range in thickness from 60 to 150 feet. These deposits comprise the most extensive and thickest aquifer in the region. In the Hartford area, this aquifer is referred to as the Main Sand and is formed by the Cahokia sands and Henry Formation outwash deposits.

The Site has been defined in the AOC as being bounded by Rand Avenue to the north, the nearest railroad tracks along the east side of Olive Street to the east, Donna Drive and the south boundary of Hartford Park to the south, and Illinois State Highway 3 to the west. In general, the environmental concerns in Hartford are located within an area bounded by Hawthorne Street to the south, North Olive Street to the east, Illinois State Highway 3 to the west, and Rand Avenue to the north (Figure 2-1) (Clayton, January 2004). The Site boundaries may differ from the Hartford corporate boundaries.

2.2 SITE HISTORY AND PREVIOUS WORK

Odor issues dating back to May 1966 and occasional fires in subsequent years, both attributed to petroleum vapor intrusions, have been documented in northern Hartford. Maps from early site investigations depict petroleum underlying the majority of northern Hartford. In 1978, petroleum was identified in monitoring wells. Three primary areas of LNAPL accumulation were identified (Figure 2-2): the largest was depicted as centered under Elm Street in the center of northern Hartford; an intermediate area was depicted as centered under Birch Street, also in the center of northern Hartford; and the smallest area was depicted adjacent to North Olive Street between East Cherry and East Date Streets.

Subsequent site investigation maps have also depicted LNAPL within the Main Sand, based on monitoring well data. In 1982, LNAPL was depicted as extending just beyond Rand Avenue, and the three separate LNAPL areas identified in 1978 were depicted as connected (Figure 2-3). A new observation was depicted as a small, isolated area of LNAPL immediately east of the intersection of East Elm and North Olive Streets. The 1978 and 1982 apparent LNAPL thicknesses were essentially the same, with the exception of the newly depicted LNAPL areal extent. In 1990, the identified LNAPL extent was smaller (Figure 2-4). A comparison of these historic representations of the LNAPL plume location with the location of the plume today shows that the plume has decreased in size.

In 1978 and 1979, two hydrocarbon recovery wells were installed. Recovery well RW-1 was installed on property located on the east side of North Delmar Avenue just north of West Forest Street. RW-2 was installed on the west side of North Olive Street midway between East Cherry and East Date Streets. In 1992, a vapor control system (VCS) was installed. The VCS was designed as an SVE system, to extract petroleum vapors from the unsaturated zone and from the LNAPL at the groundwater surface. The VCS wells were located in an area approximately bounded by East Birch Street on the north, North Olive Street on the east, East Forest Street on the south and Old St. Louis Road on the west. A third product recovery well was installed in the early 1990s. Recovery well RW-3 was completed on property located on the south side of East Birch Street between North Market and North Olive Streets. The VCS was upgraded in 2004-2005, with segments brought on-line in January and subsequently in the spring of 2005. In addition, a temporary VCS has been in operation in the northwest portion of Hartford, at the Hartford Community Center, since April 2005 and remains pending connection to the VCS.
The gauged extent of LNAPL appears reduced due to LNAPL recovery efforts consisting of the operation of two recovery wells since the late 1970s, and the operation of the soil vapor extraction (SVE) system

and an additional recovery well since the early 1990s. Site investigations since 2004 have observed isolated LNAPL in both the Rand and EPA Strata. Previous investigations in these areas did not identify LNAPL due to the fact that monitoring wells were not screened specifically in these individual strata.

2.3 GEOLOGY

The geology and hydrogeology of northern Hartford is illustrated in generalized cross sections (Figure 2-5) developed by Clayton (December 2005). The geologic units consist of alternating alluvial deposits of clay and silt overlying the regionally extensive Main Sand (American Bottoms Aquifer). The permeable zones within the alluvial deposits are locally known (in descending order) as the North Olive, the Rand, and the EPA Strata. These deposits are overlain and bounded by several clay deposits identified (in descending order) as the A Clay, B Clay, C Clay and D Clay Strata. A finer-grained portion of the Main Sand is referred to as the Main Silt.

The clay strata in Hartford consists primarily of silty clay with trace amounts of sand. The uppermost clay deposit, the A Clay Stratum, is present throughout Hartford and overlies the North Olive Stratum, where present. The A Clay Stratum ranges in thickness from 5 to 24 feet. The B Clay Stratum underlies and defines the extent of the North Olive Stratum, where present, and overlies the Rand Stratum. The B Clay Stratum ranges in thickness from less than 1 foot to 12 feet. The Rand Stratum, where present, is underlain by, and defined by the extent of the C Clay Stratum. The C Clay Stratum ranges in thickness from less than 1 foot to approximately 8 feet. The C Clay Stratum overlies the EPA Stratum, where present, and the Main Sand. The D Clay Stratum underlies and defines the extent of the EPA Stratum, and overlies the Main Sand. The D Clay Stratum ranges in thickness from approximately 2 to 7 feet and could be considered a discontinuous lens within the Main Sand based on its relative thickness and limited extent.

This Section focuses on the more permeable zones that contain LNAPL. Specifically, the Main Sand Stratum has been identified as the stratum containing the majority of the LNAPL to be addressed by the recovery system proposed. Two isolated exceptions, which are also addressed by this Proposal, have been identified in the Rand and EPA Strata.

Rand Stratum

The Rand Stratum is composed primarily of silt with lesser amounts of clay and trace sand and is similar to the Main Silt in some areas. It is present at depths ranging from approximately 12 to 27 feet (average 19 feet) below ground surface (bgs). This stratum appears to extend across the majority of northern Hartford south to East Forest Street. To the south of Date Street, the Rand Stratum grades laterally into the Main Silt. The Rand Stratum pinches out east of North Olive Street between East Date and East Forest Streets and is locally absent near the intersections of West Rand Avenue with both North Delmar Avenue and Old St. Louis Road, where the B and C Clay Strata are undifferentiated.

Main Silt Stratum

The Main Silt, which overlies and is hydraulically connected to the Main Sand, consists primarily of silt to fine-grained sand with varying amounts of clay. The Main Silt is identified at depths ranging from approximately 6 to 30 feet bgs (average of 16 feet bgs), where the B and/or C Clay Strata are absent and where it is overlain by the A Clay Stratum. There are certain areas where the contact between the Main Silt and Main Sand is gradational and difficult to interpret, especially in the southern portion of Hartford. The upper surface of the Main Silt is equivalent to the same horizon as the top of the North Olive Stratum. The majority of the base of the Main Silt is equivalent to the same horizon as the top of the EPA Stratum. In a localized area near the intersections of West Date Street and North Delmar Avenue, and East Elm Street and North Market Street, the Main Silt overlies the C Clay Stratum.

EPA Stratum

The EPA Stratum is composed primarily of sand with lesser amounts of silt and trace clay. The EPA Stratum is only found in the northeastern portion of Hartford at depths ranging from 27 to 46 feet bgs (average of 31 feet bgs). This stratum is defined and separated from the Main Sand by the D Clay Stratum. The EPA Stratum grades laterally into the Main Sand to the south of a southeasterly-trending line drawn from the Old St. Louis Road and Delmar Avenue intersection to just north of the East Date Street and North Olive Street intersection. Along this boundary the EPA Stratum and Main Sand are hydraulically connected.

Main Sand

The Main Sand underlies the entirety of Hartford and surrounding areas. In Hartford, it is present at depths ranging from 19 to 45 feet bgs (average of 28 feet bgs) and ranges in thickness from approximately 80 to 104 feet. It is thickest near the municipal water supply wells in the west central portion of Hartford. The top of the Main Sand varies based on the presence or absence of the overlying clay strata. Where the B and/or C Clay Strata are absent in the central portion of Hartford, the upper surface of the Main Sand is hydraulically connected to the Main Silt. Discontinuous silty clay and clayey silt lenses of limited thickness and extent occur at various depths within the Main Sand.

The top of the Main Sand is encountered from approximately 393 to 413 feet above mean sea level (MSL). The top of the Main Sand is at the same horizon as the top of the EPA Stratum, where the D Clay is absent. The elevation of the top of the Main Sand generally decreases towards the east-northeast. Where the Main Sand underlies the D Clay in the northeastern portion of Hartford, the top of the Main Sand is encountered at depths ranging from 39 to 45 feet bgs (approximately 386 to 393 above MSL). The top of the Main Sand below the D Clay is highest (approximately 393 feet above MSL) at the intersection of North Delmar Avenue and Old St. Louis Road. The elevation of the top of the Main Sand decreases towards the east-northeast. The thickness of the Main Sand below the D Clay Stratum in Hartford is unknown.

2.4 HYDROGEOLOGY

The hydrogeology of Hartford and the occurrence of groundwater in the Rand, EPA and the Main Sand strata are briefly discussed below. Monitoring wells screened in each of the individual strata were gauged monthly from September 2004 through October 2005. Representative maps (November 15-17, 2004; February 23-24, 2005; May 11-12, 2005; August 3-5, 2005; and October 4-5, 2005) for each of these strata (Rand, EPA, and Main Sand) are presented in this report; specifically: Figures 2-6 through 2-10 representing groundwater flow in the Rand Stratum, Figures 2-11 through 2-15 representing groundwater flow in the EPA Stratum, and Figures 2-16 through 2-20 representing groundwater flow in the Main Sand.

Rand Stratum

Groundwater in the Rand Stratum appears to be confined (meaning that the entire stratum thickness is saturated with fluid – there is no unsaturated portion of the stratum) northeast of Hartford at the Shell Rand Avenue Site, though this is the only area where the Rand Stratum is known to be completely saturated. Groundwater flow maps of the Rand Stratum indicate a groundwater divide, located northeast of the Site, trending along a general northwest/southeast axis. Groundwater flow on the southern side of the divide is in a southwesterly direction and on the northern side is in a northeasterly direction. In general, groundwater in the Rand Stratum, south of Rand Avenue, is also considered to represent localized areas of perched water on the surface of the underlying C Clay Strata. The southwesterly flow gradient has ranged from 0.0178 to 0.0305 during 2005. Evaluation of the average hydraulic conductivity indicates it ranges from 5.5E-05 to 7.9E-03 centimeters per second (cm/s) (Clayton, December 2005).

EPA Stratum

Groundwater in the EPA Stratum is confined and hydraulically connected to the Main Sand in Hartford, and on the Shell Tannery Property, the Shell Rand Avenue Site, and the Premcor facility. Groundwater flow maps of the EPA Stratum also indicate a groundwater divide, located northeast of the Site, trending along a general northwest/southeast axis. Groundwater flow on the southern side of the divide is in a southwesterly direction and on the northern side is in a northeasterly direction. However, as groundwater flows southwesterly beyond the extent of the D Clay Stratum, it changes direction and flows northwestward within the Main Sand, because these strata are hydraulically connected (Figure 2-21). The southwesterly flow gradient was calculated as ranging from 0.0014 to 0.0607 during 2005. The average hydraulic conductivity has been calculated to range from 1.5E-05 to 3.8E-04 cm/s (Clayton, December 2005).

Main Sand

Natural groundwater movement within the American Bottoms is westerly, draining from the limestone bluffs (east wall of the floodplain valley) located east of Hartford, to the Mississippi River (Engineering-Science 1992). However, the natural movement of groundwater in the American Bottoms has been altered in the Hartford vicinity due to large-scale industrial water pumping. The withdrawal of water for use in industrial production processes has created cones of depression in the groundwater in the vicinity

of Hartford. In general, the net effect of this drawdown has resulted in localized altered flow in the Main Sand to the north and northwest.

In Hartford, groundwater appears to be confined where it underlies the C Clay Stratum and the D Clay Stratum; however, it becomes unconfined generally south of West Date and East Forest Streets. Groundwater elevations within the Main Sand have fluctuated over the years, ranging from approximately 416 (1993) to 380 (mid-1950s) feet MSL (Clayton December 2005 and Schicht 1965).

Groundwater flow maps of the Main Sand indicate a groundwater flow trend that is northerly to northwesterly within Hartford, with localized northeasterly flow on the east side of the Village between Hawthorne and Elm Streets. The overall northerly groundwater flow direction at the Site is consistent with historical interpretations and the operation of the pumping centers in the Hartford vicinity. The general northerly flow gradient has ranged from 0.0002 to 0.0029 during 2005. The average hydraulic conductivity has been calculated to range from 1.6E-02 to 3.1E-02 cm/s (Clayton, December 2005).

3.0 LNAPL CHARACTERIZATION AND DISTRIBUTION

LNAPL characterization and distribution in geologic strata are discussed in detail in the CSM. This Proposal considers only specific LNAPL characterization information including:

- LNAPL sampling and analysis for identification of product type (including gasoline and diesel range organic evaluation), density, viscosity and interfacial tension
- LNAPL recharge evaluation via baildown testing and recovery measurements collected as part of HVR pilot testing at the Site
- Soil core sampling, photography and analysis for LNAPL saturation, capillary pressure, soil grain-size distribution and LNAPL mobility

This data, along with other site-specific information, was used in an API liquid-phase LNAPL recovery model to determine the comparative effectiveness of various LNAPL recovery techniques (Section 5.0).

3.1 LNAPL SAMPLING AND ANALYSIS

Clayton collected LNAPL samples from twenty-nine (29) monitoring and recovery wells at the Site in August and September, 2005. LNAPL sampling was conducted from within distinct Rapid Optical Screening Tool (ROST™) signature areas and geological settings in order to identify the range of product types across the mobile (free product) LNAPL extent. Underlying groundwater samples were also obtained to evaluate interfacial tension between the groundwater and LNAPL. LNAPL sampling locations and testing rationale are shown in Table 3-1. LNAPL sample locations are shown in Figures 3-1 through 3-3.

The samples were collected from wells using a clean, sealed, and dedicated polyvinyl chloride (PVC) bailer. After collection, samples were immediately placed into new laboratory-supplied containers, labeled, placed in appropriate shipping containers, and delivered under chain-of-custody procedures to Torkelson Geochemistry, Inc. (Torkelson). The water samples were kept on ice after collection and during shipping.

The hydrocarbon characterization (including gasoline and diesel range evaluation) was completed by Torkelson using capillary gas chromatography. LNAPL samples were also analyzed by Torkelson for

density and viscosity by the American Society for Testing and Materials (ASTM) Method D445 and API Method RP40, and interfacial tension by DuNouy ring tensiometer using ASTM Method D971. The test results and information from these samples were used to provide input for the API model (Section 5.0).

Based on interpretation of the chromatographs, the majority of the mobile LNAPL underlying the Site consists of gasoline-range organics (GRO). The northern and eastern portions of the Site also contain varying percentages of diesel range organics (DRO). LNAPL density values ranged from 0.7335 (gasoline range) to 0.8528 (diesel range) grams per milliliter. LNAPL viscosity ranged from 0.47 to 3.39 centipoise, with the higher viscosity values generally associated with samples containing a higher percentage of DRO. The air/water surface tensions ranged from 51.0 to 68.8 dynes per centimeter. The air/LNAPL surface tensions ranged from 16.0 to 24.1 dynes per centimeter. The LNAPL/water surface tensions ranged from 19.2 to 26.4 dynes per centimeter, with higher surface tensions associated with samples containing a higher percentage of DRO. Surface tension represents the strength of the film separating two immiscible fluids or a liquid and its own vapor.

A summary of the approximate percentages of GRO and DRO at each well location is included as Table 3-2 and is presented in Figure 3-4. The majority of LNAPL is present in the Main Sand with two isolated exceptions. HMW-48C revealed LNAPL in the EPA Stratum while MP-29C revealed LNAPL in the Rand Stratum. LNAPL sample analytical results are included in Appendix A. Monitoring wells that contained predominantly DRO are all located in northeast Hartford and are screened in the Rand or EPA strata.

As the properties of refined products vary due to a number of factors (e.g., the petroleum source and the refining process itself, interaction of the products with the subsurface soils and groundwater, and the time that the products have been in the subsurface), the following results are discussed only in a representative manner and should not be construed as indicative of a particular source of the identified LNAPL.

3.2 LNAPL DISTRIBUTION IN PERMEABLE STRATA

The LNAPL distribution in permeable strata is described in detail in the CSM (Clayton, December 2005) and is presented in Figure 3-16. Clayton has defined the lateral and vertical extent of the LNAPL at the Site using ROST methodology along with the observation of product in monitoring wells. Residual LNAPL is found in all of the permeable strata covering much of northern Hartford. However, mobile LNAPL

(sufficient saturation and volume to flow into a well) is primarily limited to the Main Sand over a portion of northern Hartford.

3.3 LNAPL RECHARGE EVALUATION

3.3.1 Introduction and Objectives

One indication of LNAPL mobility and recoverability is how quickly it will recharge in a well after it has been removed via vacuum or baildown. LNAPL recharge into selected wells was measured during 2004 and 2005 following baildown testing and HVR short-term extraction events. (The HVR pilot tests are described in detail in Section 4.0 of this Proposal.) Recharge data was used to plot LNAPL recharge curves to evaluate recharge rates across northern Hartford, and to estimate the relative permeability to LNAPL in those areas, based on calculated hydraulic conductivity and transmissivity[1]. This data and calculations allow a semi-quantitative evaluation of LNAPL recovery potential for given conditions.

Initial baildown tests were conducted from March 2-4, 2004. A second set of baildown tests was conducted from September 22-24, 2004. A third set of baildown tests was conducted on August 9, 12, 23-24 and 30-31, and September 1, 2005. HVR events and pilot tests were conducted at select wells from May 9, 2005 through November 4, 2005. LNAPL recharge data was collected for most of these HVR events.

3.3.2 Well Locations

Well locations for baildown testing and recharge analysis were selected on the basis of apparent LNAPL thickness, composition and spatial coverage across the Site (see Figure 3.5). Although baildown testing and recharge analysis are not typically performed on wells with less than one foot of LNAPL, a number of wells fitting this description were subjected to this testing and analysis in order to achieve the primary goal of characterizing LNAPL mobility across the entire plume. Tables 3-3 and 3-4 provide the baildown and HVR test locations along with the rationale for selecting each location.

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1 Hydraulic conductivity (K) is a measure of a material's capacity to transmit water; Kn refers to K with regard to LNAPL. Transmissivity (T) is a measure of the capacity of an aquifer to transmit water through its *entire* saturated thickness; Tn refers to T with regard to LNAPL.

3.3.3 Protocols and Equipment

3.3.3.1 Baildown Test Procedure

Field procedures utilized for the baildown tests included gauging of depth to product and water prior to each event, the removal of multiple “slugs” of LNAPL utilizing a hand bailer, and subsequent gauging of depth to product and water to measure LNAPL recharge into each well. In general, production of water through this procedure was minimal. The baildown test method followed those of Lundy and Zimmerman (Undated) and Huntley (2000), which are in general agreement. Baildown test data sheets are included in Appendix B.

3.3.3.2 HVR Events

HVR testing was used to extract LNAPL from various wells by applying negative pressure to a well via a stinger pipe set at or near the LNAPL surface. HVR is discussed in detail in Section 4; the objective of the tests was to generate data for use in determining LNAPL production and recharge potential across the Site. The method has advantages over other techniques, including the ability to operate in different modes depending on conditions, and the fact that the well’s sand pack is drained of LNAPL during operation, which yields data that can be more representative of sustainability.

Field procedures for the HVR events included initial gauging of depth to product and water, installation of a downhole stinger into a well positioned within the LNAPL zone, sealing of the well, and the application of vacuum (air flow) to extract LNAPL and vapor simultaneously. Approximately 95% of the HVR events exhibited some water production. The HVR events typically ran for about 8 hours, and were followed with depth to product and water measurements for approximately 4 to 8 hours to monitor LNAPL recharge into the wells.

The HVR events are a variation of the published methods wherein variable quantities of water (up to 1700 gallons) were extracted. The HVR events may reach closer to a “steady-state” condition of LNAPL recharge into the wells than the baildown tests (i.e., the relatively longer events with larger extraction volumes minimize concern of filter pack recharge effects). The HVR testing drains the well’s sand pack of

LNAPL faster than the surrounding formation. Therefore, the results of the HVR testing are more representative of the formation rather than potentially only the sand pack.

3.3.3.3 Data Analysis

The analysis of LNAPL recharge data for determining Kn and Tn generally follows that described by Huntley (2000).

The analysis included the following:

- Compilation of well construction, gauging and recharge data for each test/event
- Evaluation of gauging data versus well screen elevations
- Entry of well and test-specific data into AquiferTest Pro® v. 4.0
- Import of recharge data into AquiferTest Pro® v. 4.0
- Calculation of raw K by Bouwer and Rice Slug Test Methodology (DTP v. Time)
- Calculation of raw T and K by Cooper et al Slug Test Methodology (DTP v. Time)
- Calibration of Bouwer and Rice vs. Cooper et al results to optimize data/curve match
- Export of all calculated T and K values into Microsoft Excel®
- Calculation of density adjusted Tn and Kn for each baildown test and HVR Event
- Development of trend graphs for all Tn and Kn values

Because the tests consisted of either multiple “slug” withdrawals or multiple hours of extraction, filter pack recharge effects were generally not observed. Further, wells typically either recharged fairly quickly or did not recharge fully for several days. For neither case were barometric pressure and aquifer level trend adjustments considered; in quickly recharging wells, such adjustments are too small to appear in the analyzed portion of the recharge data, and in slowly recharging wells (multiple days to reach 100% recharge), the effects are limited due to the apparent low mass/mobility of LNAPL adjacent to the well.

3.3.4 Results

3.3.4.1 Summary of Results

A summary of wells, event types, dates of events, LNAPL thicknesses, depths to top of product, densities, Kn (individual event and average for each well) and Tn (individual event and average for each well) is provided in Table 3-5. A discussion of the Kn and Tn trends is provided in Section 3.3.4.2 below. The

average recharge rate values are plotted and contoured in Figure 3-6. Because of the range of variability in recharge rates at the Site, the following method was utilized to generate the values for this map: LNAPL recharge rate data for each well was collected and evaluated for the initial 6-8 hour monitoring period following each baildown test or HVR event. The length of time to recharge to 90% of initial LNAPL thickness was divided into the percentage achieved (at or above 90%). If the well did not reach at least 90% recharge, then the final time was divided into the final recharge percent. These values were then averaged for each well.

Summary graphs of LNAPL recharge as a percentage of original LNAPL thickness, and LNAPL recharge in feet versus time are provided separately for the baildown tests and the HVR events (Figures 3-7 through 3-10). Contour maps of average Kn and Tn are provided in Figures 3-11 and 3-12. Due to limited recharge in some wells and the presence of fluid levels above the screened interval in others, not all of these baildown tests and HVR events yielded data that could be analyzed for Kn and Tn.

The table below summarizes general statistics for the baildown tests and HVR events.

Statistic	Minimum	Maximum
No. of Baildown Tests Analyzed	N/A	17
No. of HVR Events Analyzed	N/A	50
Total No. of Recharge Analyses	N/A	67
Depth to Product (DTP) below TOC	27.75 feet	34.94 feet
LNAPL Thickness	0.47 feet	3.89 feet
Oil Conductivity (Kn) Range	2.29 E-7 cm/s	2.64 E-2 cm/s
Oil Transmissivity (Tn) Range	1.05 E-5 cm2/s	1.01 E-0 cm2/s

3.3.4.2 Variability of Kn and Tn

As noted in the table above, both Kn and Tn varied by five orders of magnitude across the Site. The average Kn and Tn contour maps provide order of magnitude contours that identify areas of substantially higher Kn and Tn in the area of historically greatest LNAPL thickness along the axis from HMW-44C to MP-45C. Four additional localized areas around wells MP-50C, HMW-19, MP-39C, and MP-35D also exhibited higher than average Kn and Tn values. The results correspond to the general rule that Kn and Tn tend to be greater with greater saturation.

A scatter plot (Figure 3-13) of all values (baildown and HVR) suggests there is no significant bias in calculated results between the two methods. The Kn and Tn values obtained from HVR and baildown events were utilized primarily to evaluate trends. Figure 3-14 depicts the Tn values by well and identifies trend lines for each well.

3.3.4.3 Permeability to Oil

An important concept used in interpretation of LNAPL characterization data is that of permeability to oil. In general, permeability to oil (LNAPL) is not only a function of the properties of the strata, but of the LNAPL saturation in the strata. If LNAPL is present below a minimum saturation, called the irreducible oil saturation, it is trapped as globules or droplets in the larger pores, and it will not move. Therefore, if LNAPL saturations are at or below the irreducible limit, permeability to oil is zero and there will be no flow of liquid LNAPL. If LNAPL saturations exceed the irreducible limit, the permeability to oil increases. This was demonstrated at individual monitoring wells in that recoveries were progressively slower after LNAPL had been removed from the wells multiple times, indicating lower permeability as LNAPL saturation decreased. This information is important, because it affects how recovery systems are designed; it indicates that systems and expectations need to be adjusted over time, as the limits to the recovery of liquid LNAPL are approached.

3.4 SOIL CORE SAMPLING

3.4.1 Sampling Protocol

Based on the results of the LNAPL sampling, baildown testing, and other site data evaluation, soil core locations were selected and samples were collected and analyzed for evaluation of LNAPL recoverability within differing geological and hydrogeological settings. Soil borings were advanced at five (5) locations across the Site (HCSB-1 through 5) and soil cores were collected for LNAPL testing. Soil borings were advanced using a conventional drill rig equipped with 4 ¼-inch hollow stem augers and operated by Philip Environmental Services Corporation (PESC) of Columbia, Illinois. For borings where there was an adjacent ROST response at specific intervals, an attempt was made to collect soil samples at the interval of the ROST response. Samples were collected by pushing a 3-inch diameter Shelby tube. At depths in the soil borings where saturated sands were encountered, a piston-driven attachment was placed on the

end of the Shelby tube to enhance recovery. The Shelby tubes were placed on dry ice upon completion and delivered under chain-of-custody procedures for analysis to PTS Laboratories Inc. (PTS) of Santa Fe Springs, California. Soil core locations are shown in Figure 3-15. A summary table showing the soil core locations and description of site-specific information, including the monitoring well/recovery well adjacent to each core location is presented in Table 3-6.

As part of their analysis, PTS cut the frozen Shelby tubes, allowed them to thaw to just above 0 degrees Celsius and photographed the soil cores. The five cores were photographed under natural light to identify changes in soil lithology (color and texture) and again under ultraviolet light, which will cause petroleum hydrocarbons to fluoresce.

After review of the photographs, specific sample intervals were identified for the various laboratory tests, as outlined below. The tests were conducted on plug samples drilled out of the core by PTS. The plugs were drilled in a frozen state and were approximately 1 inch in diameter and 2 inches long.

The plugs were analyzed for soil properties including density and porosity by the API Publication Method RP-40. Soil grain size particles larger than 75 micrometers (μm) (retained by the No. 200 sieve) were evaluated by sieving following the ASTM Method D422. The grain-size particles finer than 75 μm (passing the No. 200 sieve) were evaluated using a Laser Method (ASTM method D4464M) for grain size analysis.

Special core analyses consisted of soil-fluid interaction properties. Plugs from each sample were selected for special core analysis and were analyzed for water and LNAPL saturations by ASTM D2216/API Method RP-40. Air/water drainage capillary pressure curves were measured using the centrifugal technique following ASTM Method D425M.

Soil cores were also analyzed for free-product mobility by comparing water and LNAPL saturations before and after a plug was centrifuged at 1,000 times the force of gravity. This method, known as the Dean-Stark analysis (ASTM D425M), is a distillation extraction method of determining fluid saturations. The sample is weighed and the water fraction is vaporized by boiling solvent. The water is condensed and collected in a calibrated receiver. Vaporized solvent also condenses, soaks the sample, and extracts the

LNAPL. The sample is oven-dried and weighed. The LNAPL content is then determined by gravimetric difference.

3.4.2 Sampling Results and Interpretation

Core photography was generally consistent with previous site observations such as ROST responses. However, the soil cores demonstrated that LNAPL is not present as a continuous layer, but is disseminated in the strata in more or less discrete globules or ganglia in the pores, and is present in relatively low saturations.

LNAPL soil saturation values (i.e., the percentage of the soil's *pore space* containing LNAPL) in soil cores collected from the five (5) borings selected for analysis generally ranged from 0 to 10.2 percent, with one exception. HCSB-1 (31 to 33 ft bgs) exhibited LNAPL saturation values ranging from 21.8 to 40.2 percent. These LNAPL soil saturation data demonstrate that the LNAPL does not fully saturate, or fill, the soil pore space (typical porosity for sand ranges from 25 to 50% [Freeze and Cherry, 1979]).

The LNAPL mobility data (comparing the initial and residual LNAPL saturations after centrifuging) correlated well to both the site geologic conditions and the initial LNAPL saturations (Table 3-7). In upper, more cohesive silt and clayey soils there were low LNAPL saturations and very limited to no LNAPL recovery. In areas with higher initial LNAPL saturation, which also tended to correspond with higher permeability zones, there was higher liquid LNAPL recovery, indicating that LNAPL saturation correlated with mobility.

The other physical data, including capillary pressure and grain size analysis, also appears similar to previous geotechnical data collected. PTS analytical reports are included in Appendix C

A detailed discussion of soil core analytical results and their relationship to the API model is included as part of the *LNAPL Distribution and Recovery Model* report prepared by The RETEC Group, Inc. (RETEC), which is discussed further in Section 5.0 and included in Appendix D.

4.0 PILOT TESTING

Four different types of LNAPL recovery technology pilot tests were performed in Hartford, Illinois during 2004 and 2005. The technologies tested included:

- Soil Vapor Extraction (SVE)
- Skimmer Pump Recovery (SPR)
- Multi-phase Extraction (MPE - also previously referred to as High Vacuum Remediation or HVR)
- Dual Phase Extraction (DPE)

Results for SVE pilot testing were previously reported by (Clayton, March 2005). The March 2004 SVE pilot testing provided design data for the currently operating SVE system. The 2004 and 2005 SVE pilot testing provided radius of influence (ROI) and vapor-phase production data to facilitate the technology evaluations in this report (Section 6).

The SPR pilot testing was previously reported by (Clayton, May 2004) as well. Extended LNAPL skimming was performed by Clayton at wells RW-4A and RW-5 during 2004 and 2005. Downhole skimmer pumps were utilized to extract primarily LNAPL from each well on a continuous basis. This data provided the site-specific SPR data utilized for the technology evaluations included in this report (Section 6).

MPE pilot testing results have also been reported previously by Clayton (*Multi-Phase Extraction Tests*, August 2004) for wells RW-4A and RW-5. Extensive MPE pilot testing from various wells across the LNAPL plume area was performed by H_2A in 2005. In addition, H_2A simulated DPE pilot testing in comparison to MPE from wells RW-4A and RW-5 in 2005 (report included as Appendix E).

The MPE pilot tests performed by H_2A in 2005 evaluated plume-wide LNAPL production and recharge characteristics under a variety of operating conditions to determine optimal operating parameters. In addition, fluid production and well recharge versus initial fluid elevations (water and LNAPL) and stratigraphic boundaries under different seasonal conditions were evaluated to determine critical factors controlling LNAPL production and recharge.

The 2005 MPE/DPE comparison pilot tests were designed to evaluate formation response (drawdown, vacuum and capture zone ROI) and LNAPL and water production characteristics of the two technologies.

The results of the plume-wide MPE pilot testing and MPE/DPE comparison pilot testing by H_2A, which provides new data not previously reported, are summarized in the following sections. In addition, results of all pilot tests (SVE, SPR, MPE and DPE) are compared (Section 4.3) to facilitate the technology evaluations (Section 6) included in this report.

4.1 H_2A PLUME-WIDE MPE PILOT TESTING IN 2005

H_2A conducted MPE pilot testing on nineteen (19) existing wells with LNAPL in Hartford, Illinois from May 9 through November 4, 2005. H_2A used a mobile MPE system to extract LNAPL from each well. H_2A's testing accomplished vacuum-enhanced fluid recovery by applying negative pressure to a well via a stinger pipe set at or near the LNAPL surface. The pilot testing initially consisted of five cycles of daily MPE pilot testing from 10 wells to evaluate LNAPL production and recharge characteristics across northern Hartford. Subsequently, additional daily and sequential daily MPE pilot tests were performed from some of the original 10, as well as 9 additional existing wells with LNAPL.

The pilot testing was performed utilizing MPE equipment with the flexibility to operate in different applications. During the initial five cycles of screening pilot testing, various vacuum levels, stinger levels, and other operating parameters were tested to obtain preliminary data on LNAPL production and recharge levels that result from different operating parameters. The scope of operating parameters and equipment selection for the 2005 MPE pilot tests was selected based on information gained from the 2004 MPE pilot tests, and represents a refined technology application. In general, this MPE pilot testing was implemented to maximize LNAPL production while minimizing water production by minimizing drawdown.

This pilot testing was subsequently extended to target specific wells (the sequential daily MPE wells noted above) to better understand their LNAPL production capabilities on a sustained basis as the regional aquifer water levels fluctuated.

Objectives of the H_2A MPE pilot testing activities included the following:

- Identify LNAPL removal rates via MPE throughout the northern Hartford LNAPL plume.
- Compare the relation of apparent LNAPL thickness to recoverable LNAPL for different hydrogeologic conditions via removal rates and LNAPL/water ratios.
- Assess effects of LNAPL location, water table elevation, and site stratigraphy on LNAPL recovery.
- Delineate the range of liquid LNAPL.
- Use measured recharge data to calculate LNAPL/water transmissivities and hydraulic conductivities.
- Utilize MPE pilot testing in conjunction with baildown testing and LNAPL saturation investigation results to identify sustainability of recovery.

A complete summary of H_2A's MPE pilot testing is provided in Appendix E. A brief summary of pilot test results critical to understanding LNAPL distribution, production and recharge is provided herein. The relative ranking of LNAPL and Total Hydrocarbon production in the following sections from Low to Very High is based on natural breaks in production rates between the wells, as identified in Figures E-227 and E-236 (Appendix E).

- LNAPL production rates were quantified separately from vapor-phase recovery and are an important aspect of this Proposal. Figure 4-1 provides average LNAPL removal rate contours that demonstrate the majority of the LNAPL plume area yielded relatively low LNAPL (as liquid) removal rates. Locations of high to very high LNAPL production include wells MP-29D, HMW-19, MP-50C, MP-53C, MP-47C, MP-55C, and HMW-44C (Figure 4-2).
- Average total hydrocarbon removal rate for each well is plotted and contoured as Figure 4-3. In general, this map indicates that most of the LNAPL plume area represents consistent and low to moderate total hydrocarbon (LNAPL and vapor) production. Locations with high to very high average total hydrocarbon removal rates include wells HMW-19, MP-29D, MP 50C, MP-53C, MP-47C, MP-55C, and HMW-44C (Figure 4-4).
- Vapor-phase removal was evaluated separately from the LNAPL removal. Figure 4-5 provides contoured average vapor-phase removal rates for each well. In general, this map indicates vapor recovery is consistent across nearly all of the LNAPL plume area, with vapor-phase production declining near the LNAPL plume margins, in wells with predominantly DRO, and in wells with submerged screens.
- LNAPL (as liquid) vs. vapor-phase removal was evaluated for each well to assess locations of preferential phase recovery. Figure 4-6 indicates that the primary recoverable phase is vapor for the majority of the LNAPL plume area. Locations of primarily LNAPL production included wells HMW-48C, MP-29D, HMW-19, MP-50C, MP-53C, MP-47C, MP-55C, HMW-20, and HMW-44C.

- LNAPL recharge rates (post-MPE test) were contoured to evaluate the sustainability of LNAPL production from the wells. Figure 4-7 indicates the majority of the LNAPL plume area exhibits low LNAPL recharge potential. Locations of high LNAPL recharge potential include wells HMW-19, MP-50C, MP-51D, MP-53C, MP-47C, MP-55C, and HMW-44C. Moderate recharge potential was demonstrated at wells HMW-48C, MP-29D, MP-79C and HMW-20.

- LNAPL hydraulic conductivity (Kn) values calculated from both baildown tests and MPE recharge data were averaged for each well and contoured to identify map trends (Figure 4-8). Estimates of Kn across the majority of the LNAPL plume area appear to show relatively low Kn, on the order of E-6 to E-7. However, specific locations exist where Kn ranges from E-4 to E-3, 1 to 3 orders of magnitude higher. These locations included wells MP-35D, MP-39C, HMW-19, MP-50C, MP-45C, MP-55C, HMW-20 and HMW-44C.

Comparison of these data results in the following conclusions:

- LNAPL liquid recovery and recharge potential across much of northern Hartford is relatively low.

- Specific, but limited, areas of the plume exhibit higher sustainable hydrocarbon production rates; much of the plume area will not sustain high levels of LNAPL recovery on a continuous basis based on observed seasonal variability.

- Wells that underwent multiple MPE events exhibited variation in LNAPL production that appears to be related primarily to seasonal fluid level variations in the aquifer.

- The largest water-producing wells were generally some of the smallest hydrocarbon-producing wells (and vice versa); supporting this finding is the fact that five of the top seven hydrocarbon-producing wells produced minimal amounts of water.

- The estimated ROI for vapor recovery for MPE was approximately 60 to 100 feet as documented in Section 5 of Appendix E.

4.2 H_2A DPE PILOT TESTING (RW-4A/RW-5) IN 2005

H_2A conducted DPE pilot testing in comparison to MPE from wells RW-4A and RW-5 in 2005 (Appendix E). The MPE/DPE comparison pilot tests were designed to evaluate formation response (drawdown, vacuum and capture zone radii of influence) and LNAPL and water production characteristics of the two technologies. The critical difference between these two technologies is the creation of a groundwater cone of depression in DPE by depressing the water table via pumping. The DPE pilot tests were specifically designed to create a groundwater cone of depression in the formation surrounding the extraction wells while simultaneously applying vacuum to the formation via the extraction well. H_2A's mobile MPE system was utilized to apply vacuum and to power the downhole electric submersible pumps

utilized to extract fluids. In addition, automated fluid and pressure data loggers were installed in multiple wells to capture drawdown and vacuum data.

The DPE pilot tests at RW-4A and RW-5 required pumping large quantities of water to recover relatively small amounts of LNAPL. Figures 4-9 and 4-10 present comparisons of the volumes of water and LNAPL produced at RW-4A and RW-5, respectively. The LNAPL recovery rates achieved were quite low compared to other more productive wells in northern Hartford. This is likely related to the lack of significant mobile volumes of hydrocarbon in the vicinity of these wells during the tests.

The estimated ROI for vapor recovery for DPE at the tested flow rates documented in Section 5.2 of Appendix E was approximately 60 to 100 feet. The estimated ROI for liquid recovery for DPE at the tested flow rates documented in Section 5.2 of Appendix E was approximately 40 to 60 feet.

4.3 TECHNOLOGY COMPARISONS

Pilot test results for SVE, SPR, MPE and DPE are compared in the following sections to identify the most effective and efficient technology for the removal of LNAPL from the tested wells.

4.3.1 Comparison of MPE and DPE Pilot Testing

As part of H_2A's 2005 pilot testing within northern Hartford, H_2A completed MPE and DPE testing at the same locations as the 2004 MPE testing (RW-4A and RW-5 areas). The total petroleum hydrocarbons removed during both years' MPE pilot tests and the 2005 DPE pilot test at RW-4A and RW-5 are summarized in the following table:

Well	Test	Duration	Water (gal)	LNAPL (gal)	LNAPL / Water Ratio	Vapor (gal)	Total Hydrocarbon (gal)
RW-4A	2004 MPE	40 days	NM	0	--	40	40
RW-4A	2005 MPE	77 hours	401	11	0.03	25.5	36.5
RW-4A	DPE	21 hours	6085	12	0.002	15.2	27.2

Well	Test	Duration	Water (gal)	LNAPL (gal)	LNAPL / Water Ratio	Vapor (gal)	Total Hydrocarbon (gal)
RW-5	2004 MPE	19 days	NM	0	--	9.5	9.5
RW-5	2005 MPE	21 hours	9	3	0.33	13.6	16.6
RW-5	DPE	29 hours	16,086	15	0.0009	24.5	39.5

NM – Not Measured

Variability is observed between the various MPE and DPE Pilot Tests. However, the following comparative conclusions can be drawn:

- Sustainable LNAPL removal rates by both MPE and DPE from these wells are low. However, the water production required to implement DPE is approximately 15 to 1,800 times greater than with MPE. Consequently, LNAPL removal via MPE is considerably more efficient than via DPE. This is consistent with pilot test results from other wells in northern Hartford wherein increasing water production rates did not significantly increase LNAPL removal rates.
- During the MPE pilot tests at RW-4A and RW-5, the majority of petroleum recovery came from vapor-phase removal, indicating that the wells will not provide sustainably high liquid LNAPL removal rates.
- Field observations indicate that for each of the MPE and DPE tests, an estimated 80 to 90% of the total liquid LNAPL recovery occurred within approximately the first four hours.

4.3.2 Comparison with SVE and SPR Pilot Tests

An SVE pilot test was conducted in January 2004 for a period of 14 consecutive hours at a single 4-inch well located approximately 100 feet southeast of RW-4. The pilot test well was screened from 7-17 feet below ground surface (bgs). The SVE pilot test resulted in a calculated petroleum recovery rate of approximately 85 gallons per day (gpd). The ROI was estimated at 150 to 200 feet based on observed vacuum response (which was greater than the observed ROI of 60 to 100 feet for MPE, or an estimated 10 to 30 feet for skimming). This pilot test was conducted for one day only; therefore, the petroleum recovery rate could be anticipated to drop after extended operation. By comparison, over the most recent two months of operation, where the present regional well network has been complete, a petroleum recovery rate of approximately 400 gpd (approximately 12 gpd per well based on 34 wells) for the SVE

system has been observed. This site-wide SVE network includes shallow wells in less impacted soils to control vapor migration, so this recovery rate may underestimate the potential effectiveness of LNAPL removal via SVE.

SPR pilot testing was conducted in 2004 on recovery wells RW-2 and RW-3, which are located within 10 feet of wells RW-5 and RW-4A, respectively. The SPR testing conducted at the two recovery wells indicated steady and continuous decreases in product thickness in the test wells throughout the entire pumping period (Tables 4-1 and 4-2, respectively). No influence due to skimming was observed in adjacent wells during this pilot test (all observed LNAPL thickness variations appear to be due to seasonal water table fluctuations as predicted by the Dual Optimal LNAPL Response model [DOLR, see Section 4.4]). Therefore the ROI is estimated at 10 to 30 feet.

Approximately 1,191 gallons of LNAPL were recovered from RW-2 during the SPR pumping period (27.6 gpd). The hydrocarbon thickness recovery percentage 28 days after pumping was discontinued was 95%. Approximately 50 gallons of LNAPL were recovered from RW-3 during the SPR pumping period (1.9 gpd). The hydrocarbon thickness recovery percentage 28 days after pumping was discontinued was 49% at RW-3. The rate of recharge graphs for these wells were previously provided in the SPR pilot test report (Clayton, May 2004).

The average SPR pumping rate decreased from 27.6 gpd to approximately 5 gpd at the RW-2/RW-5 area from late summer 2004 through late summer 2005. SPR data from the same time period indicates that the pumping rate at the RW-4A/RA-3 area remained minimal, but relatively stable (approximately 3 gpd) (Table 4-3).

4.3.3 Comparison of SVE, Skimming, MPE and DPE

A direct comparison of 2005 MPE and DPE testing at RW-4A and RW-5 to the 2004 SPR pilot testing is not appropriate without considering the decreasing production of the wells. The relatively higher LNAPL recovery rates achieved during the initial SPR pilot test in 2004 were not sustainable; therefore, they cannot be compared to the 2005 MPE/DPE pilot test results after the majority of mobile recoverable LNAPL in the vicinity of the wells had apparently been removed. However, the SPR production rates during sustained operations from the wells in 2005 are directly comparable to the MPE/DPE pilot test

results in 2005. This data, like that generated at most of the wells that underwent MPE and DPE pilot testing in 2005, indicated that low to moderate amounts of LNAPL were re-entering the wells and that sustainable LNAPL recovery rates at these locations would be limited.

The following conclusions can be made in comparing MPE, DPE, SVE and SPR at the RW-2/RW-5 and RW-3/RW-4A areas:

- Liquid petroleum recovery at the RW-3/RW-4A area is limited with SPR, DPE and MPE. Vapor recovery using SVE is more efficient at recovering LNAPL at this location.
- Liquid petroleum recovery at the RW-2/RW-5 area, while initially moderate to high during the 2004 SPR pilot test, had dropped significantly to the point where liquid removal cannot be significantly enhanced with SPR, DPE or MPE. Vapor recovery using SVE is anticipated to be more efficient at recovering LNAPL at this location.
- DPE and MPE provide low LNAPL recovery rates that are higher than SPR LNAPL recovery rates.
- DPE requires 15 to 1,800 times greater water production than MPE.

Based on the pilot tests, MPE provided a better combination of both LNAPL removal effectiveness and efficiency compared to SPR and DPE. However, for the specific wells tested, due to their relatively low LNAPL removal rates, SVE may also represent an efficient LNAPL recovery technology.

4.4 DUAL OPTIMAL LNAPL RESPONSE (DOLR) MODEL

This section includes a description of the model developed to explain the variations in LNAPL thickness and production in northern Hartford due to fluctuating water table conditions. DOLR explains the difference in LNAPL thickness and production trends observed under confined versus unconfined conditions in northern Hartford. Under unconfined conditions, a falling regional water table produces increased LNAPL thicknesses and production rates. Under confined conditions, a rising water table produces increased LNAPL thicknesses and production rates. A more detailed discussion of this model including the production hydrostratigraphs from which it was derived is provided in Appendix E.

DOLR can explain the seasonal variations in LNAPL thicknesses that occur due to changing aquifer levels. DOLR can also be used to predict the relative LNAPL production capacity of wells on the basis of the water table elevation and historical well production during MPE Pilot Testing in 2005.

The DOLR model conforms to both site-specific evidence and theory of LNAPL response to fluctuating water table conditions that periodically create confined and unconfined conditions for the LNAPL and water in the Main Sand. Basically, the DOLR model states that LNAPL thicknesses and production rates increase in response to two conditions:

- Confining conditions that create a hydrostatic head driving LNAPL into the wells, which act as pressure relief points for LNAPL accumulation.
- Unconfined conditions that allow drainage of LNAPL (above residual LNAPL concentrations) from the upper portion of the Main Sand as the water table falls and LNAPL accumulates at the water/LNAPL/Air interface zone.

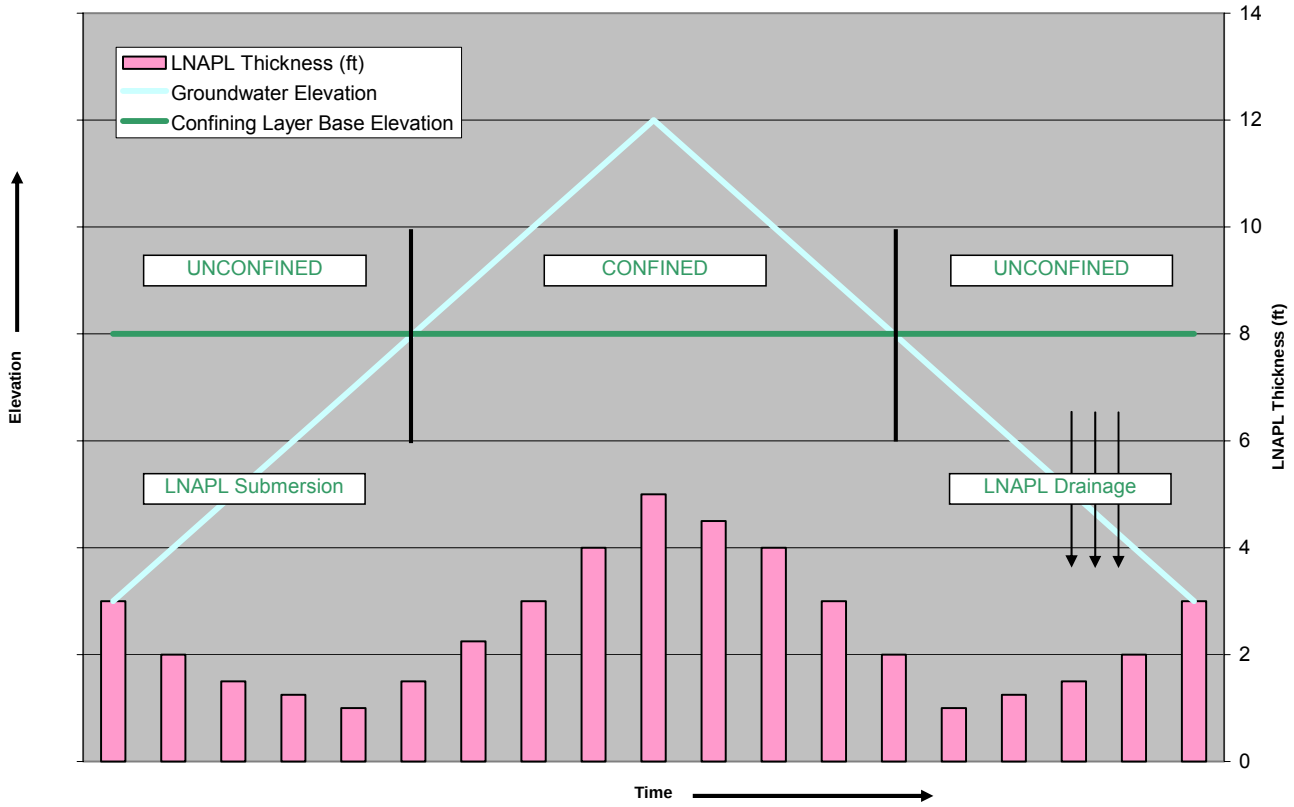
In summary, LNAPL thicknesses and production capacities are at their highest during confined conditions and during unconfined conditions where water table elevations have dropped sufficiently to release submerged residual LNAPL, thus allowing accumulation. LNAPL thicknesses, production and recharge may be low during intermediate unconfined water table elevations when lower mobile LNAPL volumes are available and the driving confining pressure maximizing LNAPL drainage into the wells is eliminated. The figure below shows relative LNAPL thicknesses the DOLR model predicts during changing water table scenarios. While the figure below is an idealized depiction, it illustrates the rising LNAPL thicknesses during confined conditions and also the rising LNAPL thickness in an unconfined and falling aquifer caused by LNAPL drainage.

The DOLR model explains the variations in LNAPL thickness and production capacity observed in the Main Sand wells as a result of water table fluctuations, and can also be utilized to predict relative LNAPL production rates based on water table elevations, stratigraphic contact elevations, and well construction details. Therefore, the DOLR model represents not just an explanatory model of LNAPL conditions, but also a predictive tool for the management and implementation of remediation options in northern Hartford. Implications for the DOLR model to technology selection include the following:

- The DOLR model demonstrates that during confined conditions, maximum LNAPL removal is achieved via MPE utilizing the formation confining pressure to drive LNAPL into the well to achieve the highest LNAPL removal rates with very low water production. By contrast, DPE would result in decreased LNAPL removal rates and much higher water production rates under these conditions as the associated drawdown would eliminate the natural confining pressures driving LNAPL into the wells.

- DOLR identifies the cause and timing for significant variations in LNAPL thickness and production from the same well during different fluid elevations in the formation. Consequently, the selected remediation technology(ies) must be flexible enough to adapt to each of these different conditions.

Idealized Dual Optimal LNAPL Response (DOLR) Model Depiction



5.0 LNAPL MODELING

To evaluate various LNAPL recovery methods in northern Hartford, RETEC completed predictive LNAPL recovery modeling using the API LNAPL distribution and recovery model (Charbeneau, 2003). RETEC's report, *LNAPL Distribution and Recovery Model Summary*, is included in Appendix D and provides a more detailed discussion than is presented herein.

The API model predicts both LNAPL distribution and recovery at a given soil core location. The distribution portion of the API model predicts LNAPL saturation and permeability based on measured LNAPL thickness in a monitoring well and several site-specific soil, fluid (i.e., LNAPL and groundwater), and soil-fluid interaction parameters. Using the results of the distribution model, the recovery portion of the API model predicts LNAPL recovery over time, using different methodologies. After predicting LNAPL recovery, the model results were validated against actual LNAPL recovery data from northern Hartford.

The objective of the API modeling work was to evaluate the relative effectiveness of LNAPL recovery technologies. The technologies evaluated included:

- Skimmer Pump Recovery (SPR) – Floating LNAPL recovery pumps which do not induce a significant cone of depression.
- Vacuum-Enhanced Skimmer Pump Recovery (VES) – SPR with vacuum extraction at the well to enhance LNAPL recovery rates. Assumed to be analogous to multi-phase extraction (MPE).
- Dual-Pump Recovery (DPR) – LNAPL and groundwater pumps to remove water and LNAPL and lower the water table near the extraction area to create a cone of depression.
- Dual-Phase Extraction (DPE) – DPR with vacuum extraction at the well to enhance the LNAPL recovery rates.

The model was not used to evaluate LNAPL recovery or vapor-phase LNAPL removal via SVE or other technologies similar to SVE, because the model was not designed to calculate vapor recovery. Modeling was conducted using site-specific LNAPL and subsurface characterization data collected from five (5) locations (HCSB-1 through 5, in Figure 3-15). As described in Section 3.0, these locations were considered to be representative of differing geologic/hydrogeologic settings, spatial distribution of LNAPL and different product types (i.e., GRO or DRO) found in northern Hartford.

The model was also applied to generate an LNAPL-specific thickness (feet^3/feet^2) (D_o) for a given measured LNAPL well thickness based on the soil core characterization data. D_o is the integral of LNAPL saturation over the entire length of the soil column, also known as the specific thickness of LNAPL (i.e., the true amount of LNAPL in the subsurface) over a given soil column area. This should not be confused with or conceptualized as a continuous layer of LNAPL in the soil formation (i.e., a "pool" or "pancake" of LNAPL does not exist in the porous media in the subsurface). Instead, it represents a total thickness of LNAPL which is often disseminated in discontinuous pockets, throughout the LNAPL-impacted soil column. In most cases, measured LNAPL thicknesses in monitoring wells do not accurately represent the true thickness of LNAPL in the subsurface because liquid-solid capillary forces do not exist in a monitoring well due to the absence of soil, and the LNAPL thickness measured in a well is exaggerated due to density differences between LNAPL and water (Appendix D). The measured LNAPL thickness versus the calculated D_o at each of the five core sample locations is shown in Table 5-1. A discussion of D_o and its application across northern Hartford is provided in the CSM (Clayton, 2005).

The recovery modeling predicted the following:

- LNAPL recovery using DPE, DPR or VES (assumed to be analogous to MPE), was approximately 3 to 30 times greater than SPR (see Table 5-2).
- The same relative LNAPL recovery using DPE, DPR or VES.
- The highest LNAPL recovery was at HCSB-1 (HMW-44C area).
- Approximately 80 to 90% of LNAPL recovery at HCSB-1 would occur in the first year.

The modeled recovery data is also shown in Figures 5-1 to 5-5. Modeled recovery results were also evaluated by comparing predicted recovery volumes for MPE to actual recovery volumes from pilot testing at HMW-44C (refer to Section 4.0). The modeling results matched pilot test results that indicated the HMW-44 area was the highest production area.

6.0 IDENTIFICATION AND EVALUATION OF REMEDIAL ALTERNATIVES

This section includes LNAPL recovery objectives (Section 6.1), descriptions of the potentially applicable recovery technologies for addressing LNAPL in north Hartford (Section 6.2), descriptions of the criteria used to evaluate the alternatives (Section 6.3), and the alternative evaluations for addressing unique conditions in different areas of north Hartford (Sections 6.4 through 6.6), including proposals for active LNAPL recovery in the respective areas.

The eight LNAPL recovery technology alternatives evaluated were based on the CSM, current knowledge of the LNAPL composition, pilot testing results, recovery modeling, remediation technology experience, and USEPA directive (May 9, 2005 letter to the HWG). The technologies were defined in Section 1.0 and are discussed in greater detail in Section 6.1.

Characteristics and recoverability of the LNAPL varies by area in north Hartford as indicated in Sections 3.0 and 4.0. Technology options are evaluated separately for different areas of north Hartford based on recovery / recharge rates and LNAPL characterization. The data used to support this evaluation primarily included:

- ROST signature (Figure 6-1)
- Corrected (D_o) LNAPL thickness (Figure 6-2)
- LNAPL removal category (Figure 6-3)
- LNAPL recharge rates (Figure 6-4)
- Primary removal phase during HVR (Figure 6-5)

Recoverability and recharge of LNAPL in monitoring wells was divided into areas of high, moderate, and low rates, as described in Section 4. Table 6-1 includes the information used to define the different recovery areas in north Hartford. The area surrounding well HMW-44 exhibited high liquid-phase LNAPL recovery and recharge rates relative to other areas and was designated “Area A”. Localized areas outside Area A exhibiting moderate liquid-phase recovery and recharge rates were designated “Area B”. Area B was further divided into subsections B1 thru B4 based on further consideration of product type or recovery rates (Table 6-1). The remaining area of North Hartford exhibited poor liquid-phase recovery and recharge rates and higher vapor than liquid-phase LNAPL production and consequently was designated “Area C”. These areas are conceptually shown in Figure 6-6. Alternatives for LNAPL

recovery were evaluated individually for each of the different areas. The representation of these areas may change during the 90% design process to reflect areas of similar recoverability and recharge.

6.1 LNAPL RECOVERY OBJECTIVES

The following Active Recovery System Objectives are used to evaluate the effectiveness of the active recovery alternatives:

- Control the threat, if any, to human health via ingestion of constituents in groundwater which could result from subsurface oil identified in northern Hartford reaching the Hartford Municipal Wells or its five-year recharge area; and
- Control the threat, if any, to human health via inhalation of vapors above designated levels that arise from subsurface oil identified in northern Hartford; and
- Control the threat, if any, of potential oil releases to the Mississippi River that arise from subsurface oil identified in North Hartford; and
- Actively recover, as required, subsurface oil in the form of either LNAPL (mobile or residual), or vapors to mitigate the threat of vapor inhalation, discharge to the Mississippi River and impact on the Hartford Municipal Wells.

The selected technologies will be used to their practical or effective limits to achieve the objectives. The existing and planned expansion of the SVE system will continue to operate to remove non-mobile LNAPL in the vadose zone, with the added benefit of vaporization of the predominantly GRO LNAPL (residual and mobile). Given the two-fold effectiveness of SVE (LNAPL removal and vapor intrusion mitigation) operation of the SVE system is an integral part of the proposed active recovery alternatives.

6.2 DESCRIPTION OF IDENTIFIED LNAPL RECOVERY TECHNOLOGIES

6.2.1 Dual Phase Extraction

DPE refers to use of a groundwater depression pump and LNAPL pump similar to a dual pump recovery system (additional detail in Section 6.1.2 below), but with the addition of vacuum enhancement. When LNAPL sustainable production is low, hydrocarbon removal is primarily through SVE. DPE is operated in a series of recovery wells with water sent for treatment and LNAPL sent to storage for re-use. A DPE

system lowers the water table and produces a cone of depression. High volume drawdown pumping is typically applied when hydraulic control of an actively mobile plume is needed. A cross section view of a DPE system is provided in Figure 6-7.

6.2.2 Dual Pump Recovery

A DPR system is designed to pump LNAPL and groundwater from recovery wells or trenches. Pumping removes water and lowers the water table near the extraction area to create a cone of depression. The cone of depression in the vicinity of the extraction well produces a gravity head that, depending upon the degree of mobility of the LNAPL, causes flow of LNAPL toward the well and increases the thickness of the LNAPL layer in the well. Under favorable conditions, the production of a cone of depression will increase LNAPL recovery rates. The dual pump configuration uses one pump located below the water table to remove water to create the groundwater depression and a second located in the LNAPL layer to recover LNAPL. A cross section view of a dual pump recovery system is provided in Figure 6-8.

Drawdown pumping can be effective for LNAPL recovery when the aquifer has moderate to high hydraulic conductivity and a thick layer of low-viscosity LNAPL (spread over a large area). On the other hand, dual pumping is not as effective when the aquifer exhibits high residual LNAPL saturation or high sorption capabilities, in which case the residual LNAPL is difficult to remove from soil pores.

6.2.3 Multi-Phase Extraction

MPE, sometimes referred to as bioslurping, is a technology that uses a high vacuum system to remove various combinations of groundwater, LNAPL, and hydrocarbon vapor from the subsurface. MPE is an in situ remedial technology that can simultaneously accomplish LNAPL removal in the saturated zone and soil remediation in the unsaturated zone. MPE provides the flexibility to vary stinger depths to accommodate seasonal groundwater fluctuations without extracting large quantities of groundwater. Liquid removal using a high vacuum system allows LNAPL to be lifted off the water table and released from the capillary fringe. This also minimizes changes in the water table elevation, which in turn minimizes the creation of a smear zone. MPE of unsaturated zone soils is achieved by vacuum extraction of soil gas via the recovery well. A cross section view of a MPE system is provided in Figure 6-9.

In MPE systems for liquid/vapor treatment, a high vacuum system is utilized to remove liquid and vapor from low permeability or heterogeneous formations. The vacuum extraction well includes a screened section in the zone of impacted soils and groundwater. MPE removes hydrocarbons from above and below the static water table within the limits of drawdown, unlike SVE or VES, which tends to mound groundwater and only remove hydrocarbons above the mounded water table. Hydrocarbons in the unsaturated zone are also accessible to vapor extraction. MPE is also applicable at sites with a deep groundwater table (>30 feet). Extracted liquids are collected for disposal.

The effectiveness of MPE can be limited in low-permeability soils (K<1E-05 cm/s), if no secondary permeability and porosity features providing preferential pathways for hydrocarbons are present. Frequently, the off-gas from a MPE system requires treatment before discharge. Since the fuel, water and air are removed from the subsurface in one stream, mixing of the phases occurs. These mixtures may require special oil/water separators or treatment before the process water can be discharged.

6.2.4 Skimmer Pump Recovery

SPR systems recover floating LNAPL only, and do not generally induce a significant cone of depression. Floating filter recovery systems, for example, can remove LNAPL down to thin layers as they track fluctuations in the water table. Although recovery rates are generally smaller than with submersible pumping systems, skimmer systems have the advantage that treatment of water is not required. Such systems tend to be most suitable for highly permeable formations, or where recovery rates would not be sufficient to justify the operation of a more costly and/or aggressive recovery system. A cross section view of a skimmer pump recovery system is provided in Figure 6-10.

6.2.5 Vacuum-Enhanced Skimmer Pump Recovery

VES is a technology that uses very similar principles to skimmer pump systems to recover LNAPL (see Section 6.1.4). VES utilizes the enhancement of vacuum extraction on the skimmer pump well to assist with LNAPL recovery rates, usually at lower vacuums than SVE or MPE systems. VES can be a cost-effective in situ remedial technology that can simultaneously accomplish LNAPL removal and soil remediation in the unsaturated zone, but is generally more effective in highly permeable soils, where upwelling of LNAPL and water in a well is limited. Minimal groundwater extraction is an advantage of this

method. Off-gas treatment requirements are also similar to those required with MPE and SVE. A cross section view of vacuum enhanced skimming is provided in Figure 6-11.

6.2.6 Soil Vapor Extraction

SVE is an in situ remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove VOCs and lighter end SVOCs. Exhaust gas resulting from the process may require treatment to recover or destroy the chemicals of concern, depending on local and state air discharge regulations. Vertical extraction wells are typically used at depths of 5 feet or greater and have been successfully applied as deep as 300 feet.

Soil that has a high percentage of fines and a high degree of saturation can hinder the operation of the SVE system and requires higher vacuums, which results in increasing costs. A cross section view of a SVE system is provided in Figure 6-12.

6.2.7 Periodic Manual Removal

PMR refers to the recovery of LNAPL by hand using various equipment types, or with a mobile vacuum unit. Removal by hand can be conducted using dedicated or disposable bailers, or with a peristaltic or submersible pump. A mobile vacuum truck can also be used to “quickly” remove LNAPL from the well without sustained operation (i.e., < 10 minutes). Each of these techniques is easily implementable; most notably, they lack any required construction (with the potential exception of additional required well installation). Use of a mobile unit may require the cost associated with multiple mobilizations. On the other hand, use of a mobile unit may be more effective at removing LNAPL on a shorter-term basis than by hand. Periodic manual removal is most appropriate for low to moderate LNAPL volumes, as can be encountered in low permeability aquifers (K<1E-05 cm/s) or for moderate LNAPL accumulations (< 6 in. accumulation in wells) in higher-permeability groundwater units (TCEQ, 2002, TRRP-32, NAPLs, Draft Version 8.0, October 18, 2002, Texas Risk Reduction Program, Texas Commission on Environmental Quality, Austin, Texas).

6.2.8 Periodic Multi-Phase Extraction

PMPE refers to operation of MPE on an as-needed basis, or at specified intervals, using a mobile extraction unit. PMPE has some of the same advantages as MPE, including the ability to address all LNAPL phases simultaneously and the flexibility to vary stinger depths to accommodate groundwater fluctuations. PMPE can be successfully implemented in low production and recharge areas due to its periodic nature, and can be conducted using either commercial vacuum trucks or PMPE systems (either internal combustion engine [ICE] or liquid ring pump [LRP] systems).

6.3 EVALUATION CRITERIA

The alternatives were evaluated on the basis of the criteria identified in the AOC (Section VI. Paragraph 53), which are protectiveness, long-term effectiveness, implementability, and cost. Short-term effectiveness and community impact were also evaluated. For evaluating each of these criteria, the following sources from both the Resource Conservation and Recovery Act (RCRA) and the Comprehensive, Environmental Responsibility Compensation, and Liability Act (CERCLA) programs were used: 40 CFR 300.430 (*Remedial Investigation/Feasibility Study and Selection of Remedy*), and USEPA (*A Guide to Selecting Superfund Remedial Actions*, 1990; *RCRA Corrective Action Plan*, 1994; *The Role of Cost in the Superfund Remedy Selection Process*, 1996; and *Rules of Thumb for Superfund Remedy Selection*, 1997). A brief description of the evaluation criteria are provided below.

Protectiveness

Protectiveness is defined as overall protection of human health and the environment. This criterion addresses whether or not a remedy provides adequate protection of both short- and long-term risks to human health and the environment.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time during the construction and implementation of the recovery system. Specifically, the following are considered under this criterion:

- Short-term risks that might be posed to the community during implementation of an alternative;
- Potential impacts on workers (both operational and construction safety) during recovery system operation and the effectiveness and reliability of protective measures; and
- Potential environmental impacts of the recovery system and the effectiveness and reliability of mitigative measures during implementation.

Long-Term Effectiveness

Each alternative is also evaluated for long-term reliability and effectiveness. This criterion evaluates the ability of the recovery approach to control the threats as identified in Sections 1.0 and 6.1 for the long-term by evaluation of the permanence that the recovery method affords, and the degree of certainty that the alternative will prove successful.

Specifically, each alternative will be evaluated based on site-specific conditions for its ability to recover and manage LNAPL by a practical means to achieve the overall recovery goals, as detailed above, over time. Also considered under long-term effectiveness is the type of residuals that may remain onsite and their management.

Implementability

Implementability refers to the ease or difficulty of implementing the alternative, and is assessed by considering both the technical and administrative feasibility of a remedy. Technical implementability considers site-specific constraints that may make an alternative infeasible (e.g., infrastructure and accessibility). Evaluation of administrative implementability considers institutional aspects such as the ability to obtain permits, the availability of treatment, storage and disposal services, and the availability of equipment and other resources, including the availability of materials and services needed to implement a particular option.

Community Impact

Community Impact refers to issues that could affect the public in the Village of Hartford during operation of the selected recovery technology, including aesthetic, noise and odor, general convenience, traffic disruption, and structural stability factors.

Cost

Cost is an appropriate consideration in the selection of a recovery technology. Cost considerations include estimated capital and operation and maintenance costs; cost totals are typically presented as net present worth estimates. Assuming comparable protectiveness, cost can be used to aid in selection between alternatives that are also comparable in effectiveness and implementability. Cost is not used to justify the selection of a recovery technology that is not effective in achieving the objectives.

Current Status of the Active Recovery Objectives

- Control the threat, if any, to human health via ingestion of constituents in groundwater which could result from subsurface oil identified in northern Hartford reaching the Hartford Municipal Wells or its five-year recharge area.

Based on groundwater sampling results collected since December 2003 (quarterly since April 2004), the sentinel wells have not been impacted. These sentinel wells are located between the five-year recharge zone for the Hartford municipal wells and the LNAPL plume to the north. Groundwater flow and direction has historically been depicted in a general northerly direction, which also has been evident in recent investigations. Based upon the current understanding of groundwater flow and direction, and no groundwater impact noted in the sentinel wells, there is no evident risk to human health via ingestion of constituents in groundwater resulting from subsurface oil identified in northern Hartford reaching the Hartford municipal wells or their five-year recharge area.

- Control the threat, if any, to human health via inhalation of vapors above designated levels that arise from subsurface oil identified in northern Hartford.

The HWG has implemented building-specific Interim Measures to break the potential vapor intrusion pathway, and to periodically assess the integrity of the building-specific measures. In addition, a Contingency Plan is in place to respond to potential vapor intrusion events and undertake, if needed, appropriate protective measures. On a larger scale, the HWG has implemented an SVE system to address potential vapor intrusion at the Site by regionally breaking the potential pathway of vapors from the subsurface into buildings. The *Draft – Effectiveness Monitoring Plan* (submitted by the HWG to the Agency December 9, 2005) proposes a methodology to monitor the effectiveness of the SVE system; monitoring to date has shown that the SVE system is successful at preventing vapor entry into buildings, based on the proposed criteria. Further, the SVE system is currently being expanded to cover the entire area of potential vapor intrusion. The HWG intends to continue to operate the SVE system, so long as necessary (currently in place and after expansion) to provide an effective break in the vapor intrusion pathway, thus controlling the risk to human health via inhalation of vapors above designated levels that arise from subsurface oil in northern Hartford.

- Control the threat, if any, of potential oil releases to the Mississippi River that arise from subsurface oil identified in northern Hartford.

The HWG implemented a sewer monitoring program in and around the Hartford Community Center (HCC) in 2004 following the identification of vapor intrusion issues. Observations made as part of this monitoring program did not indicate the presence of oil in the sewers that would have the potential to cause a release to the Mississippi River. Neither observations of the sewers through direct inspection, work in and around other construction activities nor during rehabilitation by the Village of Hartford have identified the presence of oil. Additionally, the majority of the sewer system in northern Hartford is a combined system (storm and sanitary combined) and is directly discharged to the Wood River wastewater treatment facility for treatment prior to discharge to the Mississippi River. The remaining sewers not combined with the sanitary sewers drain to ditches along Route 3 with no direct connection to the Mississippi River.

Furthermore, a comparison of historic representations of the LNAPL plume location with the location of the plume today shows that the location has become smaller in size and stabilized in location

- Actively recover, as appropriate, subsurface oil in the form of either LNAPL (mobile or residual), or vapors to further mitigate the threat of vapor inhalation, discharge to the Mississippi River and impact on the Hartford Municipal Wells.

The proposed approach for active recovery of LNAPL is presented in this document. The approach for determining the achievement of the objective will be on the basis of oil recoverability or recovery rates. For example, the use of an additional oil recovery technology is proposed in conjunction with soil vapor extraction for areas of Hartford. When the recovery rate of the additional technology reaches a similar rate to soil vapor extraction alone, continuation of the additional technology may no longer be practical. Further refinement of the decision point determination will be included in the 90% design document. An additional benefit of the proposed recovery will be the favorable effects on other environmental media.

6.4 EVALUATION OF RECOVERY ALTERNATIVES FOR AREA A

Key factors considered in identifying areas for LNAPL recovery (e.g., LNAPL composition, modeling and pilot test data) are provided in Table 6-1. The subsequent alternative evaluation for each area was based on the criteria outlined in Section 6.3 and is summarized in Table 6-2. A summary of estimated cost ranges for each alternative in Area A are presented in Table 6-3 for relative comparison purposes. This information forms the basis for selecting a recovery system for Area A. Key factors considered in evaluating the criteria for Area A (6.4.1), and a narrative of the alternative selection process (6.4.2), are provided below.

6.4.1 Key Factors for Alternative Selection

A more detailed explanation for the alternative evaluation factors is provided in Table 6-2 for each of the alternative technologies.

DPE/DPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media similar to MPE/VES (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)

- **Short-term Effectiveness** – Pressurized lines for water and LNAPL could have potential for release, extensive infrastructure necessary

- **Long-term Effectiveness** – Recovery similar to MPE and VES, similar ROI as MPE, creates smear zone, hydraulic control of LNAPL plume unnecessary, low flexibility to changing hydrogeologic conditions, pump fouling

- **Implementability** – Requires large Waste Water Treatment Plant (WWTP), permitting, ROI necessary to implement can be achieved with high pumping rate, effective on both GRO and DRO areas of plume

- **Community Impact** – Excavation of streets, sensitive concern for perceived potential foundation impact due to pumping, aesthetic concerns

- **Cost** – Relative cost 2 to 3 times higher than MPE, VES, SPR

MPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media with same effectiveness as DPE/DPR/VES (SVE throughout northern Hartford addresses potential vapor intrusion pathway)

- **Short-term Effectiveness** – Vacuum lines for vapor offer limited potential for release, pressurized lines for LNAPL potential for release

- **Long-term Effectiveness** – Similar recovery as DPE, DPR and VES, similar ROI as DPE and DPR, flexible to changing hydrogeologic conditions, effective on both GRO and DRO areas of plume

- **Implementability** – Little water generated, uses some existing infrastructure and some new infrastructure vapor/liquid separator necessary in Area A, vapor treatment required, offsite blower/vapor treatment requires crossing railroad tracks

- **Community Impact** – Excavation of streets, less equipment in village for operation

- **Cost** – Relative cost almost 3 times less than DPE/DPR, comparable to VES and SPR

SPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address vapor intrusion pathway)

- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release

- **Long-term Effectiveness** – Less than half the LNAPL recovery of DPE, DPR, MPE and VES, and low model-predicted LNAPL recovery in Area A, limited ROI, relies on natural groundwater elevation fluctuations to be effective

- **Implementability** – Limited access for required well spacing, little water generated, storage tanks will be necessary in village, effective on both GRO and DRO areas of plume

- **Community Impact** – Excavation of streets, multiple wells/tanks and air compressors throughout village

- **Cost** – Relative cost half that of DPE/DPR, comparable to MPE, VES

VES

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)

- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release

- **Long-term Effectiveness** – Similar LNAPL recovery as DPE, DPR and MPE, ROI similar to MPE, , less effective under confined hydrogeologic condition, effective on both GRO and DRO areas of plume

- **Implementability** – Little water generated, storage tanks will be necessary in the village, vapor treatment required, offsite blower/vapor treatment requires crossing railroad tracks

- **Community Impact** – Excavation of streets, multiple tanks and air compressors throughout village

- **Cost** – Relative cost almost 3 times less than DPE/DPR, comparable to MPE, SPR

SVE

- **Protectiveness** – Planned throughout northern Hartford to address potential vapor intrusion pathway, LNAPL recovery reduces constituent source to environmental media

- **Short-term Effectiveness** – Vacuum lines for vapor offer limited potential for release

- **Long-term Effectiveness** – Existing system effective at mass removal, most of plume is GRO, good ROI, high groundwater elevation reduces effectiveness

- **Implementability** – Infrastructure exists for planned expansion, ROI will achieve effectiveness via accessible areas, vapor treatment required

- **Community Impact** – Excavation of streets, no operating equipment in village

- **Cost** – Incremental cost low due to existing and planned expansion to SVE system

PMR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Minimal safety concerns
- **Long-term Effectiveness** – Small ROI, lengthy timeframe for recovery
- **Implementability** – Additional wells required for infrastructure, labor intensive operation
- **Community Impact** – Traffic safety, release potential via manual transfer of LNAPL from well to tank
- **Cost** – Relative cost 5 times less than DPE/DPR, slightly less than PMPE, half that of SPR, VES and MPE

PMPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness –** Vacuum lines offer limited potential for release, traffic safety, LNAPL handling with mobile tanks
- **Long-term Effectiveness –** Successful in low production/recharge areas, , flexible to changing hydrogeological conditions, limited production and long life-cycle due to discontinuous operation
- **Implementability –** Mobile unit with vapor treatment required, no infrastructure except new wells required
- **Community Impact –** potential disruption of traffic and residents during operation, noise and odor concerns during operation
- **Cost –** Relative cost 5 times less than DPE/DPR, slightly higher than PMR, half that of SPR, VES and MPE

6.4.2 Alternative Selection Narrative

In a high LNAPL mass area such as Area A, a permanent remedial system compares more favorably than PMPE and PMR in long-term effectiveness, because of the anticipated long life-cycles of these periodic technologies. Thus, the periodic mobile technologies were eliminated from consideration and only the more aggressive technologies were considered (DPE, DPR, MPE, VES, SPR, and SVE).

MPE pilot testing data for Area A demonstrated that high volumes of LNAPL could be removed from this area. The API model results for Area A indicate similar LNAPL recovery with DPE, DPR and VES and less recovery with SPR (refer to recovery vs. time plots in Figures 5-1 to 5-5). MPE is similar to VES in the modeling context, and it is assumed they would have a similar modeled recovery volume. Actual recovery volumes for MPE in northern Hartford are anticipated to be higher than VES, because upwelling will likely limit the vacuum influence of VES. The stinger used in MPE minimizes upwelling around the extraction wells. This allows the application of higher vacuum with MPE which can lead to greater recovery rates.

Also, based on the pilot testing data in northern Hartford, the recovery volumes were similar for the technologies tested (MPE and DPE). Since MPE and VES are enhancements to SVE and SPR, respectively, and pilot test data in Area A showed high liquid-phase petroleum recovery versus vapor-phase petroleum recovery, SVE is not expected to perform as well as MPE, and thus they are eliminated from consideration as primary LNAPL remedies in Area A. The remaining technologies, MPE, DPE and DPR, are evaluated for Area A based on the other criteria.

The DOLR model (Section 4.4) demonstrates that during confined conditions, maximum LNAPL removal is achieved via MPE utilizing the formation confining pressure to drive LNAPL into the well to achieve the highest LNAPL removal rates with very low water production. By contrast, DPE would result in decreased LNAPL removal rates and much higher water production rates under these conditions as the associated drawdown would eliminate the natural confining pressures driving LNAPL into the wells. Modeling results predicted that under unconfined conditions that MPE would be as effective as DPE. MPE would allow for optimal LNAPL recovery under both hydrogeologic conditions.

The Implementation difficulties (e.g., siting, lack of infrastructure, presence of utilities) and long timetable involved in constructing a WWTP and discharge line to the Mississippi River, and the long permitting timetables involved in implementing DPE and DPR, are among the reasons for not further considering these technologies in Area A. DPE and DPR also compared unfavorably to other technologies in short-term effectiveness, because of the many safety concerns associated with the required pressurized piping, vaults, aboveground storage tanks (ASTs), possible wellhead surge tanks, and other electrical/ mechanical equipment (including lift stations).

Large volumes of water are generally required to be withdrawn and managed when employing DPE and DPR. DPE and DPR may contribute to community concerns related to the potential effect of massive groundwater pumping on home foundations. In addition, as discussed in Section 2.2, the LNAPL plume has historically remained within the same general location since the late 1970s, and has decreased in magnitude. Therefore, the added benefit of hydraulic control that DPE and DPR can provide is not expected to be significant. Further, during low water-table conditions, DPE and DPR could potentially cause entrapment of LNAPL in pore spaces below the water table in areas free of LNAPL contamination.

As a last consideration, estimated capital and operation and maintenance (O&M) costs were developed to allow for a relative evaluation of the various technologies. Table 6-3 summarizes the relative evaluation cost ranges for each alternative in Area A. Due to the size of Area A and the infrastructure required for DPE and DPR, the cost ranges for DPR/DPE include implementation in both Areas A and B. Costs for DPR ($23MM to $26MM) and DPE ($25MM to $28MM) were approximately 2 to 3 times higher compared to the combined costs for Areas A and B for MPE ($9MM to $10.5MM) and VES ($9.5MM to $11.5MM). Costs for SPR ($14.25MM to $17.5MM) in Areas A & B combined were half that of DPE/DPR with MPE and VES being about ⅔ the cost for SPR. Combined Areas A and B cost for PMPE ($5.75MM to $7.25MM) and PMR ($4.25MM to $6MM) were 5 times less that DPE/DPR, half that of MPE/VES and approximately ⅓ the cost for SPR.

In summary, MPE was chosen as the recovery technology for Area A based on its protectiveness being equivalent or better than that of the other alternatives, the high LNAPL recovery comparable to the other alternatives, minimal water generation during operation, fewer implementability issues compared to the other technologies, and cost.

6.5 EVALUATION OF RECOVERY ALTERNATIVES FOR AREA B

Key factors considered in identifying areas for LNAPL recovery (e.g., LNAPL composition, modeling and pilot test data) are provided in Table 6-1. The subsequent alternative evaluation for each area was based on the criteria outlined in Section 6.3 and is summarized in Table 6-2. A summary of estimated cost ranges for each alternative in Area B are presented in Table 6-3. This information forms the basis for selecting recovery systems for Area B. Key factors considered in evaluating the criteria for Area B (6.5.1) and a narrative of the alternative selection process (6.5.2), are provided below.

6.5.1 Key Factors for Alternative Selection

A more detailed explanation for the alternative evaluation factors is provided in Table 6-2 for each of the alternative technologies

DPE/DPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media similar to MPE/VES (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Pressurized lines for water and LNAPL could have potential for release, extensive infrastructure necessary
- **Long-term Effectiveness** – Recovery similar to MPE and VES, similar ROI as MPE, creates smear zone, hydraulic control of LNAPL plume unnecessary, low flexibility to changing hydrogeologic conditions
- **Implementability** – Requires large WWTP, permitting, ROI necessary to implement can be achieved with high pumping rate, effective on both GRO and DRO areas of plume
- **Community Impact** – Excavation of streets, sensitive concern for perceived potential foundation impact due to pumping, aesthetic concerns
- **Cost** – Relative cost 2 to 3 times higher than MPE, VES, SPR

MPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media with same effectiveness as DPE/DPR/VES (SVE throughout northern Hartford addresses potential vapor intrusion pathway)
- **Short-term Effectiveness –** Vacuum lines for vapor offer limited potential for release, pressurized lines for LNAPL potential for release
- **Long-term Effectiveness** – Similar recovery as DPE, DPR and VES, similar ROI as DPE and DPR, flexible to changing hydrogeologic conditions, effective on both GRO and DRO areas of plume
- **Implementability** – Little water generated, uses some existing infrastructure and some new infrastructure, vapor/liquid separators necessary in Area B, vapor treatment necessary, offsite blower/vapor treatment requires crossing railroad tracks
- **Community Impact** – Excavation of streets, less equipment in village for operations

- **Cost** – Relative cost almost 3 times less than DPE/DPR, comparable to VES and SPR

SPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release
- **Long-term Effectiveness** – Less than half the LNAPL recovery of DPE, DPR, MPE and VES, and low predicted LNAPL recovery in Area A, limited ROI, relies on natural groundwater elevation fluctuations to be effective
- **Implementability** – Limited access for required well spacing, little water generated, storage tanks will be necessary in village, effective on both GRO and DRO areas of plume
- **Community Impact** – Excavation of streets, multiple wells/tanks and air compressors throughout village
- **Cost** – Relative cost half that of DPE/DPR, comparable to MPE, VES

VES

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release
- **Long-term Effectiveness** – Similar LNAPL recovery as DPE, DPR and MPE, ROI similar to MPE, less effective under confined hydrogeologic condition, effective on both GRO and DRO area of plume
- **Implementability** – Little water generated, storage tanks will be necessary in the village, vapor treatment required, offsite blower/vapor treatment requires crossing railroad tracks
- **Community Impact** – Excavation of streets, multiple wells/tanks and air compressors throughout village
- **Cost** – Relative cost almost 3 times less than DPE/DPR, comparable to MPE, SPR

SVE

- **Protectiveness** – Planned throughout northern Hartford to address potential vapor intrusion pathway, LNAPL recovery reduces constituent source to environmental media
- **Short-term Effectiveness** – Vacuum lines for vapor offer limited potential for release
- **Long-term Effectiveness** – Existing system effective at mass removal, Only GRO and light-end DRO portion of B4 plume can be addressed, good ROI, high groundwater elevation reduces effectiveness
- **Implementability** – Infrastructure exists for planned expansion, ROI will achieve effectiveness via accessible areas, vapor treatment required
- **Community Impact** – Excavation of streets, no operating equipment in village
- **Cost** – Incremental cost low due to existing and planned expansion to SVE system

PMR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Minimal safety concerns
- **Long-term Effectiveness** – Small ROI, lengthy timeframe for recovery
- **Implementability** – Additional wells required for infrastructure, labor intensive operation
- **Community Impact** – Traffic safety, release potential via manual transfer of LNAPL from well to tank
- **Cost** – Relative cost 5 times less than DPE/DPR, slightly less than PMPE, half that of SPR, VES and MPE

PMPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Vacuum lines offer limited potential for release, traffic safety, LNAPL handling with mobile tanks
- **Long-term Effectiveness** – Successful in low production/recharge areas such as B3, flexible to changing hydrogeological conditions, limited production and long life-cycle due to discontinuous operation

- **Implementability** – Mobile unit with vapor treatment required, no infrastructure except new wells required
- **Community Impact** – Potential disruption of traffic and residents during operation, noise and odor concerns during operation
- **Cost** – Relative cost 5 times less than DPE/DPR, slightly higher than PMR, half that of SPR, VES and MPE

6.5.2 Alternative Selection Narrative

MPE pilot testing data for Area B demonstrated that moderate volumes of LNAPL could be removed from this area. The API model results for Area B show similar LNAPL recovery with DPE, DPR and VES and less recovery with SPR (refer to recovery vs. time plots in Figures 5-2, 5-3 and 5-5). The Area B pilot testing data also indicates that the recovery volumes were similar for the technologies tested (MPE and DPE). Since MPE is an enhancement of SVE, and pilot test data showed more liquid-phase petroleum recovery than vapor-phase petroleum recovery, SVE could not be expected to perform as well as MPE. Similarly, since VES is an enhancement of SPR, VES is expected to perform better than SPR. The over-riding factor in the elimination of SPR, however, was the lack of access to residential properties; SPR recovery wells would need to be spaced on 25 to 50-foot centers to capture the LNAPL plume. Recovery volumes for MPE in northern Hartford would be anticipated to exceed those of VES, because upwelling would likely limit the vacuum influence of VES (see Section 6.4.2). VES was also eliminated, because implementability issues such as limited access for required well spacing are an issue.

The DOLR model (Section 4.4) demonstrates that during confined conditions, maximum LNAPL removal is achieved via MPE utilizing the formation confining pressure to drive LNAPL into the well to achieve the highest LNAPL removal rates with very low water production. By contrast, DPE would result in decreased LNAPL removal rates and much higher water production rates under these conditions as the associated drawdown would eliminate the natural confining pressures driving LNAPL into the wells. Modeling results predicted that under unconfined conditions that MPE would be as effective as DPE. MPE would allow for optimal LNAPL recovery under both hydrogeologic conditions.

The Implementation difficulties (e.g., siting, lack of infrastructure, presence of utilities) and long timetable involved in constructing a WWTP and discharge line to the Mississippi River, and the long permitting

timetables involved in implementing DPE and DPR, are among the reasons for not further considering these technologies in Area B. DPE and DPR also compared unfavorably to other technologies in short-term effectiveness, because of the many safety concerns associated with the required pressurized piping, vaults, ASTs, possible wellhead surge tanks, and other electrical/mechanical equipment (including lift stations).

Large volumes of water are generally required to be withdrawn and managed when employing DPE and DPR. DPE and DPR may also contribute to community concerns related to the potential effect of massive groundwater pumping on home foundations. In addition, as discussed in Section 2.2, the LNAPL plume has historically remained within the same general location since the late 1970s, and has decreased in magnitude. Therefore, the added benefit of hydraulic control that DPE and DPR can provide is not expected to be significant. Further, during low water-table conditions, DPE and DPR could potentially cause entrapment of LNAPL in pore spaces below the water table in areas free of LNAPL contamination. In Area B, LNAPL recovery may be highly variable depending on hydrogeologic conditions (as noted in the DOLR model), thereby favoring a flexible system, such as MPE.

As a last consideration, estimated capital and O&M costs were developed to allow for a relative evaluation of the various technologies. Table 6-3 summarizes these relative evaluation cost ranges for each alternative in Area B. The cost ranges for DPR/DPE include implementation in both Areas A and B. Costs for DPR ($23MM to $26MM) and DPE ($25MM to $28MM) were approximately 2 to 3 times higher compared to the combined costs for Areas A and B for MPE ($9MM to $10.5MM) and VES ($9.5MM to $11.5MM). Costs for SPR ($14.25MM to $17.5MM) in Areas A & B combined were half that of DPE/DPR with MPE and VES being about ⅔ the cost for SPR. Combined Areas A and B cost for PMPE ($5.75MM to $7.25MM) and PMR ($4.25MM to $6MM) were 5 times less that DPE/DPR, half that of MPE/VES and approximately ⅓ the cost for SPR.

Areas B1 and B2

The vacuum technologies (SVE, MPE, DPE and VES) would be the most effective for removing LNAPL and residuals from the unsaturated zone, because they effectively address the light-end hydrocarbons (GRO) of which the LNAPL in Areas B1 and B2 is composed. VES and DPE are eliminated as discussed

above and based on key factors listed in Table 6-1, leaving MPE and SVE for consideration in Areas B1 and B2.

While implementing MPE is more difficult than SVE (e.g., new wells would be necessary to provide access to LNAPL and additional knockout tanks and transfer pumps may be necessary to manage fluid flow), MPE would more effectively remove LNAPL, because it has the key capability to be optimized to varying fluid level elevations at different times or in different areas (due to stratigraphic and LNAPL mass variabilities) of northern Hartford, as observed during MPE pilot testing. Not only would MPE remove the LNAPL at a greater mass extraction rate than SVE, but it would also remove the lower volatility, mobile liquid (recoverable) portion of the LNAPL more effectively than SVE. MPE will also enhance vapor-phase recovery and bioventing when conditions are favorable (during low LNAPL thickness and production conditions). MPE could also be operated in an SVE-type mode if conditions warranted.

Area B3

Area B3 is unique within Area B, because it is a small area where MPE pilot testing has shown moderate LNAPL recovery, but limited sustainability potential. Given the Area's limited LNAPL production sustainability, and that periodic mobile technologies present little implementability concern and don't have the short-term effectiveness (safety) concerns of permanent systems, only the mobile technologies were considered for Area B3. PMPE was preferred over PMR based on long-term effectiveness considerations such as its flexibility, potentially greater ROI, and ability to address all phases of LNAPL. Based on these criteria, PMPE was selected as the recovery technology for Area B3. If Area B3 proves to be a more sustainable LNAPL producing area, the remedy selected may be modified. If Area B3 proves to be unsustainable in terms of LNAPL production, it may be incorporated into the recovery technology for Area C.

Area B4

SVE was not considered as the sole alternative for LNAPL recovery as a remedy in Area B4 where a portion of the LNAPL is diesel range organics (DRO), which are not relatively conducive to SVE. Because MPE can be effective as a remedial solution for DRO LNAPL, it was chosen for Area B4 with SVE (being implemented in all areas) addressing the GRO portion of the LNAPL in this area.

6.6 EVALUATION OF RECOVERY ALTERNATIVES FOR AREA C

Key factors considered in identifying areas for LNAPL recovery (e.g., LNAPL composition, modeling and pilot test data) are provided in Table 6-1. The subsequent alternative evaluation for each area was based on the criteria outlined in Section 6.3 and is summarized in Table 6-2. A summary of estimated cost ranges for each alternative in Area C are presented in Table 6-3. This information forms the basis for selecting a recovery system for Area C. Key factors considered in evaluating the criteria for Area C (6.6.1), and a narrative of the alternative selection process (6.6.2), are provided below.

6.6.1 Key Factors for Alternative Selection

A more detailed explanation for the alternative evaluation factors is provided in Table 6-2 for each of the alternative technologies

DPE/DPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media similar to MPE/VES (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Pressurized lines for water and LNAPL could have potential for release, extensive infrastructure necessary
- **Long-term Effectiveness** – Recovery similar to MPE and VES, similar ROI as MPE, creates smear zone, hydraulic control of LNAPL plume unnecessary, low flexibility to changing hydrogeologic conditions, pump fouling
- **Implementability** – Requires large WWTP, permitting, ROI necessary to implement can be achieved with high pumping rate, effective on both GRO and DRO areas of plume
- **Community Impact** – Excavation of streets, sensitive concern for perceived potential foundation impact due to pumping, aesthetic concerns
- **Cost** – Relative costs are almost twice that of MPE and VES, comparable to SPR and 3 times that of PMPE and PMR

MPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media with same effectiveness as DPE/DPR/VES (SVE throughout northern Hartford addresses potential vapor intrusion pathway)

- **Short-term Effectiveness** – Vacuum lines offer limited potential for release, pressurized lines for LNAPL potential for release

- **Long-term Effectiveness** – Pilot test results show greater vapor than liquid recovery and low liquid recovery sustainability, flexible to changing hydrogeologic conditions, effective on both GRO and DRO areas of plume

- **Implementability** – Little water generated, uses some existing infrastructure and some new infrastructure, vapor/liquid separators necessary in Area C, vapor treatment required, offsite blower/vapor treatment requires crossing railroad tracks

- **Community Impact** – Excavation of streets, less equipment in village for operation

- **Cost** – Relative cost almost half that of DPE/DPR, comparable to VES, half that of SPR and twice that of PMPE and PMR

SPR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)

- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release

- **Long-term Effectiveness** – Less than half the LNAPL recovery of DPE, DPR, MPE and VES, and low model-predicted LNAPL recovery in Area C, limited ROI, relies on natural groundwater elevation fluctuations to be effective

- **Implementability** – Limited access for required well spacing, little water generated, storage tanks will be necessary in village, effective on both GRO and DRO areas of plume

- **Community Impact** – Excavation of streets, multiple wells/tanks and air compressors throughout village

- **Cost** – Relative cost comparable to DPE/DPR, almost twice that of MPE and VES, 3 times the costs of PMPE and PMR

VES

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)

- **Short-term Effectiveness** – Pressurized lines for LNAPL could have potential for release, pressurized air lines and air compressors could have potential for release

- **Long-term Effectiveness** – Similar LNAPL recovery as DPE, DPR and MPE, ROI similar to MPE less effective under confined hydrogeologic condition, effective on both GRO and DRO area of plume

- **Implementability** – Little water generated, storage tanks and air compressors will be necessary in village, vapor treatment required, offsite blower/vapor treatment requires crossing railroad tracks

- **Community Impact** – Excavation of streets multiple well/tanks and air compressors throughout village

- **Cost** – Relative cost almost twice that of DPE/DPR, comparable to MPE, half that of SPR and 3 times more than PMPE and PMR

SVE

- **Protectiveness** – Planned throughout northern Hartford to address potential vapor intrusion pathway, LNAPL recovery reduces constituent source to environmental media

- **Short-term Effectiveness** – Vacuum lines for vapor offer limited potential for release

- **Long-term Effectiveness** – Most effective with limited LNAPL mobility and sustained production, existing system effective at mass removal, most of plume is GRO, good ROI, high groundwater elevation reduces effectiveness

- **Implementability** – Much of Area C already addressed with existing system, infrastructure exists for planned expansion, ROI will achieve effectiveness via accessible areas

- **Community Impact** – Excavation of streets, no operating equipment in village

- **Cost** – Incremental cost low due to existing and planned expansion to SVE system

PMR

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)

- **Short-term Effectiveness** – Minimal safety concerns

- **Long-term Effectiveness** – Small ROI, lengthy timeframe for recovery
- **Implementability** – Additional wells required for infrastructure, labor intensive operation
- **Community Impact** – Traffic safety, release potential via manual transfer of LNAPL from well to tank
- **Cost** – Relative cost 3 times less than DPE/DPR, half the cost of MPE and VES, 3 times less than SPR and comparable to PMPE

PMPE

- **Protectiveness** – LNAPL recovery reduces constituent source to environmental media (SVE planned throughout northern Hartford to address potential vapor intrusion pathway)
- **Short-term Effectiveness** – Vacuum lines for vapor offer limited potential for release, traffic safety, LNAPL handling with mobile tanks
- **Long-term Effectiveness** – Pilot testing shows more vapor than liquid production, flexible to changing hydrogeological conditions, limited production and long life-cycle due to discontinuous operation
- **Implementability** – Mobile unit with vapor treatment required, no infrastructure except new wells required
- **Community Impact** – Potential disruption traffic and residents during operation, noise and odor concerns during operation
- **Cost** – Relative cost 3 times less than DPE/DPR, half the cost of MPE and VES, 3 times less than SPR and comparable to PMPE

6.6.2 Alternative Selection Narrative

In reviewing alternatives for remedy selection for Area C, the periodic mobile technologies (PMPE and PMR) were eliminated from consideration as primary recovery technologies, because of the long life-cycles that would be required to affect an area as large as Area C; accordingly, only the more aggressive technologies were considered (DPE, DPR, MPE, VES, SVE, and SPR).

The recovery volumes in Area C were similar for the technologies tested (MPE, DPE and SVE), based on the pilot testing data. SVE compares favorably with MPE and DPE, because the pilot testing showed that vapor-phase hydrocarbon recovery was greater than liquid-phase hydrocarbon recovery throughout

Area C. Recovery volumes for MPE in northern Hartford would be anticipated to exceed those of VES, because upwelling would likely limit the vacuum influence of VES (see Section 6.4.2).

The API model results were slightly different, showing similar LNAPL recovery with DPE, DPR and VES, and less recovery with SPR. DPR is not expected to perform as well as DPE, because it does not utilize vapor extraction. The composition of the LNAPL in Area C (GRO) favor remediation via SVE, MPE, DPE and VES. In summary, the similar long-term effectiveness of most of the non-mobile technologies in Area C focused the evaluation for Area C on the other criteria.

DPE and DPR were eliminated from further consideration based on anticipated implementation difficulties (e.g., siting, lack of infrastructure, presence of utilities) and long timetables involved in constructing a WWTP and discharge line to the Mississippi River and permitting. In addition, DPE and DPR were considered unfavorably to be less effective than other technologies in the short-term, because of the many safety concerns associated with the required pressurized piping, vaults, ASTs, possible wellhead surge tanks, and other electrical/mechanical equipment (including lift stations).

Large volumes of water are generally required to be withdrawn and managed when employing DPE and DPR. DPE and DPR may contribute to community concerns related to the potential effect of massive groundwater pumping on home foundations. In addition, as discussed in Section 2.2, the LNAPL plume has historically remained within the same general location since the late 1970s, and has decreased in magnitude. Therefore, the added benefit of hydraulic control that DPE and DPR can provide is not expected to be significant. Further, during low water-table conditions, DPE and DPR could potentially cause entrapment of LNAPL in pore spaces below the water table in areas free of LNAPL contamination.

As a last consideration, estimated capital and O&M costs were developed to allow for a relative evaluation of the various technologies. Table 6-3 summarizes the estimated cost ranges for each alternative in Area C. The cost ranges for DPR/DPE include implementation in Areas A, B and C. Costs for DPR ($28.5MM to $32MM) and DPE ($31MM to $36MM) were almost 2 times higher compared to the combined costs for Areas A, B and C for MPE ($18MM to $21.25MM) and VES ($19.25MM to $22.75MM). Costs for SPR ($30.25MM to $36MM) in Areas A, B & C combined were approximately the same as that of DPE/DPR with MPE ($18MM to $21.25MM) and VES ($19.25MM to $22.75MM) being about half the cost for SPR. Combined Areas A, B & C cost for PMPE ($9.75MM to $12.5MM) and PMR

($7.75MM to $10.5MM) were 3 times less that DPE/DPR, half that of MPE/VES and a little more than ⅓ the cost for SPR.

Of the remaining technologies (SVE, MPE, SPR and VES), implementation of SVE is not an issue since the system already exists in northern Hartford and is in the process of being expanded to address all of the LNAPL recovery areas as part of the Phase 2B and 3 expansion planned for 2006. SVE also compares favorably in short-term effectiveness because it requires less equipment than MPE, SPR or VES. Operational costs of SVE are also lower than those of MPE, SPR or VES.

Lastly, the non-sustainable liquid LNAPL production in Area C minimizes the advantages of any of the fluid withdrawal technologies. This is supported by MPE pilot testing that indicates the majority of LNAPL is removed in the vapor-phase throughout Area C.

SVE was chosen as the recovery technology for Area C based on the criteria provided above. Removal of liquid-phase LNAPL via other methods is not practical in Area C based on available production data; however, SVE is capable of liquid-phase LNAPL removal via the vapor-phase, which will reduce the potential source of constituents to other environmental media. The risk of migration of the LNAPL plume appears minimal based on historical investigation indicating that the sentinel wells have not been impacted and that the LNAPL plume has remained within the same general location for nearly 30 years. The depth of the Main Sand LNAPL plume and the presence of the intermediate clay layers also minimize the vapor intrusion risk, but regardless, continued use of SVE in northern Hartford renders vapor intrusion an incomplete exposure pathway.

7.0 CONCEPTUAL DESIGN OF SELECTED LNAPL RECOVERY SYSTEM ALTERNATIVES

The evaluation of recovery alternatives for the various LNAPL-impacted areas within northern Hartford resulted in a proposal for active LNAPL recovery that was outlined in Sections 6.3 through 6.5. This section presents general descriptions of the conceptual designs for the selected LNAPL recovery alternatives in northern Hartford (Section 7.1). Figure 7-1 presents the LNAPL-impacted areas together with the proposed LNAPL recovery alternatives. These areas are general conceptual area boundaries that may be adjusted during the development of the 90% LNAPL recovery design document. SVE is proposed to be implemented in all LNAPL-impacted areas irrespective of the selected LNAPL recovery alternative as a means to ensure that the vapors emanating from the impacted subsurface will continue being directed to the existing VCS. SVE will also provide hydrocarbon mass removal throughout northern Hartford in addition to health protectiveness. Section 7.2 presents discussion on the timeframe required for the design and implementation of each of the selected LNAPL recovery alternatives for each area. This section also addresses time-critical aspects of the selected recovery method such as securing access to restricted areas, crossing non-publicly accessible areas, utilities availability, identification and selection of LNAPL storage and treatment compound areas, and other key factors. Section 7.4 presents a brief description of the required construction, operation and environmental permits needed to implement the various LNAPL recovery alternatives at each area.

7.1 CONCEPTUAL DESIGN

This section presents the general conceptual designs for each LNAPL recovery technology selected by area, as defined in Sections 6.3 through 6.5. Each subsection includes a brief description of the technology, including key factors such as projected effectiveness, materials and equipment necessary to implement the alternative, the level of effort that will be required to implement the selected technology, and other key design factors.

7.1.1 Area A – Multi-Phase Extraction

The proposed LNAPL recovery for Area A is an MPE LNAPL recovery system with vapor extraction and treatment. Figure 7-2 presents a simple schematic of the conceptual design for the proposed LNAPL recovery at Area A.

The proposed MPE system includes a number of extraction wells located in Area A. Each well will be equipped with a stinger pipe that has the flexibility to be placed at a given depth interval such that the tip of the stinger line is intended to withdraw primarily LNAPL, thus minimizing the generation of water. This allows enough flexibility to accommodate the fluctuations in groundwater table elevation and if conditions warranted, operate in SVE mode when the stinger pipe is raised. Depending on the actual delineation of Area A, it is possible that portions of Area B will be incorporated into the Area A recovery system. The MPE wells ROI will range from approximately 60 to 100 feet (depending on the stratigraphy of the areas where the MPE wells will be installed) based on the MPE pilot tests conducted at RW-4A and RW-5. Based on earlier field tests performed, each MPE well in Area A is expected to produce an air flow of about 75 standard cubic feet per minute (scfm). The vapor concentrations from these wells are expected to be high.

The MPE wells will be connected to common LNAPL and vapor collection lines that will allow for transfer of LNAPL, water and vapors to the MPE treatment area, where the LNAPL recovery, blower and vapor destruction systems will be located.

An LNAPL/water knock-out tank may be needed near the MPE wells to improve performance of the system. The LNAPL/water recovered by the wells will then be transferred via underground pressurized piping to a location outside the Village of Hartford that contains an LNAPL/water separation system. The separated LNAPL will be temporarily stored in an LNAPL storage and transfer tank. The water phase will be directed to a waste water treatment system or disposed of at an offsite location. The disposition of the recovered LNAPL and water will be evaluated as part of the development of the 90% design. Alternatives for recovered LNAPL management include offsite treatment and disposal and local recycling.

The blower system will exert vacuum high enough to be capable of transferring LNAPL/water to a knock-out tank and the extracted vapors from the MPE wells to the vapor destruction system. A vapor/liquid separator will allow for the separation of water condensate and possibly LNAPL from the vapor-phase before the vapor is directed to the vapor destruction system. The size of the blower system will be determined once the limits of Area A are defined and the number of MPE wells is determined. The vapor destruction system determination will be made during the 90% design if additional equipment is needed or if the existing thermal oxidizers for the SVE system could be used to conduct this vapor treatment.

7.1.2 Areas B1, B2 and B4 – Multi-Phase Extraction via Upgraded SVE System

MPE is proposed for Areas B1, B2, and B4. The MPE system proposed will be implemented by utilizing the expanded SVE system modified to operate in a flexible MPE mode to take advantage of changes in recoverability. The MPE wells' ROI is expected to range from approximately 60 to 100 feet based on the MPE pilot testing conducted at RW-4A and RW-5.

The proposed MPE system includes a number of vapor extraction wells equipped with stinger pipes that have the flexibility to be located at a given depth interval. The tip of the stinger line is intended to withdraw primarily LNAPL and minimize water generation. This allows enough flexibility to accommodate the fluctuations in groundwater table elevation and if warranted, operate in SVE mode. The MPE wells will have a screened interval that will be placed near the saturated zone with the tip of the stinger pipe placed within the LNAPL. Figure 7-3 presents a conceptual design of the LNAPL recovery alternative for Areas B1, B2 and B4. LNAPL/water knock-out tanks may be needed near the MPE wells to improve performance of the system. The LNAPL/water recovered by the wells would then be transferred via underground pressurized piping to a location outside the Village of Hartford that contains an LNAPL/water separation system.

The additional MPE wells in Areas B1, B2 and B4 may require additional SVE capacity (both piping and equipment) beyond those included in the planned VCS expansion plans (Phase 2B and 3). Based on earlier field tests performed, each MPE well is expected to produce approximately 75 scfm. The vapor concentration expected from these wells is high. The existing and future piping infrastructure that is necessary for the Phase 2B and 3 VCS system expansions will allow for access to locations where the new MPE wells will be needed.

7.1.3 Area B3 – Periodic Multi Phase Extraction

The proposed LNAPL alternative for Area B3 is PMPE primarily focused around the well MP-79C area on East Birch Street. The proposed LNAPL recovery consists of a mobile extraction unit operated periodically on a series of recovery wells located near well MP-79C. The existing VCS will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL. The extracted vapor from the subsurface will be treated at the mobile MPE extraction unit. The

MPE stinger line depth will be varied to accommodate groundwater fluctuations. PMPE will be implemented using either commercial vacuum trucks or PMPE systems (ICE or LRP). The captured fluids disposal options include offsite disposal and utilization of the LNAPL recovery system used for Area A. Utility requirements are essentially non-existent given that the vacuum trucks and mobile MPE systems (ICE or LRP) are utility independent, with onboard fuel (diesel or propane) and electrical generators, as required.

The conceptual design of the LNAPL recovery alternative for Area B3 is illustrated in Figure 7-4. An LNAPL/water storage tank will be required to collect and transfer the extracted fluids.

7.1.4 Area C – Soil Vapor Extraction

The LNAPL present in Area C is composed primarily of GRO and exhibits low liquid production compared to vapor production.

The proposed SVE system includes vapor extraction wells that will be installed with screened intervals primarily placed above the water table to minimize upwelling of water during operation. This will provide vapor extraction that maximizes the mass transfer of the GRO. The SVE well screened interval may or may not be placed at elevations where other upper strata are located; this will depend on whether LNAPL is present in upper strata.

Based on earlier pilot tests performed by Clayton, each SVE well is expected to produce an average airflow of 75 scfm. The vapor concentration from these wells is expected to be higher than that from the existing SVE system shallow wells, which are frequently screened across less impacted soil zones. Current SVE operation results indicate that the SVE wells' ROI will range from approximately 50 to 200 feet, depending on the stratigraphy of the areas where the SVE wells will be installed. A somewhat smaller ROI is expected for SVE wells installed in permeable strata overlying the Main Sand where LNAPL is present.

The existing and expanded VCS system will be retrofitted to add the additional SVE wells. The current Phase 2A expansion includes the addition of SVE wells located on West Arbor Street and West Birch Street. The proposed Phase 2B Expansion will incorporate SVE wells for this purpose south of West

Date Street on Delmar Avenue, on West Elm Street, in alleyways between West Date Street and West Elm Street, and between Old St. Louis Road and Delmar from West Elm Street to West Watkins Street. The proposed Phase 3 Expansion will incorporate SVE wells along the North Olive Street corridor, on East Cherry Street and at the alleyway between East Date and East Elm Streets. The existing and future piping infrastructure that is necessary for Phases 2B and 3 will allow for access to locations where the new SVE wells may be needed.

The effectiveness of the SVE system implementation will be monitored via a program similar to the one used to monitor the current VCS system including vacuum monitoring, vapor sampling/field screening and flow determinations, and periodic monitoring of LNAPL at specific key locations.

7.2 ESTIMATED TIME REQUIRED TO DESIGN AND IMPLEMENT THE PROPOSED LNAPL ACTIVE RECOVERY SYSTEM AT EACH AREA

This section presents a general discussion pertaining to the timeframe associated with the design and implementation of each of the selected LNAPL recovery alternatives.

7.2.1 Area A

The design and implementation of the Area A LNAPL recovery alternative will require determination of the following:

- The design criteria based on field data and testing (e.g., radius of influence, equipment sizing requirements);
- The final location where the MPE treatment compound will be located;
- Selection of residuals management (i.e. LNAPL, water) method and location; and
- The proposed routing of LNAPL recovery and vacuum extraction lines.

The following items present a brief explanation of these and other time-critical aspects of this project.

Proposed MPE Wells and Associated Piping

The number and location of MPE wells will be determined once the design criteria are finalized. The installation of MPE wells and connection piping are not expected to be time-critical items. Piping to the main blower/treatment system compound may become a time-critical item depending on the final system location and proximity to the MPE wells.

Proposed MPE Treatment Area

A final location for the equipment and treatment area will be made during the 90% design. Proximity of railroads and other utility corridors surrounding Area A, and access to install infrastructure piping, may become a time-critical item for implementation.

Proposed LNAPL and Water Separation Equipment

There appears to be no time-constraining limitations with respect to the procurement and installation of the LNAPL and water separation equipment. This type of equipment is generally available "off-the-shelf" for assembly. Fabrication and delivery of the assembled equipment systems are expected to take between 3 and 6 months.

Proposed LNAPL/Water Management

There is uncertainty with respect to the management and treatment of LNAPL/water generated by this alternative. LNAPL management options that will be evaluated as part of the 90% design include recycling at a local facility and disposal at a non-local facility. Options to be evaluated for the separated water include offsite treatment, re-injection, or onsite treatment.

Proposed Utilities

The availability of power and natural gas are necessary for the implementation of this alternative. The projected time to procure power and natural gas depends on the location selected for the treatment compound. Based on past experience with local utilities, this is anticipated to be a time-critical item.

Necessary improvements must begin immediately upon commencement of the implementation of this alternative.

7.2.2 Areas B1, B2 and B4

LNAPL recovery alternatives for Areas B1, B2 and B4 are the same and the design and implementation require similar timeframes to complete. The following items present brief explanations of the design and implementation aspects for these areas.

Proposed MPE Wells and Associated Piping

The number and location of MPE wells will be determined once the design criteria are finalized. The installation of MPE wells and associated piping are not expected to be time-critical items.

Proposed LNAPL and Water Separation Equipment

Areas B1, B2 and B4 may require vapor/liquid separators to transfer the separated liquid to either a remote storage tank or the treatment compound for Area A, if feasible. Consideration will be given to locating these tanks belowground to reduce any community impact issues. All these items employ routine equipment and materials that are not expected to be time-critical.

Proposed VCS Equipment Additions

An evaluation of the need for additional vacuum blowers/thermal oxidizers will be conducted as part of the 90% design. If additional vacuum blowers/thermal oxidizers are necessary, this type of equipment is generally available “off-the-shelf” for assembly. Fabrication and delivery of the assembled equipment systems are expected to take between 3 and 6 months.

Proposed Utilities

The availability of electrical power is necessary for the implementation of this alternative where there is a need to transfer total fluids to other centralized locations or to a treatment area. Based on past

experience with the local electrical utility, this is anticipated to be a time-critical item. Utility improvements necessary must begin immediately upon commencement of the implementation of this alternative.

7.2.3 Area B3

The LNAPL recovery alternative for Area B3 requires minimal infrastructure and can be readily implemented.

Proposed PMPE Wells and Associated Piping

The number and location of PMPE wells to use for this alternative will be determined when the design criteria are finalized during the 90% design phase. The installation of PMPE wells and/or associated piping are not expected to be time-critical items.

7.2.4 Area C

The LNAPL recovery alternative for Area C requires the expansion of the existing VCS to the LNAPL-impacted area. The VCS expansion is being implemented in phases. Phase 2A is currently being implemented while Phases 2B and 3 are planned to be implemented during calendar year 2006. The implementation of Phases 2B and 3 will make vapor collection lines available to be used to expand the VCS system to include those LNAPL-impacted areas that are not covered by the current VCS expansion program. The timeframe for this alternative will depend on the implementation of Phases 2B and 3 of the VCS expansion program.

Proposed SVE Wells and Associated Piping

The number and location of SVE wells to use for this alternative will be confirmed once the design criteria are finalized. The installation of SVE wells in Area C and associated piping are not expected to be time-critical items.

Proposed VCS Equipment Additions

An evaluation of the need for additional vacuum blowers/thermal oxidizers will be conducted as part of the 90% design. This evaluation will consider the requirements for the current vapor intrusion mitigation program, for remediation of Areas B1, B2 and B4 by upgrading the system to include MPE wells with stingers, and for remediation of Area C. If additional vacuum blowers/thermal oxidizers are necessary, this type of equipment is generally available "off-the-shelf" for assembly. Delivery of the assembled equipment systems are expected to take between 3 and 6 months.

7.3 REQUIRED PERMITS

This section presents a brief description of the potentially required installation, construction, operation and other environmental permits needed to implement the various LNAPL recovery alternatives at each area.

7.3.1 Area A

The implementation of LNAPL recovery in Area A requires multiple authorizations and permits necessary to access restricted areas, construct and operate new water/LNAPL storage facilities and install new air emission sources. In addition to USEPA approvals, Title 35 of the Illinois Administrative Code may require Illinois Environmental Protection Agency (Illinois EPA) Bureaus of Land, Water, and Air permits for installation, construction and operation. Also, the Illinois State Fire Marshal requires the registration of LNAPL/water storage and process tanks and other equipment. The Village of Hartford may require installation and construction permits as well.

Other entities may be required to issue installation, construction and operation permits. Once the proposed LNAPL recovery alternative for Area A is approved and the routing of the various piping and infrastructure requirements are defined, a thorough evaluation of other permitting requirements will be performed.

7.3.2 Areas B1, B2 and B4

The implementation of LNAPL recovery in Areas B1, B2 and B4 requires several permits to operate the MPE systems. At minimum, the installation of knockout tanks for collection of total fluids, and piping to transfer these to a centralized location, would require notification and permits from the Illinois EPA Bureaus of Land, Water and Air. Also, the Illinois State Fire Marshal requires the registration of LNAPL/ water storage and process tanks and other equipment. The Village of Hartford may require installation and construction permits as well. Coordination with the Village of Hartford is also necessary to locate infrastructure in public right-of-ways.

7.3.3 Area B3

The implementation of LNAPL recovery in Area B3 calls for obtaining an air discharge operation permit to conduct PMPE. At a minimum, notification and permit requirements of the Illinois EPA Bureau of Air need to be met. Coordination with the representatives from the Village of Hartford is also necessary to gain access to public right-of-ways.

7.3.4 Area C

The implementation of LNAPL recovery in Area C may require obtaining an air discharge operation permit for any new air treatment equipment that may be necessary.

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FIGURES

TABLES

APPENDIX A

LNAPL SAMPLE RESULTS – TORKELSON GEOCHEMISTRY

APPENDIX B

BAILDOWN TEST DATA SHEETS

APPENDIX C

PTS ANALYTICAL REPORT

APPENDIX D

RETEC REPORT

APPENDIX E

H_2A REPORT

U.S. ARMY CORPS.
OF ENGINEERS
MISSISSIPPI RIVER
GAUGING STATION
#0201B
ALTON, IL

ELEV.=399.14
(AUGUST 3, 2005)

LEGEND

- MONITORING WELL (HMW, SP, P, RMW)
- 402 GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- CONTOUR INTERVAL = 0.5 FT.
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS IF PRESENT.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL PREMCOR FACILITY WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2004 AND 2005. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.
4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

CHECK BY	KDC
DRAWN BY	BCP/KP
DATE	8-26-05
SCALE	AS SHOWN
CAD NO.	0309507e65
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
AUGUST 3-5, 2005 – EPA STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-14

U.S. ARMY CORPS.
OF ENGINEERS
MISSISSIPPI RIVER
GAUGING STATION
#0201B
ALTON, IL

ELEV.=401.95
(MAY 12, 2005)

SP-40
402.75

SP-2B
403.35

SP-43
402.79

SP-37
403.98

HMW-49C
399.41

HMW-48C
(400.78)

HMW-3
402.01

HMW-50B
403.57

P-107
404.14

P-105
400.90

P-81
401.11

RMW-5B
405.11

RMW-35B
404.21

RMW-35C
401.45

RMW-34B
(400.14)

RMW-4B
403.17

RMW-26C
401.54

RMW-25A
401.22

RMW-40
401.41

RMW-42B
400.29

400.0
400.5
401.0
401.5
402.0
402.5
403.0
403.5
404.0
404.5
405.0

N. DELMAR AVE.
W. RAND AVE
E. RAND AVE
W. ARBOR ST
W. BIRCH ST
E. BIRCH ST
W. CHERRY ST
E. CHERRY ST
W. DATE ST
E. DATE ST
W. ELM ST
E. ELM ST
W. FOREST ST
E. FOREST ST
W. WATKINS ST
E. WATKINS ST
E. HAWTHORNE STREET
E. 1ST STREET
E. 2ND STREET
ILLINOIS STATE ROUTE 3
OLD ST. LOUIS AND ALTON ROAD
N. DELMAR AVENUE
N. MARKET STREET
N. OLIVE STREET
S. OLIVE ST.
ALTON RAILROAD CO.
C.C.C. & STL. RR.

MONITORING WELL (HMW, SP, P, RMW)

405 GROUNDWATER CONTOUR

GROUNDWATER FLOW DIRECTION

CONTOUR INTERVAL = 0.5 FT.

(400.78) GROUNDWATER ELEVATION ANOMALY: HMW-48C, RMW-34B

INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS IF PRESENT.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL PREMCOR FACILITY WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2004 AND 2005. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.
4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

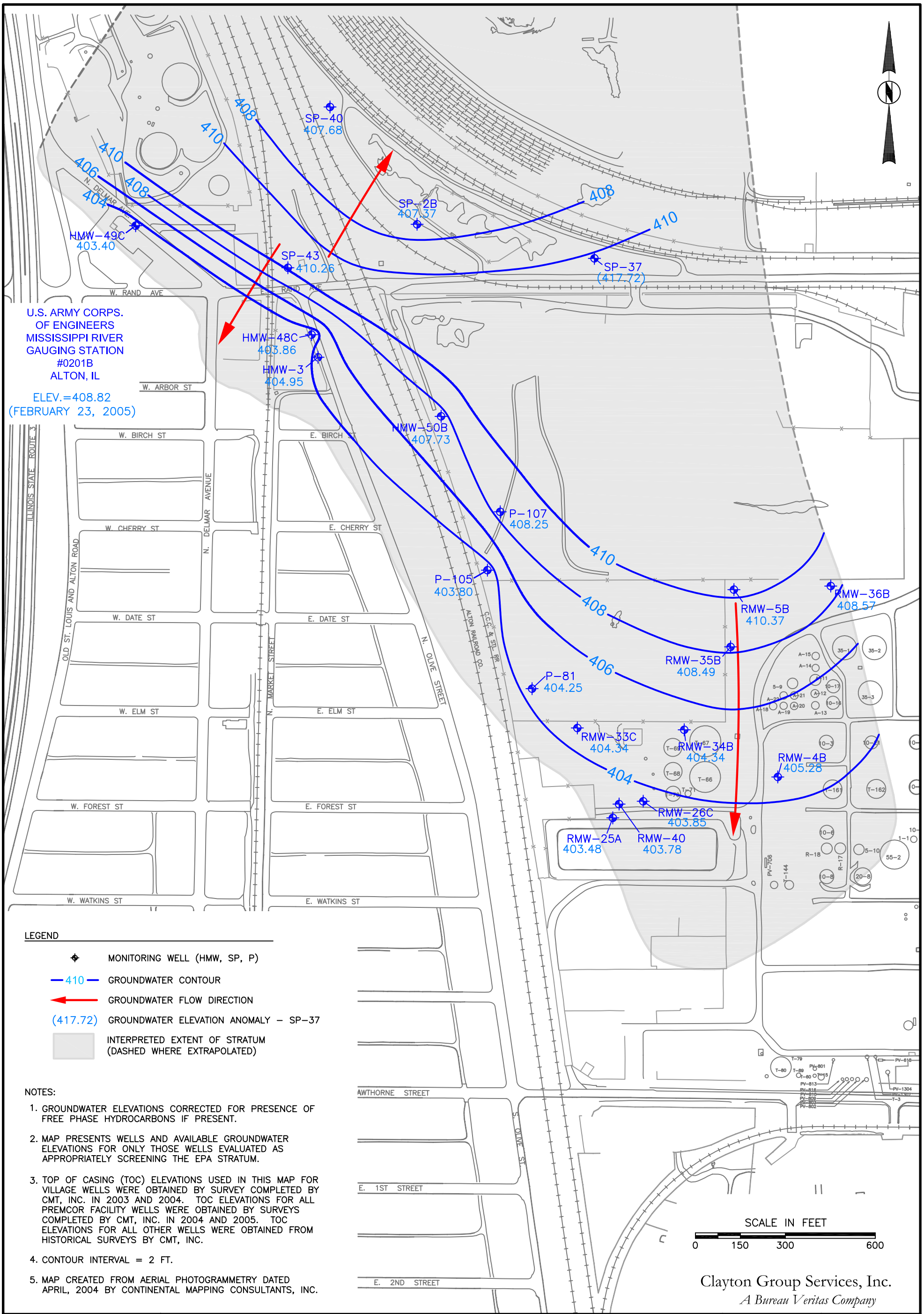
CHECK BY	KDC
DRAWN BY	BCP/KP
DATE	6-3-05
SCALE	AS SHOWN
CAD NO.	0309507e53
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
MAY 11-12, 2005 - EPA STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-13



LEGEND

- MONITORING WELL (HMW, SP, P)
- 410 GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- (417.72) GROUNDWATER ELEVATION ANOMALY – SP-37
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS IF PRESENT.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEY COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL PREMCOR FACILITY WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2004 AND 2005. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 2 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

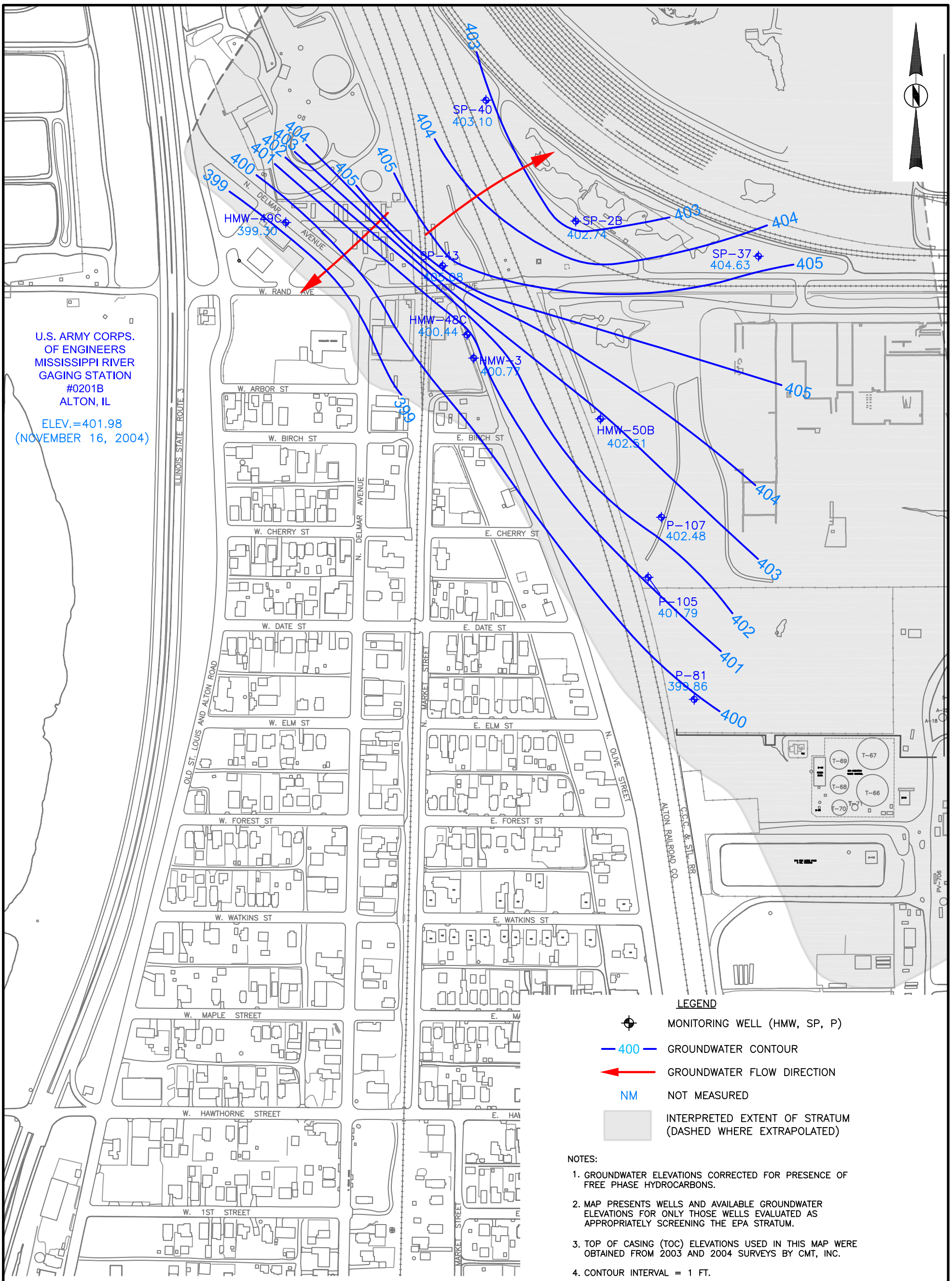
CHECK BY	KDC
DRAWN BY	BCP
DATE	3-18-05
SCALE	AS SHOWN
CAD NO.	0309507e41
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
FEBRUARY 23-24, 2005 – EPA STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-12



NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE EPA STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP WERE OBTAINED FROM 2003 AND 2004 SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

Clayton Group Services, Inc.
A Bureau Veritas Company

CHECK BY	
DRAWN BY	BCP
DATE	12-15-04
SCALE	AS SHOWN
CAD NO.	0309507e29
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
NOVEMBER 15-17, 2004 - EPA STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-11

PREMCOR RIVER DOCK
MISSISSIPPI RIVER
WATER GAUGE
ELEV.= 399.72
(OCTOBER 4, 2005)

LEGEND

- MONITORING WELL (HMW, SP)
- MONITORING PROBE (MP)
- 413 — GROUNDWATER CONTOUR
- 416.36 — GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- (1.02) — LINEAR FEET OF WATER IN PROBE/WELL
- (0.24)* — WATER IN PROBE/WELL IS WITHIN THE SUMP OF WELL AND/OR BELOW BASE OF STRATUM
- (403.74) — EXCLUDED GROUNDWATER ELEVATION: HMW-45B
- NM — NOT MEASURED
- CONTOUR INTERVAL = 1.0 FT.
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.

SCALE IN FEET
0 150 300 600

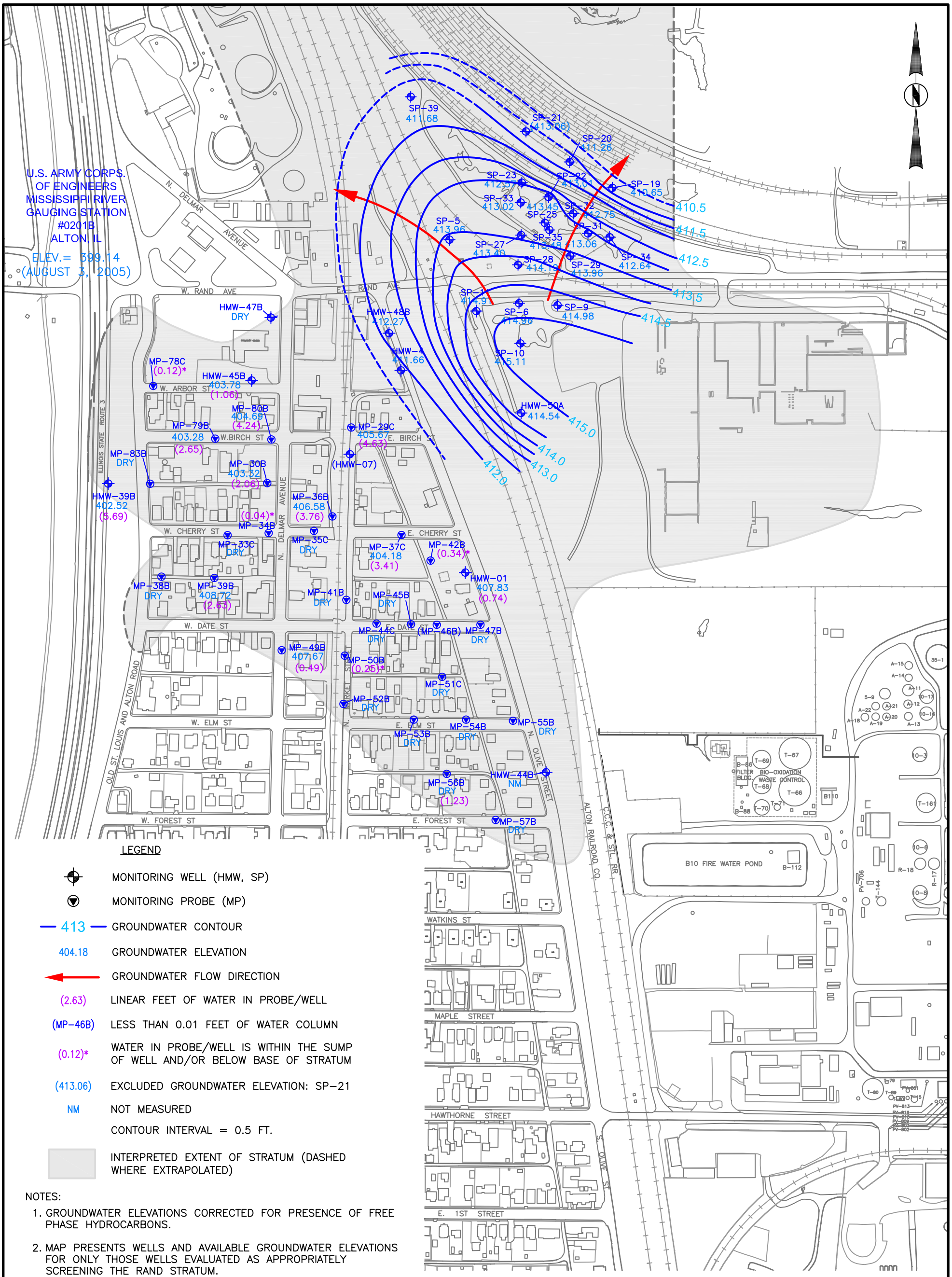
Clayton Group Services, Inc.
A Bureau Veritas Company

CHECK BY	
DRAWN BY	BCP
DATE	10-31-05
SCALE	AS SHOWN
CAD NO.	0309507e72
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
OCTOBER 4-5, 2005
RAND STRATUM
THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-10



LEGEND

- MONITORING WELL (HMW, SP)
- MONITORING PROBE (MP)
- 413 — GROUNDWATER CONTOUR
- 404.18 — GROUNDWATER ELEVATION
- GROUNDWATER FLOW DIRECTION
- (2.63) — LINEAR FEET OF WATER IN PROBE/WELL
- (MP-46B) — LESS THAN 0.01 FEET OF WATER COLUMN
- (0.12)* — WATER IN PROBE/WELL IS WITHIN THE SUMP OF WELL AND/OR BELOW BASE OF STRATUM
- (413.06) — EXCLUDED GROUNDWATER ELEVATION: SP-21
- NM — NOT MEASURED
- CONTOUR INTERVAL = 0.5 FT.
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
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SCALE IN FEET

0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

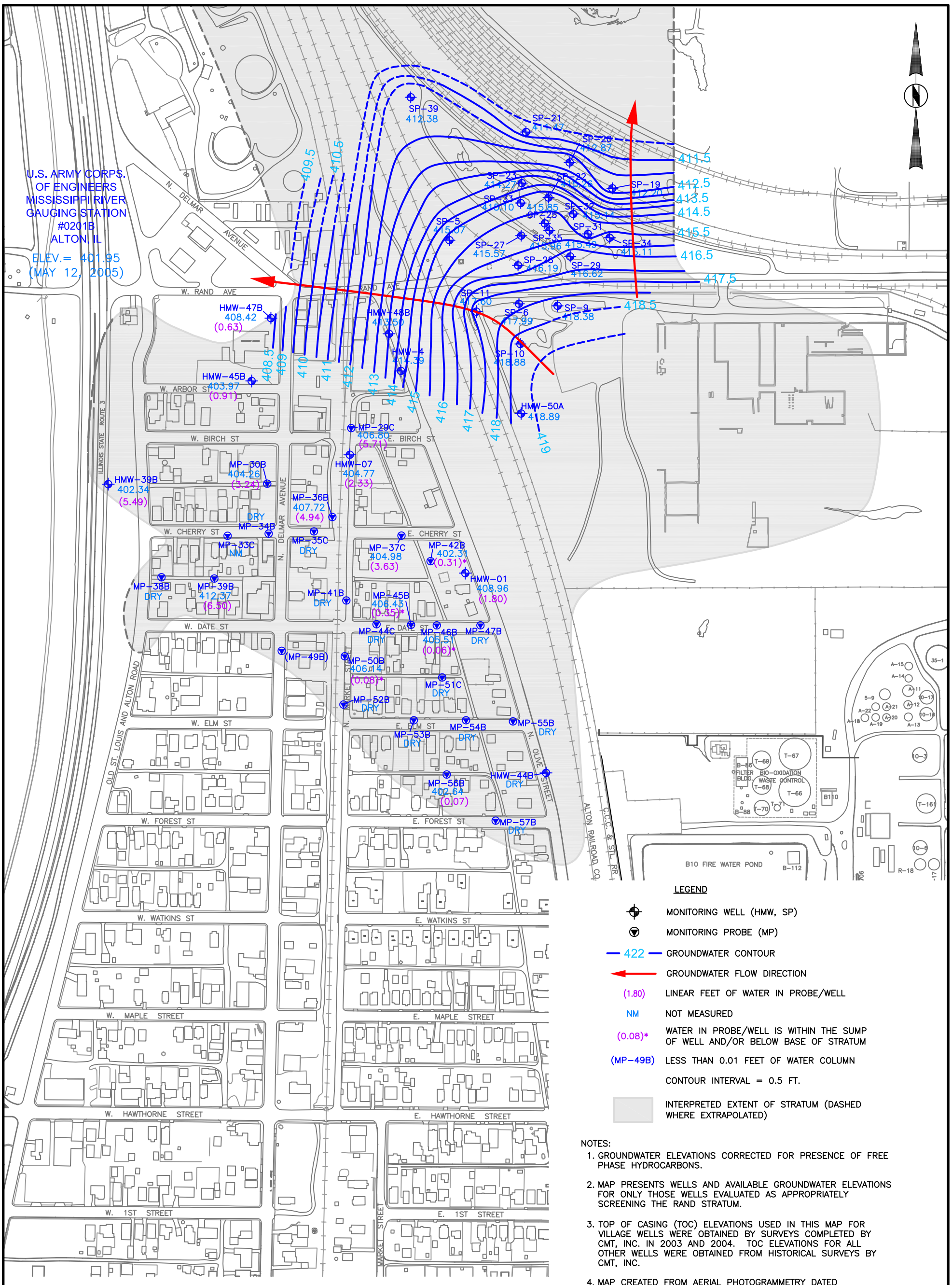
CHECK BY	
DRAWN BY	BCP
DATE	8-26-05
SCALE	AS SHOWN
CAD NO.	0309507e64
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
AUGUST 3-5. 2005 – RAND STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-9



LEGEND

⊕	MONITORING WELL (HMW, SP)
▼	MONITORING PROBE (MP)
— 422 —	GROUNDWATER CONTOUR
←	GROUNDWATER FLOW DIRECTION
(1.80)	LINEAR FEET OF WATER IN PROBE/WELL
NM	NOT MEASURED
(0.08)*	WATER IN PROBE/WELL IS WITHIN THE SUMP OF WELL AND/OR BELOW BASE OF STRATUM
(MP-49B)	LESS THAN 0.01 FEET OF WATER COLUMN
	CONTOUR INTERVAL = 0.5 FT.
	INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
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4. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET

0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

CHECK BY	
DRAWN BY	BCP
DATE	6-3-05
SCALE	AS SHOWN
CAD NO.	0309507e52
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
MAY 11-12. 2005 – RAND STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2-8

U.S. ARMY CORPS.
OF ENGINEERS
MISSISSIPPI RIVER
GAUGING STATION
#0201B
ALTON, IL
ELEV.= 408.82
(FEBRUARY 23, 2005)

W. RAND AVE
E. RAND AVE
N. DELMAR AVENUE
ILLINOIS STATE ROUTE 3
W. ARBOR ST
W. BIRCH ST
E. BIRCH ST
W. CHERRY ST
E. CHERRY ST
W. DATE ST
E. DATE ST
W. ELM ST
E. ELM ST
W. FOREST ST
E. FOREST ST
W. WATKINS ST
E. WATKINS ST
W. MAPLE STREET
E. MAPLE STREET
W. HAWTHORNE STREET
E. HAWTHORNE STREET
W. 1ST STREET
E. 1ST STREET
OLD ST. LOUIS AND ALTON ROAD
N. MARKET STREET
N. OLIVE STREET
ALTON RAILROAD CO.
C.C.C. & STL. RR.

SP-39 423.40
SP-21 (421.34)
SP-20 422.32
SP-23 423.38
SP-22 422.84
SP-19 420.22
SP-33 422.38
SP-26 422.26
SP-32 (424.99)
SP-25
SP-31
SP-5 422.35
SP-35 422.21
421.96
SP-27 421.85
SP-34 421.72
SP-28 421.07
SP-29 422.38
SP-11 423.75
SP-6 423.74
SP-9 423.90
SP-10 425.70
HMW-47B 410.27 (2.48)
HMW-48B 421.88
HMW-45B 405.06 (2.00)
HMW-4 422.79
HMW-50A 426.57
MP-29B 412.03 (2.83)
MP-29C 411.37 (10.28)
HMW-07 406.58 (3.61)
HMW-39B 404.28 (7.43)
MP-30B 407.42 (6.40)
MP-36B 409.69 (6.91)
MP-37B 407.24 (0.71)
MP-34B DRY
MP-33C DRY
MP-35C DRY
MP-37C 407.37 (6.02)
MP-42B 403.63 (1.63)
HMW-01 411.77 (4.58)
MP-38B DRY
MP-39B 415.96 (10.09)
MP-41B 405.63 (0.10)
MP-45B 406.51 (0.47)
MP-40B 404.13 (1.27)
MP-44C 406.02 (0.18)
MP-46B 405.52 (0.07)
MP-47B 406.83 (0.18)
MP-49B 411.35 (2.75)
MP-50B 406.89 (0.83)
MP-51C DRY
MP-52B 407.72 (0.23)
MP-55B 406.57 (0.88)
MP-54B DRY
MP-53B 406.11 (0.19)
HMW-44B DRY
MP-56B 405.43 (2.86)
MP-57B DRY

424 425 426 423 422 421

T-67 T-69 T-68 T-66 T-70 T-71 T-16 T-144 PV-706 R-18 R-17 35-1 10-3 10-6 10-8 10-16 10-17 A-11 A-12 A-13 A-14 A-15 A-18 A-19 A-20 A-21 A-22 5-9

LEGEND

- MONITORING WELL
- MONITORING PROBE
- 424 GROUNDWATER CONTOUR
- GROUNDWATER FLOW DIRECTION
- (424.99) GROUNDWATER ELEVATION ANOMALY: SP-21, SP-32
- (2.75) LINEAR FEET OF WATER IN PROBE/WELL
- INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP FOR VILLAGE WELLS WERE OBTAINED BY SURVEYS COMPLETED BY CMT, INC. IN 2003 AND 2004. TOC ELEVATIONS FOR ALL OTHER WELLS WERE OBTAINED FROM HISTORICAL SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 1 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET
0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

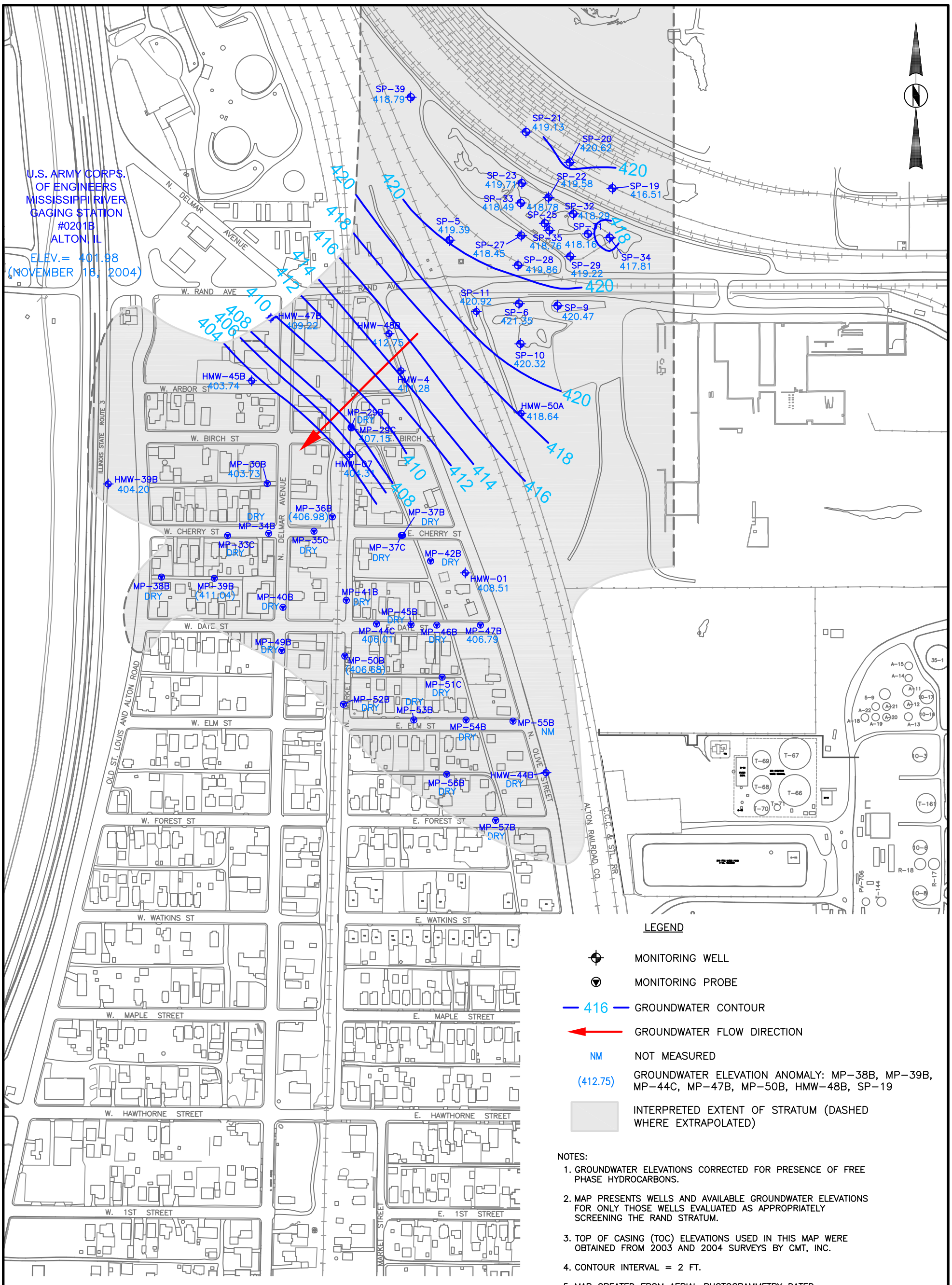
CHECK BY	
DRAWN BY	BCP
DATE	3-18-05
SCALE	AS SHOWN
CAD NO.	0309507e40
PRJ NO.	15-03095

GROUNDWATER FLOW MAP
FEBRUARY 23-24, 2005 - RAND STRATUM

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS 1828

FIGURE
2-7



LEGEND

⊕	MONITORING WELL
⊕	MONITORING PROBE
— 416 —	GROUNDWATER CONTOUR
←	GROUNDWATER FLOW DIRECTION
NM	NOT MEASURED
(412.75)	GROUNDWATER ELEVATION ANOMALY: MP-38B, MP-39B, MP-44C, MP-47B, MP-50B, HMW-48B, SP-19
	INTERPRETED EXTENT OF STRATUM (DASHED WHERE EXTRAPOLATED)

NOTES:

1. GROUNDWATER ELEVATIONS CORRECTED FOR PRESENCE OF FREE PHASE HYDROCARBONS.
2. MAP PRESENTS WELLS AND AVAILABLE GROUNDWATER ELEVATIONS FOR ONLY THOSE WELLS EVALUATED AS APPROPRIATELY SCREENING THE RAND STRATUM.
3. TOP OF CASING (TOC) ELEVATIONS USED IN THIS MAP WERE OBTAINED FROM 2003 AND 2004 SURVEYS BY CMT, INC.
4. CONTOUR INTERVAL = 2 FT.
5. MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL, 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.

SCALE IN FEET

0 150 300 600

Clayton Group Services, Inc.
A Bureau Veritas Company

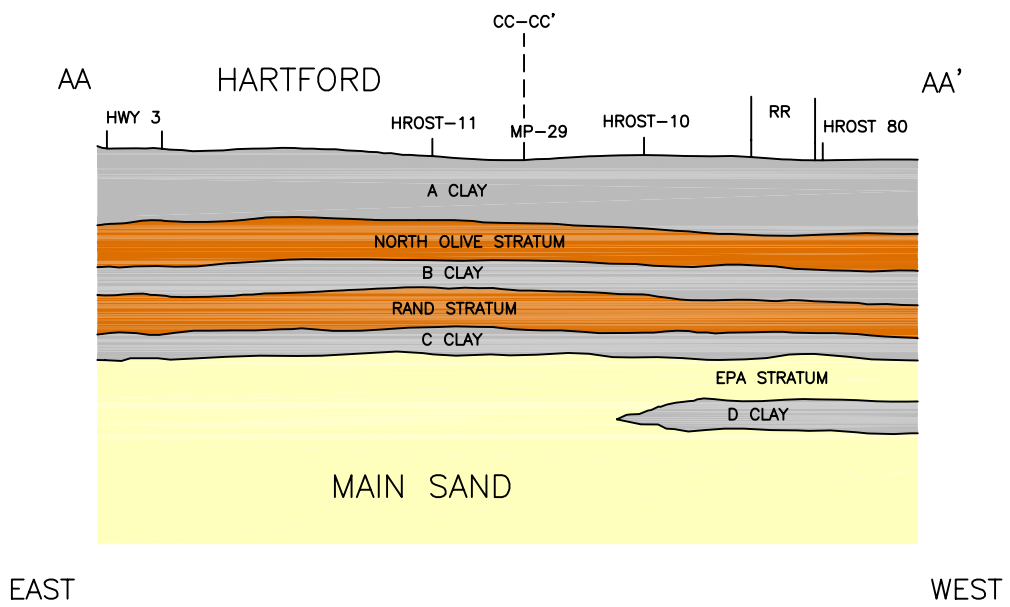
CHECK BY	
DRAWN BY	BCP
DATE	12-15-04
SCALE	AS SHOWN
CAD NO.	0309507e28
PRJ NO.	15-03095

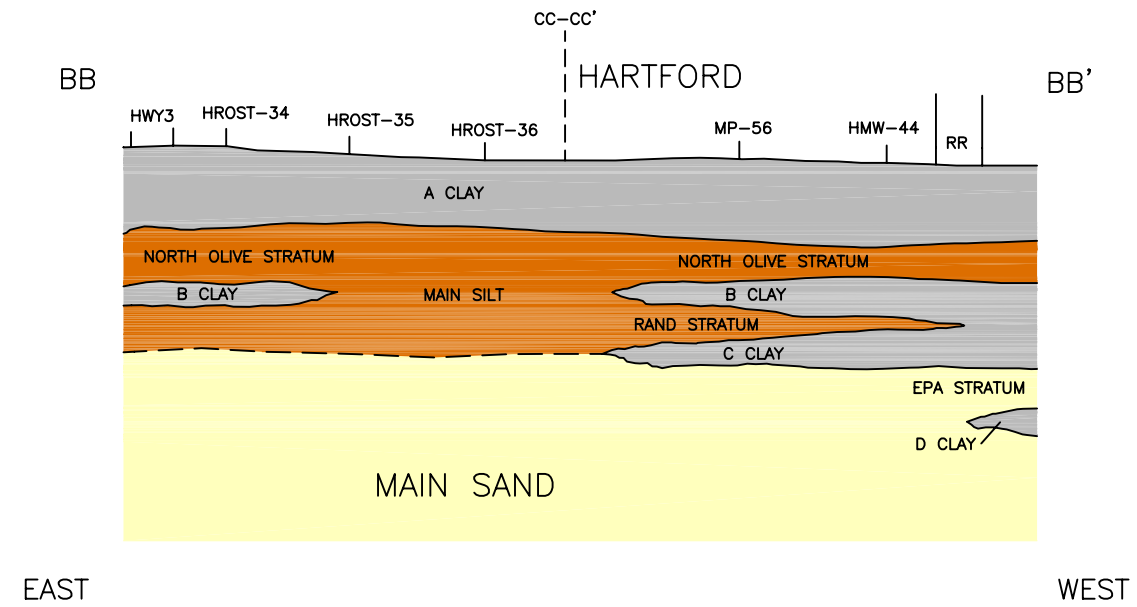
GROUNDWATER FLOW MAP
NOVEMBER 15-17, 2004 – RAND STRATUM

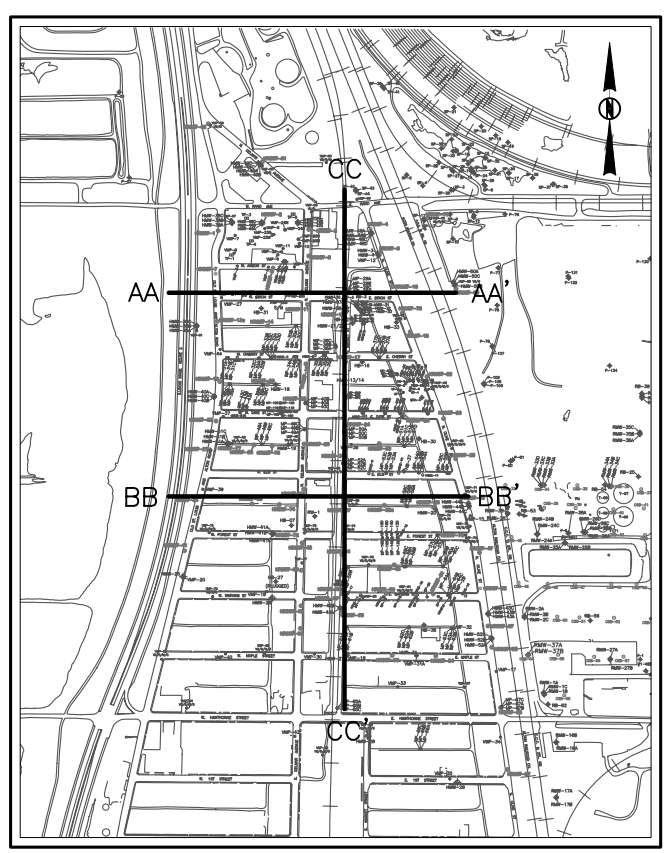
THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS 1828

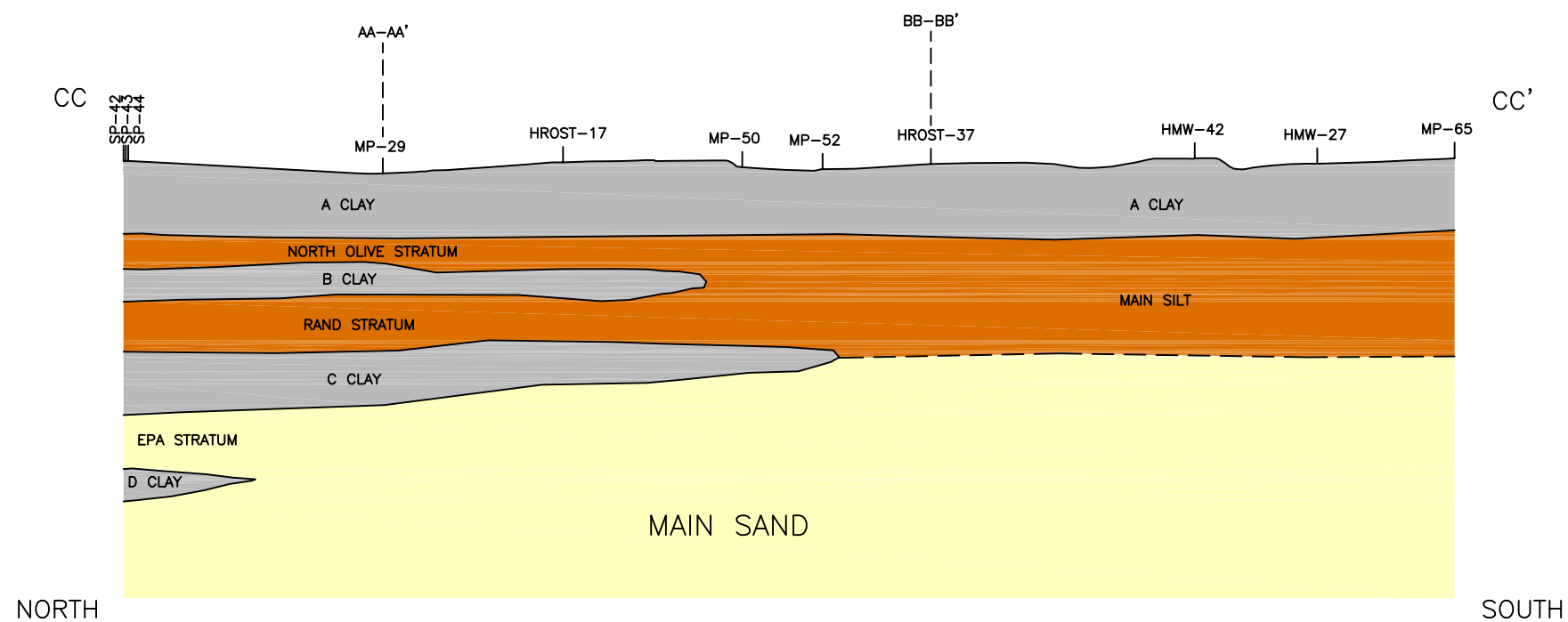
FIGURE 2-6







CROSS SECTION REFERENCE



NOTES:

1. VERTICAL AND LATERAL EXTENT OF GEOLOGIC STRATA REFLECT GENERALIZED REPRESENTATIONS FOR THE PURPOSE OF SIMPLIFYING THE UNDERSTANDING AND IDENTIFICATION OF THE MAJOR LITHOLOGIC STRATA WITHIN THE STUDY AREA.
2. VERTICAL EXTENT OF STRATA NOT TO SCALE.
3. BASE OF MAIN SAND NOT SHOWN.

Clayton Group Services, Inc.
A Bureau Veritas Company

CHECK BY	DJL
DRAWN BY	OS
DATE	12–7–05
SCALE	AS SHOWN
CAD NO.	0309514020a
PRJ NO.	15–03095.14

GENERALIZED GEOLOGIC CROSS SECTIONS
AA–AA', BB–BB', AND CC–CC'

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE
2–5

Legend

Gauged Product

Source: Engineering-Science, Inc., March 1992.
History of Hydrocarbon Releases in the Village of Hartford, Illinois

1990 Product Contours (ft)

1990 Gauged Extent

Pipeline Installation Date

Early 1940s

Early 1950s

Early 1980s

4-8" Pipelines & 3-8" & 1-3" Pipelines Source:
Wood River Refining Corp. Drwg. # WR00-RB1 1943

2-10" Pipelines & 2-10" & 1-14" Pipelines Source:
Wood River Refining Corp. Drwg. # WR017-FM3 1952

2-10" & 1-14" Pipelines Source:
Clark Oil & Refining Corp. Drwg. # WR043-FB-29 1982

Aerial Photo Number - Illinois Department of Transportation NAPP93 5798-253 dated 3/7/93

FIGURE 2-4

HISTORIC LNAPL CONTOURS - 1990

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

0 60 120 240 360 480 Feet

BUREAU VERITAS

Clayton Group Services, Inc
A Bureau Veritas Company

Legend

Gauged Product
Source: Mathes, G.M. 1982.
Spilled petroleum recovered from atop water table of Mississippi Aquifier. Civil Engineering - ASCE. V. 53, No. 6, p. 58-59.

1982 Product Contours (ft)

1982 Gauged Extent

Pipeline Installation Date

Early 1940s — 4-8" Pipelines & 3-8" & 1-3" Pipelines Source: Wood River Refining Corp. Drwg. # WR00-RB1 1943

Early 1950s — 2-10" Pipelines & 2-10" & 1-14" Pipelines Source: Wood River Refining Corp. Drwg. # WR017-FM3 1952

Early 1980s — 2-10" & 1-14" Pipelines Source: Clark Oil & Refining Corp. Drwg. # WR043-FB-29 1982

Aerial Photo Number - Illinois Department of Transportation 3890-44-IL476 dated 4/7/88

FIGURE 2-3

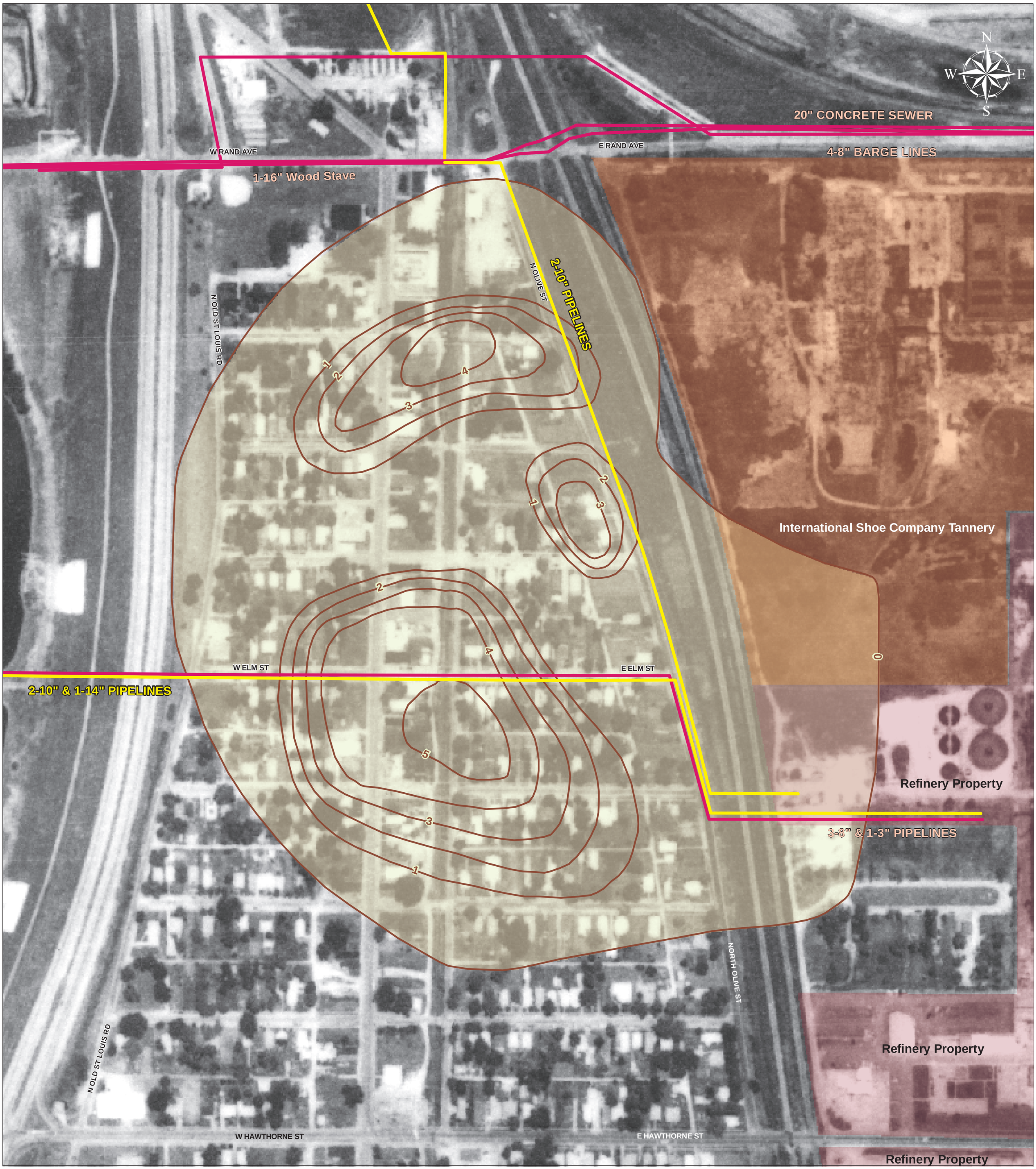
HISTORIC LNAPL CONTOURS - 1982

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

0 60 120 240 360 480 Feet

BUREAU VERITAS

Clayton Group Services, Inc
A Bureau Veritas Company



Legend

Gauged Product
Source: John Mathes & Assoc., Inc. 1978
Product Thickness in Feet, June 20, 1978, Village of Hartford, Illinois

1978 Product Contours (ft)
1978 Gauged Extent

Pipeline Installation Date
Early 1940s
Early 1950s

4-8" Pipelines & 3-8" & 1-3" Pipelines Source:
Wood River Refining Corp. Drwg. # WR00-RB1 1943

2-10" Pipelines & 2-10" & 1-14" Pipelines Source:
Wood River Refining Corp. Drwg. # WR017-FM3 1952

Aerial Photo Number - Illinois Department of Transportation USDA-40-17119 dated 6/9/78

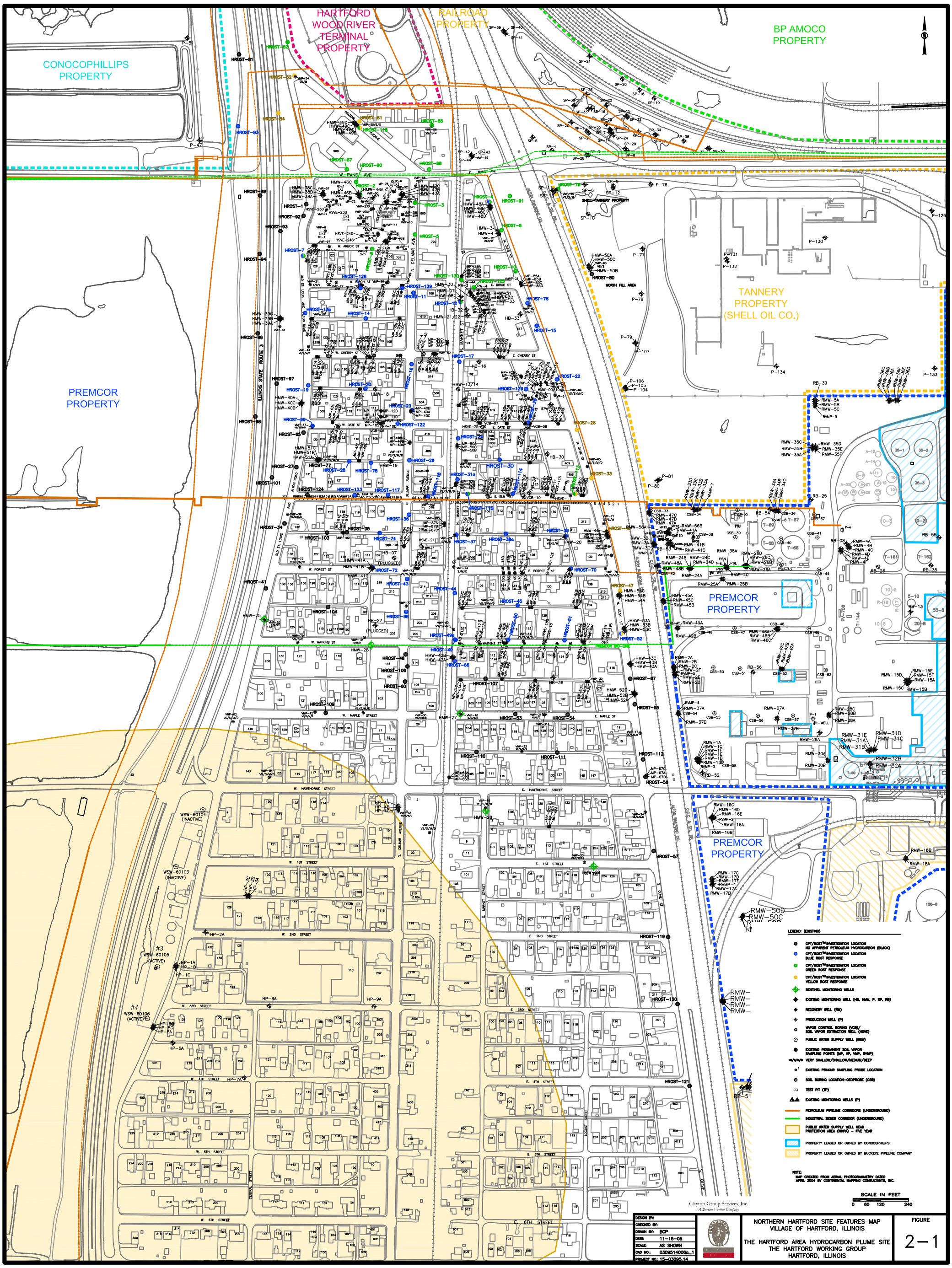
HISTORIC LNAPL CONTOURS -1978

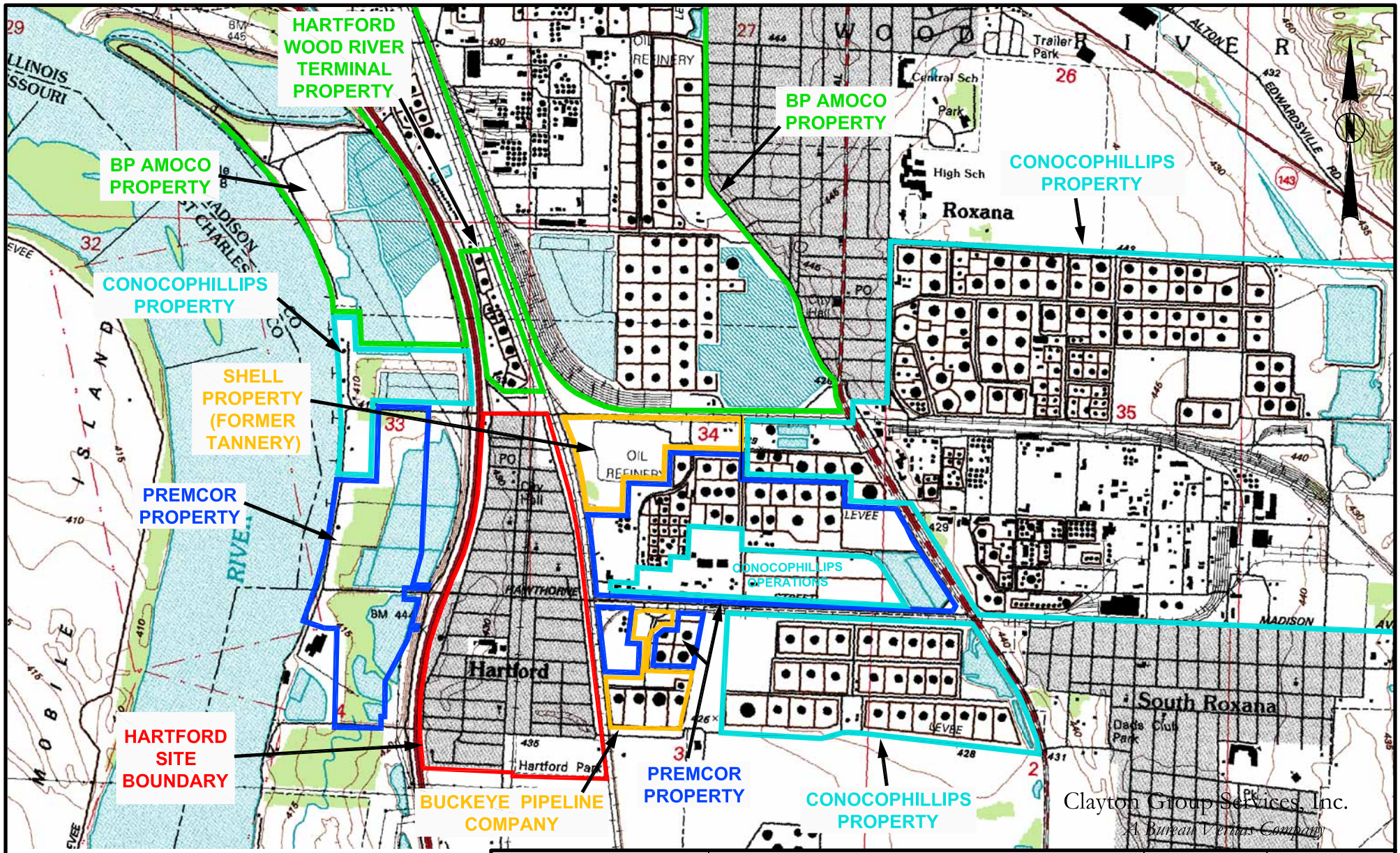
THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

0 60 120 240 360 480 Feet

FIGURE 2-2

BUREAU VERITAS
Clayton Group Services, Inc
A Bureau Veritas Company


HARTFORD WOOD RIVER TERMINAL PROPERTY
RAILROAD PROPERTY
BP AMOCO PROPERTY
CONOCOPHILLIPS PROPERTY
PREMCOR PROPERTY
TANNERY PROPERTY (SHELL OIL CO.)
SHELL-TANNERY PROPERTY
NORTH FILL AREA
ILLINOIS STATE ROUTE 3
ALTON RAILROAD CO.
C.C.C.& St. L. RR
W. RAND AVE
E. RAND AVE
W. ARBOR ST
W. BIRCH ST
E. BIRCH ST
N. DELMAR AVE
N. MARKET ST
N. OLIVE ST
W. CHERRY ST
E. CHERRY ST
W. DATE ST
E. DATE ST
W. ELM ST
E. ELM ST
W. FOREST ST
E. FOREST ST
W. WATKINS ST
E. WATKINS ST
W. MAPLE STREET
E. MAPLE ST
W. HAWTHORNE STREET
E. HAWTHORNE STREET
W. 1ST STREET
E. 1ST STREET
W. 2ND STREET
E. 2ND STREET
W. 3RD STREET
E. 3RD STREET
W. 4TH STREET
E. 4TH STREET
W. 5TH STREET
E. 5TH STREET
W. 6TH STREET
E. 6TH STREET
S. DELMAR AVENUE
S. MARKET STREET
S. OLIVE ST
LOCUST STREET
CENTRAL STREET
OLD ST. LOUIS AND ALTON ROAD
WSW-60104 (INACTIVE)
WSW-60103 (INACTIVE)
#3 WSW-60105 (ACTIVE)
#4 WSW-60106 (ACTIVE)
LEGEND: (EXISTING)
CPT/ROST™ INVESTIGATION LOCATION NO APPARENT PETROLEUM HYDROCARBON (BLACK)
CPT/ROST™ INVESTIGATION LOCATION BLUE ROST RESPONSE
CPT/ROST™ INVESTIGATION LOCATION GREEN ROST RESPONSE
CPT/ROST™ INVESTIGATION LOCATION YELLOW ROST RESPONSE
SENTINEL MONITORING WELLS
EXISTING MONITORING WELL (HB, HMW, P, SP, RB)
RECOVERY WELL (RW)
PRODUCTION WELL (P)
VAPOR CONTROL BORING (VCB)/ SOIL VAPOR EXTRACTION WELL (HSVE)
PUBLIC WATER SUPPLY WELL (WSW)
EXISTING PERMANENT SOIL VAPOR SAMPLING POINTS (MP, VP, VMP, RVMP)
VS/S/M/D VERY SHALLOW/SHALLOW/MEDIUM/DEEP
EXISTING PRAXAIR SAMPLING PROBE LOCATION
SOIL BORING LOCATION-GEOPROBE (CSB)
TEST PIT (TP)
EXISTING MONITORING WELLS (P)
PETROLEUM PIPELINE CORRIDORS (UNDERGROUND)
INDUSTRIAL SEWER CORRIDOR (UNDERGROUND)
PUBLIC WATER SUPPLY WELL HEAD PROTECTION AREA (WHPA) - FIVE YEAR
PROPERTY LEASED OR OWNED BY CONOCOPHILIPS
PROPERTY LEASED OR OWNED BY BUCKEYE PIPELINE COMPANY
NOTE: MAP CREATED FROM AERIAL PHOTOGRAMMETRY DATED APRIL 2004 BY CONTINENTAL MAPPING CONSULTANTS, INC.
SCALE IN FEET
0 60 120 240
Clayton Group Services, Inc.
A Bureau Veritas Company
DESIGN BY:
CHECKED BY:
DRAWN BY: BCP
DATE: 11-15-05
SCALE: AS SHOWN
CAD NO.: 0309514006a_1
PROJECT NO.: 15-03095.14
NORTHERN HARTFORD SITE FEATURES MAP
VILLAGE OF HARTFORD, ILLINOIS
THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS
FIGURE
2-1



** NOT TO SCALE **

SOURCE:
USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP
(WOOD RIVER, ILL.–MO. – rev.1994)

CHK BY	
DWN BY	BCP
DATE	11–15–05
SCALE	AS SHOWN
CAD NO.	0309512001B
PRJ NO.	15–03095.14

VILLAGE OF HARTFORD, IL
AND SURROUNDING AREA MAP

THE HARTFORD AREA HYDROCARBON PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, ILLINOIS

BUREAU VERITAS

FIGURE

1 – 1

TABLE 6-3
RELATIVE COST EVALUATION SUMMARY

The Hartford Area Hydrocarbon Plume Site
Hartford, IL

Area A

Technology Option	COST RANGE
DPR[1]	$ 23,000,000 to $ 26,000,000
DPE[1]	$ 25,000,000 to $ 28,000,000
SPR	$ 3,500,000 to $ 4,500,000
VES	$ 3,500,000 to $ 4,500,000
MPE	$ 3,000,000 to $ 3,500,000
PMPE	$ 2,750,000 to $ 3,500,000
PMR	$ 2,000,000 to $ 3,000,000

1. Costs for DPE and DPR are for Areas A & B combined

Area B

Technology Option	COST RANGE
DPR[2]	N/A
DPE[2]	N/A
SPR	$ 10,750,000 to $ 13,000,000
VES	$ 6,000,000 to $ 7,000,000
MPE	$ 6,000,000 to $ 7,000,000
PMPE	$ 3,000,000 to $ 3,750,000
PMR	$ 2,250,000 to $ 3,000,000

2. Costs for DPE and DPR are included in Area A costs above

Area C

Technology Option	COST RANGE
DPR[3]	$ 28,500,000 to $ 32,000,000
DPE[3]	$ 31,000,000 to $ 36,000,000
SPR	$ 16,000,000 to $ 18,500,000
VES	$ 9,750,000 to $ 11,250,000
MPE	$ 9,000,000 to $ 10,750,000
PMPE	$ 4,000,000 to $ 5,250,000
PMR	$ 3,500,000 to $ 4,500,000

3. Costs for DPE and DPR are for Areas A, B & C combined

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
DPE **Dual Phase Extraction** Groundwater Depression pump and LNAPL pump with vacuum enhancement. Operated in a series of recovery wells with water sent to a waste water treatment plant (WWTP) and LNAPL to a storage tank	▪ DPE will provide protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ The pressurized lines containing LNAPL represent a risk for release and a safety concern during operation ▪ Mechanical/electrical equipment would be deployed and operated in the village (i.e., pumps, lift stations) ▪ Tanks (either above or below ground) may be needed for temporary LNAPL storage at wellheads and represent a potential safety concern from spills and exposure ▪ Vapors will be treated by SVE system at offsite location ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation	▪ The API model showed approximately the same recovery for DPE compared with DPR, and VES ▪ Pilot testing indicates that DPE generates similar LNAPL recovery volumes to MPE and SPR in Area A with higher water production. ▪ An LNAPL smear zone of several feet would be created by the drawdown pumping ▪ DPE pilot tests show a 40-60 feet liquid ROI at low pumping rates. ▪ High volume drawdown pumping appropriate when hydraulic control of actively mobile plume is needed - Hartford LNAPL plume is stable ▪ The drawdown pumping would expose residual LNAPL below the water table ▪ Low flexibility in operation – harder to adjust individual wells to match fluctuating water table conditions ▪ Fouling of down hole pumps in operation will increase the projected downtime of the system, decrease removal efficiency and increase timeframe to closure	▪ An offsite WWTP would be necessary to treat recovered groundwater ▪ Piping to an offsite WWTP requires permitting for crossing railroad tracks ▪ WWTP discharge to the Mississippi River requires permitting from U.S. Army Corps of Engineers ▪ Required permitting is expected to take two to five years to complete ▪ High pumping rates required to achieve an ROI sufficient to space recovery wells in public access areas ▪ Pumping large quantities of water may disrupt offsite groundwater control pumping operations ▪ Electrical power drops will be necessary at each wellhead ▪ May require the use of wellhead surge tanks for LNAPL to transfer to central storage tank ▪ SVE system to be used for vacuum enhancement and offsite treatment of vapors	▪ Community concern with impact to foundations by large volume pumping ▪ Surge tanks at well head locations will be an aesthetic and potential safety concern, if aboveground. ▪ Excavation of streets during installation of the system components ▪ Minimal traffic or home/business access disruption during operation (only during monitoring)	▪ Relative costs are twice that of other comparable technologies (MPE, VES). Costs approximately 5 times that of PMPE and PMR. **Area A & B**: $25,000,000 to $28,000,000 **Area A, B, C**: $31,000,000 to $36,000,000

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
DPR **Dual Pump Recovery** Groundwater Depression pump and LNAPL pump. Operated in a series of recovery wells with water sent to a waste water treatment plant (WWTP) and LNAPL to a storage tank	▪ DPR will provide protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ The pressurized lines containing LNAPL represent a risk for release and a safety concern during operation ▪ Mechanical/electrical equipment would be deployed and operated in the village (i.e., pumps, lift stations) ▪ Tanks (either above or below ground) may be needed for temporary LNAPL storage at wellheads and represent a potential safety concern from spills and exposure ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation	▪ The API model showed approximately the same recovery compared with DPE, MPE and VES(same comment as previous table) ▪ Pilot testing indicates that DPR generates similar LNAPL recovery volumes to MPE and SPR in Area A with higher water production ▪ An LNAPL smear zone of several feet would be created by the drawdown pumping ▪ Liquid ROI for DPR is anticipated to be less than or equal to DPE ▪ High volume drawdown pumping appropriate when hydraulic control of actively mobile plume is needed - Hartford LNAPL plume is stable ▪ Fouling of down hole pumps in operation will increase the projected downtime of the system, decrease removal efficiency and increase timeframe to closure ▪ The drawdown pumping would expose residual LNAPL below the water table	▪ An offsite WWTP would be necessary to treat recovered groundwater ▪ Piping to an offsite WWTP requires permitting for crossing railroad tracks ▪ WWTP discharge to the Mississippi River requires permitting from U.S. Army Corps of Engineers ▪ Required permitting is expected to take two to five years to complete ▪ High pumping rates required to achieve an ROI sufficient to space recovery wells in public access areas ▪ Pumping large quantities of water may disrupt offsite groundwater control pumping operations ▪ Electrical power drops will be necessary at each wellhead ▪ May require the use of wellhead surge tanks for LNAPL to transfer to central storage tank ▪ SVE system to be used for vacuum enhancement and offsite treatment of vapors	▪ Community concern with impact to foundations by large volume pumping ▪ Surge tanks at well head locations will be an aesthetic and potential safety concern, if aboveground ▪ Disruption of streets during installation of the system components ▪ Minimal traffic or home/business access disruption during operation (only during monitoring)	▪ Relative costs are twice that of other comparable technologies (MPE, VES). Costs approximately 5 times that of PMPE and PMR. **Area A & B**: $23,000,000 to $26,000,000 **Area A,B,C**: $28,500,000 to $32,000,000

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
MPE Multi-Phase Extraction A series of extraction wells with stingers to extract both fluids and vapor. Vacuum blowers and treatment along with LNAPL storage at an offsite location	▪ MPE will provide protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ Vacuum lines pose limited safety concern during system operation ▪ Vapors extracted from the subsurface will be treated via thermal destruction at a site outside of the village ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation ▪ The pressurized lines containing LNAPL/water represent a risk for release and a safety concern during operation	▪ The API model showed approximately the same recovery compared with DPE, DPR and VES ▪ MPE addresses all LNAPL phases simultaneously ▪ MPE stinger depths can be varied to accommodate groundwater fluctuations – flexibility in operation is very high ▪ MPE ROI is expected to be 60-100 feet based on pilot testing ▪ When LNAPL sustainable production is low, MPE essentially operates as an SVE system with similar effectiveness to SVE	▪ New MPE wells necessary to provide access to the LNAPL ▪ Reduced volume of water produced will limit the water handling and treatment requirements ▪ Additional knockout tanks and transfer pumps may be required in the village to manage the fluid flow	▪ Excavation of streets during installation of the system components ▪ No aboveground structures to provide aesthetic concerns to the residents ▪ Minimal traffic or home/business access disruption during operation (only during monitoring)	▪ Relative costs are generally half of those for DPE/DPR and comparable to VES. Costs for Area B and C are generally 2 to 3 times higher than PMPE and PMR and ⅔ the cost for SPR.
			Area A: Pilot testing results show very high and sustainable LNAPL production **Area B**: Pilot testing showed moderately more liquid production than vapor production with moderate overall LNAPL production **Area C**: Pilot testing results show more vapor production than liquid production, generally low LNAPL production, and generally low sustainability of LNAPL production	**Area A:** Belowground vapor/liquid structure may be necessary in the village **Area A**: An offsite blower and vapor treatment system will require crossing east side railroad tracks **Areas B1, B2, B3 & B4**: Upgraded SVE system with new wells to be used for MPE		**Area A**: $3,000,000 to $3,500,000 **Area B**: $6,000,000 to $7,000,000 **Area C**: $9,000,000 to $10,750,000

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
SPR Skimmer Pump Recovery Pneumatic skimming pumps deployed in a series of wells with wellhead LNAPL storage tanks	▪ SPR will provide protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ Air compressors pose a safety concern for the village during operation ▪ Pressurized air and LNAPL lines pose a safety concern for the village during operation ▪ Tanks (either above or below ground) for temporary petroleum storage at wellheads present a safety concern from spills and exposure ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation	▪ The API model showed less than half the recovery compared with DPR, DPE, MPE and VES ▪ Limited ROI (Estimated to be less than 30 feet) ▪ SPR relies on natural groundwater fluctuations to capture LNAPL ▪ SPR avoids LNAPL smearing ▪ SPR is a proven technology for LNAPL removal ▪ Low to moderate maintenance efforts and system downtime	▪ Limited or no access to residential properties to install recovery wells and equipment at appropriate spacing ▪ Installation of wells and equipment in public right-of-way will be difficult due to need for electric power and tanks at wellheads ▪ Low volume of water for disposal treatment ▪ Transport piping for LNAPL would require additional liquid piping ▪ Electrical power drops will be necessary at compressor vaults ▪ The projected area where SPR can be implemented is approximately half as much that of the LNAPL-impacted area	▪ Excavation of streets during installation of the system components ▪ Aboveground surge tanks at well head locations will be an aesthetic and potential safety concern ▪ Noise from air compressor operation ▪ LNAPL recovery in most private areas may not be implemented	▪ Relative costs are half of those for DPE/DPR. Costs for Area B and C are twice that of VES and MPE and comparable in Area A. Cost is 2 to 3 times higher than PMPE and PMR.
			Area B: Limited access to only public rights-of-way will address only about 50% of the recovery area. **Area B**: The API model predicted low to moderate LNAPL recovery **Area C:** Limited access to only public rights-of-way will address only about 45% of the recovery area **Area C**: The API model predicted low LNAPL recovery			**Area A**: $3,500,000 to $4,000,000 **Area B**: $10,750,000 to $13,000,000 **Area C**: $16,000,000 to $18,500,000

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
VES Vacuum Enhanced Skimmer Pump Recovery Pneumatic skimming pumps deployed in a series of wells with wellhead LNAPL storage tanks. Vacuum enhancement through connection of well to existing SVE system	▪ VES will provide protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ Air compressors pose a safety concern for the village during operation ▪ Pressurized air and LNAPL lines pose a safety concern for the village during operation ▪ Tanks (either above or below ground) for temporary petroleum storage at wellheads present a safety concern from spills and exposure ▪ Vapors will be treated by SVE system at offsite location ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation	▪ The API model showed approximately the same recovery compared with DPR, DPE, and MPE ▪ ROI expected to be 60 to 75 feet ▪ VES relies on natural groundwater fluctuations and vacuum enhancement to capture LNAPL ▪ VES avoids LNAPL smearing ▪ Upwelling or LNAPL mounding possible, which may reduce recovery and vacuum ROI ▪ Technology has a limited track record	▪ Vacuum-enhancement implemented by using the SVE system ▪ Limited or no access to residential properties to install recovery wells and skimmer equipment at appropriate spacing ▪ Installation of wells and equipment in public right-of-way will be difficult due to need for electric power and tanks at wellheads ▪ Moderate maintenance efforts and system downtime ▪ Transport piping for LNAPL would require additional liquid piping ▪ Electrical power drops will be necessary at each wellhead ▪ The projected area where VES can be implemented will not include all of the LNAPL-impacted area due to access to private areas	▪ Excavation of streets during installation of the system components ▪ Surge tanks at well head locations will be an aesthetic and potential safety concern if aboveground ▪ Minimal traffic or home/business access disruption during operation (only during monitoring)	▪ Relative costs are half of those for DPE/DPR. Costs for Area B and C are comparable to MPE and half those for SPR. Cost is 2 to 3 times higher than PMPE and PMR. **Area A**: $3,500,000 to $4,500,000 **Area B**: $6,000,000 to $7,000,000 **Area C**: $9,750,000 to $11,250,000

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
SVE **Soil Vapor Extraction** Series of extraction wells connected via piping to offsite vapor extraction and treatment compound	The existing SVE system and its planned expansions will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ Vacuum lines pose limited safety concern during system operation ▪ Vapors extracted from the subsurface will be treated via thermal destruction at a site outside of the village ▪ During construction, there will be some potential hazards associated with the below ground piping and vault installation	▪ LNAPL is primarily gasoline range organics (GRO), therefore SVE is effective at removing LNAPL and residuals from the unsaturated zone ▪ Existing SVE system is currently active in a portion of the LNAPL plume and is successful at mass removal ▪ Radius of influence (ROI) is greater than other technologies ▪ High water conditions reduce the effectiveness of SVE ▪ Seasonal groundwater fluctuations allow SVE removal of deeper LNAPL ▪ SVE is a proven technology for the removal of volatile constituents	▪ Infrastructure already exists for expansion of SVE system ▪ ROI will allow for well installation in publicly-accessible areas ▪ May require additional pipe crossing of railroad tracks east of village ▪ The SVE only requires utilities at the outside treatment facility that are readily available ▪ SVE will be implemented throughout the entire LNAPL plume that includes Areas A, B1, B2, B3, B4 and C	▪ Disruption of streets during installation of the system components ▪ No aboveground structures to provide aesthetic concerns to the residents ▪ Minimal traffic or home/business access disruption during operation (only during monitoring)	▪ Capital costs will be low due to incremental costs to address areas not currently a part of Phase 2B and 3 expansion ▪ Added O&M costs will be low to moderate
			Area C: SVE will be most effective since LNAPL has limited mobility or sustainable production **Area B4**: Mixture of DRO and GRO will limit SVE effectiveness to only GRO and light-end DRO	**Area C**: A majority of this area already addressed with current SVE system and planned expansion		

Table 6-2
Alternatives Evaluation Summary for LNAPL Recovery Selection Process
The Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Technology Alternative	Protectiveness Considerations	Short-Term Effectiveness Considerations[1]	Long-Term Effectiveness Considerations	Implementability Considerations	Community Impact Considerations	Cost Considerations
PMR Periodic Manual Recovery Periodic manual removal of LNAPL from a series of recovery wells	▪ PMR will provide limited protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ The transferring of LNAPL to temporary containers poses minimal safety concern from spills and exposure ▪ General risk of vehicular traffic for workers	▪ Small radius of influence, with relatively little LNAPL removed ▪ Limited "active" recovery technology ▪ Limited removal rate will not allow completion in a reasonable timeframe	▪ Construction of additional wells necessary to implement ▪ Relatively high level of man hours required to conduct LNAPL recovery ▪ The projected area where PMR can be implemented in Areas B1, B2, B4 and C is less than half as much that of the LNAPL-impacted area	▪ Some disruption of streets necessary to implement technology ▪ Odor and spill concerns during operation ▪ Potential for traffic and home/business access interruption during operation ▪ LNAPL recovery via PMR in most private areas will not be implemented	▪ Relative costs are generally 2 to 3 times lower than MPE and VES. Costs are 10 times less than DPE/DPR and slightly higher than PMR **Area A**: $2,000,000 to $3,000,000 **Area B**: $2,250,000 to $3,000,000 **Area C**: $3,500,000 to $4,500,000
PMPE Periodic Multi-Phase Extraction Periodic mobile extraction unit operated periodically on a series of recovery wells	▪ PMPE will provide limited protectiveness to the environment by reducing the source of petroleum hydrocarbons to various media (i.e., soil gas, groundwater) ▪ The existing SVE system and its planned expansion will provide required protection for the homes and businesses by cutting off the vapor intrusion pathway from the LNAPL	▪ Vacuum lines pose limited safety concern during system operation ▪ Vapors extracted from the subsurface will be treated at the mobile extraction unit ▪ During construction, there will be some potential hazards associated with the well vault installation ▪ Traffic safety during PMPE is also a consideration	▪ Periodic operation at recovery wells will be of limited effectiveness compared to continuous operation ▪ PMPE can be successfully implemented in low production and recharge areas ▪ PMPE addresses all LNAPL phases simultaneously ▪ PMPE stinger depths can be varied to accommodate groundwater fluctuations	▪ PMPE is easy to implement with a mobile unit in public access areas ▪ PMPE can be implemented by using either commercial vacuum trucks or PMPE systems (ICE or LRP) ▪ Vapor treatment will be necessary for the mobile extraction unit ▪ Fluids are captured in either the vacuum truck tank or temporary tanks ▪ Vacuum trucks and ICE or LRP PMPE systems are utility independent, with onboard fuel (diesel or propane) and electrical generators as required	▪ Some disruption of streets necessary to implement technology ▪ Noise and odor concerns during operation ▪ Potential for traffic and home/business access interruption during operation	▪ Relative costs are generally 2 to 3 times lower than MPE and VES. Costs are 10 times less than DPE/DPR and slightly higher than PMR
			Area C: Pilot testing results show more vapor production than liquid production **Area B3**: Potential lack of sustainability could make PMPE as effective as MPE			**Area A**: $2,750,000 to $3,500,000 **Area B**: $3,000,000 to $3,750,000 **Area C**: $4,000,000 to $5,250,000

NOTES:

1. Comments on safety considerations are generalized. Complete job safety analyses will be conducted before implementation of the selected technologies.
2. DPE – Dual Phase Extraction (drawdown pumping with vacuum-enhancement)
3. DPR = Dual Pump Recovery (drawdown pumping)
4. MPE – Multi-Phase Extraction
5. SPR = Skimmer Pump Recovery
6. VES = Vacuum-enhanced Skimmer Pump Recovery
7. SVE = Soil Vapor Extraction
8. PMR = Periodic Manual Removal
9. PMPE = Periodic MPE

Table 6-1
Key Factors for LNAPL Production Area Determination

The Hartford Area Hydrocarbon Plume Site
Hartford, IL

Area A

- Primarily gasoline range organics (GRO)
- Highest LNAPL production with moderate vapor production[1]
- Highest LNAPL recharge[2]
- Highest LNAPL saturation[3]
- Highest LNAPL transmissivity and conductivity[2]

Area B1

- Primarily GRO
- Slightly higher LNAPL production compared with vapor production
- Moderate LNAPL recharge
- Moderate total LNAPL production (liquid and vapor)
- Low to moderate LNAPL transmissivity and conductivity

Area B2

- Primarily GRO
- Slightly higher LNAPL production compared with vapor production
- Moderate LNAPL recharge
- Moderate total LNAPL production (liquid and vapor)
- Low to moderate LNAPL transmissivity and conductivity

Area B3

- Primarily GRO
- Slightly higher LNAPL production compared with vapor production
- Moderate LNAPL recharge
- Moderate total LNAPL production (liquid and vapor)
- Expected limited sustainability
- Low to moderate LNAPL transmissivity and conductivity

Area B4

- Primarily diesel range organics (DRO) with some GRO intermixed
- Slightly higher LNAPL production compared with vapor production
- Moderate LNAPL recharge
- Moderate total LNAPL production (liquid and vapor)
- Low to moderate LNAPL transmissivity and conductivity

Area C

- Primarily GRO
- Lower LNAPL production compared with vapor production
- Lower LNAPL recharge
- Lower LNAPL saturation
- Lower LNAPL transmissivity and conductivity

NOTES:
1 Refer to Section 5.1.2.5 of Appendix E
2 Refer to Section 3.3 of this Proposal
3 Refer to Appendix C

Table 5-2
API Model-Predicted LNAPL Recovery

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

Boring Locaton	Time	Skimming (gallons)	Vacuum Enhanced Skimming (gallons)	Dual Pump Recovery (gallons)	Dual Phase Extraction (gallons)
HCSB-1	1 year	3,895	14,010	13,462	15,646
	6 year	5,011	16,786	16,717	17,033
	10 year	5,123	16,994	16,936	17,185
HCSB-2	1 year	209	1,262	1,157	1,660
	6 year	527	2,209	2,142	2,439
	10 year	594	2,405	2,352	2,572
HCSB-3	1 year	1.5	27	23	48
	6 year	8.7	129	115	198
	10 year	13.9	185	167	263
HCSB-4	1 year	1,297	5,526	5,339	6,331
	6 year	1,971	6,821	6,794	6,733
	10 year	2,054	6,925	6,892	7,065
HCSB-5	1 year	0.1	1	1	2.4
	6 year	0.4	8	7	17
	10 year	0.7	13.0	11	23

Table 5-1
Specific LNAPL Thicknesses

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

Boring	Corre-sponding Monitoring Well	Date of Measured LNAPL Thickness and Baildown Test	Measured LNAPL Thickness (ft)	D_o (ft)		
				Total for Estimated Mobile Interval[1]	Calculated for Mobile Interval[2]	Total for Smear Zone[1]
HCSB-1	HMW-44C	9/23/2005	2.1	0.30	0.32	0.60
HCSB-2	RW-5	9/23/2005	0.32	0.01	0.02	0.15
HCSB-3	MP-50C	ROST Log 2/19/2004	0.4	0.01	0.02	0.21
HCSB-4	MP-39C	10/5/2005	1.62	0.38	0.22	0.38
HCSB-5	MP-29D	9/20/2005	0.48	0.04	0.02	0.47
HCSB-5	MP-29C	9/20/2005	0.63	0.04	0.03	0.47

NOTES:

1 Estimates are based on measured LNAPL saturation data from Dean-Stark core analyses.

2 Represents estimates based on API model that was calibrated to capillary pressure vs. saturation core analysis data.

TABLE 4-3
LNAPL Recovery using Skimmer Pumps
Aug 2004 - Aug 2005

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

TANK GAUGING DATE	WELL ID	ESTIMATED VOLUME OF LNAPL RECOVERED DURING PERIOD (gal)	ESTIMATED CUMULATIVE VOLUME OF LNAPL RECOVERED (gal)
09/16/04	RW-2/5	23	23
12/16/04	RW-2/5	271	294
03/02/05	RW-2	345	639
03/31/05	RW-2	414	1053
05/23/05	RW-2	329	1382
06/24/05	RW-2	318	1700
08/18/05	RW-2	103	1803
09/16/04	RW-4A	127	127
12/16/04	RW-4A	236	363
03/02/05	RW-4A	240	603
03/31/05	RW-4A	297	900
05/23/05	RW-4A	123	1023
06/24/05	RW-4A	39	1062
08/18/05	RW-4A	65	1127
Total Product Recovered since August 2004			**2,930**

TABLE 4-1
LNAPL Recovery Pilot Test Results
Recovery Well RW-2, Feb-April 2004

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

LNAPL THICKNESS (feet)	DATE	TIME
1.49	02/17/04	10:20 a.m.
1.52	02/18/04	10:23 a.m.
1.36	02/19/04	7:20 a.m.
1.16	02/23/04	12:15 p.m.
1.01	02/24/04	7:30 a.m.
1.20	02/27/04	8:10 a.m.
0.78	03/01/04	1:10 p.m.
0.23	03/02/04	1:05 p.m.
0.23	03/03/04	8:35 a.m.
0.90	03/04/04	3:41 p.m.
0.38	03/05/04	8:30 a.m.
0.21	03/08/04	11:45 a.m.
0.37	03/09/04	10:01 a.m.
0.25	03/11/04	9:00 a.m.
0.13	03/15/04	11:20 a.m.
0.14	03/16/04	4:17 p.m.
0.29	03/17/04	2:03 p.m.
0.04	03/18/04	9:40 a.m.
0.21	03/19/04	11:20 a.m.
0.02	03/23/04	2:02 p.m.
0.04	03/24/04	1:53 p.m.
0.40	03/30/04	12:31 p.m.
0.25	03/31/04	8:38 a.m.
0.16	03/31/04	2:14 p.m.
0.05	03/31/04	4:26 p.m.
0.06	03/31/04	4:52 p.m.
0.57	04/01/04	2:01 p.m.
0.94	04/07/04	---
1.06	04/12/04	---
1.40	04/20/04	1:59 p.m.
1.41	04/28/04	---

NOTE:
Shaded cells represent the recovery period.

TABLE 4-2
LNAPL Recovery Pilot Test Results
Recovery Well RW-3, Feb-April 2004

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

LNAPL THICKNESS (feet)	DATE	TIME
1.87	2/17/2004	8:28 a.m.
0.83	2/18/2004	3:55 p.m.
0.58	2/24/2004	9:25 a.m.
0.19	3/5/2004	3:27 p.m.
0.33	3/8/2004	1:00 p.m.
0.16	3/15/2004	8:00 a.m.
0.78	4/7/2004	---
0.91	4/12/2004	---
1.02	4/15/2004	2:15 p.m.
1.14	4/20/2004	3:21 p.m.
1.31	4/28/2004	---

NOTE:
Shaded cells represent the recovery period.

TABLE 3-7
LNAPL MOBILITY

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

		PORE FLUID SATURATIONS, % Pv			
		Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HMW-44C	9.6	82.6	3.6	60.4	3.6
HMW-44C	10.3	68.9	3.5	29.7	3.2
HMW-44C	10.8	55.6	1.1	31.7	0.9
HMW-44C	17.0	87.2	1.7	67.7	1.5
HMW-44C	17.4	90.8	0.4	83.7	0.4
HMW-44C	20.05	78.4	2.5	43.5	2.1
HMW-44C	30.0	76.2	4.8	44.9	4.8
HMW-44C	32.4	32.2	30.4	10.7	6.0
HMW-44C	40.3	50.3	9.1	7.8	5.1
MP-29D	24.0	76.1	5.9	46.9	4.9
MP-29D	35.35	57.5	6.8	5.7	6.0
MP-29D	39.35	60.1	4.0	7.8	2.8

NOTES:

Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation a
Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after cer
Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

TABLE 3-6
CORE SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

WELL AREA	CRITERIA/RATIONALE										
	LNAPL Well Thickness (ft.)	H_2A Test Location	Average H_2A Recovery Rate (gal. product/hr.)	H_2A - 50% Recharge Time (Minutes)	Baildown Tests 50% Recharge Time (Minutes)	Adjacent ROST Location	ROST Signature Area	Stratum(s) with LNAPL (ROST-based)	Torkelson Data	Plume Location	Other
HMW-44C / HCSB-1	2.00	X	24.4	1.5	<1 Bailing unable to drop product level more than 50%	HROST-40	Yellow	North Olive, Rand, Main	Gasoline Range	East/ Southeast	
RW-5 / HCSB-2	1.13	X	1.8	>350	No Data	HROST-126	Blue	Main	Gasoline Range	East-Central	Skimmer Pump
MP-50C / HCSB-3	1.45	X	11.0	7.0	No Data	HROST-24	Blue	Rand, Main	Gasoline Range	Central	
MP-39C / HCSB-4	1.00	X	2.1	>350	>350	HROST-20	Blue	Main	Gasoline Range	West-Central	
MP-29D / HCSB-5	0.44	X	4.5	>350	3.5	HROST-130	Green	Rand, Main	Gasoline Range	North-Central	Diesel Range at MP-29C

NOTES:
Simulated distillation analysis previously completed on the following wells: HMW-44C, MP-29C and MP-29D
LNAPL thickness measured on August 3-5, 2005.

TABLE 3-5
Baildown Test and HVR Event LNAPL T and K Value Summary
Hartford Area Hydrocarbon Plume Site

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR 000128249

							Cooper et al		
Well Name	Type	Date	DTP	Density	Avg Tn	Avg Kn	T_n (cm^2/s)(	K_n (cm/s)(C	L (ft)
HMW-18	BD	3/2/2004	34.94	0.7649			3.86E-02	6.55E-04	1.94
HMW-18	BD	3/4/2004	34.83	0.7649		5.31E-04	4.93E-03	9.19E-05	1.76
HMW-18	BD	8/24/2005	33.76	0.7649			4.23E-02	8.46E-04	1.64
HMW-19	BD	3/2/2004	34.85	0.7415			1.18E-02	2.74E-04	1.41
HMW-19	BD	3/4/2004	34.64	0.7415			1.34E-02	3.35E-04	1.31
HMW-19	HVR	5/23/2005	31.33	0.7415			3.49E-01	1.37E-02	0.83
HMW-19	HVR	6/7/2005	31.84	0.7415			4.53E-03	1.68E-04	0.88
HMW-19	HVR	6/21/2005	30.50	0.7415			1.39E-01	3.46E-03	1.31
HMW-19	HVR	7/8/2005	31.45	0.7415			4.14E-01	2.34E-02	0.57
HMW-19	HVR	7/22/2005	32.39	0.7415			3.41E-03	1.03E-04	1.08
HMW-19	HVR	8/9/2005	33.25	0.7415			2.13E-02	3.87E-04	1.79
HMW-19	HVR	8/10/2005	33.31	0.7415		3.22E-03	2.59E-02	4.64E-04	1.82
HMW-19	HVR	8/11/2005	33.38	0.7415			2.53E-02	4.56E-04	1.81
HMW-19	HVR	8/12/2005	33.42	0.7415			1.74E-01	3.32E-03	1.71
HMW-19	HVR	8/16/2005	33.54	0.7415			2.81E-02	5.30E-04	1.73
HMW-19	HVR	8/17/2005	33.58	0.7415			6.31E-02	1.23E-03	1.67
HMW-19	HVR	8/18/2005	33.61	0.7415			3.12E-02	6.19E-04	1.64
HMW-19	HVR	8/19/2005	33.69	0.7415			2.25E-02	4.53E-04	1.62
HMW-19	HVR	8/22/2005	33.71	0.7415			2.38E-01	5.22E-03	1.48
HMW-19	HVR	8/23/2005	33.74	0.7415			3.08E-02	7.16E-04	1.40
HMW-20	BD	3/3/2004	32.75	0.7428			1.04E-01	2.02E-03	1.69
HMW-20	HVR	5/16/2005	30.09	0.7428		5.06E-04	3.09E-04	4.00E-06	2.53
HMW-20	HVR	6/14/2005	29.28	0.7428			2.04E-04	2.25E-06	2.97
HMW-20	HVR	7/15/2005	30.29	0.7428			1.91E-05	6.26E-07	0.99
HMW-44C	HVR	5/13/2005	28.50	0.7641			2.41E-02	2.67E-04	2.95
HMW-44C	HVR	6/27/2005	27.75	0.7641			1.39E-01	1.31E-03	3.47
HMW-44C	HVR	7/14/2005	28.46	0.7641			2.39E-02	2.61E-04	2.99
HMW-44C	HVR	7/25/2005	29.28	0.7641			4.66E-02	6.32E-04	2.41
HMW-44C	HVR	7/26/2005	29.32	0.7641			5.00E-02	6.95E-04	2.35
HMW-44C	HVR	7/27/2005	29.48	0.7641			1.56E-02	2.24E-04	2.27
HMW-44C	HVR	7/28/2005	29.53	0.7641			4.00E-02	6.06E-04	2.16
HMW-44C	HVR	7/29/2005	29.57	0.7641		1.12E-03	1.56E-02	2.37E-04	2.15
HMW-44C	HVR	8/1/2005	29.65	0.7641			3.62E-03	5.51E-05	2.14
HMW-44C	HVR	8/2/2005	29.71	0.7641			1.56E-02	2.42E-04	2.10
HMW-44C	HVR	8/3/2005	29.76	0.7641			9.03E-03	1.40E-04	2.10
HMW-44C	HVR	8/4/2005	29.83	0.7641			6.27E-03	1.02E-04	2.00
HMW-44C	HVR	8/5/2005	29.92	0.7641			4.37E-03	7.12E-05	2.00
HMW-44C	HVR	8/8/2005	30.01	0.7641			1.45E-03	2.39E-05	1.99
HMW-44C	BD	9/23/2004	29.14	0.7641			9.16E-01	1.20E-02	2.50
MP-35D	BD	8/30/2005	32.40	0.7763	1.32E-01	2.57E-03	1.32E-01	2.57E-03	1.69
MP-39C	BD	9/23/2004	32.94	0.7481		3.08E-05	1.20E-03	2.38E-05	1.66
MP-39C	BD	8/31/2005	34.21	0.7481			1.75E-03	3.78E-05	1.52
MP-45C	BD	9/24/2004	30.26	0.7616		2.46E-04	6.00E-04	9.94E-06	1.98
MP-45C	BD	8/30/2005	33.64	0.7616			3.57E-02	4.82E-04	2.43
MP-47C	BD	9/24/2004	31.58	0.7569			1.64E-04	2.22E-06	2.43
MP-47C	HVR	5/10/2005	28.35	0.7569			1.00E-03	1.33E-05	2.46
MP-47C	HVR	5/25/2005	28.36	0.7569	3.25E-03	4.88E-05	2.72E-03	4.28E-05	2.07
MP-47C	HVR	6/9/2005	28.46	0.7569			8.93E-03	1.35E-04	2.15
MP-47C	HVR	7/12/2005	28.29	0.7569			3.43E-03	5.02E-05	2.24
MP-49C	BD	8/31/2005	32.72	0.7335	7.20E-05	1.25E-06	7.20E-05	1.25E-06	1.88
MP-50C	HVR	5/26/2005	29.77	0.7410			1.01E+00	2.64E-02	1.24
MP-50C	HVR	7/13/2005	29.98	0.7410			1.82E-02	4.90E-04	1.21
MP-50C	HVR	8/24/2005	31.96	0.7410		4.49E-03	5.52E-05	1.07E-06	1.68
MP-50C	HVR	8/25/2005	32.24	0.7410			3.41E-04	2.33E-05	0.47
MP-50C	HVR	8/26/2005	32.14	0.7410			9.54E-05	5.60E-06	0.55
MP-50C	HVR	8/29/2005	31.94	0.7410			1.37E-04	2.85E-06	1.57
MP-52C	BD	8/23/2005	33.08	0.7360	1.05E-05	2.29E-07	1.05E-05	2.29E-07	1.50
MP-53C	BD	9/23/2004	32.46	0.7480		3.58E-05	2.80E-05	5.36E-07	1.71
MP-53C	HVR	7/19/2005	30.50	0.7480			3.59E-03	7.10E-05	1.65
MP-55C	BD	9/23/2004	29.20	0.7705			9.54E-04	8.50E-06	3.69
MP-55C	HVR	6/17/2005	28.53	0.7705		4.16E-04	4.27E-02	1.30E-03	1.07
MP-55C	HVR	7/6/2005	28.43	0.7705			1.72E-02	1.83E-04	3.07
MP-55C	HVR	7/20/2005	28.95	0.7705			2.06E-02	1.73E-04	3.89
MP-56C	HVR	7/18/2005	29.98	0.7456	3.52E-04	1.10E-05	3.52E-04	1.10E-05	1.04
RW-4A	HVR	8/30/2005	31.80	0.7649	3.21E-03	9.00E-05T	4.81E-03	1.28E-04	1.22
RW-4A	HVR	8/31/2005	31.94	0.7649			1.61E-03	5.15E-05	1.02
RW-5	HVR	9/1/2005	31.97	0.7649	1.94E-03	6.47E-05	1.94E-03	6.47E-05	0.97

Notes:
T_n and K_n calculated according to Huntley (2000)

TABLE 3-4
H_2A RECOVERY TEST WELLS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
HMW-19		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
HMW-20		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-44C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-48C		
	EPA	REPRODUCIBILITY OF INITIAL TEST
		GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29D		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-39C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-47C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-50C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-51D		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN/CENTRAL PORTION OF PLUME
MP-52C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN/CENTRAL PORTION OF PLUME
MP-53C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL/EASTERN PORTION OF PLUME
MP-54C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN/CENTRAL PORTION OF PLUME

TABLE 3-4
H_2A RECOVERY TEST WELLS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
MP-55C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-56C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTH/CENTRAL PORTION OF PLUME
MP-57C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTH/EASTERN PORTION OF PLUME
MP-79C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/WESTERN PORTION OF PLUME
MP-80C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/WESTERN PORTION OF PLUME
RW-4A		
	MAIN	BLUE/GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/EASTERN PORTION OF PLUME
RW-5		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME

NOTES:
The recovery test activities at the above locations will be conducted as part of the H2A pilot test activities.

TABLE 3-3
BAILDOWN TEST WELLS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
HMW-18		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
HMW-19		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
HMW-20		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTH PORTION OF PLUME
HMW-22		
	MAIN	GREEN/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-44C		
	MAIN	YELLOW ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-45C		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
HMW-48C		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN/EASTERN PORTION OF PLUME
MP-29D		
	MAIN	BLUE/GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-35D		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-39C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-45C		
	MAIN	REPRODUCIBILITY OF INITIAL TEST
		BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EAST/CENTRAL PORTION OF PLUME

TABLE 3-3
BAILDOWN TEST WELLS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
MP-47C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-49C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WEST/CENTRAL PORTION OF PLUME
MP-52C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-53C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-55C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-79C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/WESTERN PORTION OF PLUME
MP-80C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/WESTERN PORTION OF PLUME

NOTES:
The baildown test activities at the above locations will be conducted with a bailer or equivalent.

TABLE 3-2
LNAPL CHARACTERIZATION SUMMARY TABLE

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, IL

Sample ID	Primary Product	Secondary Product	Simulated Distillation	Density
HMW08	Gasoline	Trace Diesel	Not Analyzed	Gasoline-Like
HMW19	Gasoline	None	Not Analyzed	Gasoline-Like
HMW19D	Gasoline	None	Not Analyzed	Gasoline-Like
HMW20	Gasoline	Trace Diesel	Not Analyzed	Gasoline-Like
HMW22	Gasoline	Diesel <10%	Not Analyzed	Gasoline-Like
HMW44C	Gasoline	Diesel +10%	Gasoline/ Diesel	Gasoline-Like
HMW45C	Gasoline Approx 60%	Diesel ~40%	Not Analyzed	Diesel-like
HMW46C	Gasoline Approx 70%	Diesel ~30%	Gasoline/ Diesel	Diesel-like
HMW48C EPA Stratum	Diesel Approx 70%	Gasoline ~30%	Diesel	Diesel-like
MP29C Rand Stratum	Diesel	Trace Gasoline	Diesel	Diesel-like
MP29D	Gasoline	Diesel ~10%	Gasoline/ Diesel	Gasoline-Like
MP29DD	Gasoline	Diesel ~10%	Gasoline/ Diesel	Gasoline-Like
MP35D	Gasoline	Diesel ~ 5%	Gasoline	Gasoline-Like
MP37D	Gasoline	Diesel <5%	Gasoline	Gasoline-Like
MP39C	Gasoline	None	Gasoline	Gasoline-Like
MP45C	Gasoline	None	Gasoline	Gasoline-Like
MP47C	Gasoline	Diesel <10%	Gasoline/ Diesel	Gasoline-Like
MP48B	Gasoline	None	Not Analyzed	Gasoline-Like

TABLE 3-2
LNAPL CHARACTERIZATION SUMMARY TABLE

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, IL

Sample ID	Primary Product	Secondary Product	Simulated Distillation	Density
MP49C	Gasoline	None	Gasoline	Gasoline-Like
MP50C	Gasoline	None	Not Analyzed	Gasoline-Like
MP51D	Gasoline	Trace Diesel	Not Analyzed	Gasoline-Like
MP52C	Gasoline	None	Gasoline	Gasoline-Like
MP53C	Gasoline	None	Not Analyzed	Gasoline-Like
MP55C	Gasoline	Diesel ~10%	Gasoline/ Diesel	Gasoline-Like
MP56C	Gasoline	None	Not Analyzed	Gasoline-Like
MP56CD	Gasoline	None	Not Analyzed	Gasoline-Like
MP57C	Gasoline	None	Not Analyzed	Gasoline-Like
MP60C	Gasoline	None	Not Analyzed	Gasoline-Like
MP79C	Gasoline	Slight Trace Diesel	Not Analyzed	Gasoline-Like
MP80C	Gasoline	None	Not Analyzed	Gasoline-Like
RW-4A	Gasoline Approx 60%	Diesel ~40%	Not Analyzed	Gasoline-Like
RW-5	Gasoline Approx 90%	Diesel ~10%	Not Analyzed	Gasoline-Like

NOTES:
Torkelson Geochemistry, Inc. provided capillary gas chromatography with flame ionization detector (GC/FID) and density data. The GC/FID data was evaluated to identify primary and secondary products.
Core Laboratories provided simulated distillation and density data.

TABLE 3-1
LNAPL SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
HMW-08		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-19		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WEST/CENTRAL PORTION OF PLUME
HMW-20		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-22		
	MAIN	GREEN/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
HMW-44C		
	MAIN	YELLOW ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
HMW-45C		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
HMW-46C		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
HMW-48C		
	EPA	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29C		
	RAND	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		APPARENT CENTRAL PORTION OF PLUME
MP-29D		
	MAIN	GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHERN PORTION OF PLUME
MP-35D		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTH/CENTRAL PORTION OF PLUME
MP-37D		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-39C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-45C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EAST/CENTRAL PORTION OF PLUME
MP-47C		
	MAIN	YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME

TABLE 3-1
LNAPL SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

WELL	STRATUM	TESTING RATIONALE
MP-48B		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WESTERN PORTION OF PLUME
MP-49C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		WEST/CENTRAL PORTION OF PLUME
MP-50C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		CENTRAL PORTION OF PLUME
MP-51D		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-52C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTH/CENTRAL PORTION OF PLUME
MP-53C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EAST/CENTRAL PORTION OF PLUME
MP-55C		
	MAIN	YELLOW/BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-56C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EAST/CENTRAL PORTION OF PLUME
MP-57C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME
MP-60C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		SOUTHEAST PORTION OF PLUME
MP-79C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHWEST PORTION OF PLUME
MP-80C		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHWEST PORTION OF PLUME
RW-4A		
	MAIN	BLUE/GREEN ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		NORTHEAST PORTION OF PLUME
RW-5		
	MAIN	BLUE ROST SIGNATURE AREA
		AREA OF APPARENT LNAPL ACCUMULATION
		EASTERN PORTION OF PLUME

NOTES:
Simulated distillation analysis previously completed on the following wells: HMW-44C, HMW-46C, HMW-48C, MP-29C
MP-29D, MP-32B, MP-35D, MP-37D, MP-39C, MP-45C, MP-47C, MP-49C, MP-52C and MP-55C.

APPENDIX A

LNAPL SAMPLE RESULTS – TORKELSON GEOCHEMISTRY

Torkelson Geochemistry, Inc.
2528 South Columbia Place, Tulsa, Oklahoma 74114-3233
Voice 918-749-8441, Fax 918-749-6005

November 1, 2005

Kenneth D. Comire
Clayton Group Services, Inc.
3140 Finley Road
Downers Grove, IL 60515

RE: Hartford Working Group Project

Mr. Comire,
Torkelson Geochemistry, Inc. received three batches of samples from Clayton Group Services for the analyses presented here. 28 product samples and 27 water samples were received 8/5/05, two product samples and two water samples were received 8/11/05 and two product samples and two water samples were received 9/1/05 (see chain of custody forms for details).

As per instructions from Clayton Group Services the analyses performed on the product samples included capillary gas chromatography with flame ionization detector, density, viscosity and surface tension. Surface tension analysis was performed on all water samples and interfacial tension was determined for all product-water pairs. Because there was no water for sample point MP48B/050804, water from sample point MP29C/050803 was used for the product-water interfacial tension analysis as instructed by Clayton Group Services.

Sincerely,

Bruce Torkelson

Bruce Torkelson

CHAIN OF CUSTODY

pg. 1 of 3 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

lient: Mayton Group Services
ddress: 3140 Finley Road
ity / State / Zip: Downers Grove, IL 60515
ontact: Brad Martin Phone: (630) 795-3249
-Mail: Fax: (630) 795-1130

Are the samples chilled? ☐ NO ☒ YES (Ice or Blue Ice)
Cooler Temperature: _____ °C
Preserved in: ☐Lab ☐ Field

Comments:

e these samples known to be involved in litigation? ☐Yes ☐No
e these samples known to be hazardous? ☐Yes ☐No
e there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
Premier Hartford Distribution	Mark Orr

Requested Due Date	Billing Instructions
See Brad Martin	PO# " "

ab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	HMW08 / ~~080~~ 050803	8/3/05 - 1335	3 X								X					X
	HMW19 / 050804	8/4/05 - 0800	3								X					X
	HMW19D / 050804	8/4/05 - 0800	3								X					X
	HMW20 / ~~08~~ 050803	8/3/05 - 1715	3								X					X
	HMW22 / 050804	8/4/05 - 1015	3								X					X
	HMW44C / 050804	8/4/05 - 0655	3								X					X
	HMW45C / 050803	8/3/05 - 1155	3								X					X
	HMW46C / 050803	8/3/05 - 1130	3								X					X
	HMW48C / 050803	8/3/05 - 1100	3								X					X
	MP29C / 050803	8/3/05 - 1215	3								X					X

Relinquished By	Date / Time	Received By	Date / Time
Mark Orr [signature]	8/4/05 - 1435	Bruce Torkelson	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 2 of 3 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

:lient: _____

ddress: _____

:ity / State / Zip: _____

:ontact: _____ Phone: _____

:-Mail: _____ Fax: _____

Are the samples chilled? ☐ NO ☐ YES (Ice or Blue Ice)

Cooler Temperature: _____ °C

Preserved in: ☐Lab ☐ Field

Comments:

'e these samples known to be involved in litigation? ☐Yes ☐No

'e these samples known to be hazardous? ☐Yes ☐No

'e there any required reporting limits to be met on the requested analysis?

Yes ☐No If yes please provide limits in comment section.

Project Name / Number

Sample Collector's Name

Requested Due Date

Billing Instructions PO#

ab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON / VOLATILES
	MP29D / 050803	8/3/05 - 1220	3								X					X
	MP29DD / 050803	8/3/05 - 1220	3								X					X
	MP35D / 050803	8/3/05 - 1005	3								X					X
	MP37D / 050803	8/3/05 - 1355	3								X					X
	MP39C / 050804	8/4/05 - 0855	3								X					X
	MP45C / 050803	8/3/05 - 1415	3								X					X
	MP47C / 050803	8/3/05 - 1425	3								X					X
	MP49C / 050803	8/3/05 - 1915	3								X					X
	MP50C / 050803	8/3/05 - 1520	3								X					X
	MP51D / 050803	8/3/05 - 1445	3								X					X

Relinquished By	Date / Time	Received By	Date / Time
[illegible]	8/4/05 - 1455	[illegible]	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 3 of 3 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: _____
Address: _____
City / State / Zip: _____
Contact: _____ Phone: _____
E-Mail: _____ Fax: _____

Are the samples chilled? ☐ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: _____ °C
Preserved in: ☐Lab ☐ Field
Comments:

Are these samples known to be involved in litigation? ☐Yes ☐No
Are these samples known to be hazardous? ☐Yes ☐No
Are there any required reporting limits to be met on the requested analysis?
☐Yes ☐No If yes please provide limits in comment section.

Project Name / Number: _____
Sample Collector's Name: _____
Requested Due Date: _____
Billing Instructions PO#: _____

Lab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	MPS2C / 050803	8/3/05 - 1510	3								X					X
	MPS3C / 050803	8/3/05 - 1705	3								X					X
	MPS5C / 050803	8/3/05 - 1640	3								X					X
	MPS6C / 050803	8/3/05 - 1740	3								X					X
	MPS6CD / 050803	8/3/05 - 1740	3								X					X
	MPS7C / 050803	8/3/05 - 1010	3								X					X
	MP60C / 050803	8/3/05 - 1025	3								X					X

Relinquished By	Date / Time	Received By	Date / Time
		Bruce Torkelson	8-5-05 / 1000

The individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and conditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: Clayton Group Services
Address: 3140 Finley Road
City / State / Zip: Downers Grove, IL 60515
Contact: Brad Martin Phone: (630) 795-3249
E-Mail: _____ Fax: (630) 795-1130

Are the samples chilled? ☒ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: — °C
Preserved in: ☐Lab ☐ Field

Comments: Hazardous samples are packed in vermiculite + [illegible]

Are these samples known to be involved in litigation? ☐Yes ☐No
Are these samples known to be hazardous? ☐Yes ☐No
Are there any required reporting limits to be met on the requested analysis? ☐Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
Premier Parkland Distribution	Mark Orr

Requested Due Date	Billing Instructions PO#
[illegible] Brad Martin	

Lab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	HMW08P/050803	8/3/05 - 1335	3 X												X	X
	HMW19P/050804	8/4/05 - [illegible]00	3												X	X
	HMW19PD/050804	8/4/05 - 0800	3												X	X
	HMW20P/050803	8/3/05 - 1715	3												X	X

Relinquished By	Date / Time	Received By	Date / Time
Mark E Orr [signature]	8/4/05 - 1435	[signature]	8-5-05 / 1000

The individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and conditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: [illegible] Group Services
Address: [illegible] Ridge Road
City / State / Zip: [illegible] Grove, IL 60515
Contact: Brad Martin Phone: (630) 795-5249
E-Mail: Fax: (630) 295-1130

Are the samples chilled? ☒ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: — °C
Preserved in: ☐Lab ☐ Field

Comments: [illegible]

re these samples known to be involved in litigation? ☐Yes ☐No
re these samples known to be hazardous? ☐Yes ☐No
re there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
[illegible]	Mark Orr

Requested Due Date	Billing Instructions PO#
[illegible] Brad Martin	

Lab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	Water	Drinking Water	Soil	Sludge	Sp. Waste	[illegible]
	[illegible]W22P/050804	8/4/05 - 1015	3												X	X
	[illegible]W44CP/050804	8/4/05 - 0655	3												X	X
	[illegible]W45CP/050803	8/3/05 - 1155	3												X	X
	[illegible]M1046CP/050803	8/3/05 - 1130	3												X	X

Relinquished By	Date / Time	Received By	Date / Time
Mark Orr [signature]	8/4/05 1435	[signature]	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK – SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

:lient: Dayton Group Services
ıddress: 3140 Finley Road
:ity / State / Zip: Downers Grove, IL 60515
:ontact: Brad Martin Phone: (630) 795-5249
:-Mail: _____ Fax: (630) 795-1130

Are the samples chilled? ☒ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: _____ °C
Preserved in: ☐Lab ☐ Field

Comments:

'e these samples known to be involved in litigation? ☐Yes ☐No
'e these samples known to be hazardous? ☐Yes ☐No
'e there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
Hunter Hartford Distribution	Mark Orr

Requested Due Date	Billing Instructions
See Brad Martin	PO# " "

ab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	HMW48CP/050803	8/3/05 - 1100	3												X	X
	MP29CP/050803	8/3/05 - 1215	3												X	X
	MP29DP/050803	8/3/05 - 1220	3												X	X
	MP29DPD/050803	8/3/05 - 1220	3												X	X

Relinquished By	Date / Time	Received By	Date / Time
Mark Orr [signature]	8/3/05 - 1435	Bruce Torkelson	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

:lient: [illegible]
\ddress: [illegible] Road
:ity / State / Zip: [illegible] IL [illegible]
:ontact: [illegible] Phone: ([illegible]) [illegible]
:-Mail: _____ Fax: ([illegible]) [illegible]

Are the samples chilled? ☒ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: _____ °C
Preserved in; ☐Lab ☐ Field

Comments:

'e these samples known to be involved in litigation? ☐Yes ☐No
'e these samples known to be hazardous? ☐Yes ☐No
'e there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
[illegible]	Mark Dr

Requested Due Date	Billing Instructions PO#
[illegible]	

.ab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	Water	Drinking Water	Soil	Sludge	Sp. Waste	HYDROCARBON	PAHER PRINT
	MP35DP/ 050803	8/5/05 1435	3												X	X	
	MP37DP/ 050803	8/5/05 1355	3												X	X	
	MP39CP/ 050804	8/5/05 0855	3												X	X	
	MP45CP/ 050803	8/5/05 1415	3												X	X	

Relinquished By	Date / Time	Received By	Date / Time
[illegible]	[illegible] 1435	Bruce [illegible]	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: [illegible] Services
Address: [illegible] Finley Road
City / State / Zip: [illegible] Grove, IL [illegible]
Contact: [illegible] Phone: (630) 793 3249
E-Mail: _____ Fax: (630) 793-1150

Are the samples chilled? ☐ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: ____ °C
Preserved in: ☐Lab ☐ Field

Comments:

Are these samples known to be involved in litigation? ☐Yes ☐No
Are these samples known to be hazardous? ☐Yes ☐No
Are there any required reporting limits to be met on the requested analysis?
☐Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
[illegible]	Mark Orr

Requested Due Date	Billing Instructions
see Brad Martin	PO# " "

Lab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	Water	Drinking Water	Soil	Sludge	Sp. Waste	[illegible]
	MP47CP/050803	8/3/05 - 1460	3												X	X
	MP48BP/050804	8/4/05 - 0825	3												X	X
	MP49CP/050803	8/3/05 - 1915	3												X	X
	MP50CP/050803	8/3/05 - 1520	3												X	X

Relinquished By	Date / Time	Received By	Date / Time
Mark Orr [signature]	8/4/05 - 1435	[signature]	8-5-05 / 1000

The individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and conditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

:lient: Clayton Group Services
ddress: 5110 Finley Road
:ity / State / Zip: Downers Grove, IL 60515
:ontact: Brad Martin Phone: (630) [illegible] 3249
:-Mail: Fax: (630) [illegible] - 1130

Are the samples chilled? ☑ NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: ____ °C
Preserved in: ☐Lab ☐ Field
Comments:

'e these samples known to be involved in litigation? ☐Yes ☐No
'e these samples known to be hazardous? ☐Yes ☐No
'e there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
Former Lakeland Discoveries	Mark Oe

Requested Due Date	Billing Instructions PO#
w/ Brad Martin	" "

Lab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	Water	Drinking Water	Soil	Sludge	Sp. Waste	[illegible]	[illegible]
	MPS1DP/050803	8/3/05 - 1445	3												X	X	
	MPS2CP/050803	8/3/05 - 1510	3												X	X	
	MPS3CP/050803	8/3/05 - 1705	3												X	X	
	MPS3CP/050803	8/3/05 - 1640	3												X	X	

Relinquished By	Date / Time	Received By	Date / Time
Mark Oe	8/3/05 - 1435	Bruce Anderson	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

:lient: Clayton Group Services
\ddress: 3140 Finley Road
:ity / State / Zip: Downers Grove, IL 60515
:ontact: Brad Martin Phone: (630) 795-3249
:-Mail: Fax: (630) 795-1130

Are the samples chilled? ☒NO ☐ YES (Ice or Blue Ice)
Cooler Temperature: — °C
Preserved in: ☐Lab ☐ Field
Comments: " "

·e these samples known to be involved in litigation? ☐Yes ☐No
·e these samples known to be hazardous? ☐Yes ☐No
·e there any required reporting limits to be met on the requested analysis?
Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
Premcor Hartford Distribution	Mark Orr

Requested Due Date	Billing Instructions
See Brad Martin	PO# " "

.ab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO3	NaOH	H2SO4	HCL	MeOH	NaHSO4	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	MP56CP/050803	8/3/05 - 1740	3												X	X
	MP56CPD/050803	8/3/05 - 1740	3												X	X
	MP57CP/050803	8/3/05 - 1810	3												X	X
	MP60CP/050803	8/3/05 - 1825	3												X	X

Relinquished By	Date / Time	Received By	Date / Time
Mark Orr [signature]	8/4/05 - 1435	[signature]	8-5-05 / 1000

e individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and nditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: CLAYTON GROUP SERVICES
Address: 3140 FINLEY ROAD
City / State / Zip: DOWNERS GROVE IL 60515
Contact: BRAD MARTIN Phone: (630) 795-3200
E-Mail: bMartin@claytongrp.com Fax: (630) 795-1130

Are the samples chilled? ☐ NO ☒ YES (Ice or Blue Ice)
Cooler Temperature: 4C °C
Preserved in: ☐ Lab ☐ Field

Comments:

Are these samples known to be involved in litigation? ☐Yes ☐No
Are these samples known to be hazardous? ☐Yes ☐No
Are there any required reporting limits to be met on the requested analysis?
☐Yes ☐No If yes please provide limits in comment section.

Project Name / Number	Sample Collector's Name
15-03095.14-006	NORMAN BOLIVAR

Requested Due Date	Billing Instructions PO#
STAT	15-03095.14-006

Lab Use Only	Sample Identification	Date/Time Sampled	# and Type of Containers: UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	MATRIX: Water	Drinking Water	Soil	Sludge	Sp. Waste	INDICATE ANALYSIS REQUESTED: HYDROCARBON FINGERPRINT
	MP-80CP/050809	8/9/05 1540	3												X	X
	MP-79CP/050809	8/9/05 1810	3												X	X
	MP-80C/050809	8/9/05 1540	3								X					X
	MP-79C/050809	8/9/05 1810	3								X					X

Relinquished By	Date / Time	Received By	Date / Time
[signature]	8/10/05 1940	[signature]	8-11-05 / 0920

The individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and conditions of this agreement on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK – SAMPLER

CHAIN OF CUSTODY

pg. 1 of 1 Work Order # _____

TEKLAB, INC. 5445 Horseshoe Lake Road ~ Collinsville, IL 62234 ~ Phone: (618) 344-1004 ~ Fax: (618) 344-1005

Client: HARTFORD WORKING GROUP
Address: 3140 FINLEY ROAD
City / State / Zip: DOWNERS GROVE IL, 60515
Contact: BRAD MARTIN Phone: (630) 795-3200
E-Mail: bmartin@clayton-grp.com Fax: (630) 795-1130

Are the samples chilled? ☐ NO ☑ YES (Ice or Blue Ice)
Cooler Temperature: 4 °C
Preserved in: ☐ Lab ☑ Field
Comments:

Are these samples known to be involved in litigation? ☐ Yes ☐ No
Are these samples known to be hazardous? ☐ Yes ☐ No
Are there any required reporting limits to be met on the requested analysis?
☐ Yes ☐ No If yes please provide limits in comment section.

Project Name / Number: 15-03095-14-006
Sample Collector's Name: NORMAN BOLIVAR
Requested Due Date: STANDARD TURNAROUND TIME.
Billing Instructions: PO# 15-03095.14-006

Lab Use Only	Sample Identification	Date/Time Sampled	UNPRES	HNO_3	NaOH	H_2SO_4	HCL	MeOH	$NaHSO_4$	Other	Water	Drinking Water	Soil	Sludge	Sp. Waste	Hydrocarbon Finley Printing
	RW-5/050830	8/30/05 1700					2				✓					✓
	RW-5P/050830	8/30/05 1705	2												✓	✓
	RW-4A/050830	8/30/05 1735					2				✓					✓
	RW-4AP/050830	8/30/05 1740	2												✓	✓

Relinquished By	Date / Time	Received By	Date / Time
Norman Bolivar	8/31/05 1700	Bruce Anderson	9-1-05 / 0920

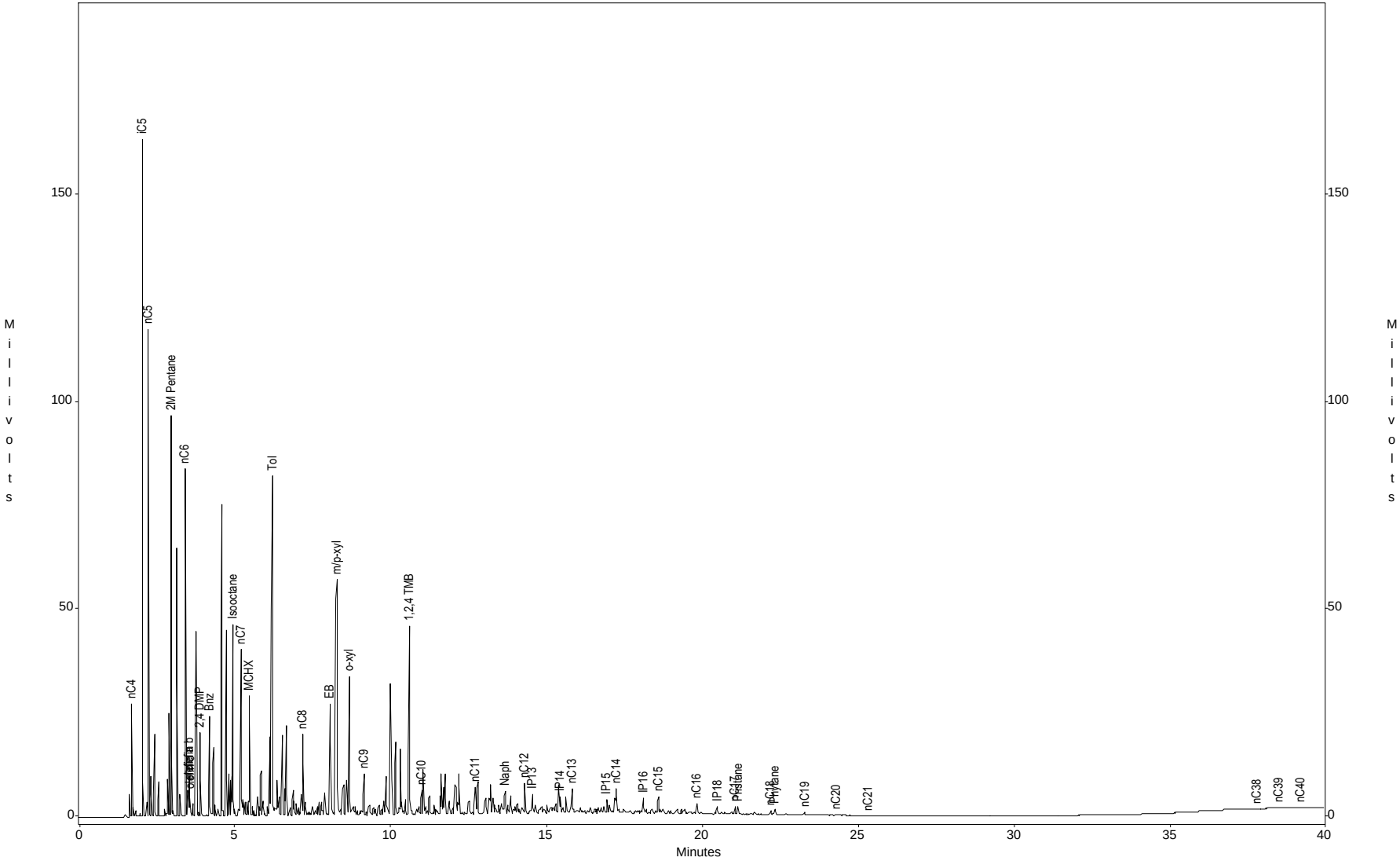
The individual signing this agreement on behalf of client acknowledges that he/she has read and understands the terms and conditions of this agreement, on the reverse side, and that he/she has the authority to sign on behalf of client.

WHITE – CLIENT YELLOW – LAB PINK - SAMPLER

Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW08/050803
Acquired : Aug 08, 2005 08:30:12

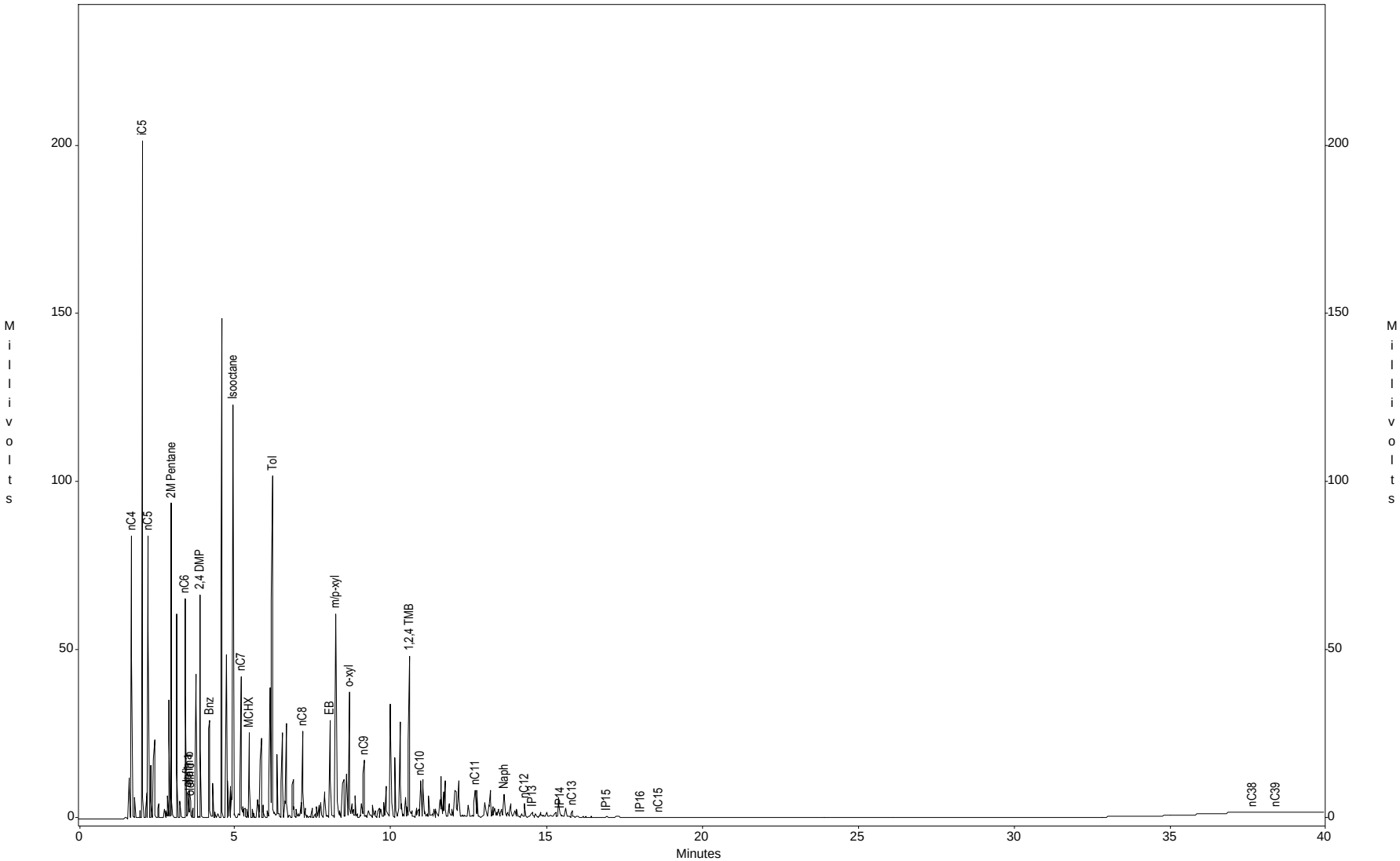
c:\ezchrom\chrom\05119\hmw08p -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW19/050804
Acquired : Aug 08, 2005 09:20:16

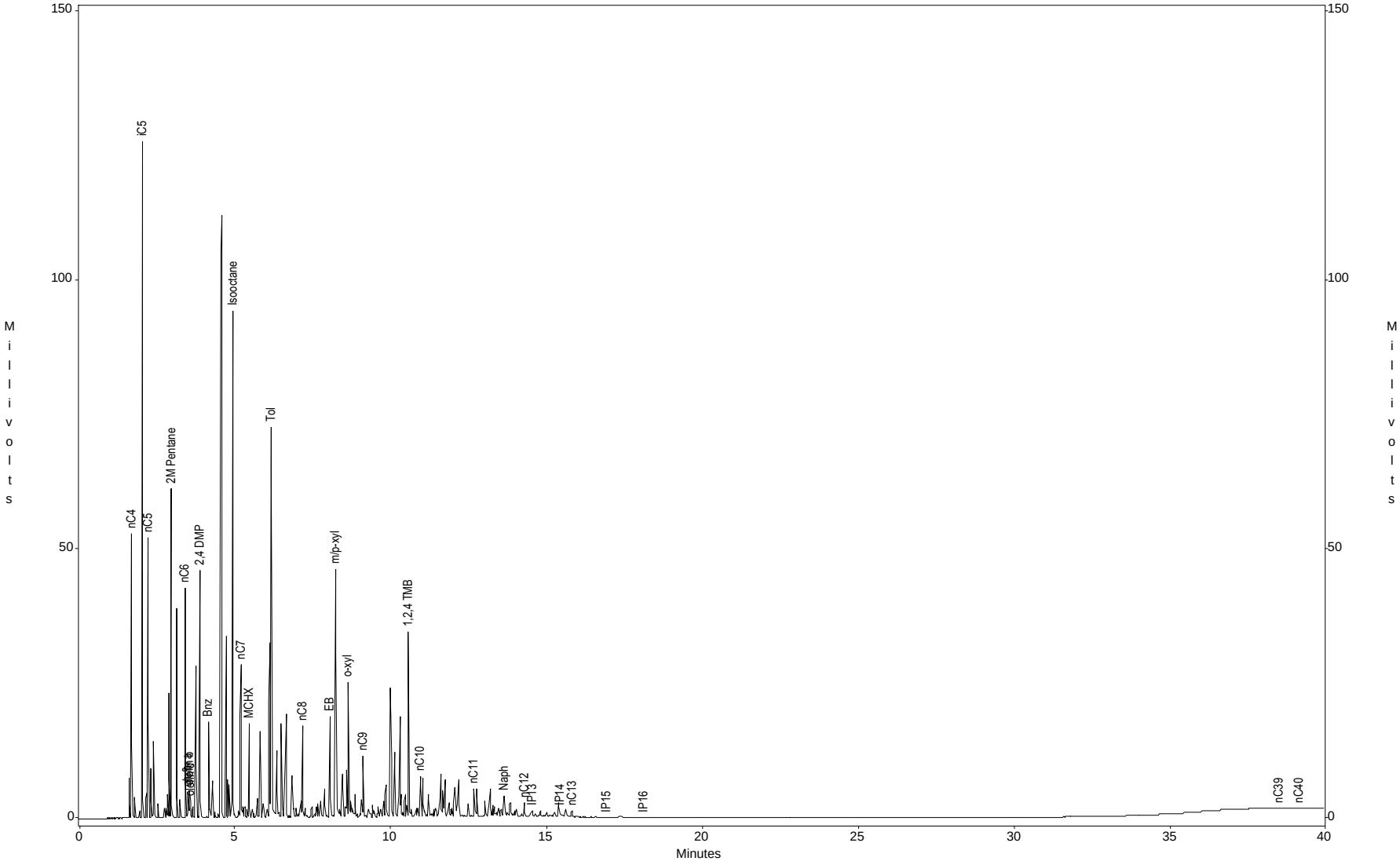
c:\ezchrom\chrom\05119\hmw19p -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW19D/050804
Acquired : Aug 08, 2005 10:09:32

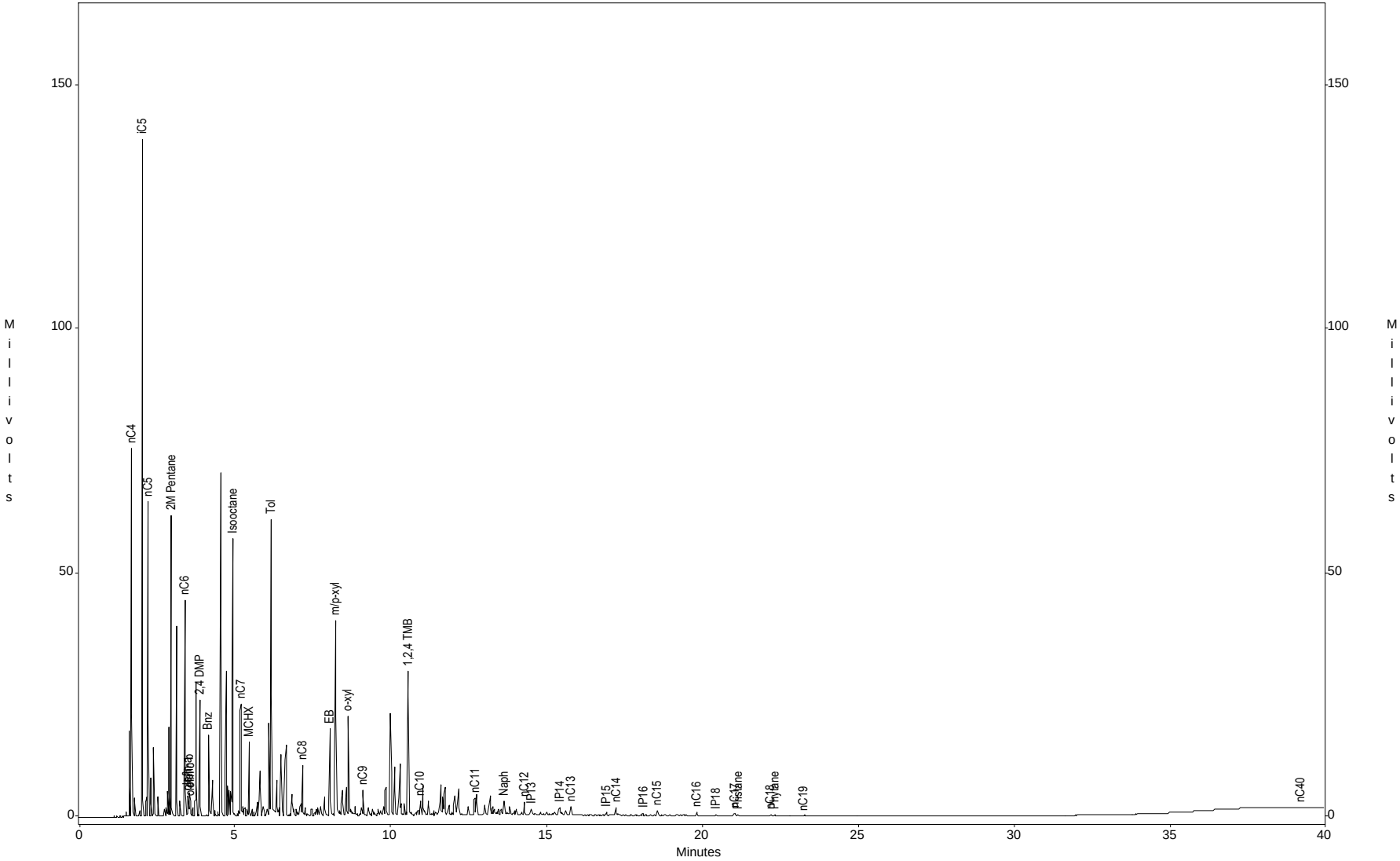
c:\ezchrom\chrom\05119\hmw19pd -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW20/050803
Acquired : Aug 08, 2005 10:59:48

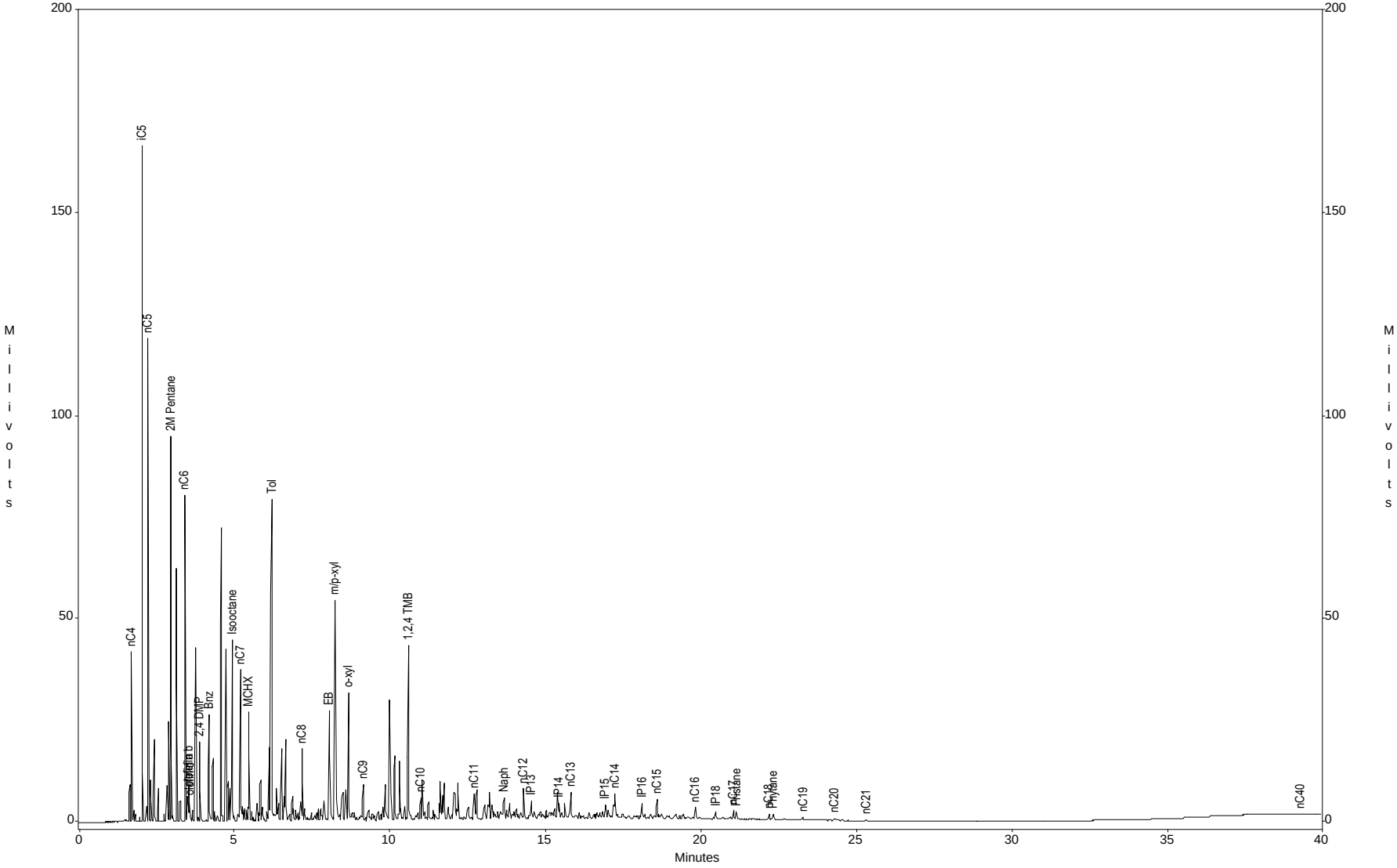
c:\ezchrom\chrom\05119\hmw20p -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW22/050804
Acquired : Aug 08, 2005 12:41:11

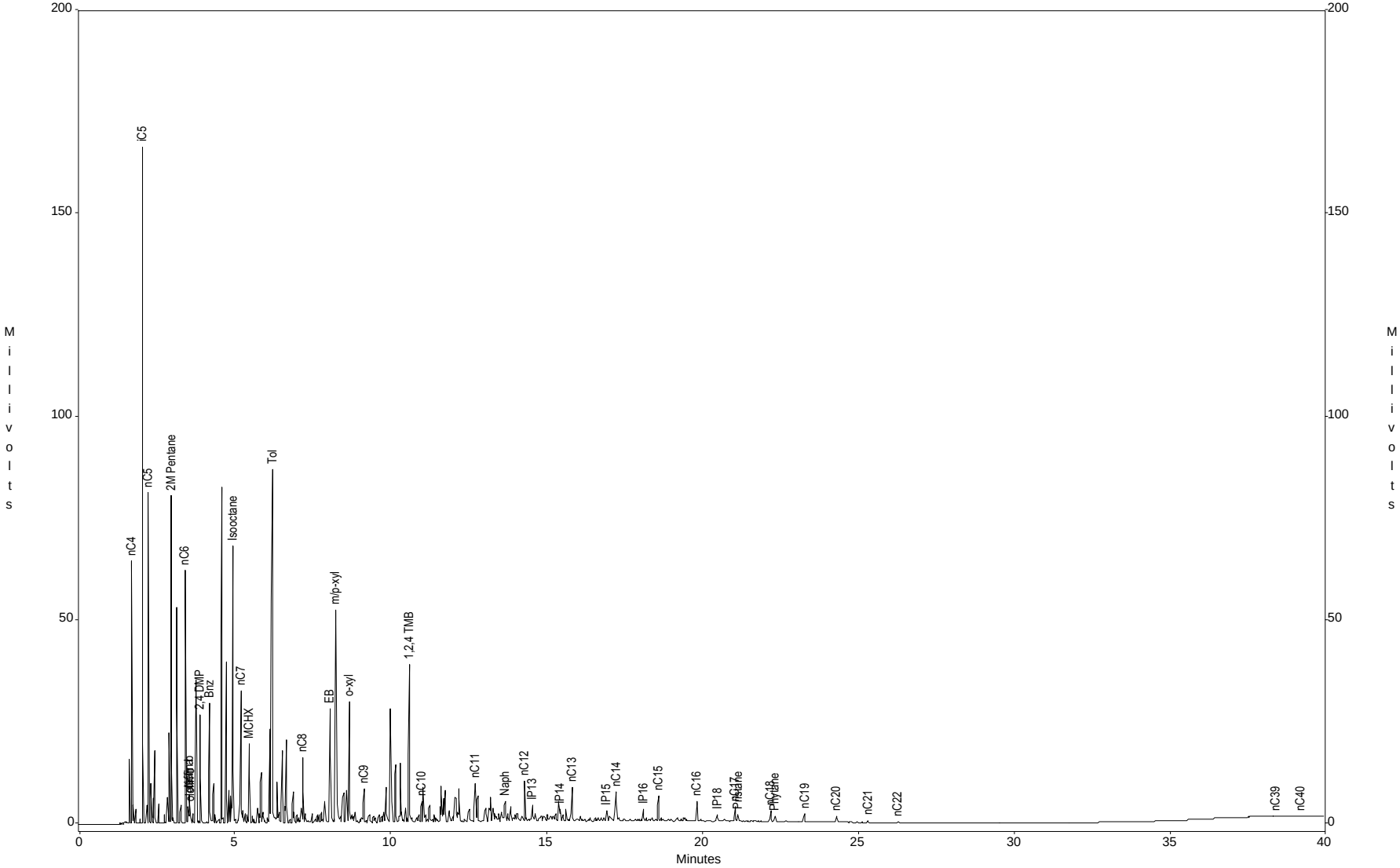
c:\ezchrom\chrom\05119\hmw22p -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW44C/050804
Acquired : Aug 08, 2005 13:30:27

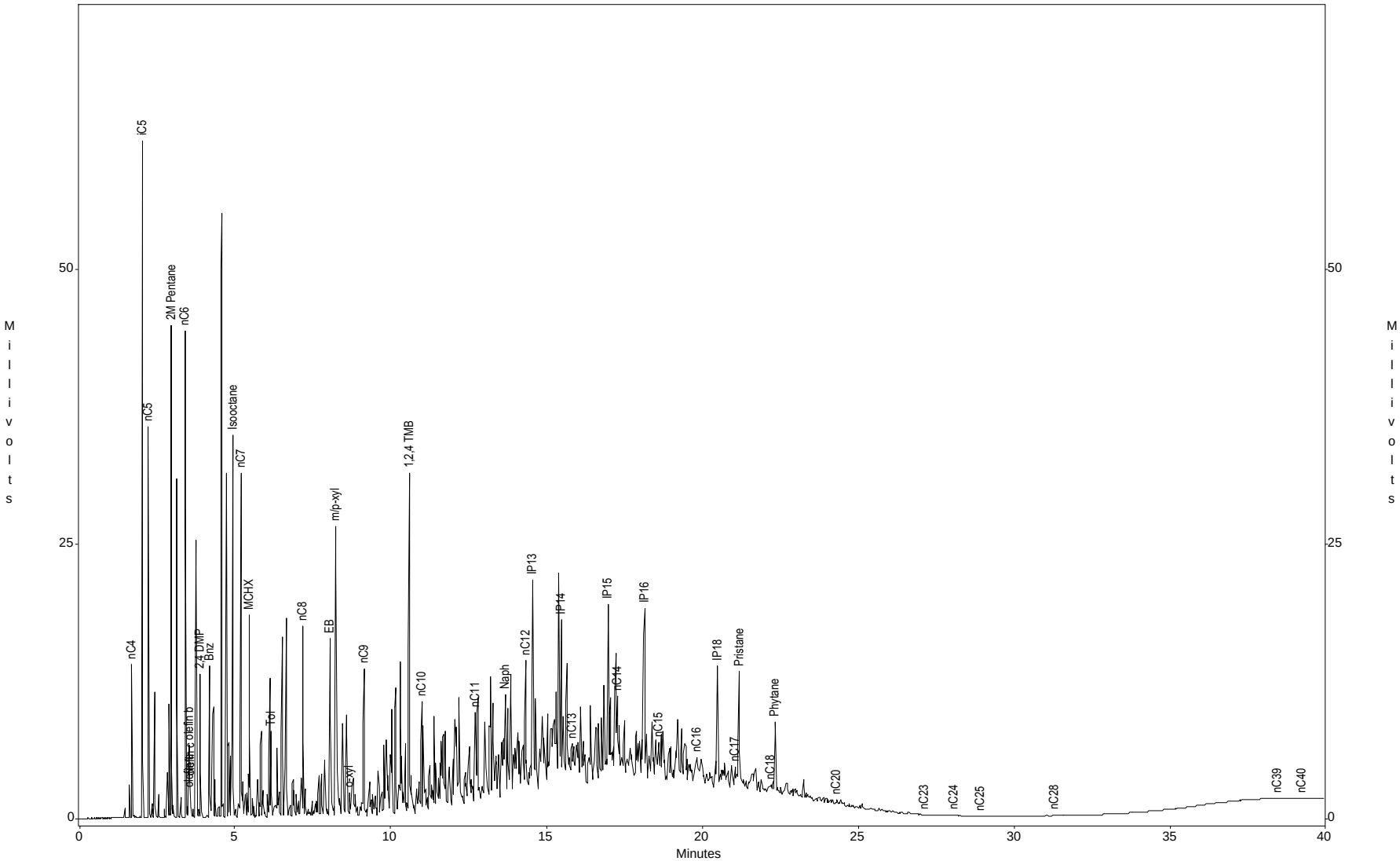
c:\ezchrom\chrom\05119\hmw44cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW45C/050803
Acquired : Aug 08, 2005 14:20:49

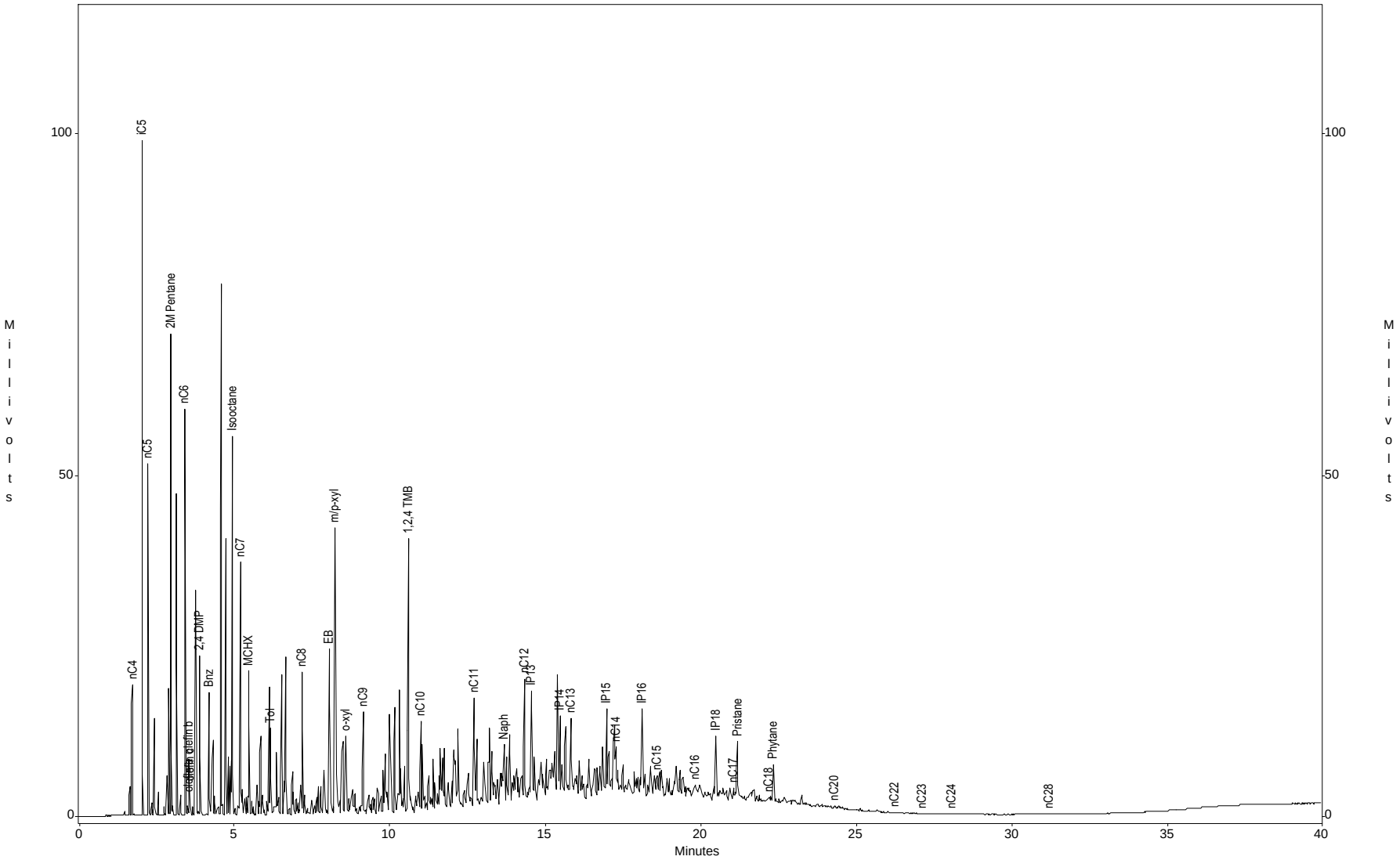
c:\ezchrom\chrom\05119\hmw45cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW46C/050803
Acquired : Aug 08, 2005 15:11:32

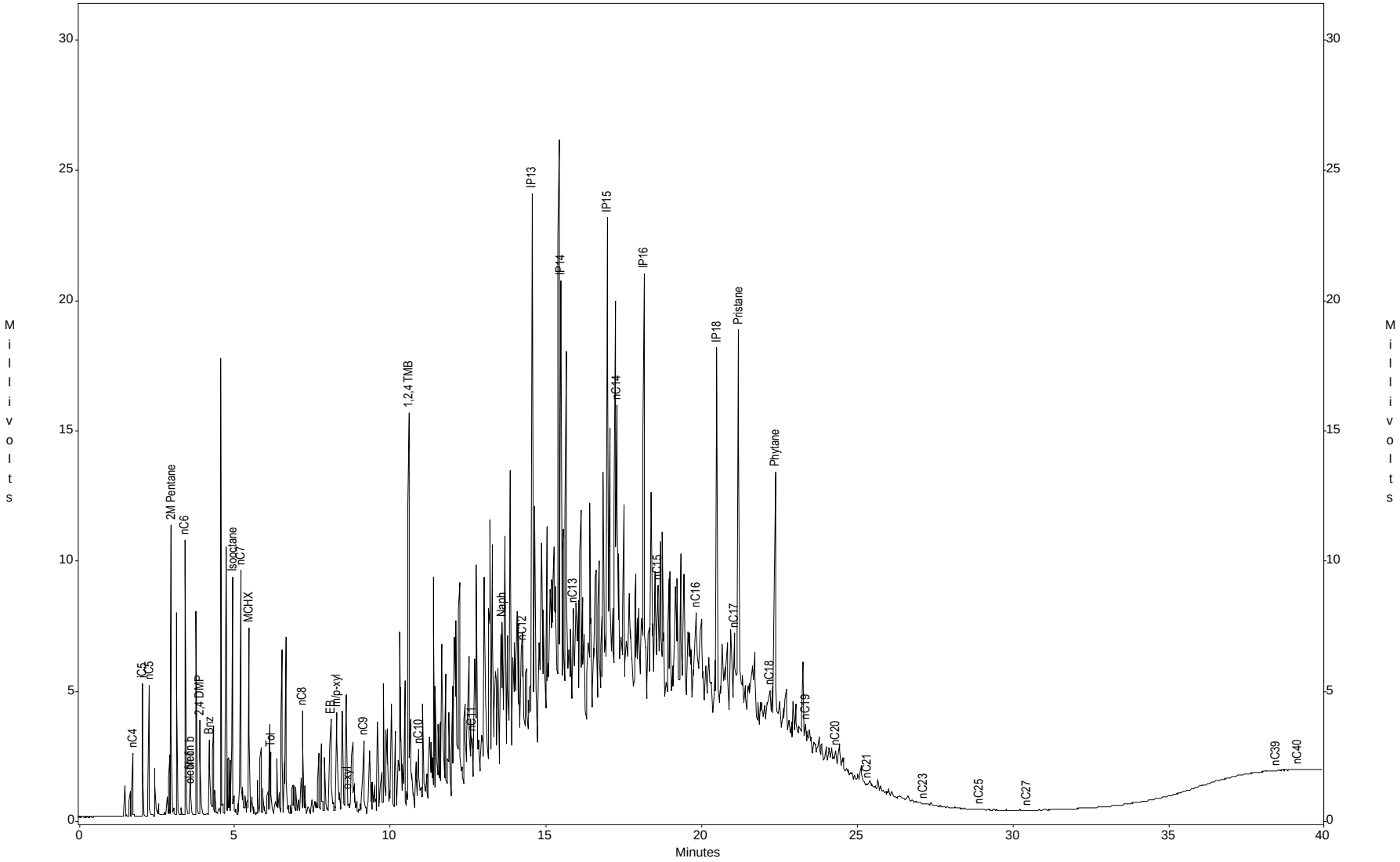
c:\ezchrom\chrom\05119\hmw46cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW48C/050803
Acquired : Aug 08, 2005 16:02:17

c:\ezchrom\chrom\05119\hmw48cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP29C/050803
Acquired : Aug 08, 2005 16:54:51

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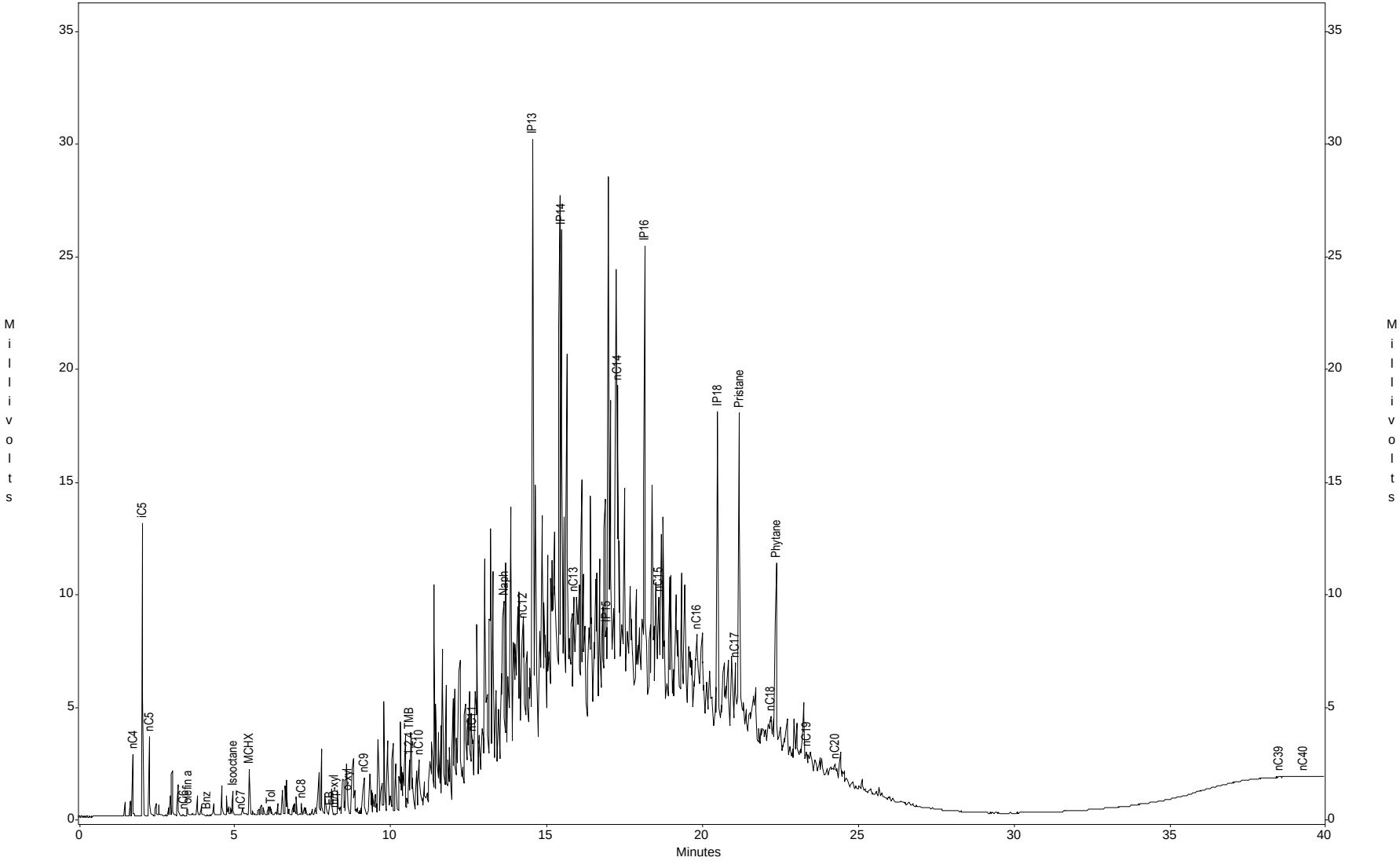
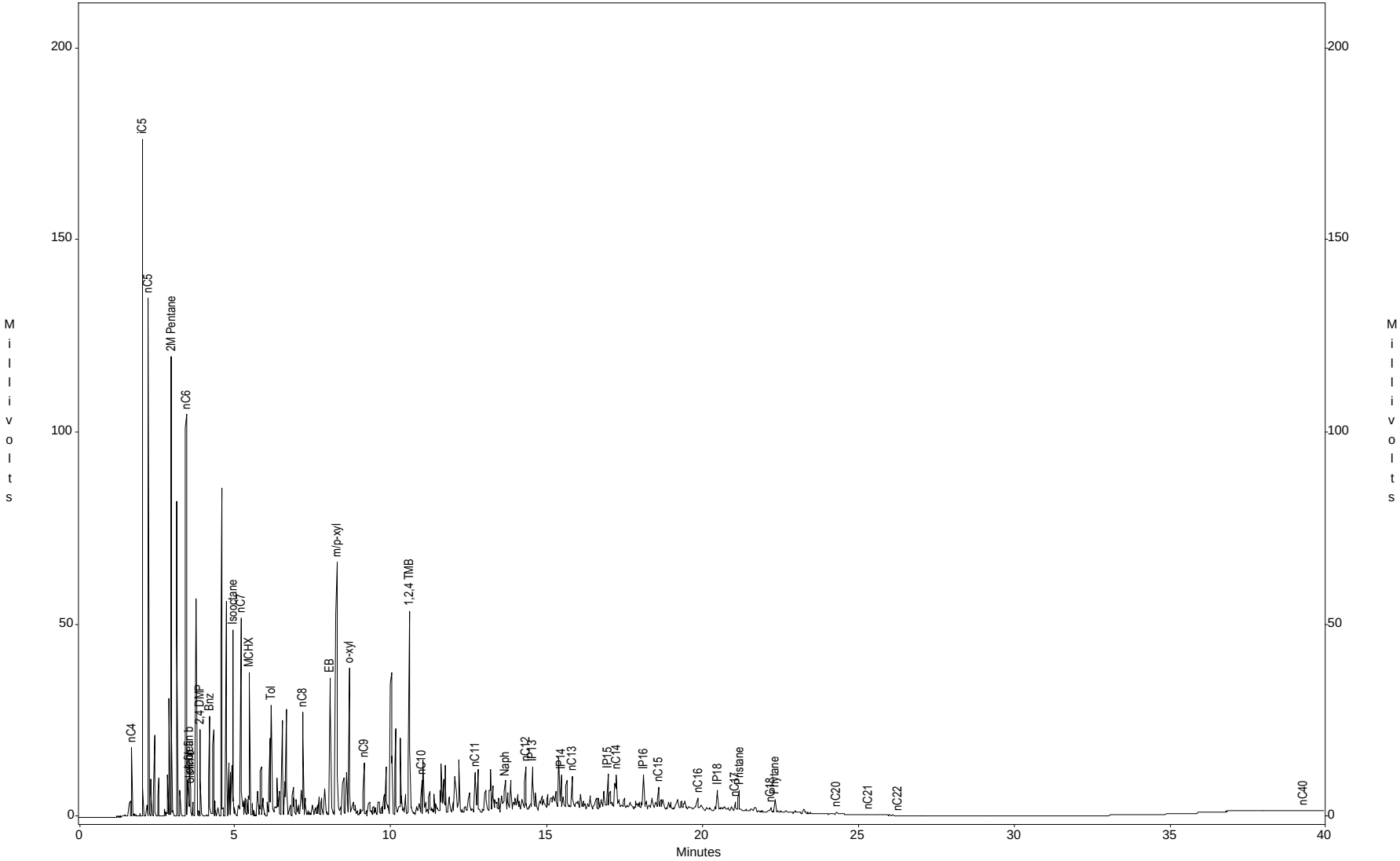


Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP29D/050803
Acquired : Aug 08, 2005 17:45:53

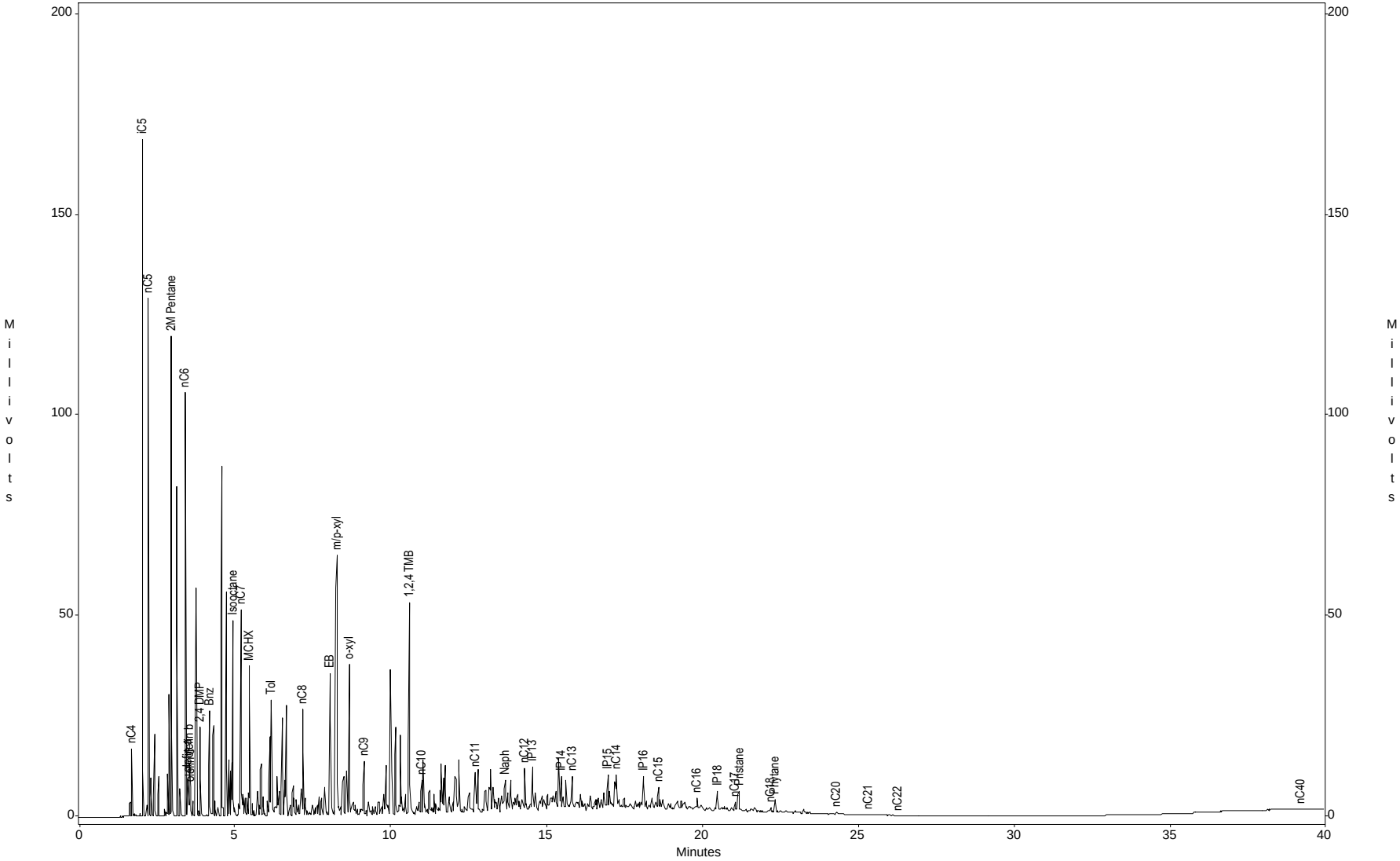
c:\ezchrom\chrom\05119\mp29dp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP29DD/050803
Acquired : Aug 08, 2005 18:36:55

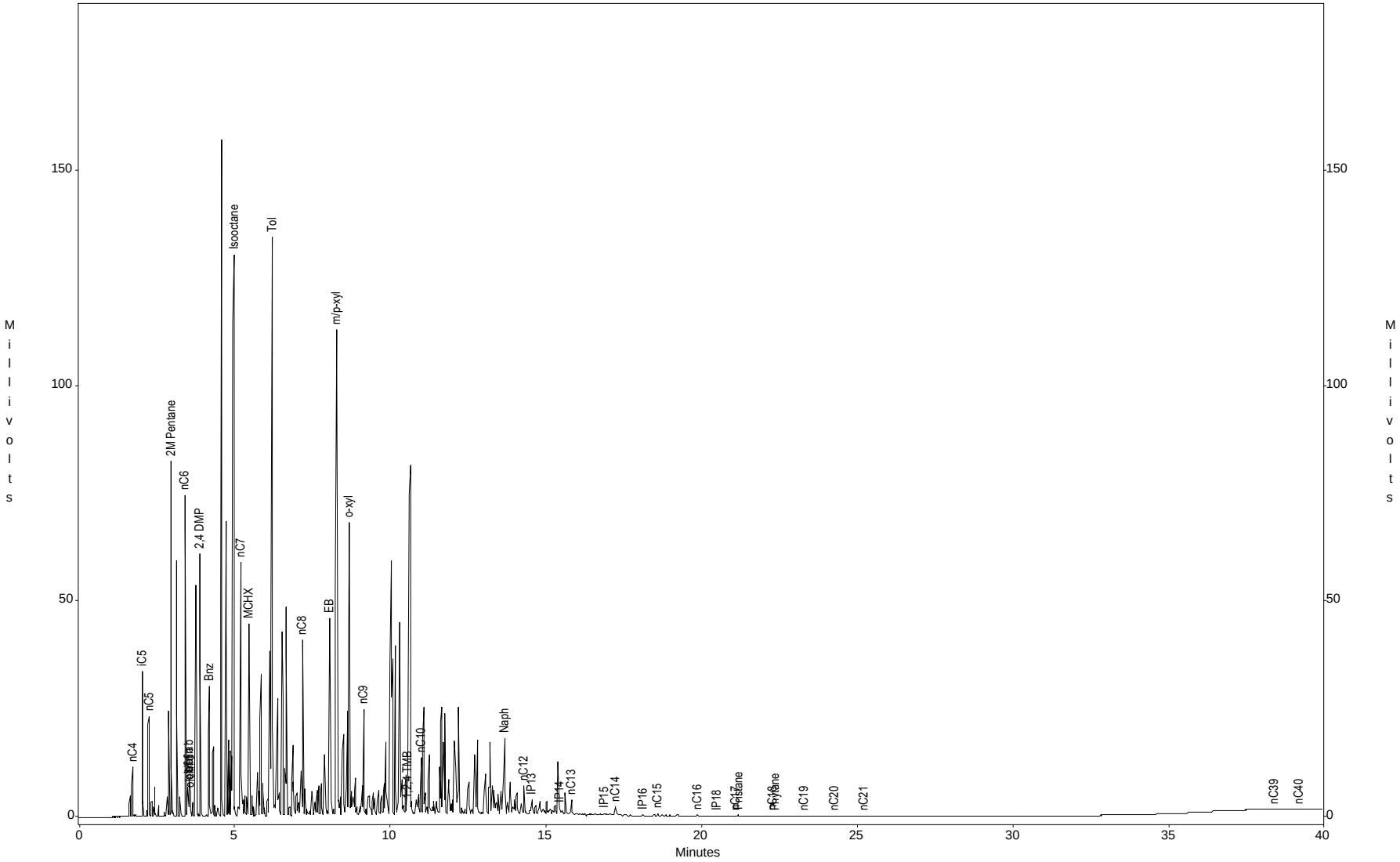
c:\ezchrom\chrom\05119\mp29dpd -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP35D/050803
Acquired : Aug 08, 2005 19:38:22

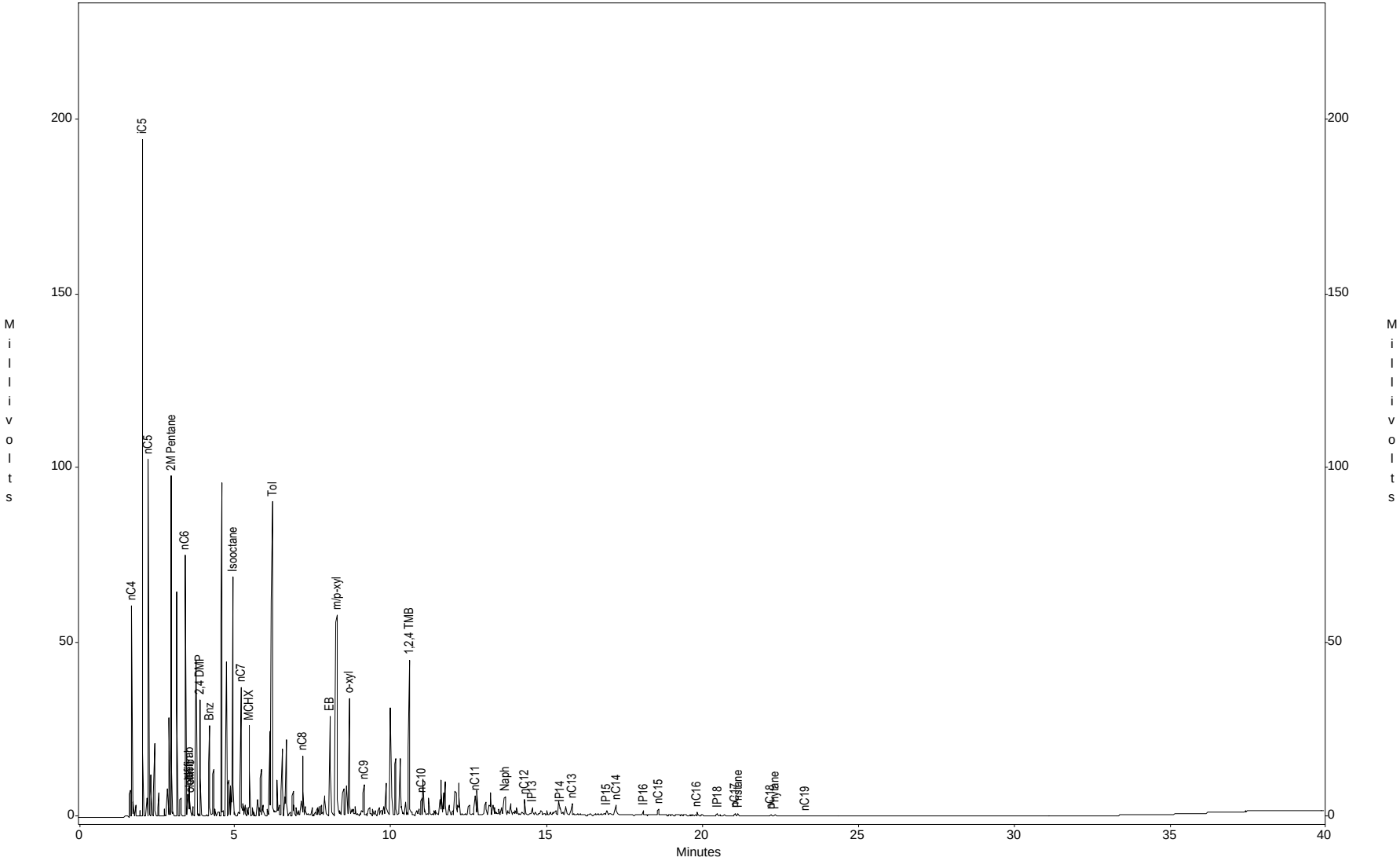
c:\ezchrom\chrom\05119\mp35dp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP37D/050803
Acquired : Aug 08, 2005 20:28:26

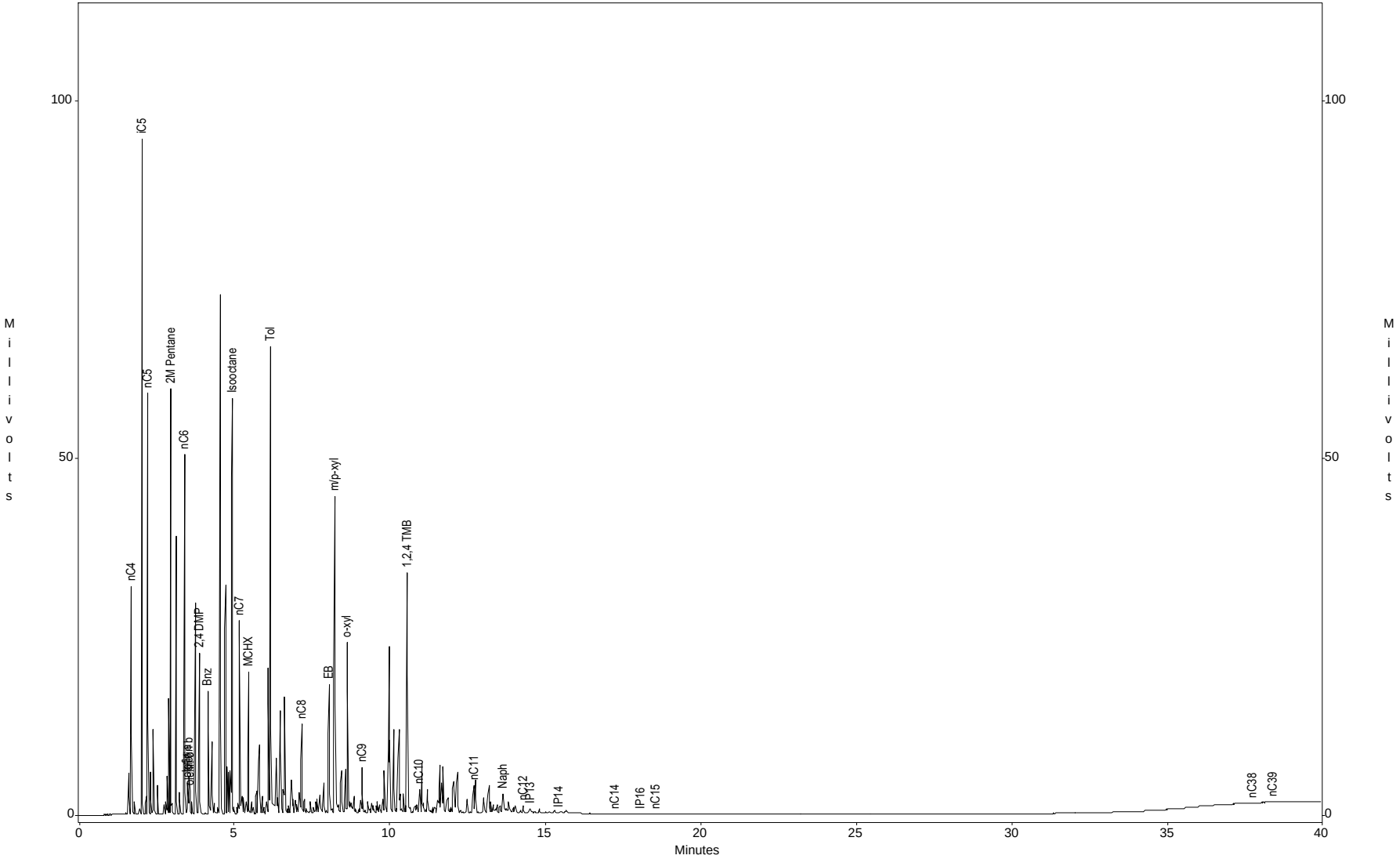
c:\ezchrom\chrom\05119\mp37dp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP39C/050804
Acquired : Aug 09, 2005 07:11:19

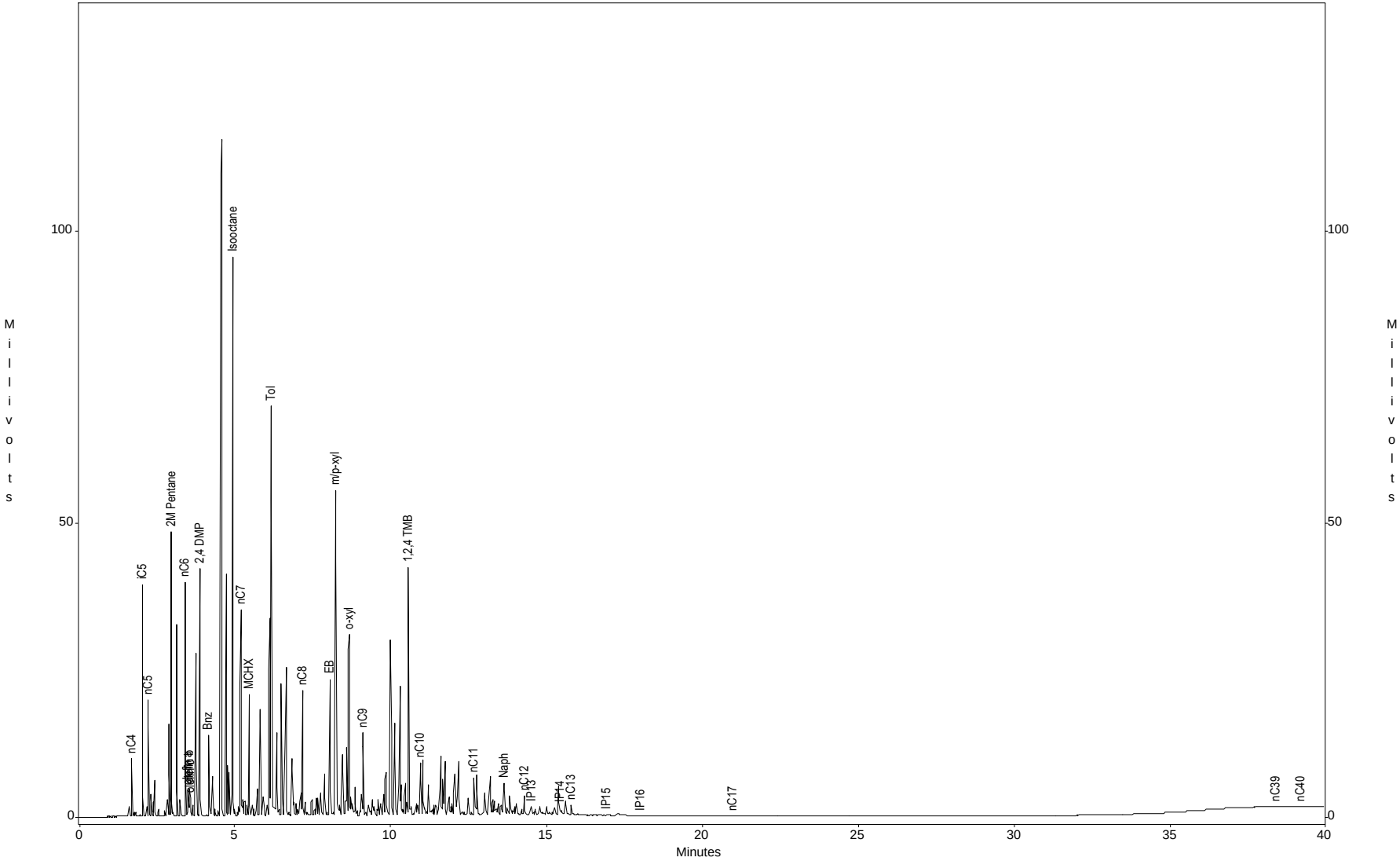
c:\ezchrom\chrom\05119\mp39cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP45C/050803
Acquired : Aug 09, 2005 08:01:37

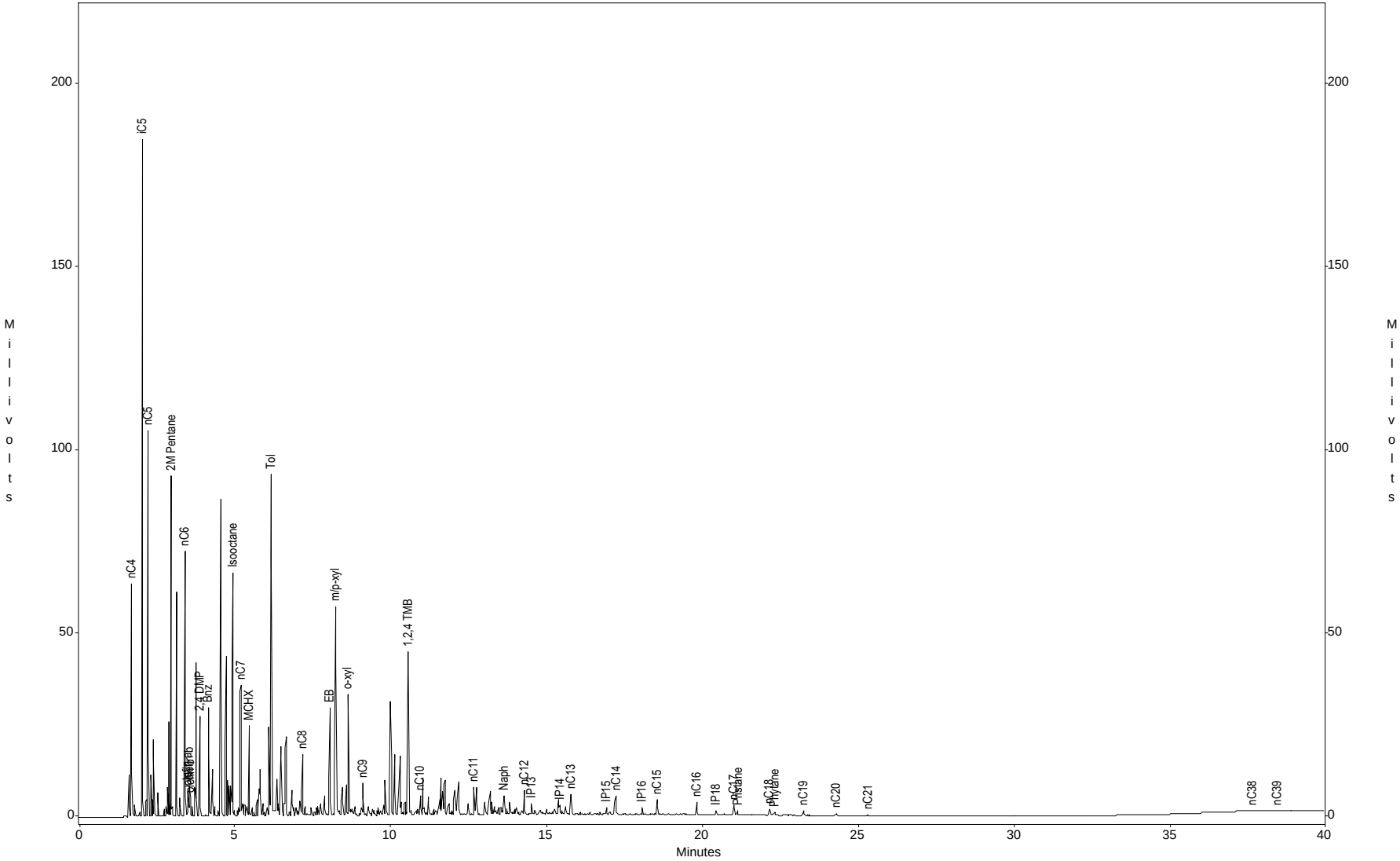
c:\ezchrom\chrom\05119\mp45cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP47C/050803
Acquired : Aug 09, 2005 08:51:53

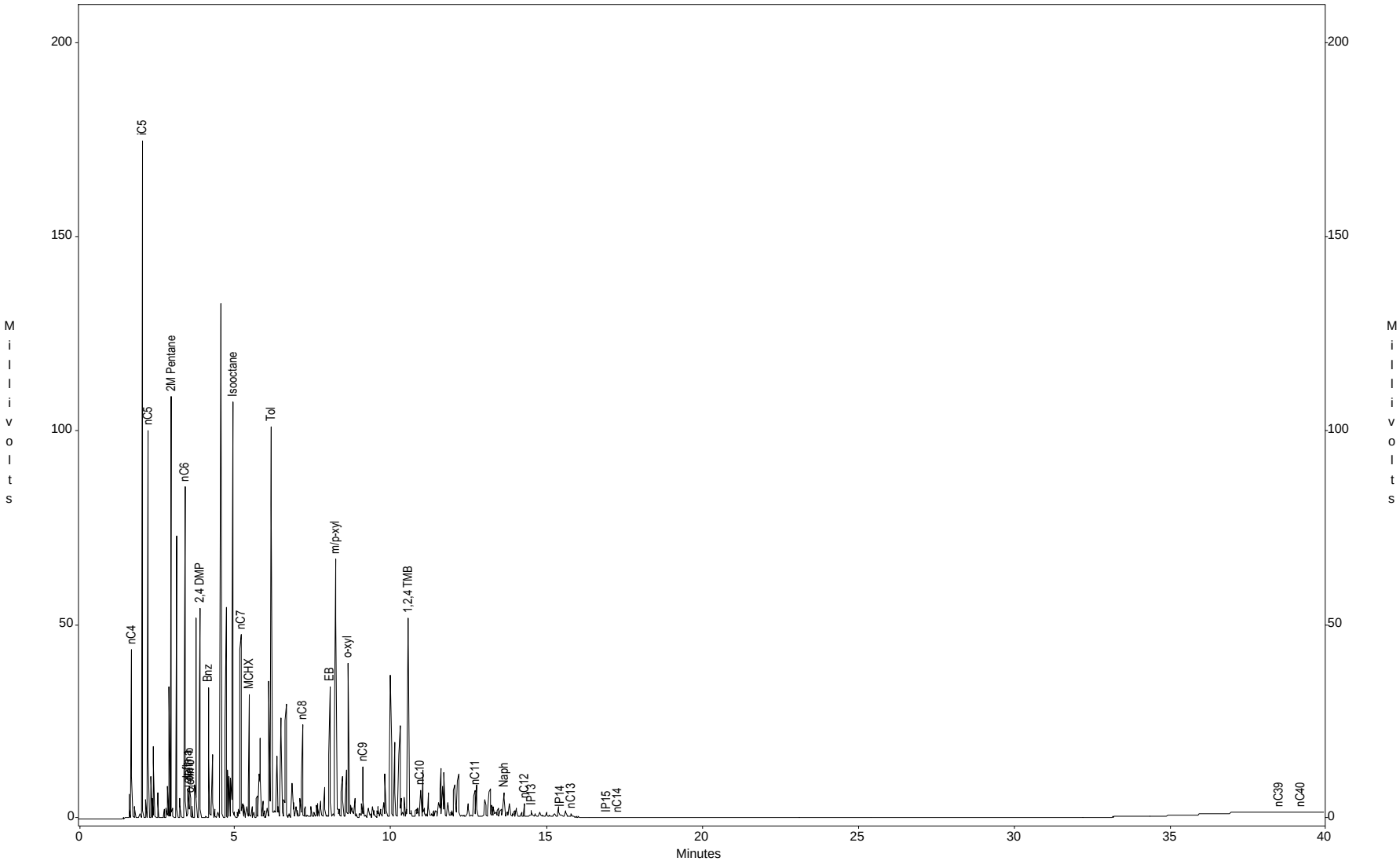
c:\ezchrom\chrom\05119\mp47cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP48B/050804
Acquired : Aug 09, 2005 09:41:27

c:\ezchrom\chrom\05119\mp48bp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP49C/050803
Acquired : Aug 09, 2005 10:29:23

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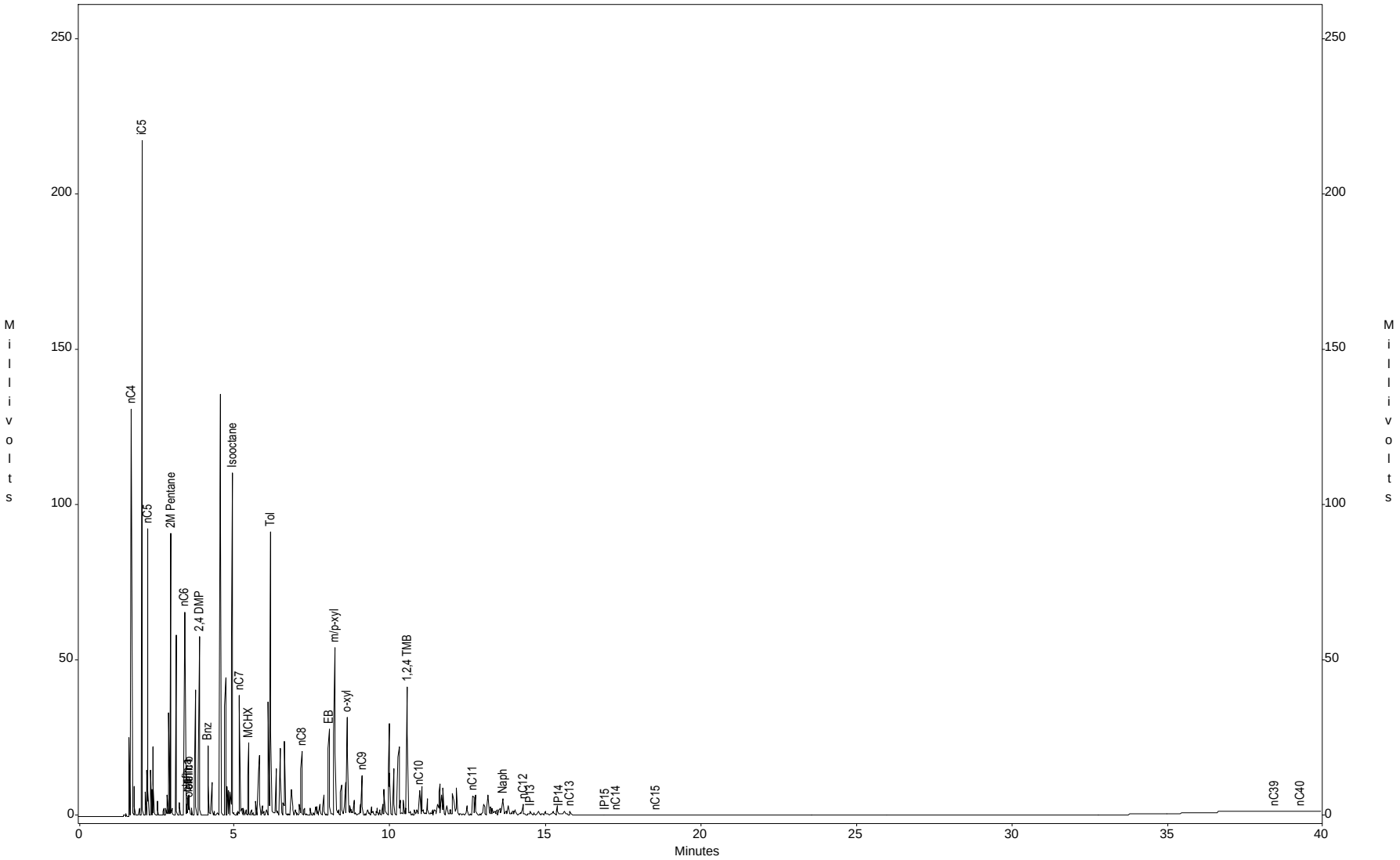

Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP50C/050803
Acquired : Aug 09, 2005 11:18:37

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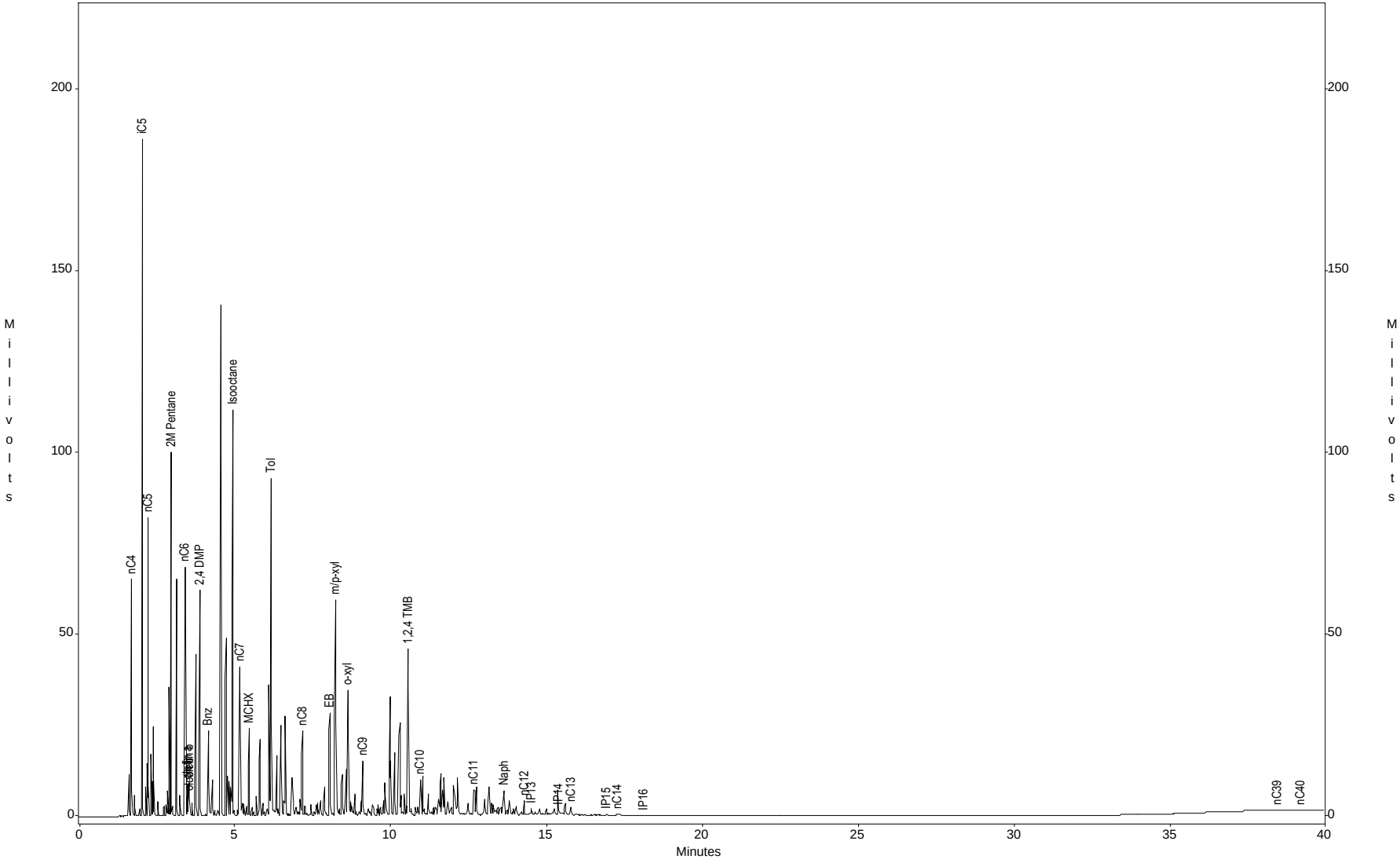

Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP51D/050803
Acquired : Aug 09, 2005 12:07:35

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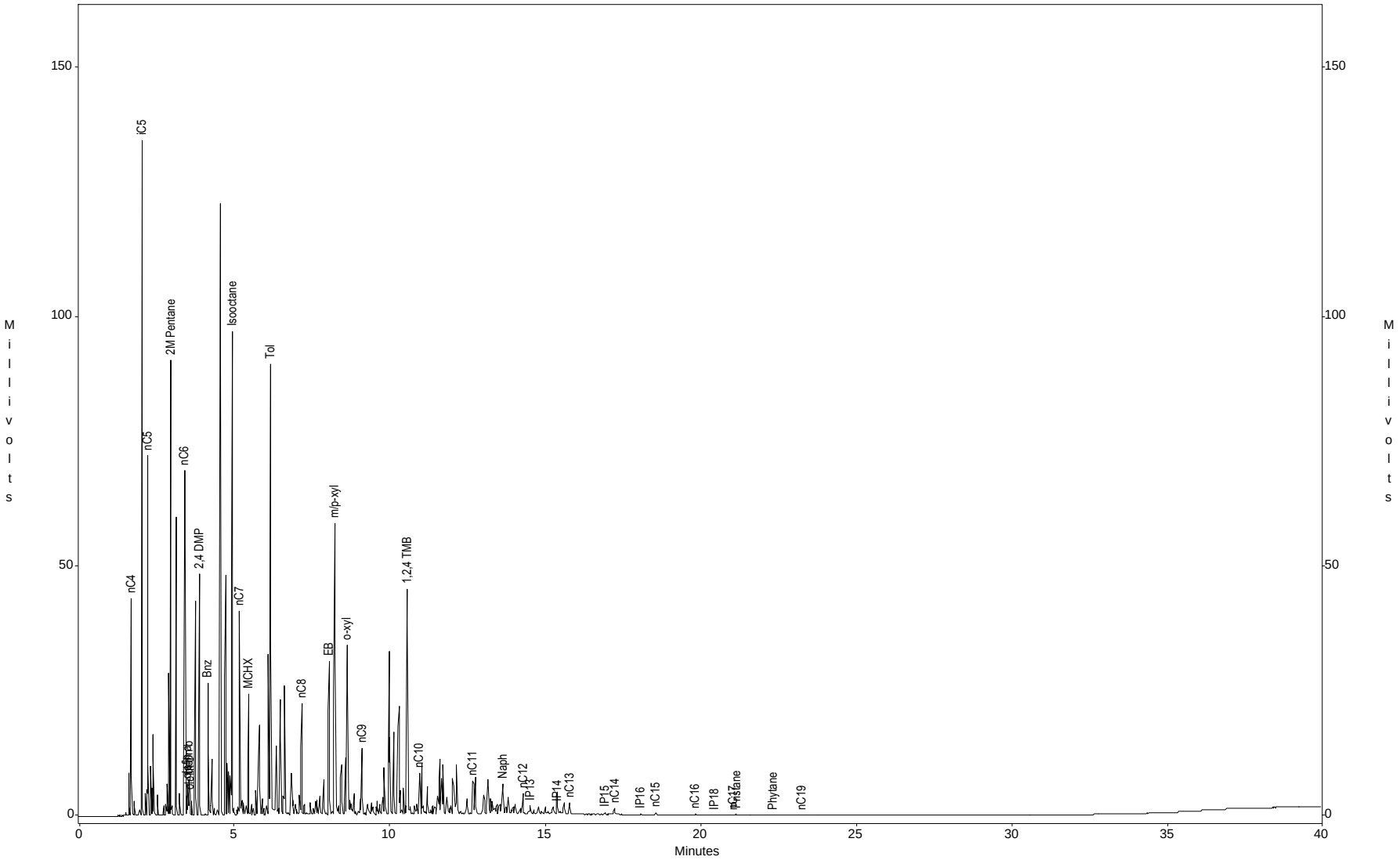
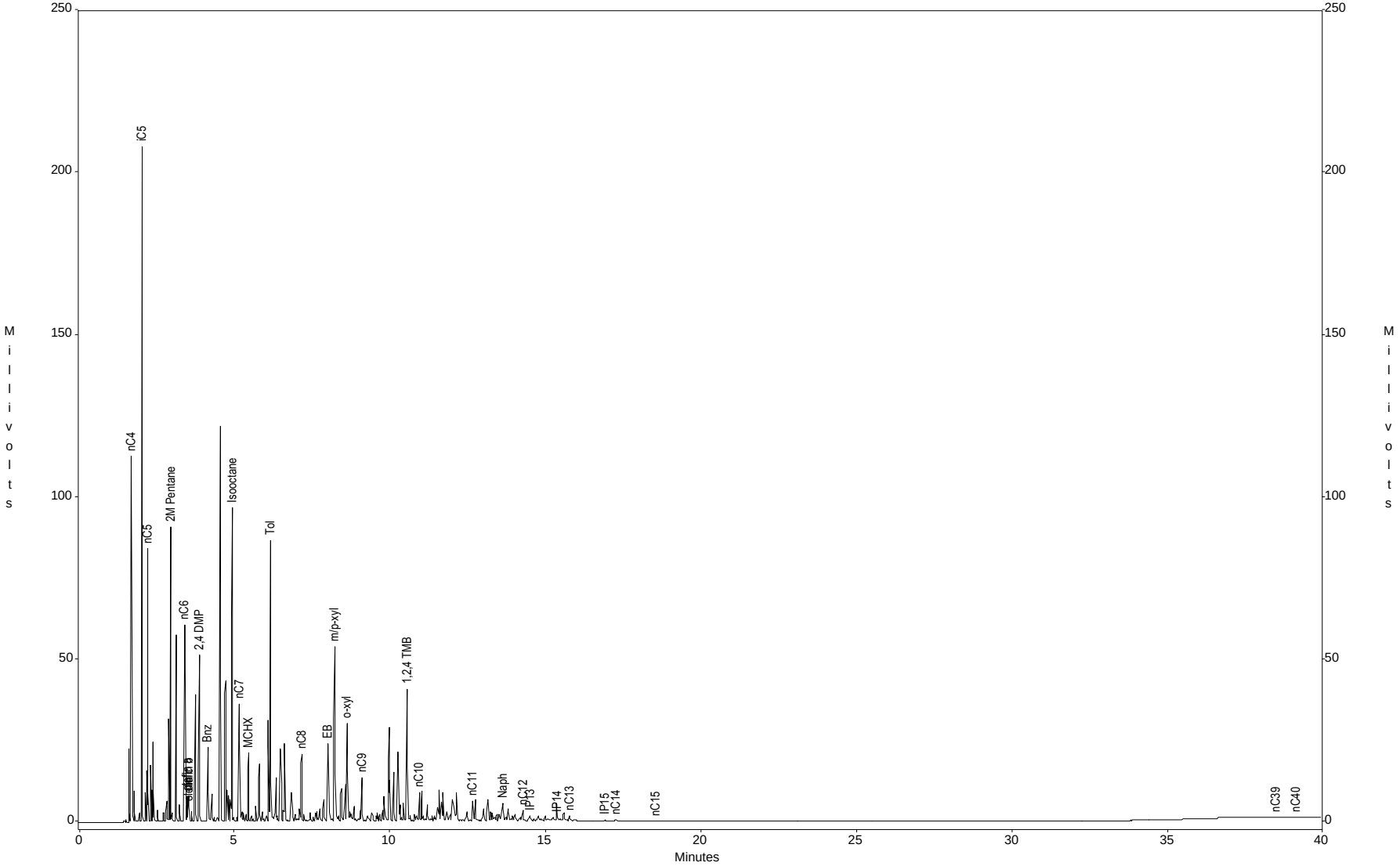


Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP52C/050803
Acquired : Aug 09, 2005 13:44:30

c:\ezchrom\chrom\05119\mp52cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP53C/050803
Acquired : Aug 09, 2005 14:32:38

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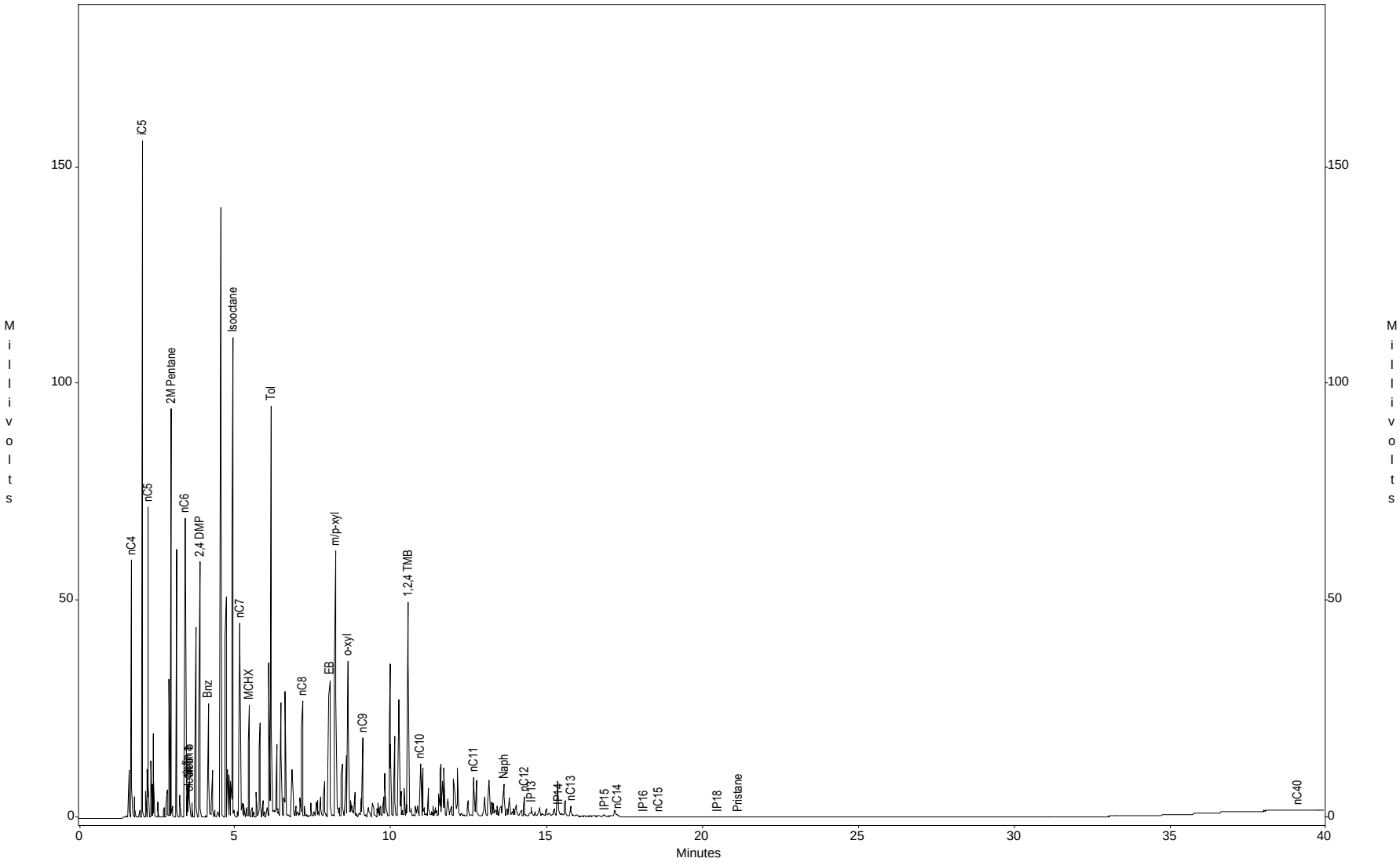
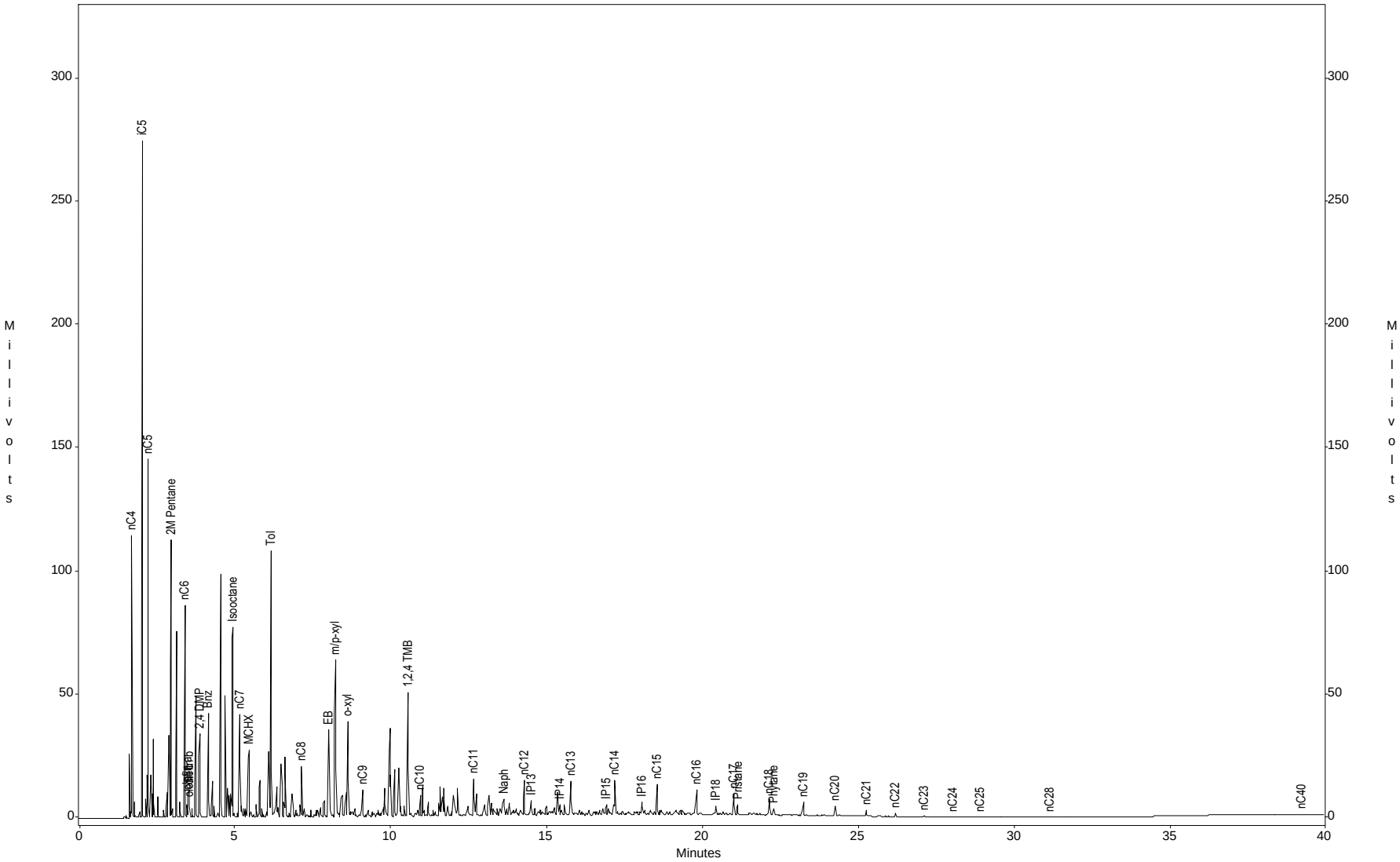


Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP55C/050803
Acquired : Aug 09, 2005 16:12:27

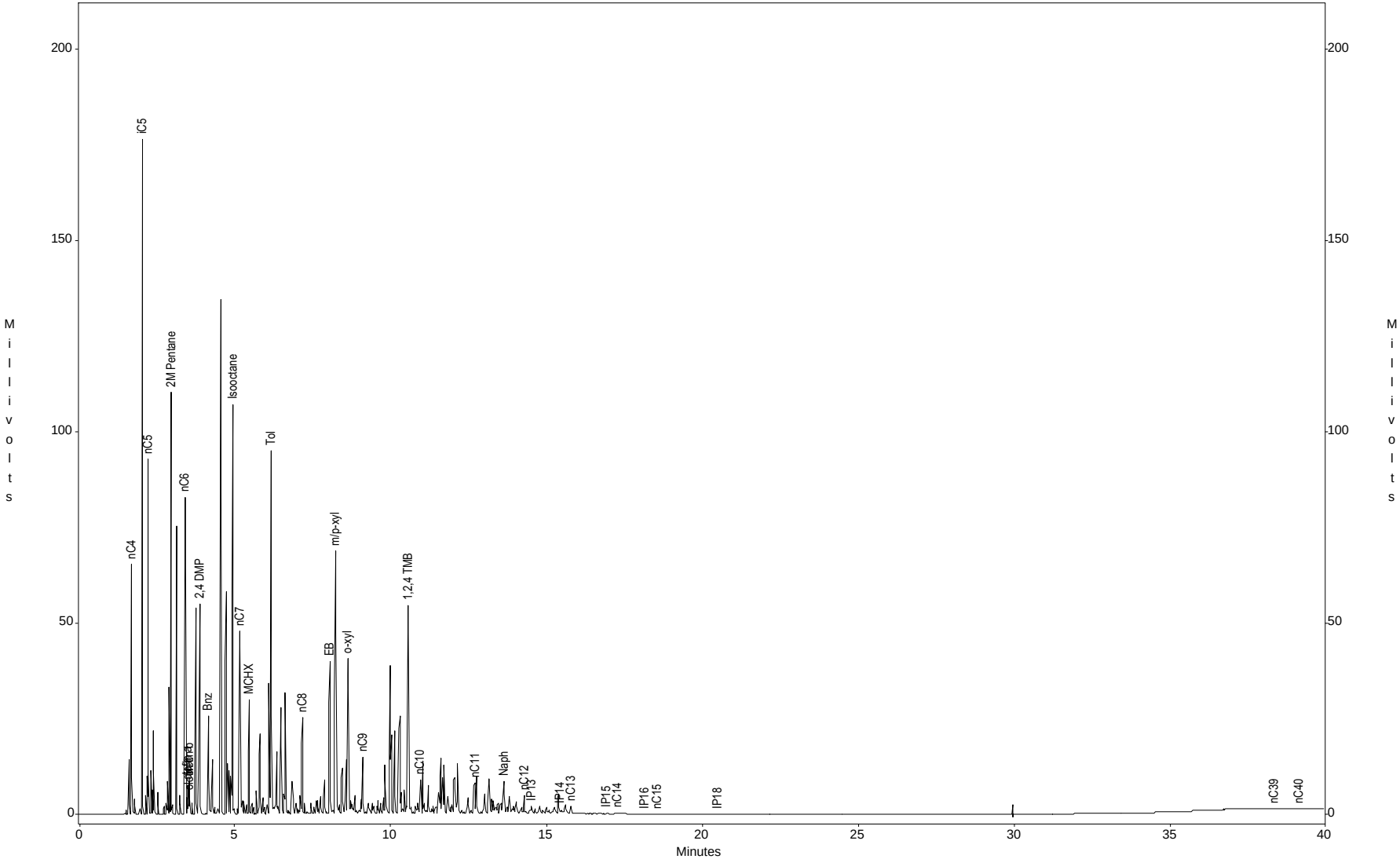
c:\ezchrom\chrom\05119\mp55cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP56C/050803
Acquired : Aug 09, 2005 17:02:01

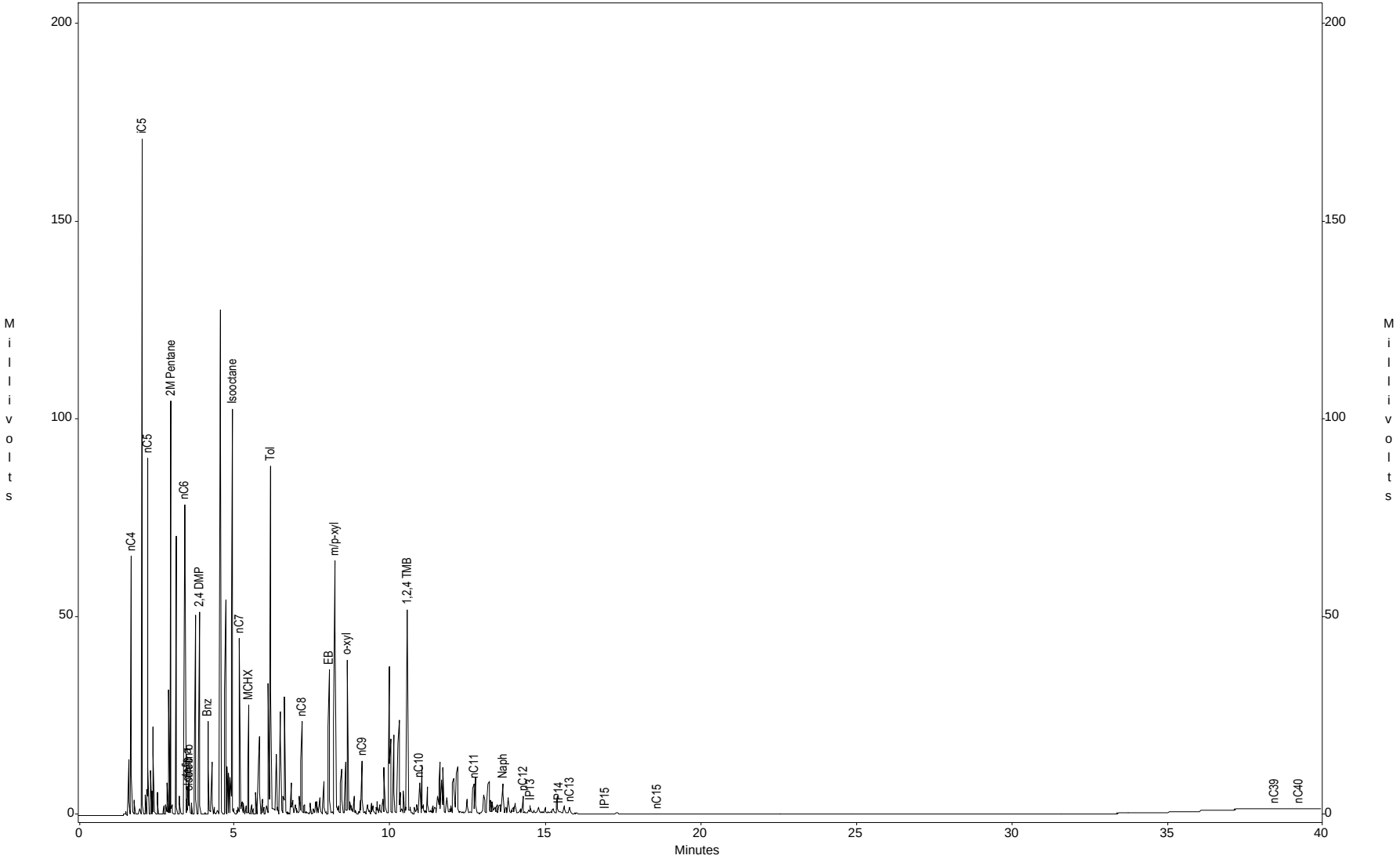
c:\ezchrom\chrom\05119\mp56cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP56CD/050803
Acquired : Aug 09, 2005 17:51:36

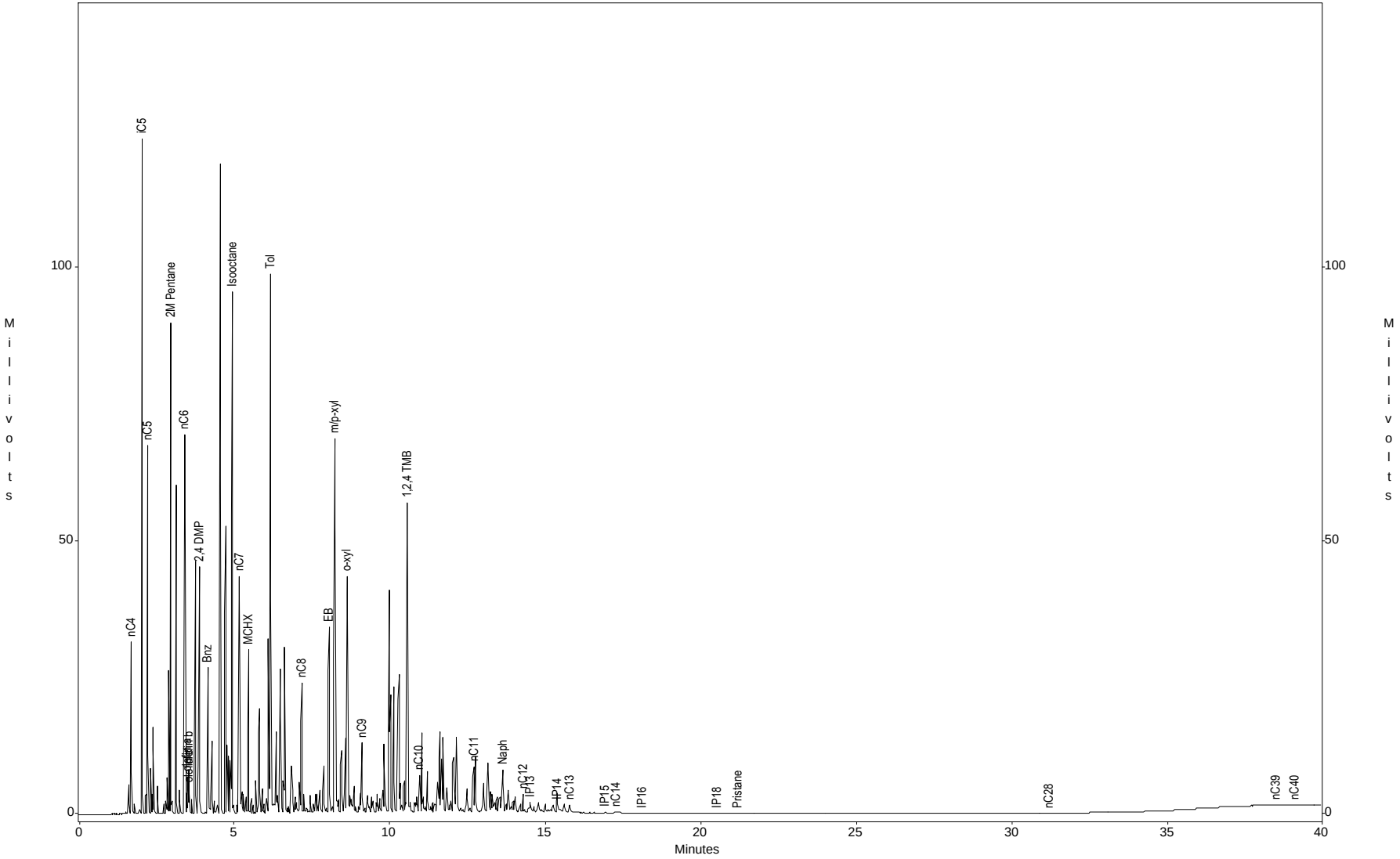
c:\ezchrom\chrom\05119\mp56cpd -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP57C/050803
Acquired : Aug 09, 2005 18:40:20

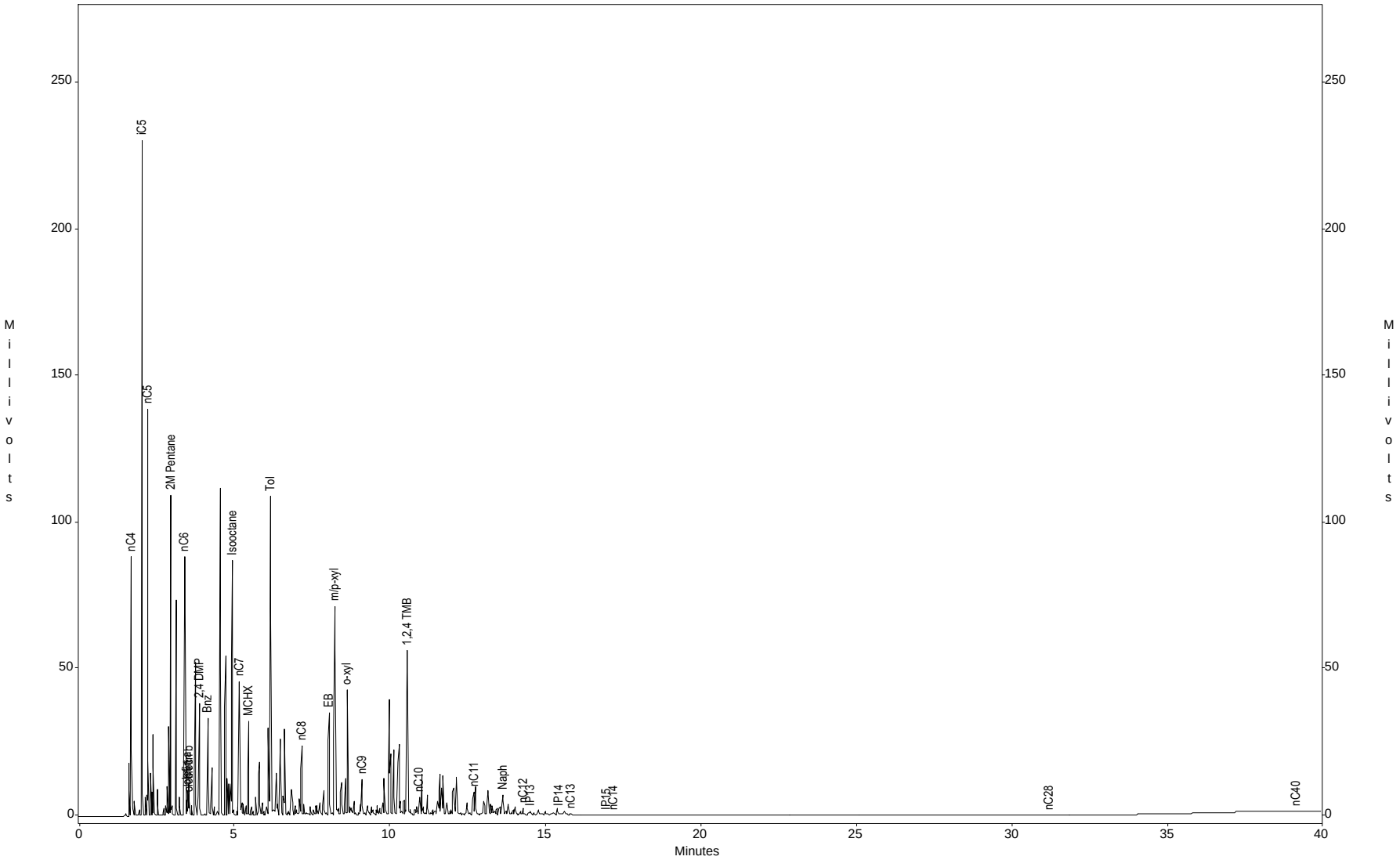
c:\ezchrom\chrom\05119\mp57cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP60C/050803
Acquired : Aug 09, 2005 19:37:29

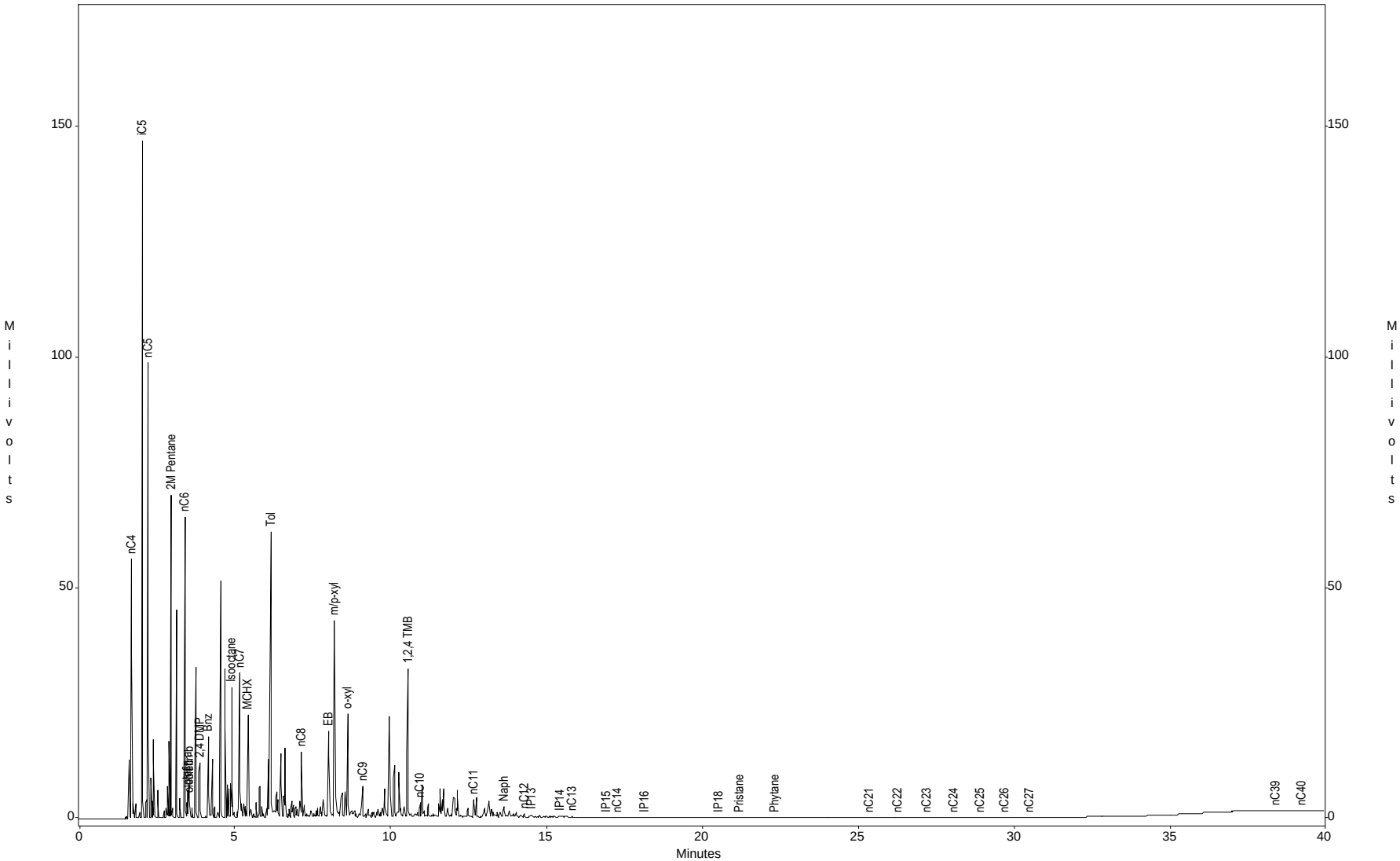
c:\ezchrom\chrom\05119\mp60cp -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP79C/050809
Acquired : Aug 12, 2005 09:34:14

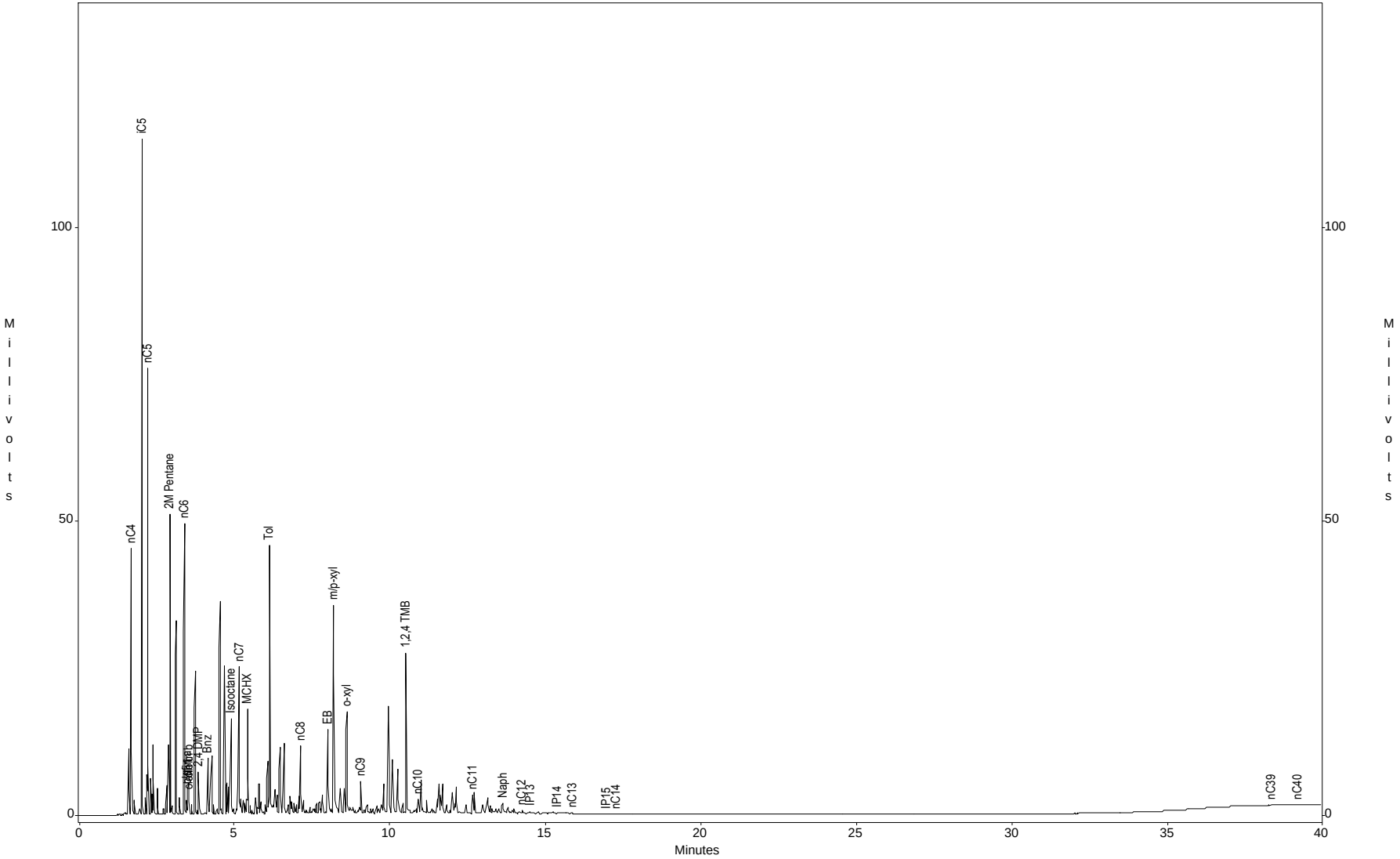
c:\ezchrom\chrom\05119\mp79c -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP80C/050809
Acquired : Aug 12, 2005 11:14:42

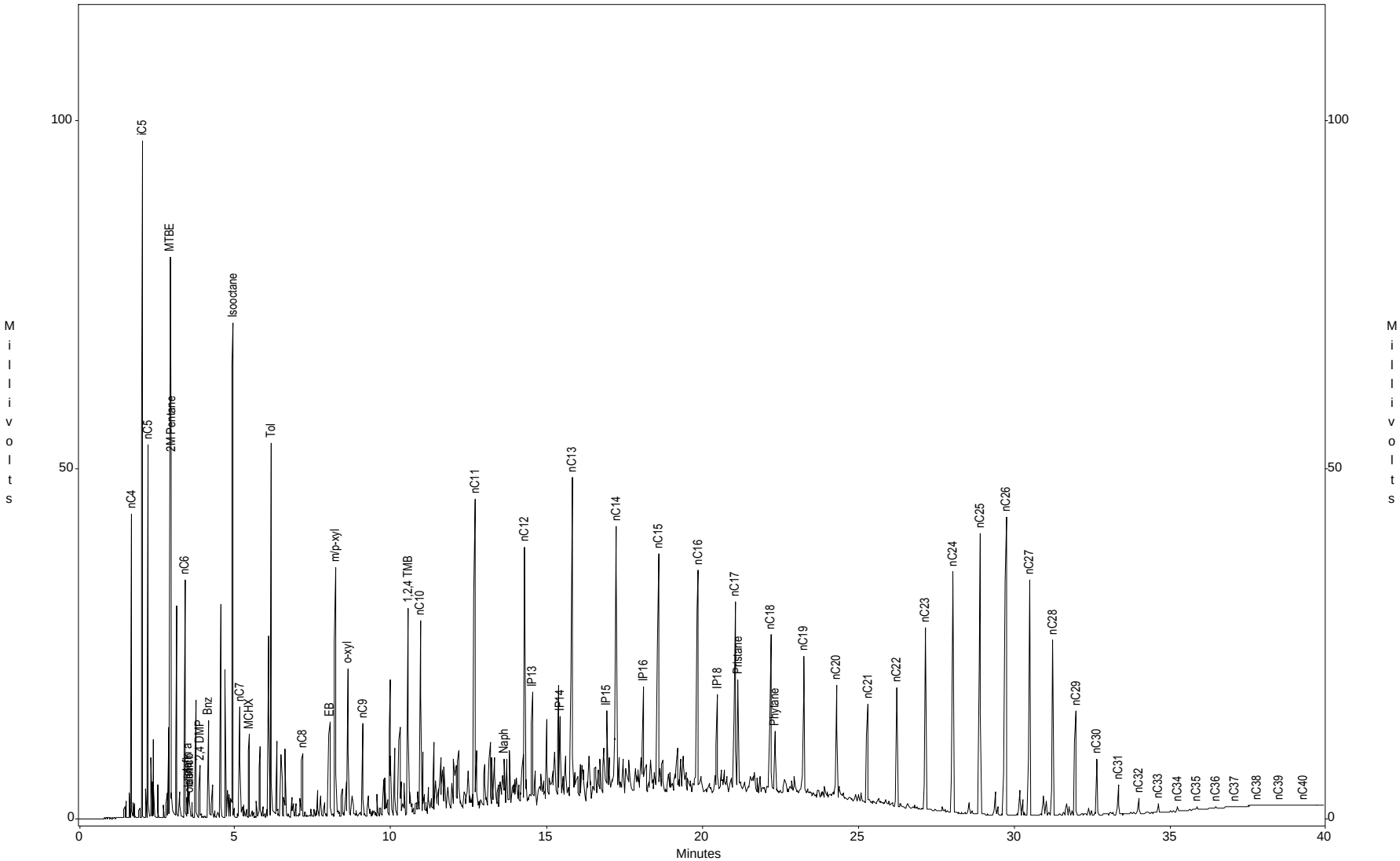
c:\ezchrom\chrom\05119\mp80c -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 08, 2005 11:50:57

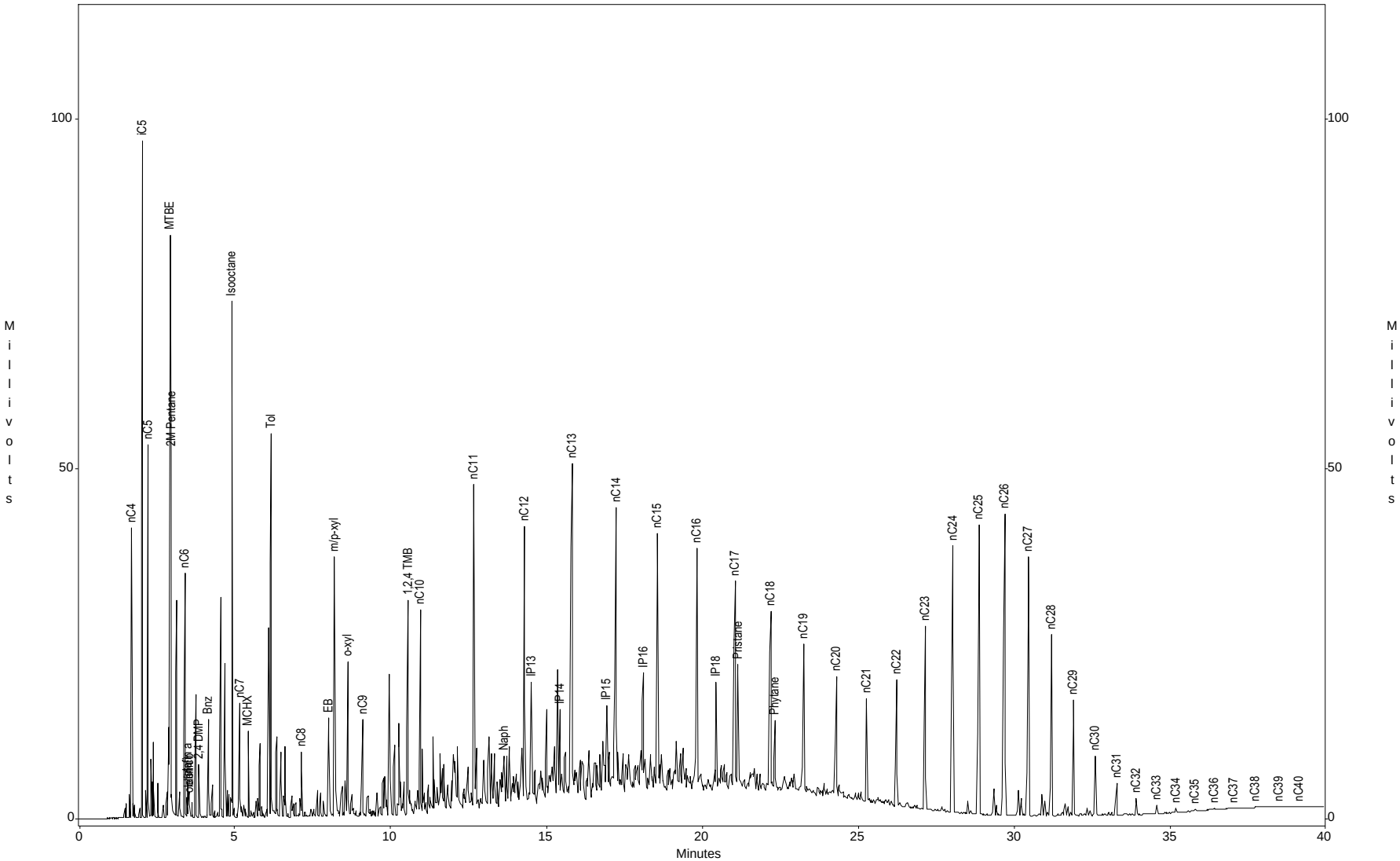
c:\ezchrom\chrom\05119\gadiwax2 -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 09, 2005 15:22:22

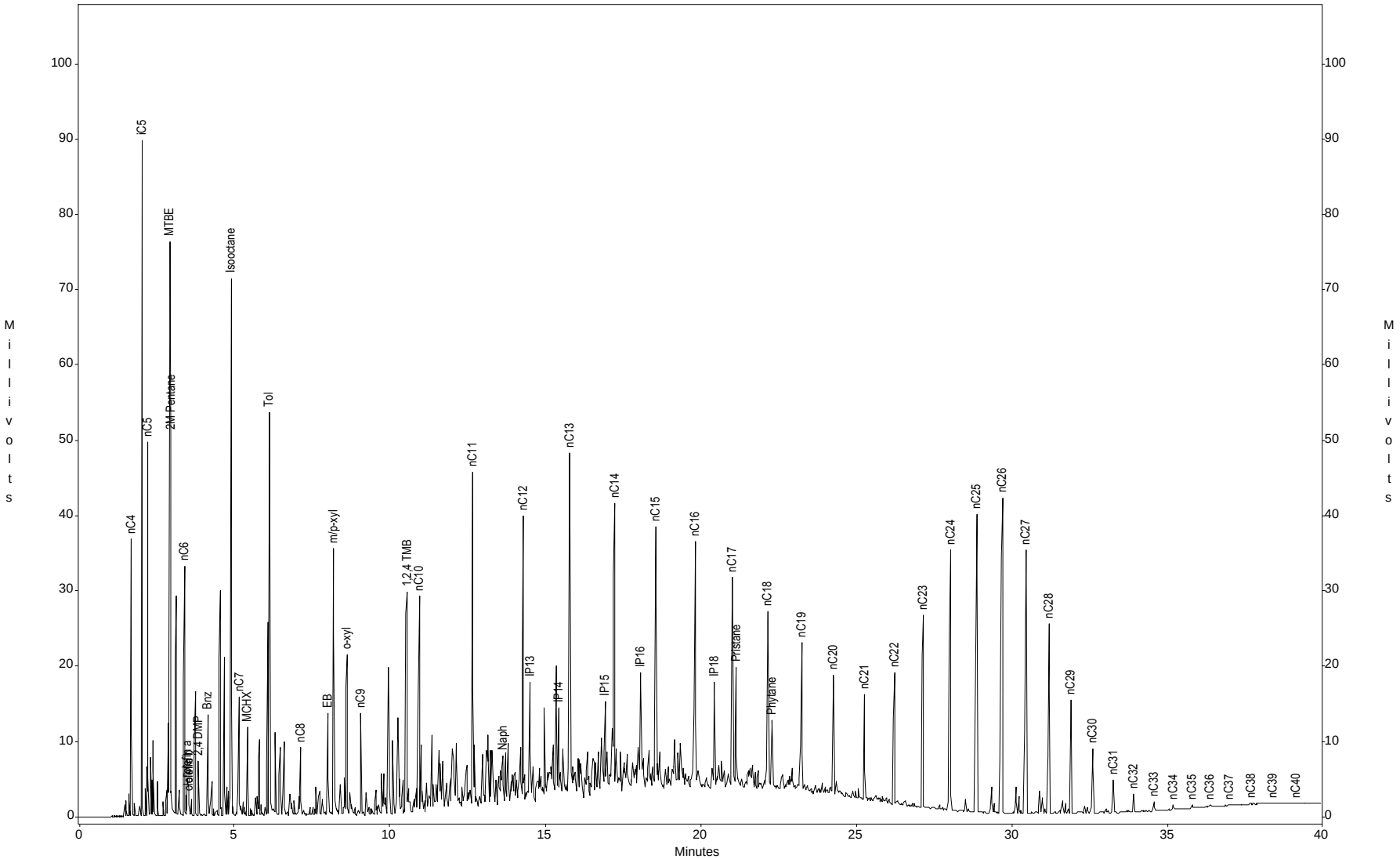
c:\ezchrom\chrom\05119\gadiwax2.3 -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 12, 2005 10:24:57

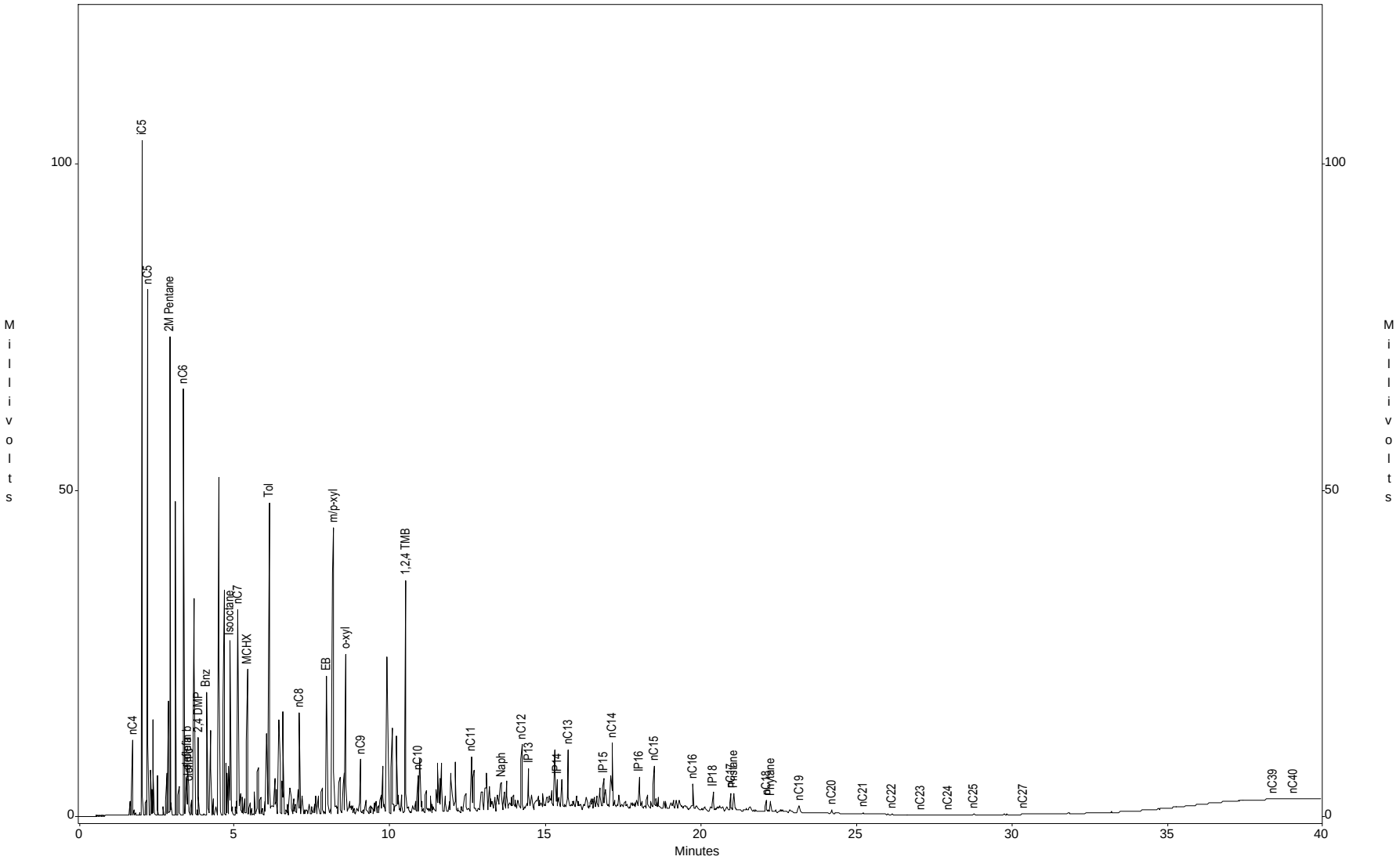
c:\ezchrom\chrom\05119\gadiwax2.4 -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : RW-4A/050830
Acquired : Sep 02, 2005 14:04:16

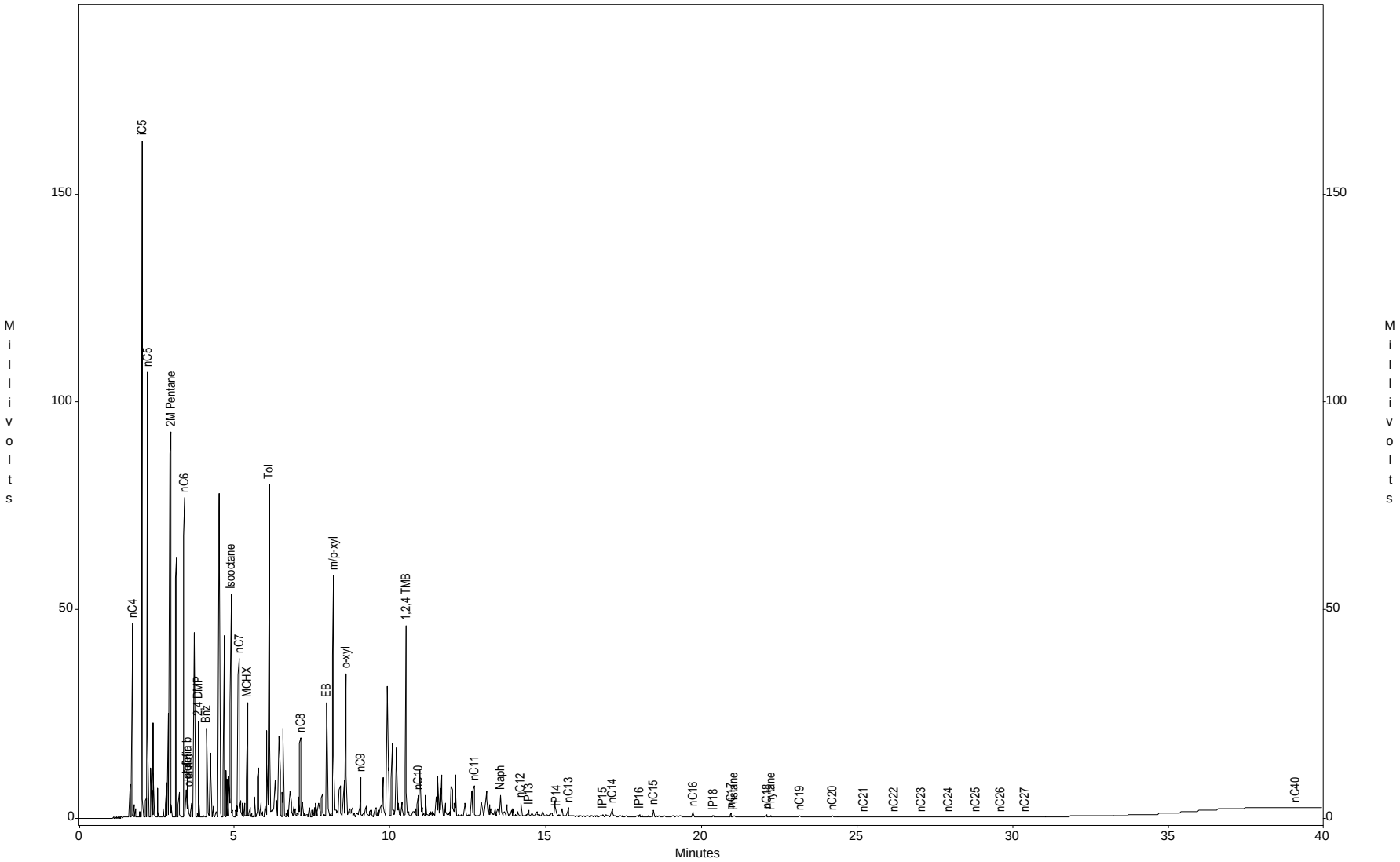
c:\ezchrom\chrom\05119\rw-4ap -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : RW-5/050830
Acquired : Sep 02, 2005 14:54:49

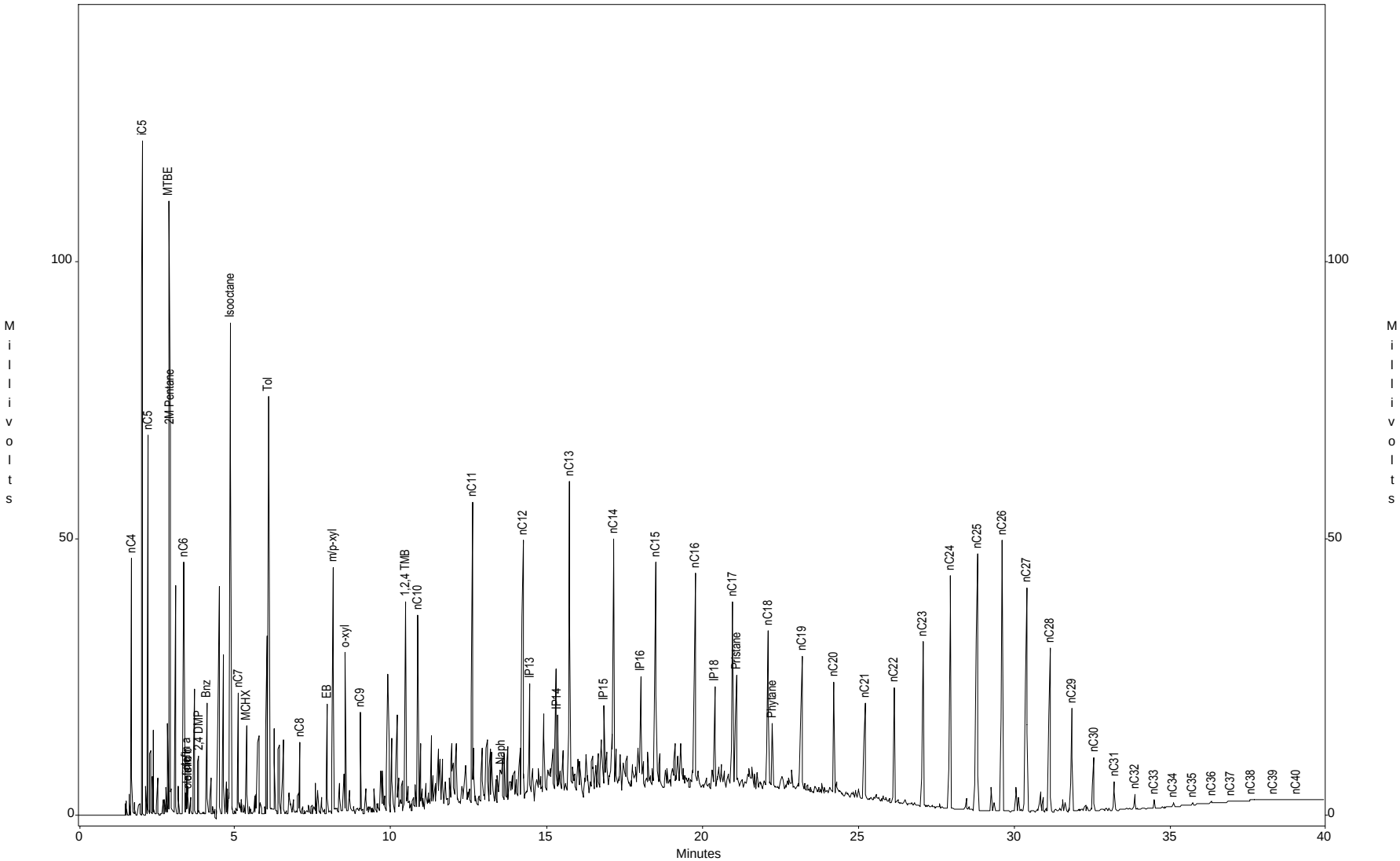
c:\ezchrom\chrom\05119\rw-5p -- Channel A



Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Sep 02, 2005 09:56:36

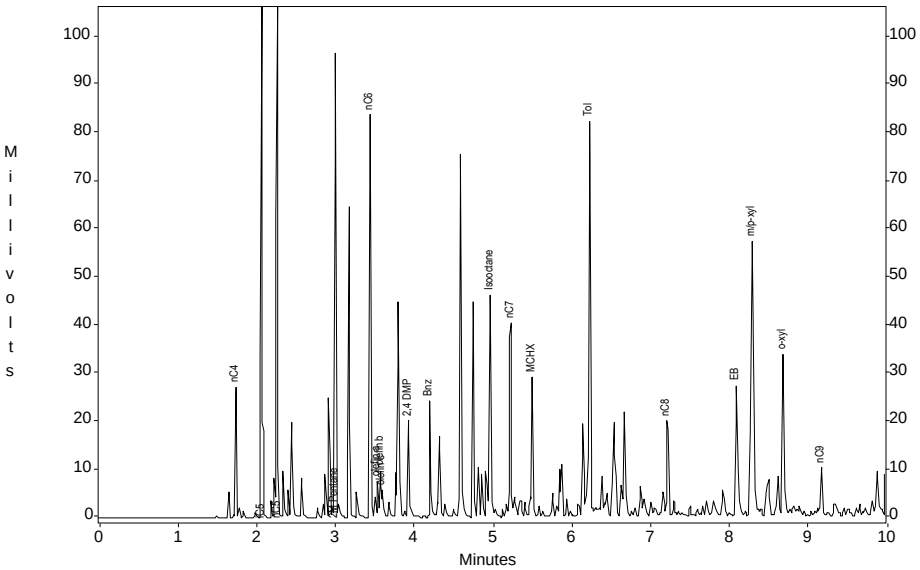
c:\ezchrom\chrom\05119\gadiwax2.5 -- Channel A



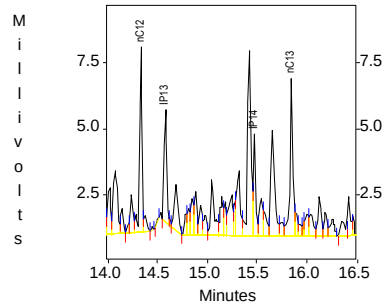
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW08/050803
Acquired : Aug 08, 2005 08:30:12

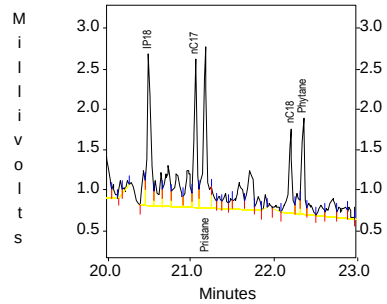
c:\ezchrom\chrom\05119\hmw08p -- Channel A



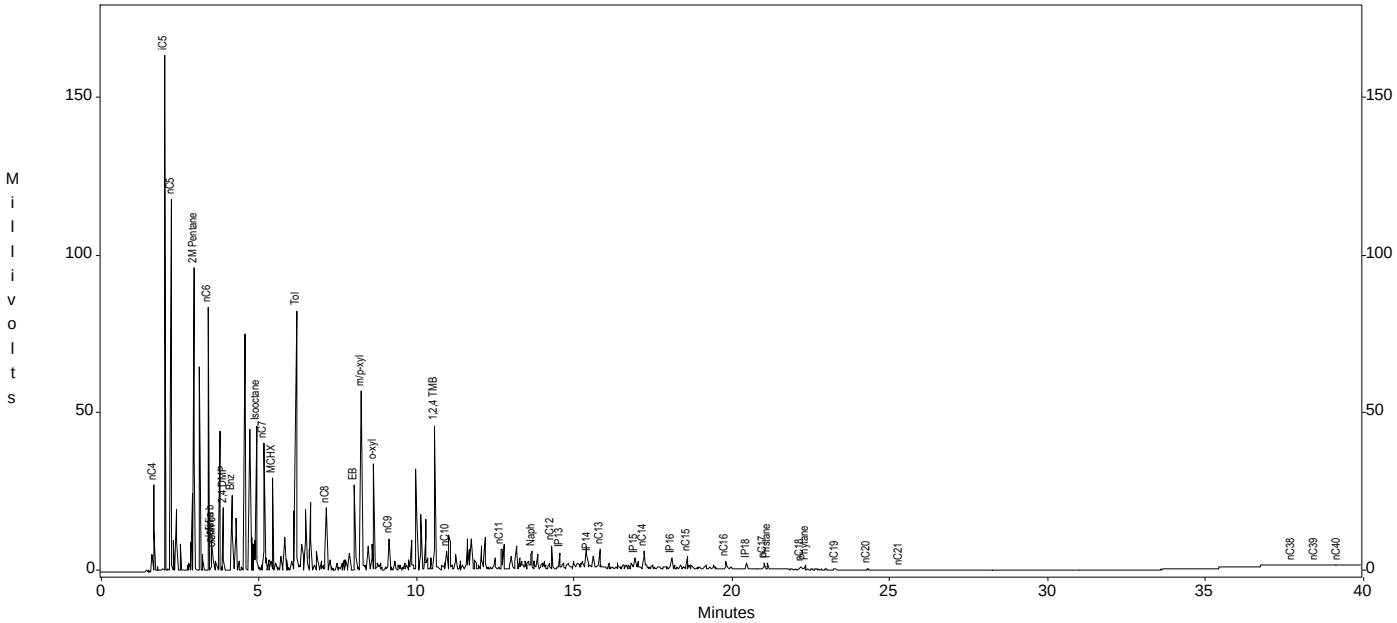
c:\ezchrom\chrom\05119\hmw08p -- Channel A



c:\ezchrom\chrom\05119\hmw08p -- Channel A



c:\ezchrom\chrom\05119\hmw08p -- Channel A



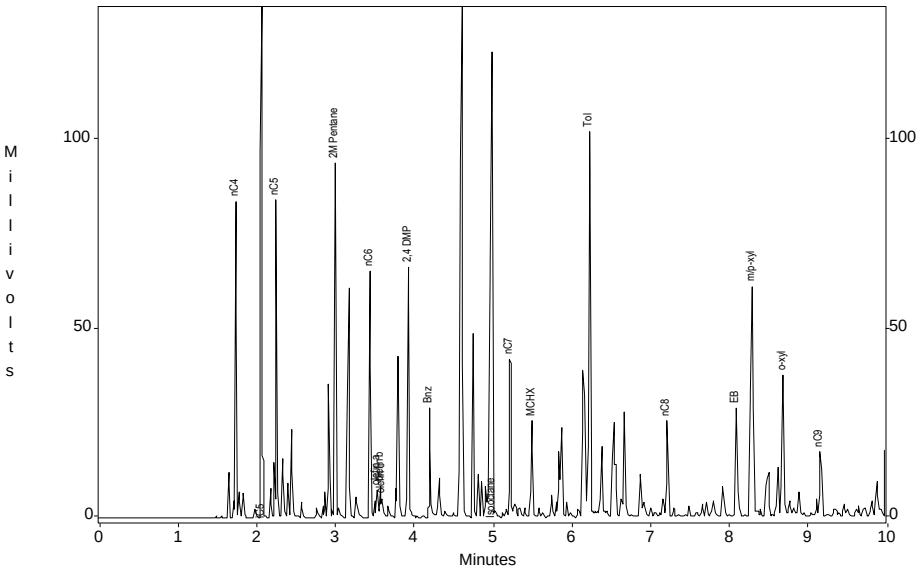
Channel A Results

Peak	Area	Height
nC4	21040	27164
iC5	133941	163294
nC5	103088	117397
MTBE	0	0
2M Pentane	97998	96471
nC6	90078	83633
olefin a	9294	7474
olefin b	11104	9683
olefin c	8877	5467
2,4 DMP	24888	20102
Bnz	36117	24037
Isooctane	59901	46100
nC7	59910	40306
MCHX	40408	29211
Tol	135394	81179
nC8	28800	19776
EB	46517	27057
m/p-xyl	152945	56941
o-xyl	55848	33548
nC9	15365	10028
1,2,4 TMB	83859	45677
nC10	9128	5791
nC11	19052	6522
Naph	16686	5379
nC12	12108	7039
IP13	6878	4221
IP14	6805	3895
nC13	11509	5955
IP15	5456	3254
nC14	12537	5556
IP16	6646	3511
nC15	8519	4056
nC16	6475	2454
IP18	5556	1869
nC17	3884	1845
Pristane	5804	1999
nC18	2685	1033
Phytane	2815	1180
nC19	2737	657
nC20	1071	320
nC21	223	89
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	197	20
nC39	69	21
nC40	108	22

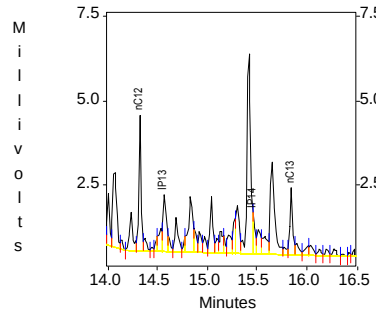
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW19/050804
Acquired : Aug 08, 2005 09:20:16

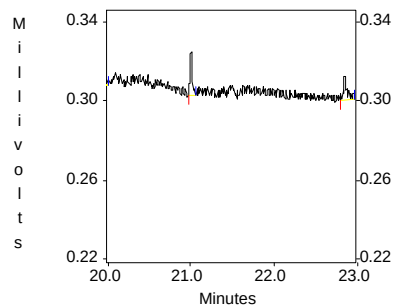
c:\ezchrom\chrom\05119\hmw19p -- Channel A



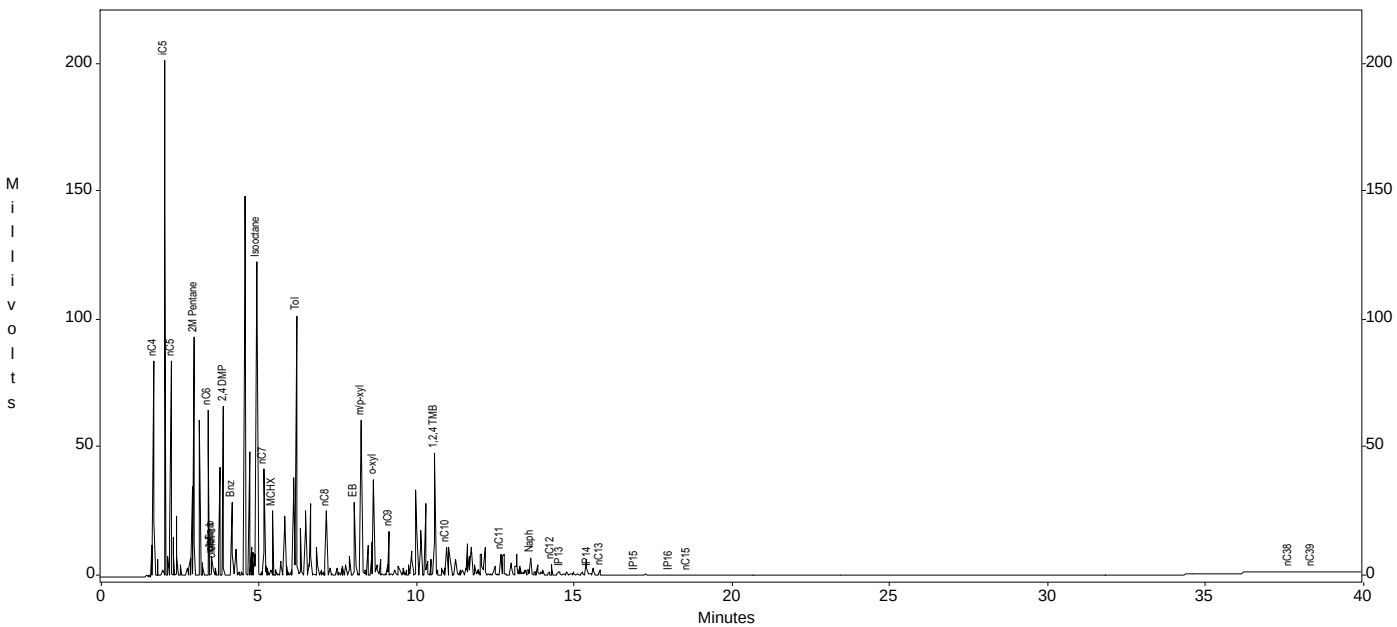
c:\ezchrom\chrom\05119\hmw19p -- Channel A



c:\ezchrom\chrom\05119\hmw19p -- Channel A



c:\ezchrom\chrom\05119\hmw19p -- Channel A



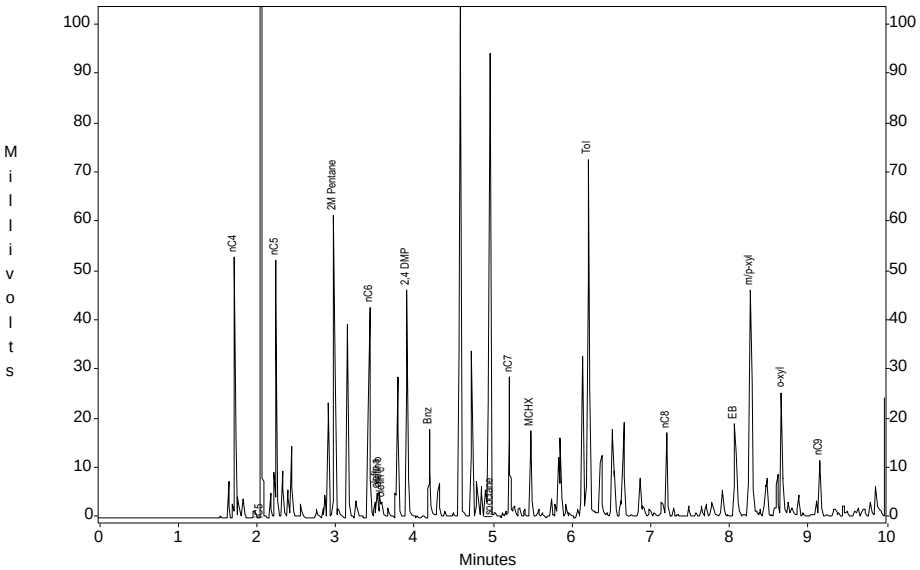
Channel A Results

Peak	Area	Height
nC4	65559	83664
iC5	167199	201334
nC5	76965	84029
MTBE	0	0
2M Pentane	95140	93731
nC6	69252	65105
olefin a	9600	7416
olefin b	9408	8093
olefin c	7941	4856
2,4 DMP	78302	66185
Bnz	42929	28800
Isooctane	216467	122728
nC7	59053	41558
MCHX	35677	25364
Tol	182096	101595
nC8	36020	25614
EB	45554	28927
m/p-xyl	163960	60740
o-xyl	63025	37265
nC9	24990	16983
1,2,4 TMB	87487	47886
nC10	16822	10898
nC11	21230	7951
Naph	19013	6689
nC12	6403	4065
IP13	4057	1674
IP14	1864	1223
nC13	3833	1997
IP15	1094	371
nC14	0	0
IP16	185	37
nC15	86	14
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	1509	25
nC39	28	14
nC40	0	0

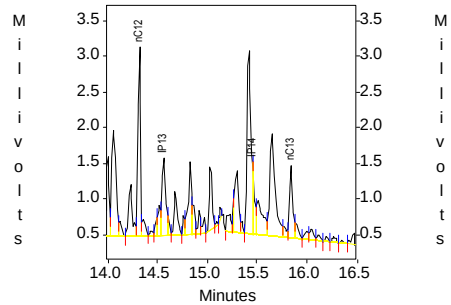
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW19D/050804
Acquired : Aug 08, 2005 10:09:32

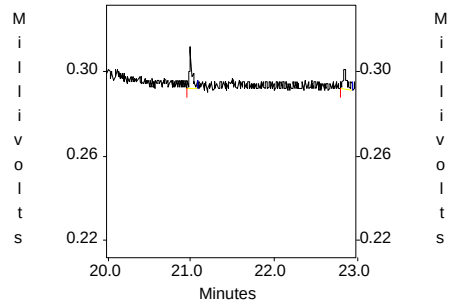
c:\ezchrom\chrom\05119\hmw19pd -- Channel A



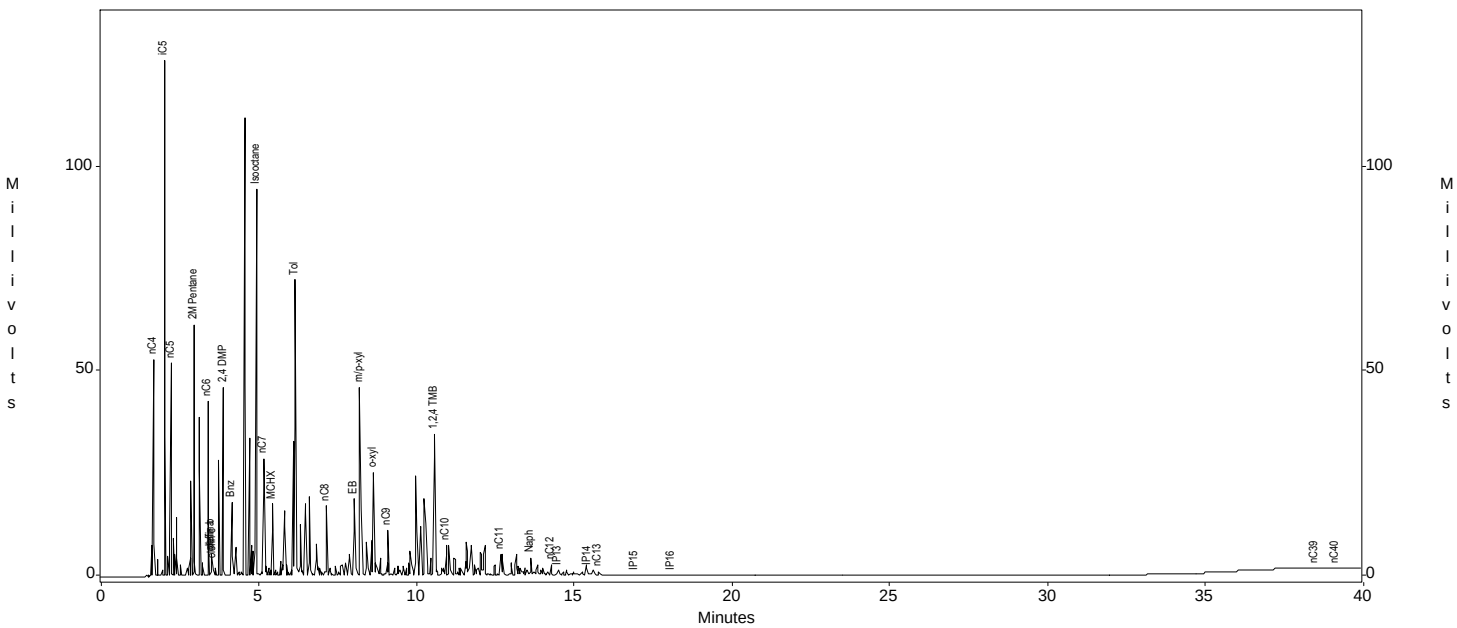
c:\ezchrom\chrom\05119\hmw19pd -- Channel A



c:\ezchrom\chrom\05119\hmw19pd -- Channel A



c:\ezchrom\chrom\05119\hmw19pd -- Channel A



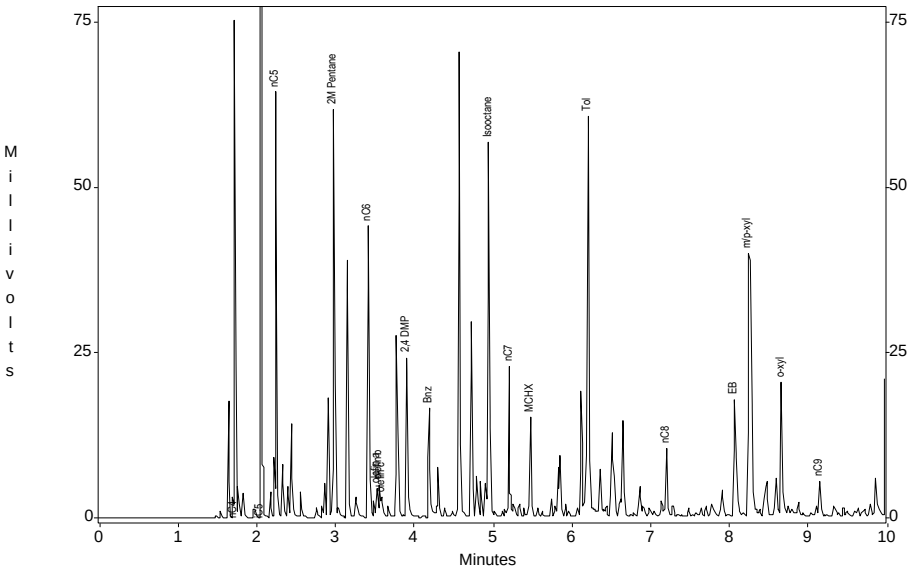
Channel A Results

Peak	Area	Height
nC4	43411	52904
iC5	111291	125814
nC5	51760	52028
MTBE	0	0
2M Pentane	63661	61267
nC6	46328	42761
olefin a	6295	4804
olefin b	6200	5179
olefin c	5704	3239
2,4 DMP	52230	46036
Bnz	28730	17867
Isooctane	145954	94286
nC7	39171	28528
MCHX	25034	17438
Tol	123140	72548
nC8	24379	17062
EB	33328	18864
m/p-xyl	111420	46111
o-xyl	42552	25196
nC9	16869	11264
1,2,4 TMB	60407	34344
nC10	11334	7338
nC11	2970	2578
Naph	12743	4038
nC12	4256	2666
IP13	2563	1079
IP14	1424	1006
nC13	2339	1028
IP15	292	107
nC14	0	0
IP16	169	14
nC15	0	0
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	82	14
nC40	46	15

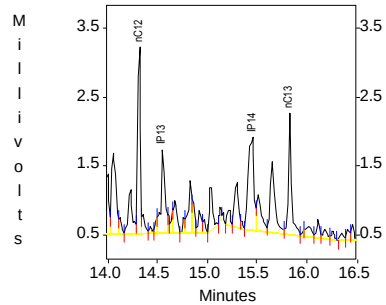
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW20/050803
Acquired : Aug 08, 2005 10:59:48

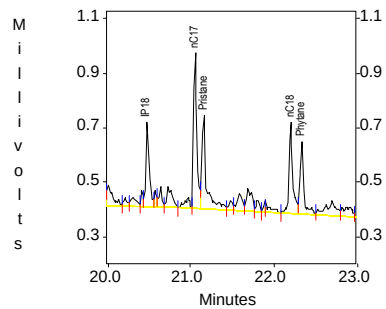
c:\ezchrom\chrom\05119\hmw20p -- Channel A



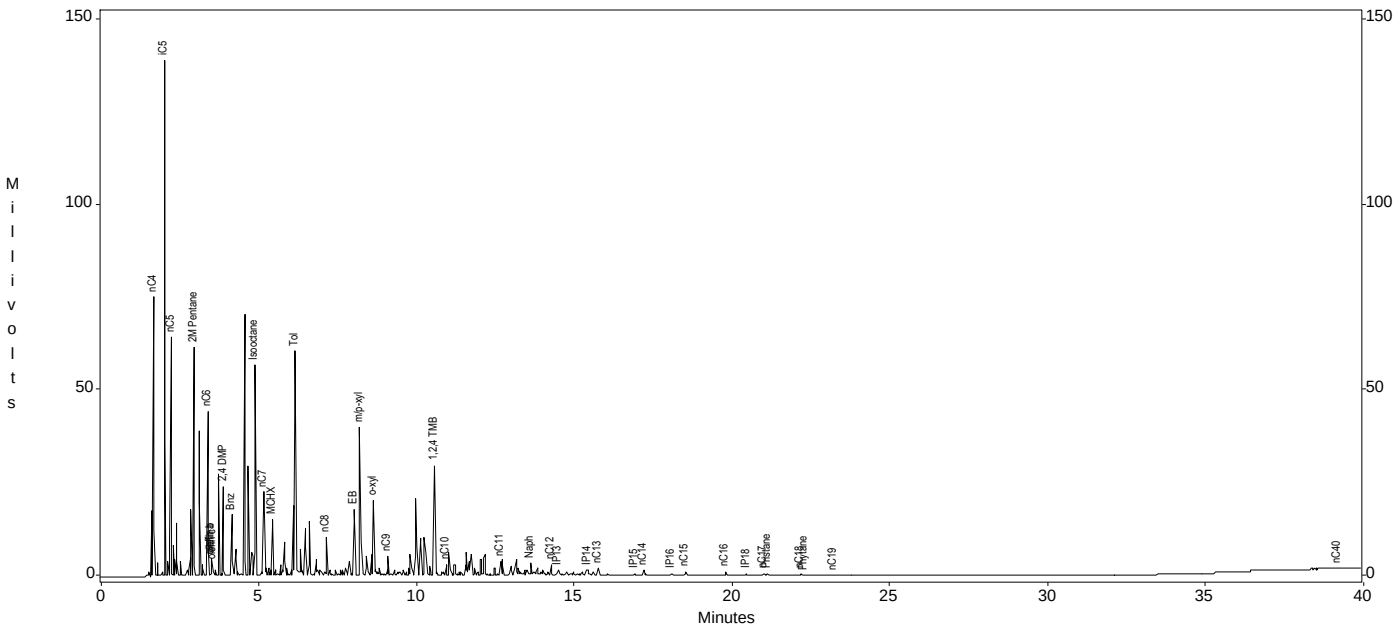
c:\ezchrom\chrom\05119\hmw20p -- Channel A



c:\ezchrom\chrom\05119\hmw20p -- Channel A



c:\ezchrom\chrom\05119\hmw20p -- Channel A



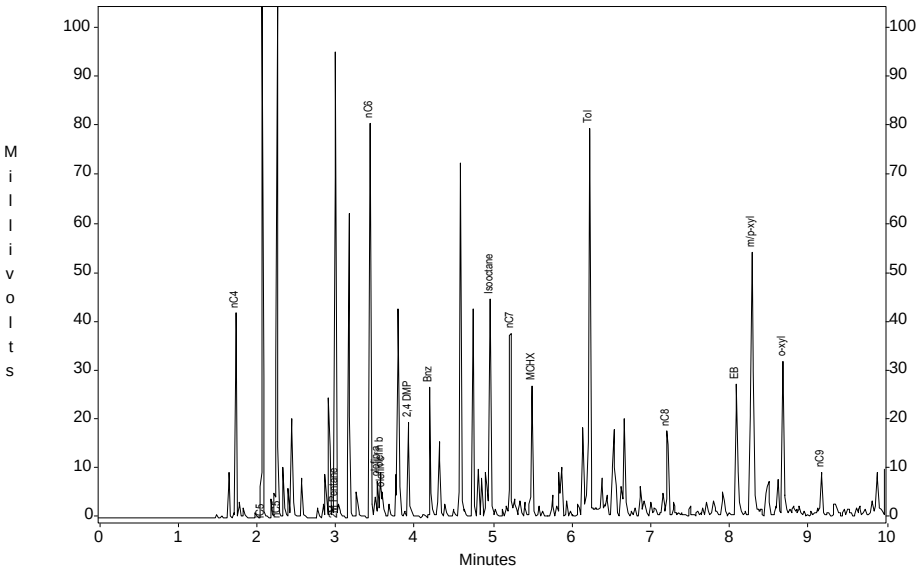
Channel A Results

Peak	Area	Height
nC4	64639	75417
iC5	123822	138885
nC5	63581	64665
MTBE	0	0
2M Pentane	62653	61806
nC6	47544	44236
olefin a	5418	4319
olefin b	6152	4980
olefin c	5476	3081
2,4 DMP	27686	24043
Bnz	26550	16590
Isooctane	77735	56897
nC7	31348	22915
MCHX	21681	15098
Tol	104484	60753
nC8	16251	10407
EB	31506	17816
m/p-xyl	63172	39979
o-xyl	35003	20342
nC9	8747	5409
1,2,4 TMB	51066	29654
nC10	4937	2982
nC11	10529	3571
Naph	9497	3031
nC12	4526	2710
IP13	3113	1213
IP14	5214	1336
nC13	3717	1758
IP15	1510	689
nC14	3703	1600
IP16	917	516
nC15	2478	1002
nC16	2479	775
IP18	884	311
nC17	1458	575
Pristane	1309	347
nC18	1023	333
Phytane	801	266
nC19	130	54
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	66	12

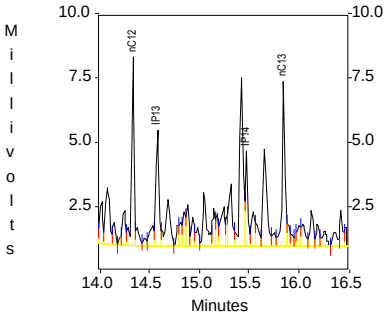
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW22/050804
Acquired : Aug 08, 2005 12:41:11

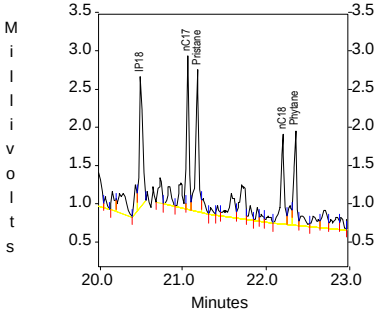
c:\ezchrom\chrom\05119\hmw22p -- Channel A



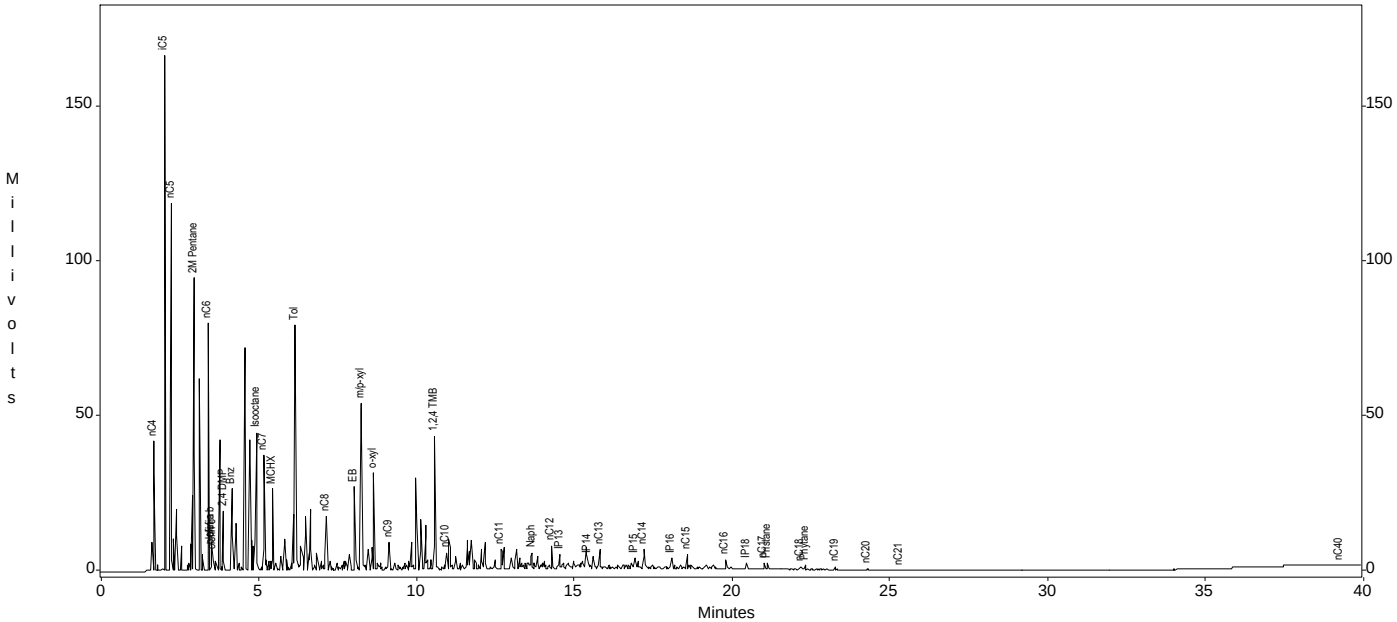
c:\ezchrom\chrom\05119\hmw22p -- Channel A



c:\ezchrom\chrom\05119\hmw22p -- Channel A



c:\ezchrom\chrom\05119\hmw22p -- Channel A



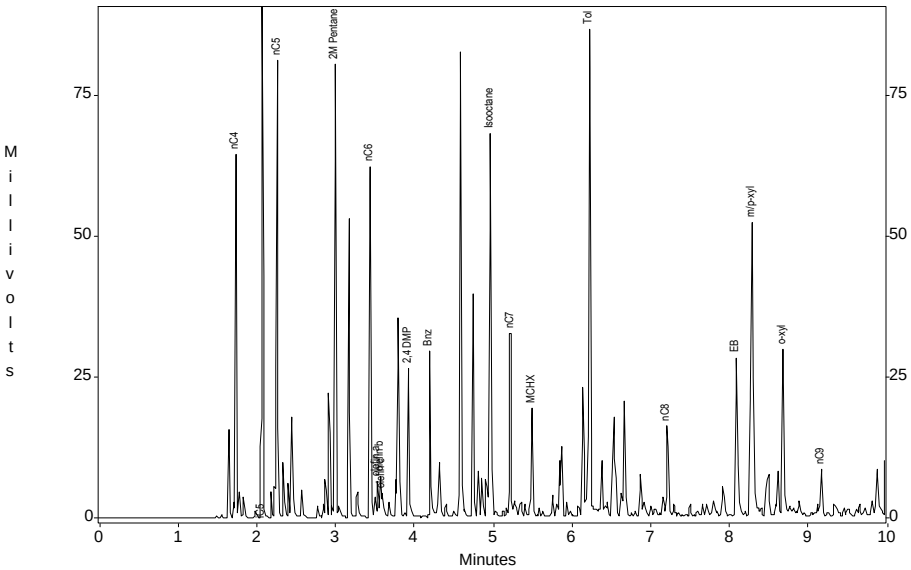
Channel A Results

Peak	Area	Height
nC4	31877	41988
iC5	135576	166594
nC5	104565	119018
MTBE	0	0
2M Pentane	96423	94909
nC6	86392	80358
olefin a	9101	7186
olefin b	10677	9212
olefin c	8664	5301
2,4 DMP	24056	19557
Bnz	39887	26446
Isooctane	57681	44738
nC7	54947	37341
MCHX	37403	26882
Tol	138549	79407
nC8	25360	17448
EB	45646	26872
m/p-xyl	141568	54085
o-xyl	51495	31428
nC9	13832	8938
1,2,4 TMB	77597	43250
nC10	8495	5304
nC11	18080	6359
Naph	12285	4382
nC12	12694	7341
IP13	8379	4481
IP14	6633	3717
nC13	12029	6423
IP15	6387	3307
nC14	14914	6156
IP16	6957	3582
nC15	9295	4583
nC16	6653	2850
IP18	4608	1697
nC17	3821	2013
Pristane	4729	1861
nC18	3041	1181
Phytane	2806	1229
nC19	2588	726
nC20	892	384
nC21	337	119
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	103	15

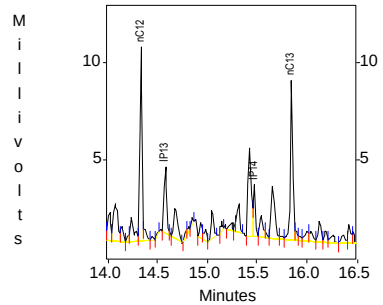
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : HMW44C/050804
Acquired : Aug 08, 2005 13:30:27

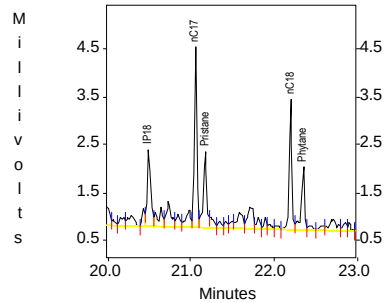
c:\ezchrom\chrom\05119\hmw44cp -- Channel A



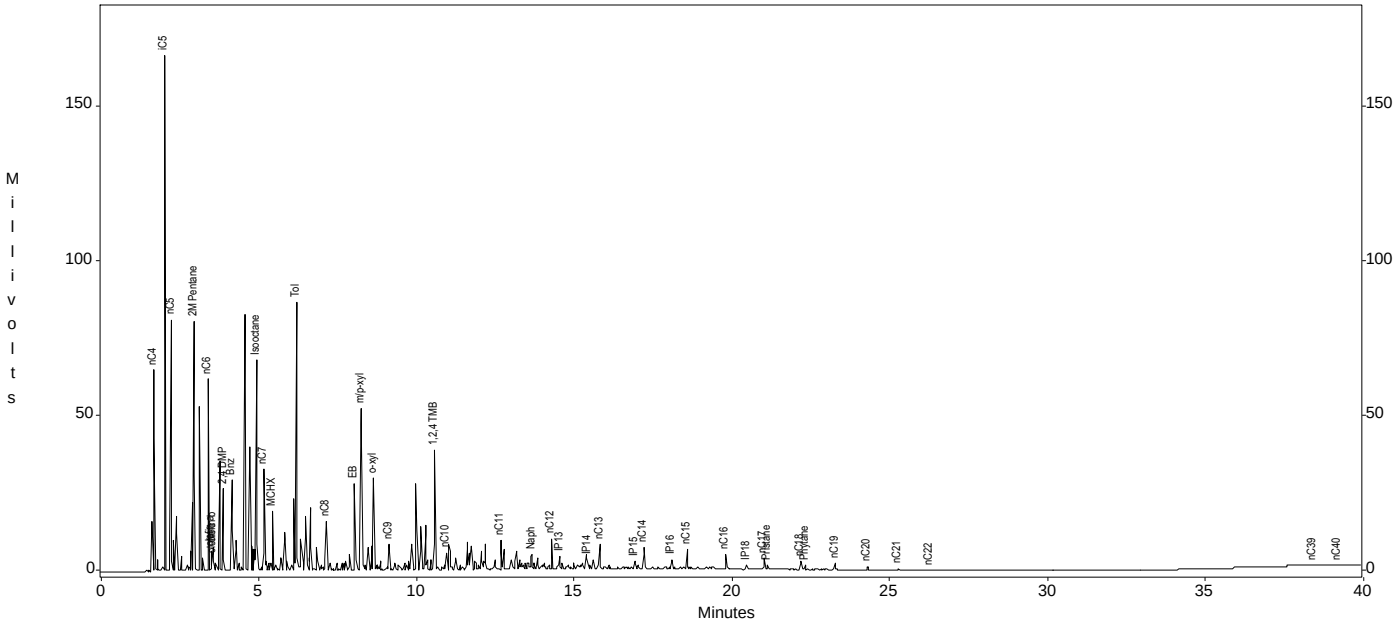
c:\ezchrom\chrom\05119\hmw44cp -- Channel A



c:\ezchrom\chrom\05119\hmw44cp -- Channel A



c:\ezchrom\chrom\05119\hmw44cp -- Channel A



Channel A Results

Peak	Area	Height
nC4	58282	64624
iC5	152513	166267
nC5	80485	81367
MTBE	0	0
2M Pentane	83190	80564
nC6	66987	62248
olefin a	7994	6262
olefin b	8775	7304
olefin c	7344	4286
2,4 DMP	31447	26591
Bnz	44563	29615
Isooctane	95363	68110
nC7	47379	32726
MCHX	27319	19446
Tol	155650	86800
nC8	23773	16040
EB	47081	28181
m/p-xyl	133789	52382
o-xyl	49415	29691
nC9	12768	8242
1,2,4 TMB	68249	38721
nC10	8428	5282
nC11	15487	9416
Naph	11696	4145
nC12	15389	9850
IP13	5483	3398
IP14	4301	2654
nC13	13690	8120
IP15	5081	2616
nC14	17111	7217
IP16	5026	2718
nC15	11829	6088
nC16	10124	4843
IP18	4801	1613
nC17	7530	3810
Pristane	4414	1620
nC18	5689	2734
Phytane	3698	1317
nC19	4692	2070
nC20	3013	1342
nC21	1659	669
nC22	925	235
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	20	13
nC40	35	12

Torkelson Geochemistry, Inc.

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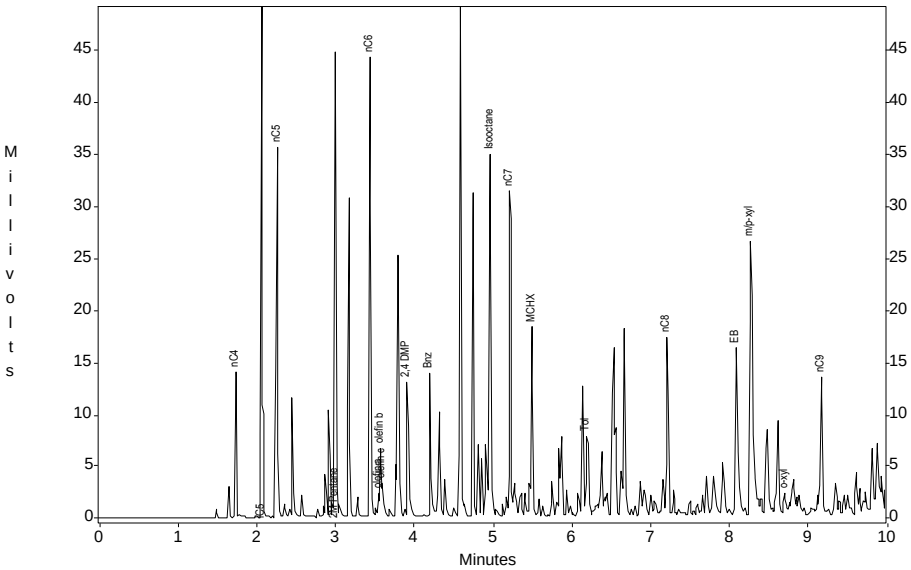
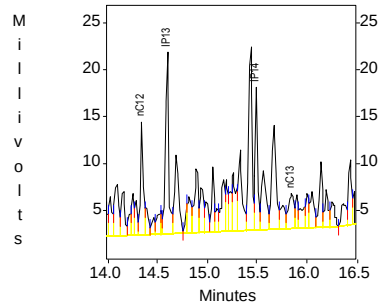
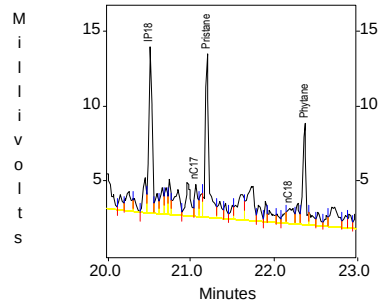
c:\ezchrom\chrom\05119\hmw45cp -- Channel A



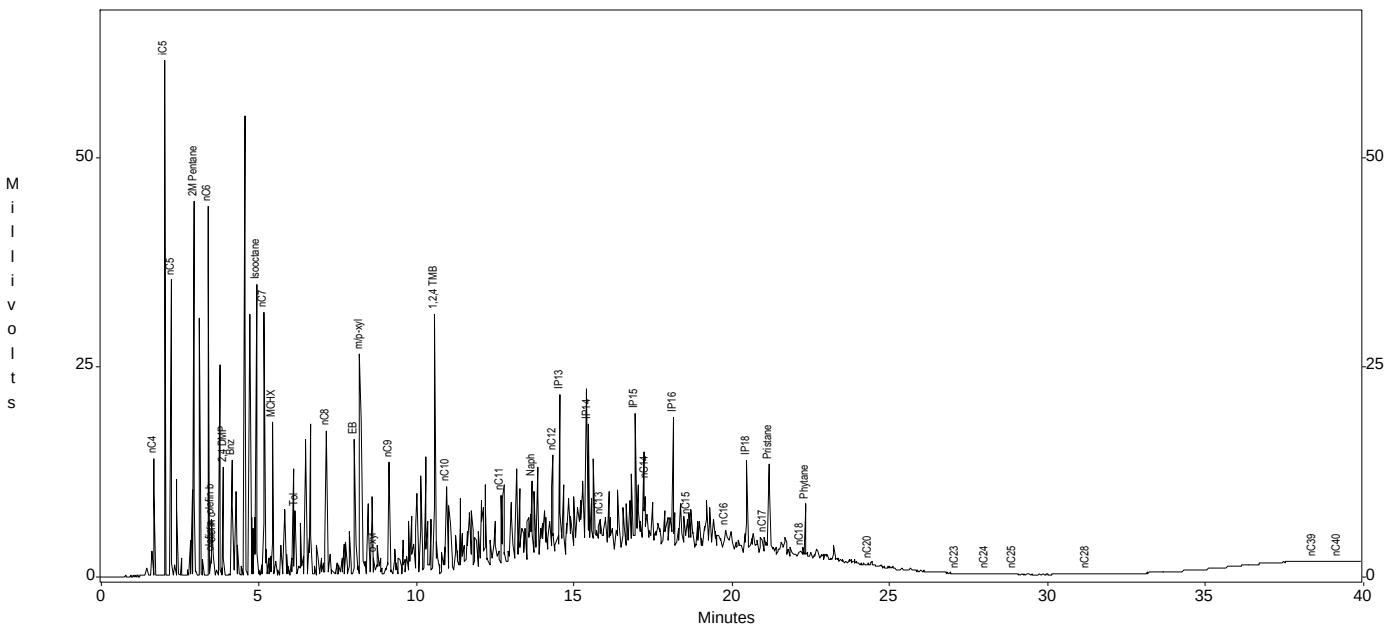
c:\ezchrom\chrom\05119\hmw45cp -- Channel A



c:\ezchrom\chrom\05119\hmw45cp -- Channel A



c:\ezchrom\chrom\05119\hmw45cp -- Channel A



Channel A Results

Peak	Area	Height
nC4	11513	13986
iC5	52899	61512
nC5	34608	35505
MTBE	0	0
2M Pentane	45524	44691
nC6	47052	44214
olefin a	2154	2279
olefin b	7950	6637
olefin c	5904	3323
2,4 DMP	16170	12991
Bnz	22520	13780
Isooctane	44154	34781
nC7	43393	31303
MCHX	25088	18290
Tol	13452	7705
nC8	25224	17252
EB	27109	16110
m/p-xyl	36902	26285
o-xyl	4677	1973
nC9	19670	13081
1,2,4 TMB	56623	30990
nC10	16760	10054
nC11	21921	8035
Naph	25380	9228
nC12	21713	12105
IP13	39528	19284
IP14	26721	15312
nC13	13312	3872
IP15	23456	14653
nC14	15092	6639
IP16	33631	15312
nC15	13032	3275
nC16	15680	2331
IP18	27465	11080
nC17	5226	2113
Pristane	32809	10812
nC18	5504	966
Phytane	17367	6684
nC19	0	0
nC20	1702	466
nC21	0	0
nC22	0	0
nC23	76	23
nC24	228	20
nC25	180	20
nC26	0	0
nC27	0	0
nC28	88	14
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	816	22
nC40	67	11

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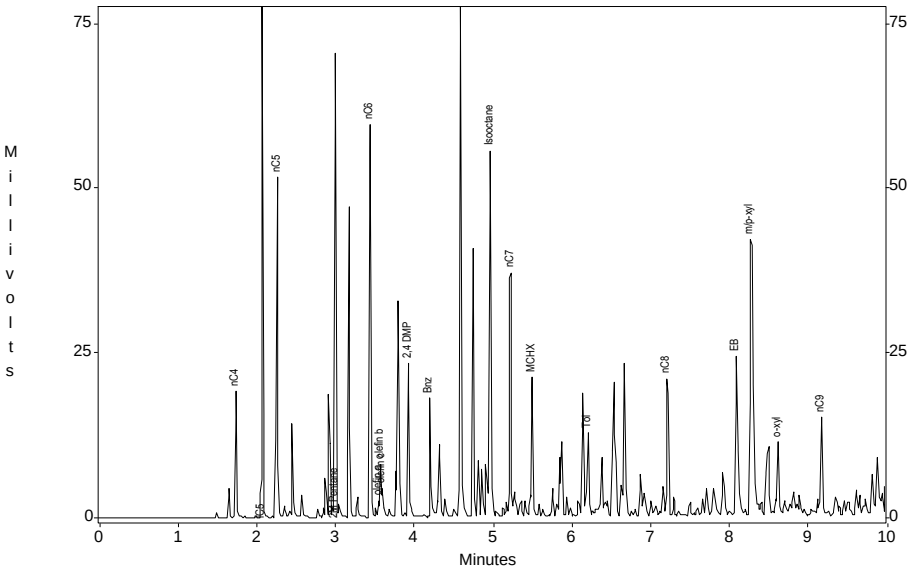
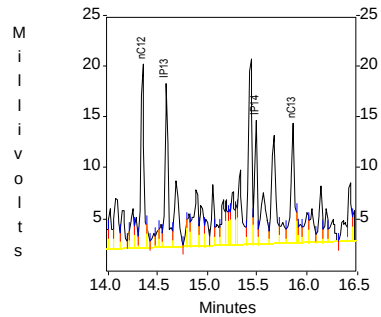
Sample ID : HMW46C/050803
Acquired : Aug 08, 2005 15:11:32

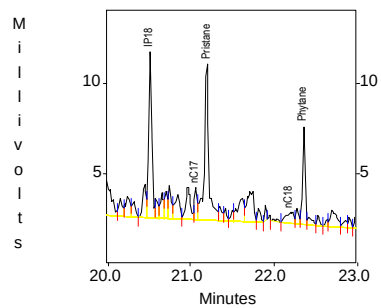
c:\ezchrom\chrom\05119\hmw46cp -- Channel A



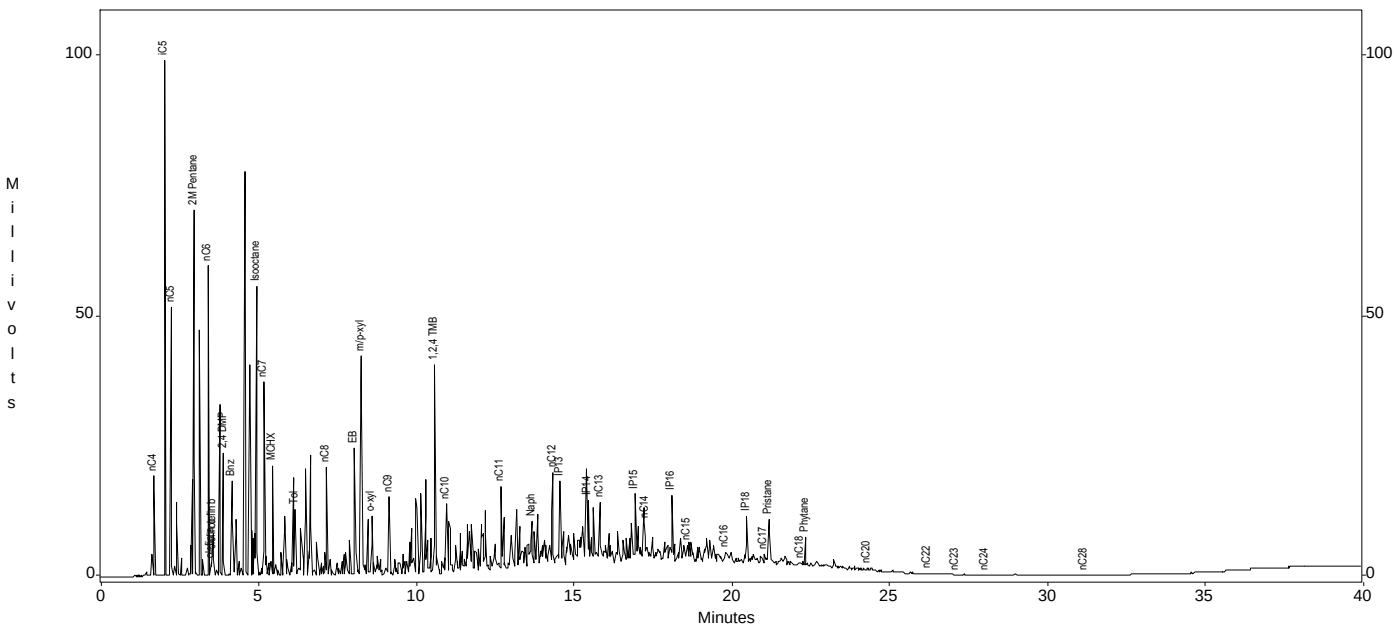
c:\ezchrom\chrom\05119\hmw46cp -- Channel A



c:\ezchrom\chrom\05119\hmw46cp -- Channel A



c:\ezchrom\chrom\05119\hmw46cp -- Channel A



Channel A Results

Peak	Area	Height
nC4	14891	19182
iC5	79283	99067
nC5	46590	51602
MTBE	0	0
2M Pentane	70584	70520
nC6	62858	59513
olefin a	2354	2598
olefin b	9444	8177
olefin c	7291	4277
2,4 DMP	27353	23382
Bnz	28368	18026
Isooctane	78052	55478
nC7	52906	37105
MCHX	29059	21173
Tol	20370	12814
nC8	30093	20859
EB	38939	24370
m/p-xyl	112458	41987
o-xyl	17506	11402
nC9	22771	15032
1,2,4 TMB	75035	40255
nC10	21753	13353
nC11	33244	15651
Naph	25757	8740
nC12	34318	18086
IP13	32753	16136
IP14	21702	12374
nC13	28737	11931
IP15	23080	12893
nC14	18873	7056
IP16	26510	12464
nC15	11797	3024
nC16	14960	1997
IP18	23011	9345
nC17	4246	1851
Pristane	30006	8778
nC18	3975	594
Phytane	12766	5537
nC19	0	0
nC20	1227	368
nC21	0	0
nC22	53	23
nC23	105	18
nC24	199	21
nC25	0	0
nC26	0	0
nC27	0	0
nC28	374	69
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	0	0

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Hartford Working Group
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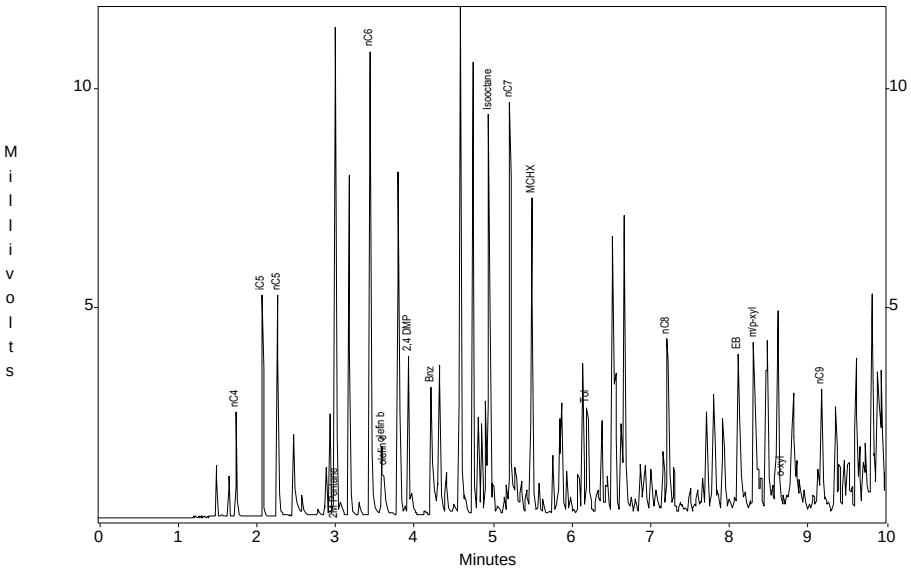
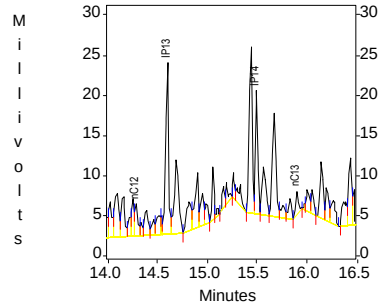
Acquired : Aug 08, 2005 16:02:17

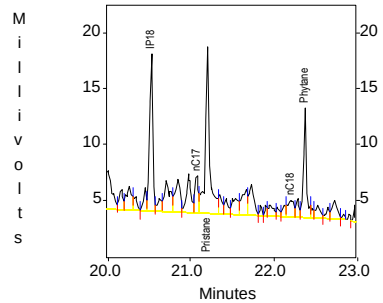
c:\ezchrom\chrom\05119\hmw48cp -- Channel A



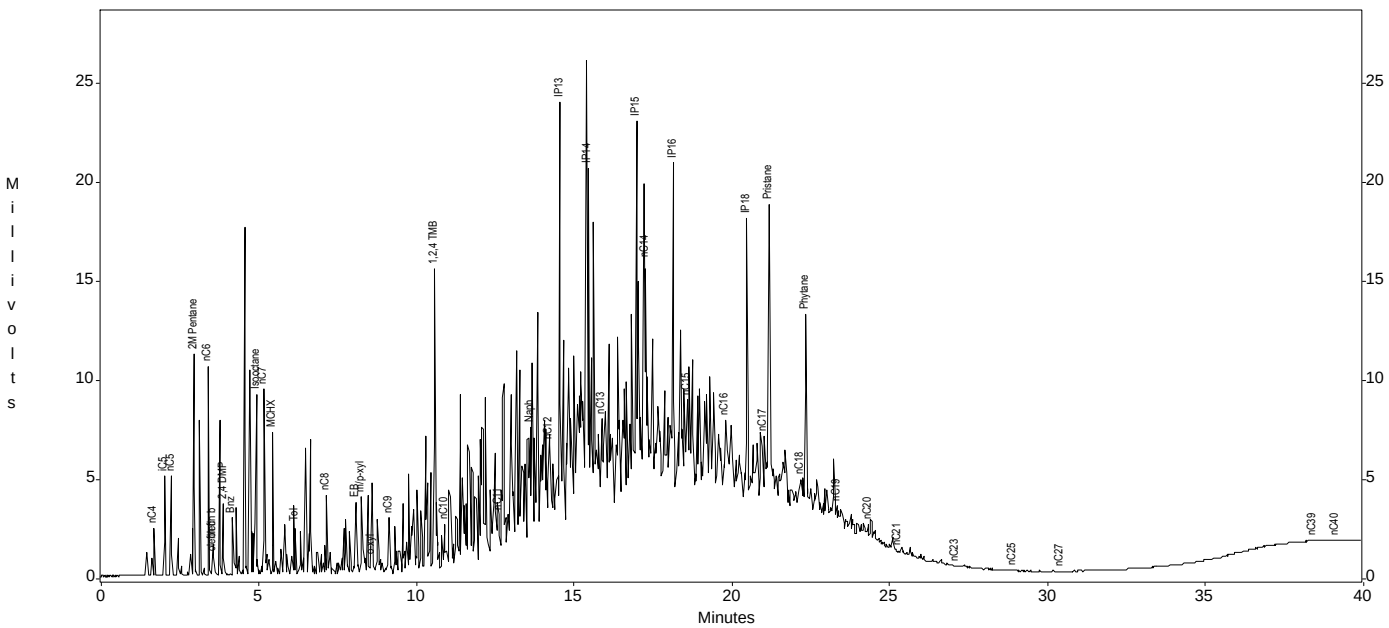
c:\ezchrom\chrom\05119\hmw48cp -- Channel A



c:\ezchrom\chrom\05119\hmw48cp -- Channel A



c:\ezchrom\chrom\05119\hmw48cp -- Channel A



Channel A Results

Peak	Area	Height
nC4	2244	2397
iC5	4841	5066
nC5	6125	5035
MTBE	0	0
2M Pentane	12694	11137
nC6	13653	10563
olefin a	0	0
olefin b	2054	1554
olefin c	2230	1001
2,4 DMP	4526	3627
Bnz	6546	2920
Isooctane	11534	9129
nC7	13388	9391
MCHX	11524	7202
Tol	4703	2373
nC8	7256	3971
EB	9190	3589
m/p-xyl	9148	3873
o-xyl	670	695
nC9	5234	2773
1,2,4 TMB	29813	15181
nC10	6367	2172
nC11	3886	1588
Naph	15633	5419
nC12	7535	4059
IP13	41493	21181
IP14	23840	15333
nC13	6534	3016
IP15	33885	18370
nC14	24279	10811
IP16	35760	15856
nC15	17906	4451
nC16	25418	3729
IP18	34117	14145
nC17	8198	3316
Pristane	52178	15025
nC18	7241	1427
Phytane	25870	9875
nC19	1919	852
nC20	1923	639
nC21	155	94
nC22	0	0
nC23	66	20
nC24	0	0
nC25	294	31
nC26	0	0
nC27	52	10
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	34	12
nC40	40	11

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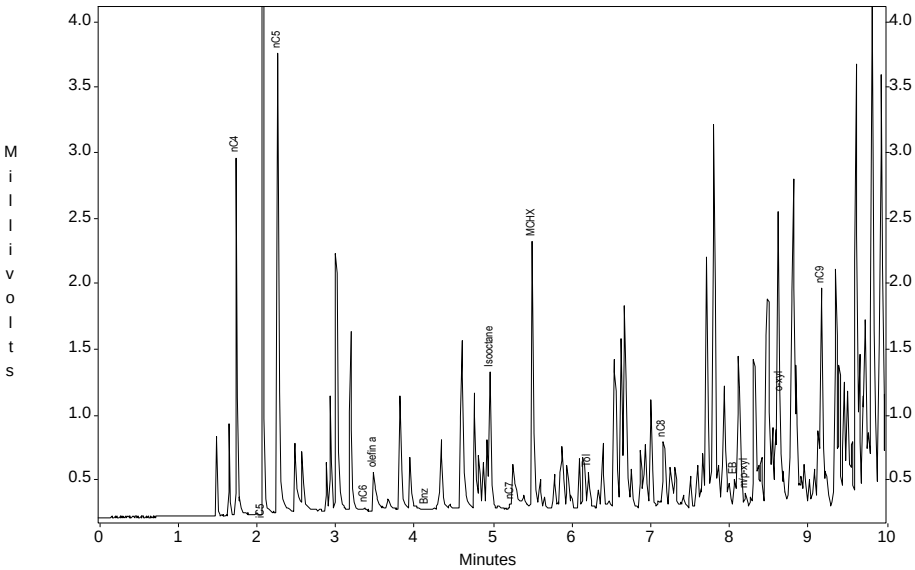
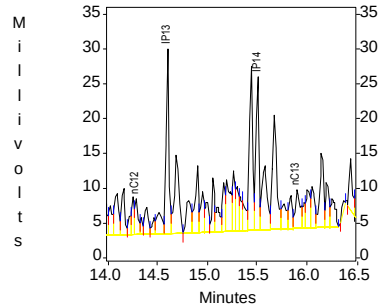
Hartford Working Group
Sample ID : MP29C/050803
Acquired : Aug 08, 2005 16:54:51

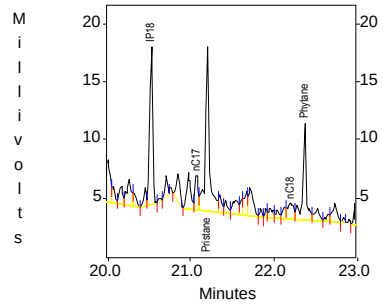
c:\ezchrom\chrom\05119\mp29cp -- Channel A



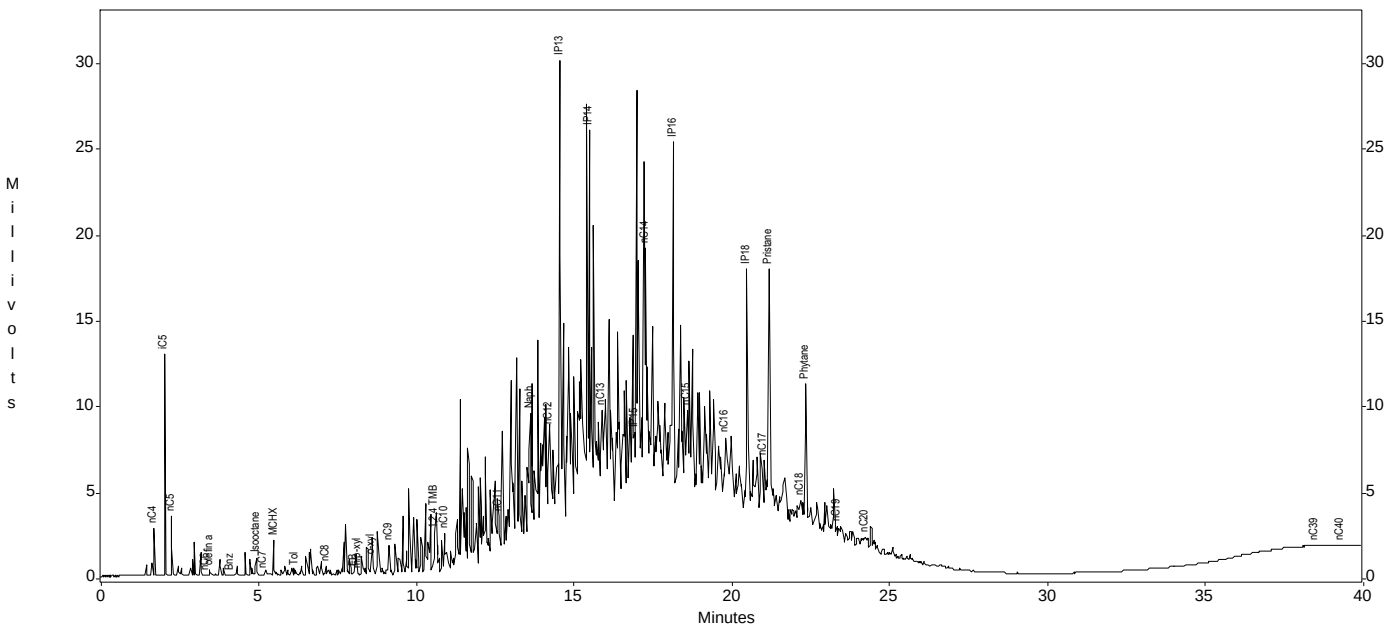
c:\ezchrom\chrom\05119\mp29cp -- Channel A



c:\ezchrom\chrom\05119\mp29cp -- Channel A



c:\ezchrom\chrom\05119\mp29cp -- Channel A



Channel A Results

Peak	Area	Height
nC4	2662	2727
iC5	13346	12965
nC5	5087	3513
MTBE	0	0
2M Pentane	0	0
nC6	43	16
olefin a	822	285
olefin b	0	0
olefin c	0	0
2,4 DMP	0	0
Bnz	15	9
Isooctane	1631	1046
nC7	78	43
MCHX	3353	2034
Tol	611	276
nC8	1078	506
EB	311	214
m/p-xyl	215	97
o-xyl	946	849
nC9	3380	1657
1,2,4 TMB	4102	2257
nC10	6301	2181
nC11	5101	1894
Naph	23016	6547
nC12	9260	5111
IP13	52285	26539
IP14	41288	22049
nC13	20017	5496
IP15	6632	3255
nC14	31116	13941
IP16	47502	20135
nC15	17650	4535
nC16	17422	3444
IP18	31233	13654
nC17	7436	2919
Pristane	44777	14127
nC18	6517	1395
Phytane	25783	8281
nC19	1399	652
nC20	1530	425
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	67	11
nC40	116	11

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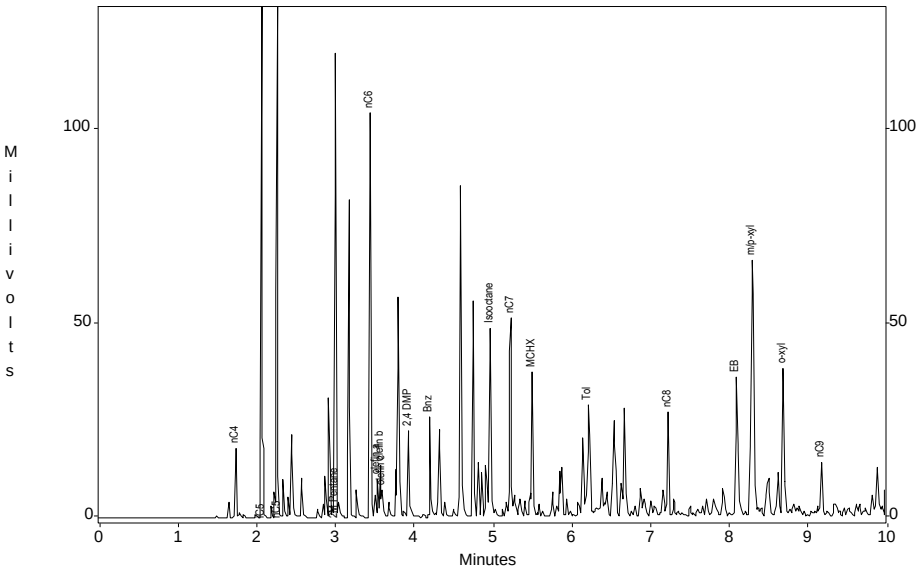
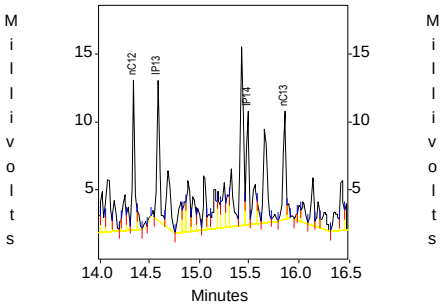
Hartford Working Group
Sample ID : MP29D/050803
Acquired : Aug 08, 2005 17:45:53

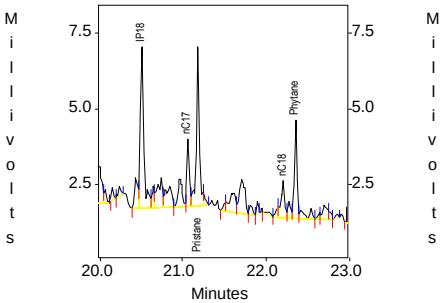
c:\ezchrom\chrom\05119\mp29dp -- Channel A



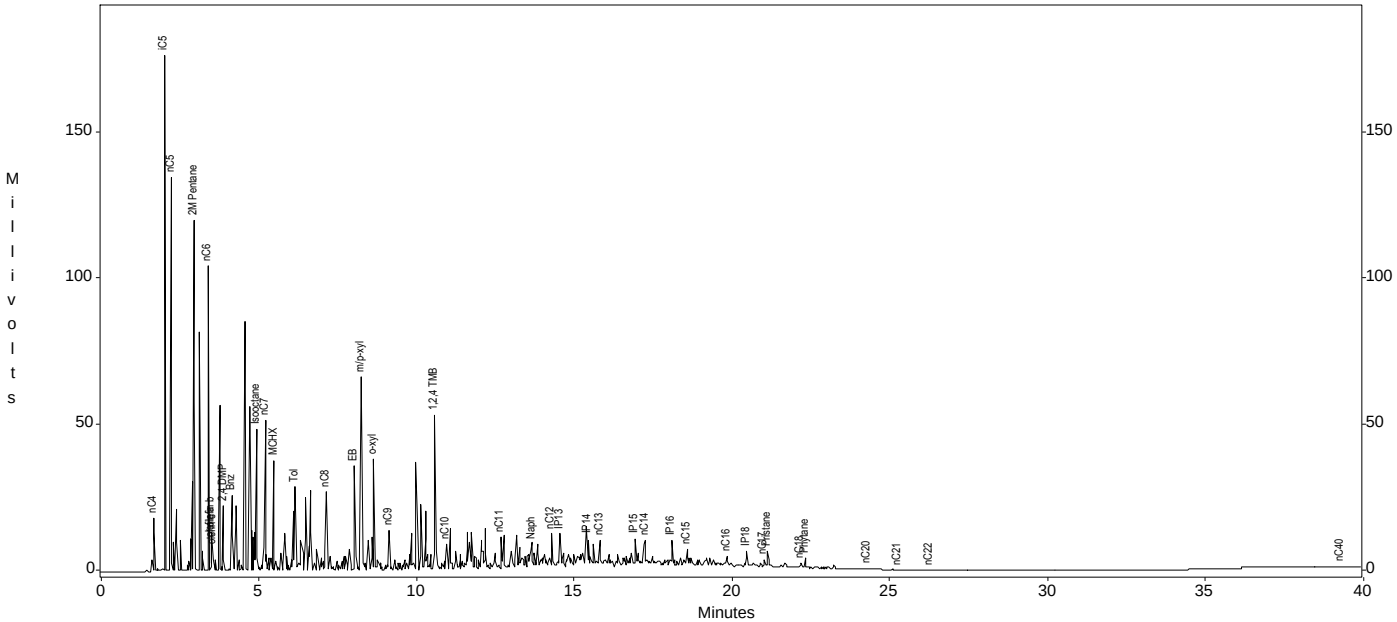
c:\ezchrom\chrom\05119\mp29dp -- Channel A



c:\ezchrom\chrom\05119\mp29dp -- Channel A



c:\ezchrom\chrom\05119\mp29dp -- Channel A



Channel A Results

Peak	Area	Height
nC4	13754	17990
iC5	138431	176261
nC5	114144	134725
MTBE	0	0
2M Pentane	125782	119736
nC6	119654	104467
olefin a	11802	9571
olefin b	14911	13290
olefin c	11343	7184
2,4 DMP	28095	22443
Bnz	38699	25982
Isooctane	64409	48460
nC7	80314	51492
MCHX	52782	37447
Tol	45167	28720
nC8	38568	26843
EB	57472	35895
m/p-xyl	185900	66163
o-xyl	65082	38312
nC9	21317	13884
1,2,4 TMB	106589	52734
nC10	13734	8692
nC11	28308	10375
Naph	25023	7702
nC12	17699	11040
IP13	18335	10417
IP14	13523	8371
nC13	13862	7911
IP15	12467	8208
nC14	18470	8038
IP16	17746	8654
nC15	10879	5303
nC16	10047	3168
IP18	14925	5319
nC17	4909	2220
Pristane	13236	5291
nC18	3413	1188
Phytane	7478	3268
nC19	0	0
nC20	1317	498
nC21	248	105
nC22	117	38
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	26	10

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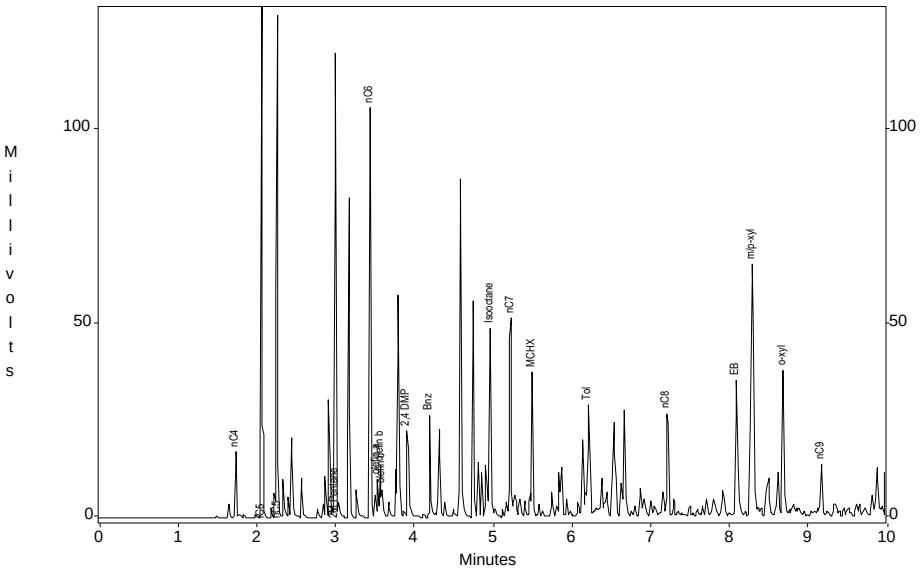
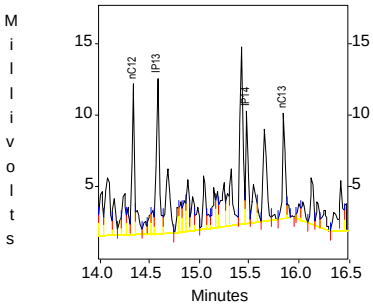
Hartford Working Group
Sample ID : MP29DD/050803
Acquired : Aug 08, 2005 18:36:55

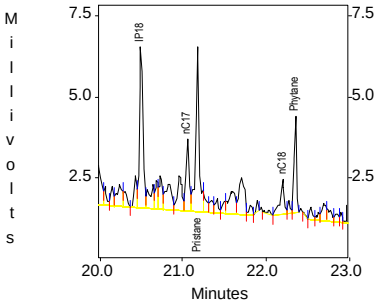
c:\ezchrom\chrom\05119\mp29dpd -- Channel A



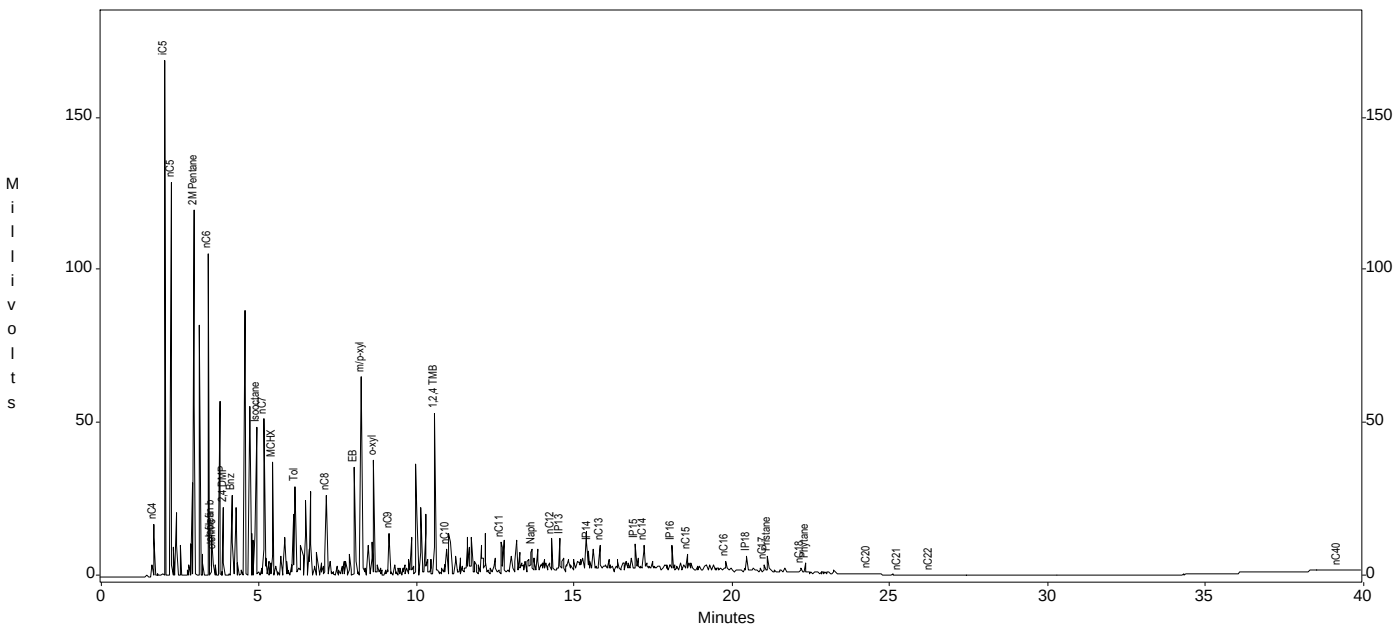
c:\ezchrom\chrom\05119\mp29dpd -- Channel A



c:\ezchrom\chrom\05119\mp29dpd -- Channel A



c:\ezchrom\chrom\05119\mp29dpd -- Channel A



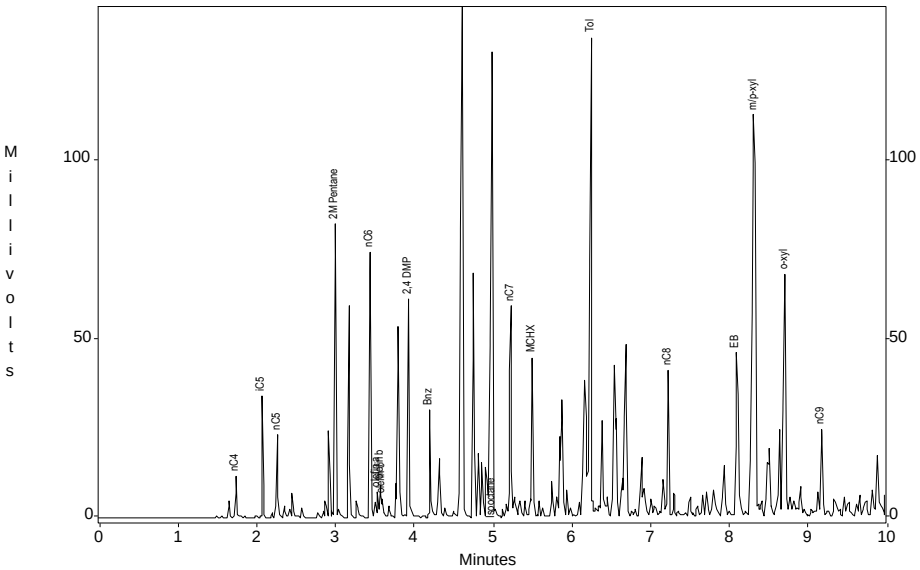
Channel A Results

Peak	Area	Height
nC4	13318	16774
iC5	139240	168761
nC5	116554	129231
MTBE	0	0
2M Pentane	128247	119665
nC6	121913	105748
olefin a	11997	9623
olefin b	15126	13343
olefin c	11726	7313
2,4 DMP	28564	22296
Bnz	39411	26335
Isooctane	64530	48679
nC7	80385	51312
MCHX	52809	37490
Tol	57658	29027
nC8	38052	26470
EB	56579	35146
m/p-xyl	183149	64809
o-xyl	64082	37746
nC9	20835	13537
1,2,4 TMB	103800	52687
nC10	13274	8294
nC11	27340	10004
Naph	24545	7753
nC12	18122	10569
IP13	22412	10922
IP14	12883	7827
nC13	13076	7408
IP15	17203	8440
nC14	20126	8343
IP16	15888	8100
nC15	13044	5548
nC16	10559	3110
IP18	13245	4932
nC17	5540	2233
Pristane	14101	5070
nC18	3579	1106
Phytane	6468	2962
nC19	0	0
nC20	1276	453
nC21	215	92
nC22	133	39
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	54	13

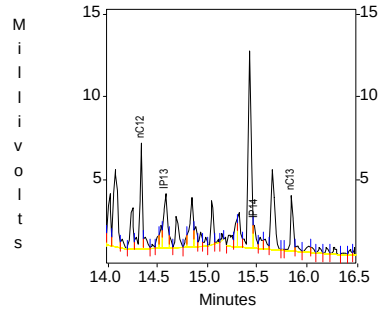
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP35D/050803
Acquired : Aug 08, 2005 19:38:22

c:\ezchrom\chrom\05119\mp35dp -- Channel A



c:\ezchrom\chrom\05119\mp35dp -- Channel A



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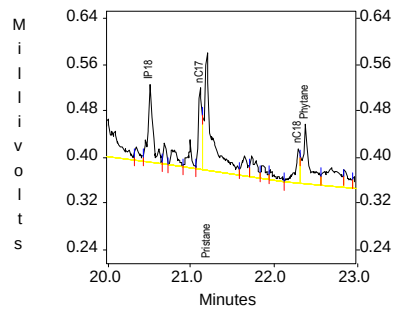

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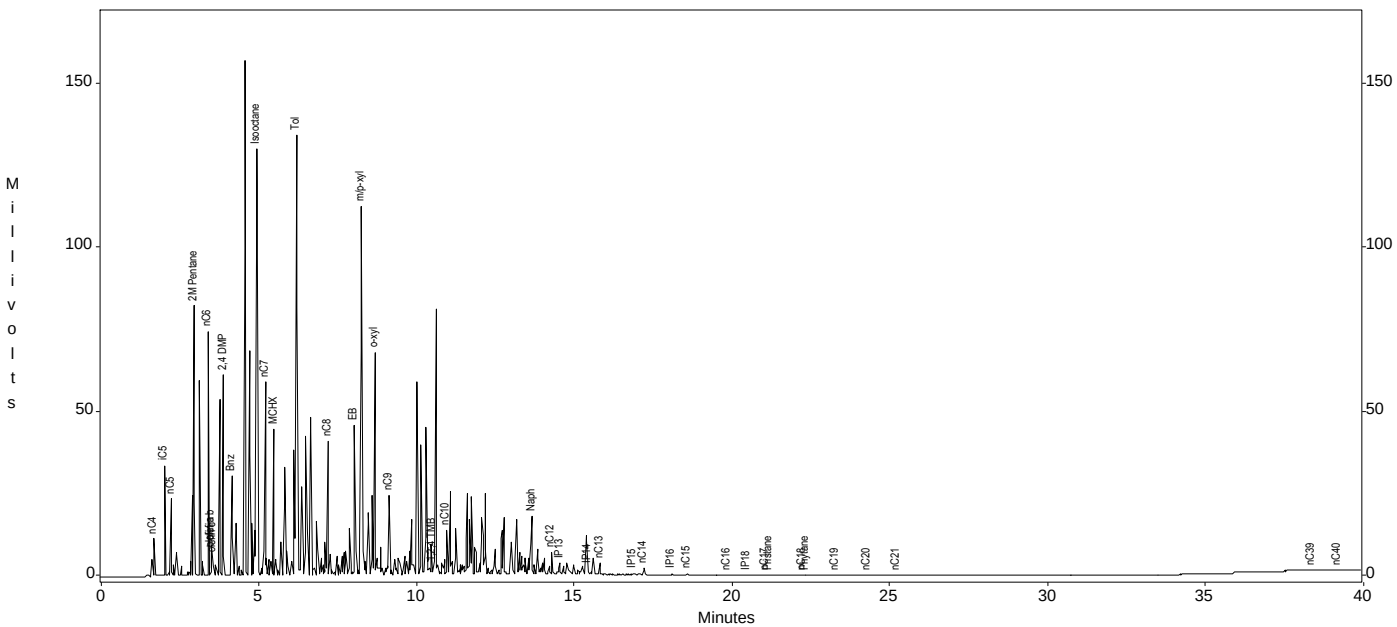


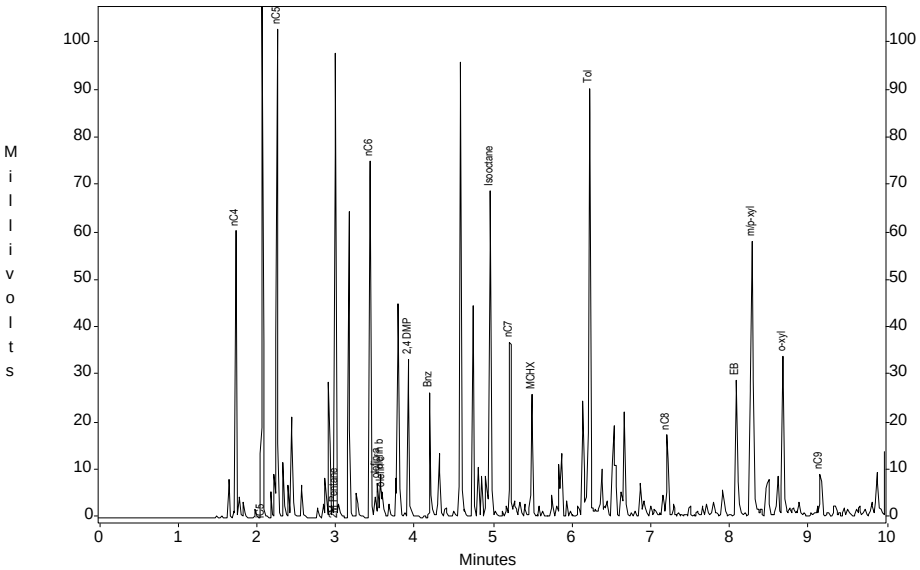
Channel A Results

Peak	Area	Height
nC4	9050	11507
iC5	28756	33794
nC5	22644	23407
MTBE	0	0
2M Pentane	83440	82341
nC6	80809	74469
olefin a	9357	7346
olefin b	10398	8978
olefin c	8879	5387
2,4 DMP	73298	61026
Bnz	45877	30197
Isooctane	241638	130154
nC7	92061	59029
MCHX	63863	44828
Tol	273473	134203
nC8	58722	40920
EB	75898	45752
m/p-xyl	286449	112533
o-xyl	133368	67961
nC9	35959	24546
1,2,4 TMB	2792	2583
nC10	21091	13281
nC11	0	0
Naph	41029	17359
nC12	11120	6374
IP13	7617	3299
IP14	2329	1430
nC13	5685	3332
IP15	1349	561
nC14	5597	1969
IP16	847	361
nC15	1588	537
nC16	1740	277
IP18	542	135
nC17	406	143
Pristane	1255	204
nC18	231	58
Phytane	517	102
nC19	70	15
nC20	25	8
nC21	120	10
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	91	17
nC40	65	12

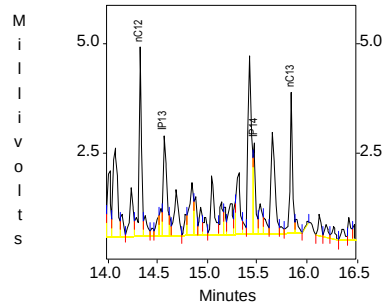
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP37D/050803
Acquired : Aug 08, 2005 20:28:26

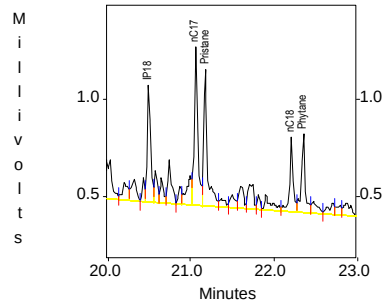
c:\ezchrom\chrom\05119\mp37dp -- Channel A



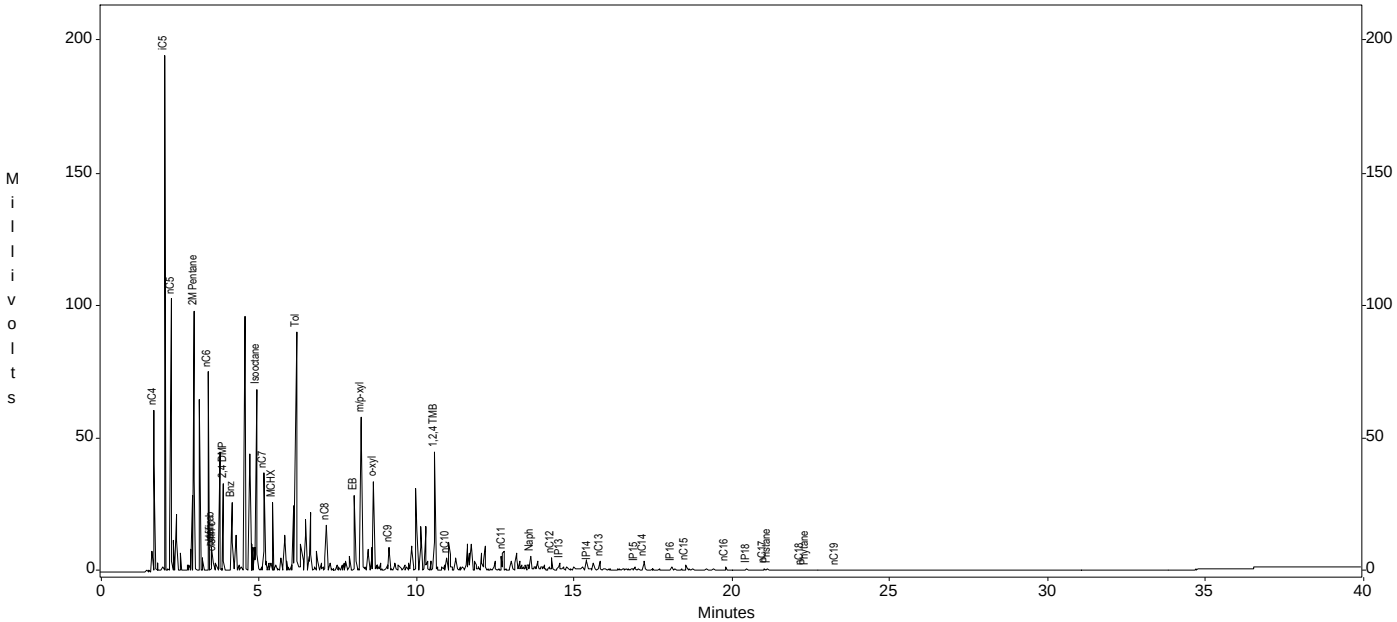
c:\ezchrom\chrom\05119\mp37dp -- Channel A



c:\ezchrom\chrom\05119\mp37dp -- Channel A



c:\ezchrom\chrom\05119\mp37dp -- Channel A



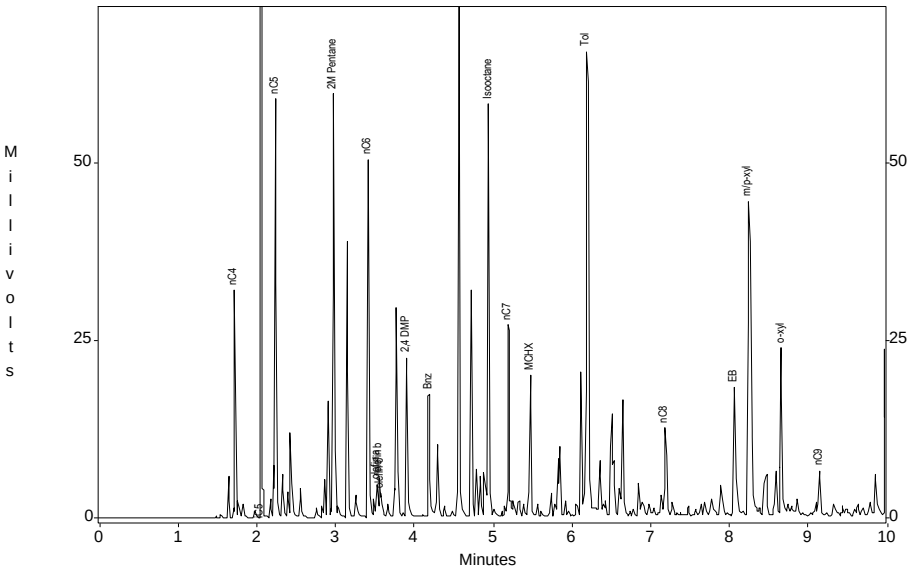
Channel A Results

Peak	Area	Height
nC4	49217	60488
iC5	166938	194492
nC5	96733	102688
MTBE	0	0
2M Pentane	100127	97860
nC6	80814	75003
olefin a	9165	7237
olefin b	10358	8863
olefin c	8769	5222
2,4 DMP	39250	33348
Bnz	40149	26176
Isooctane	100754	68852
nC7	53804	36851
MCHX	35956	25910
Tol	165215	90363
nC8	26160	17492
EB	48517	28694
m/p-xyl	152984	57781
o-xyl	56470	33744
nC9	14050	8853
1,2,4 TMB	82767	44522
nC10	8229	4912
nC11	15809	5856
Naph	16642	5205
nC12	7605	4296
IP13	4874	2281
IP14	3808	2076
nC13	5483	3178
IP15	2481	1251
nC14	8543	3017
IP16	2390	1319
nC15	4239	1818
nC16	3070	1181
IP18	1689	600
nC17	2368	819
Pristane	2211	707
nC18	1118	382
Phytane	1366	405
nC19	652	196
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	0	0

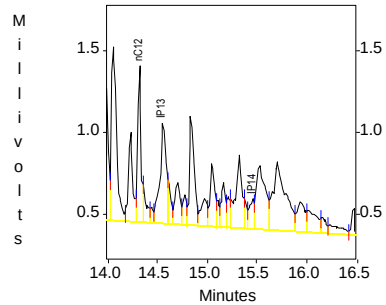
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP39C/050804
Acquired : Aug 09, 2005 07:11:19

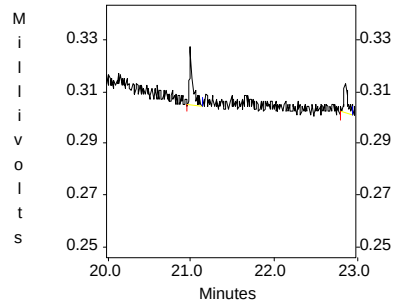
c:\ezchrom\chrom\05119\mp39cp -- Channel A



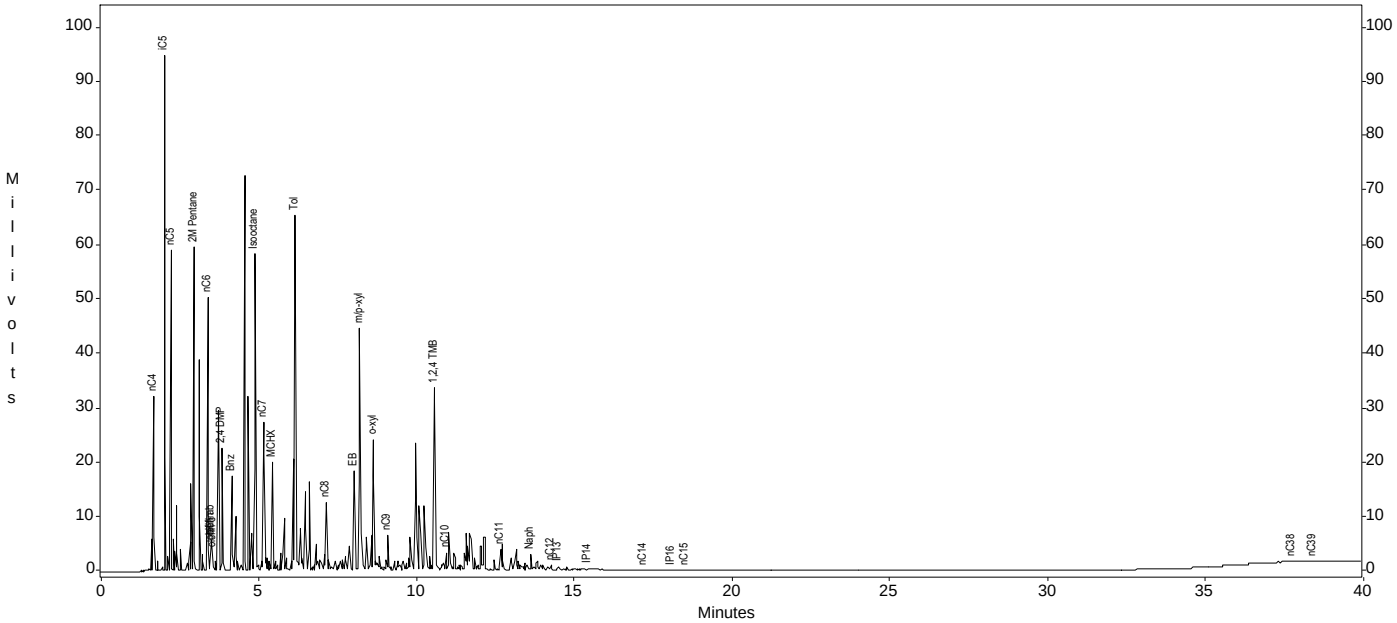
c:\ezchrom\chrom\05119\mp39cp -- Channel A



c:\ezchrom\chrom\05119\mp39cp -- Channel A



c:\ezchrom\chrom\05119\mp39cp -- Channel A



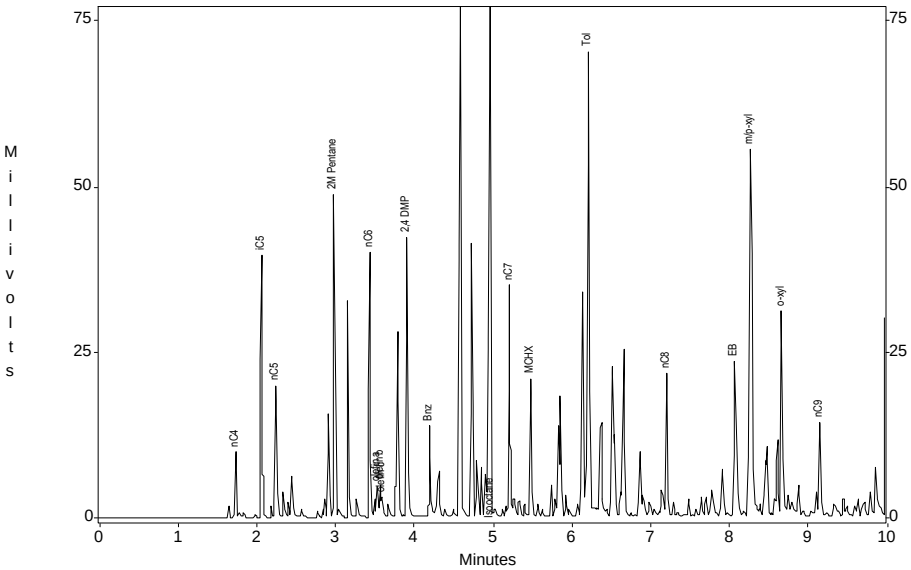
Channel A Results

Peak	Area	Height
nC4	28938	32026
iC5	87942	94703
nC5	59638	59053
MTBE	0	0
2M Pentane	61862	59733
nC6	54041	50463
olefin a	5563	4466
olefin b	6654	5439
olefin c	5890	3324
2,4 DMP	26235	22538
Bnz	27869	17245
Isooctane	78252	58213
nC7	36930	27140
MCHX	27746	19953
Tol	112264	65409
nC8	19738	12644
EB	32880	18153
m/p-xyl	108918	44512
o-xyl	40223	23893
nC9	10612	6369
1,2,4 TMB	58541	33588
nC10	5261	3193
nC11	7385	3810
Naph	8715	2705
nC12	1954	966
IP13	2578	620
IP14	684	193
nC13	0	0
IP15	0	0
nC14	22	8
IP16	95	22
nC15	43	12
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	101	31
nC39	220	16
nC40	0	0

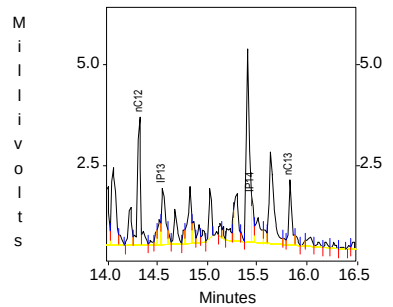
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP45C/050803
Acquired : Aug 09, 2005 08:01:37

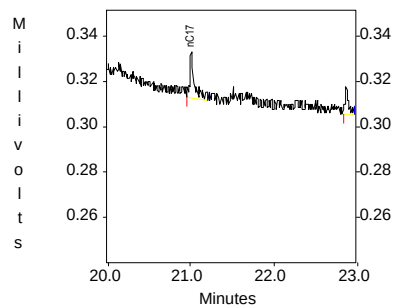
c:\ezchrom\chrom\05119\mp45cp -- Channel A



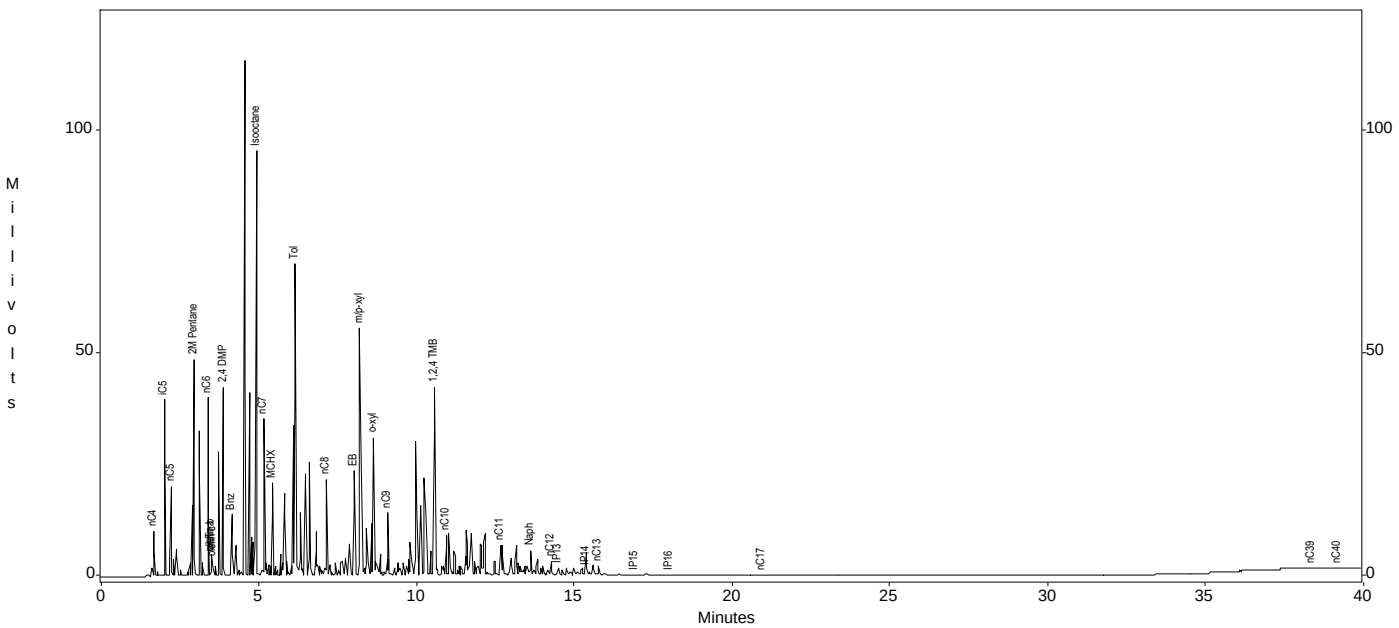
c:\ezchrom\chrom\05119\mp45cp -- Channel A



c:\ezchrom\chrom\05119\mp45cp -- Channel A



c:\ezchrom\chrom\05119\mp45cp -- Channel A



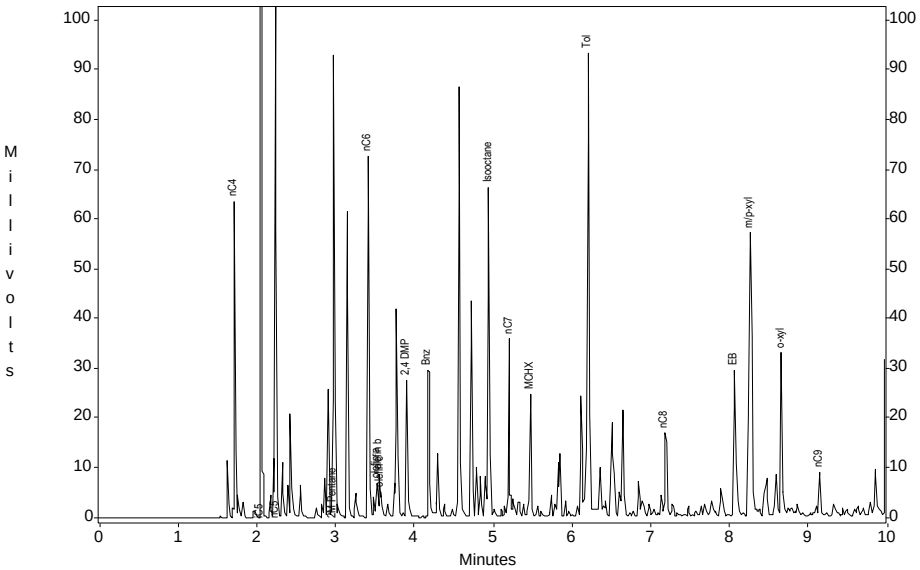
Channel A Results

Peak	Area	Height
nC4	9002	9848
iC5	37571	39611
nC5	22264	19985
MTBE	0	0
2M Pentane	51445	48679
nC6	43995	40010
olefin a	5915	4543
olefin b	5916	4841
olefin c	5626	3096
2,4 DMP	48412	42316
Bnz	23328	13933
Isooctane	148334	95586
nC7	48543	35183
MCHX	29895	20846
Tol	121163	70148
nC8	30781	21546
EB	40877	23416
m/p-xyl	139910	55429
o-xyl	51553	31032
nC9	20804	14170
1,2,4 TMB	76766	42295
nC10	13693	8853
nC11	17823	6375
Naph	16951	5307
nC12	5556	3176
IP13	3354	1391
IP14	1591	1105
nC13	3274	1654
IP15	932	202
nC14	0	0
IP16	316	27
nC15	0	0
nC16	0	0
IP18	0	0
nC17	81	20
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	59	22
nC40	96	20

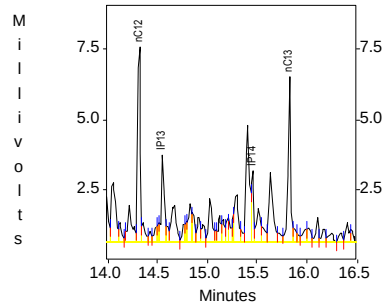
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP47C/050803
Acquired : Aug 09, 2005 08:51:53

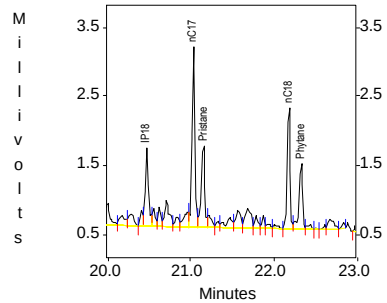
c:\ezchrom\chrom\05119\mp47cp -- Channel A



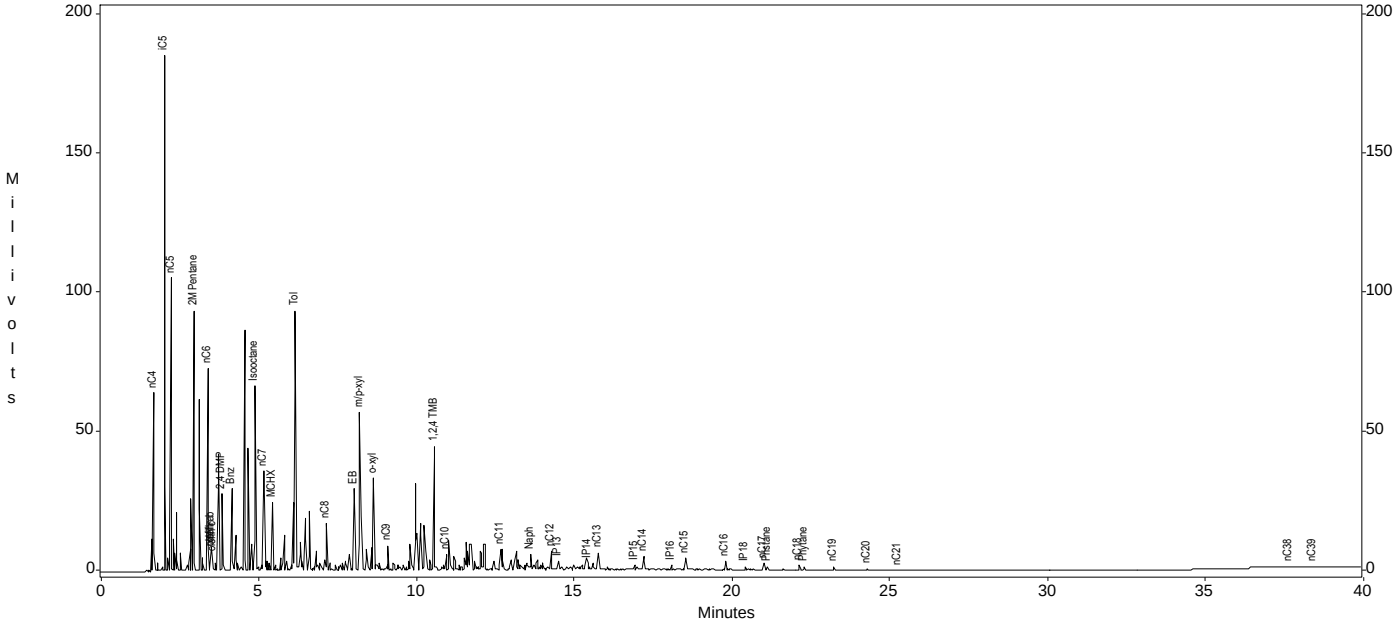
c:\ezchrom\chrom\05119\mp47cp -- Channel A



c:\ezchrom\chrom\05119\mp47cp -- Channel A



c:\ezchrom\chrom\05119\mp47cp -- Channel A



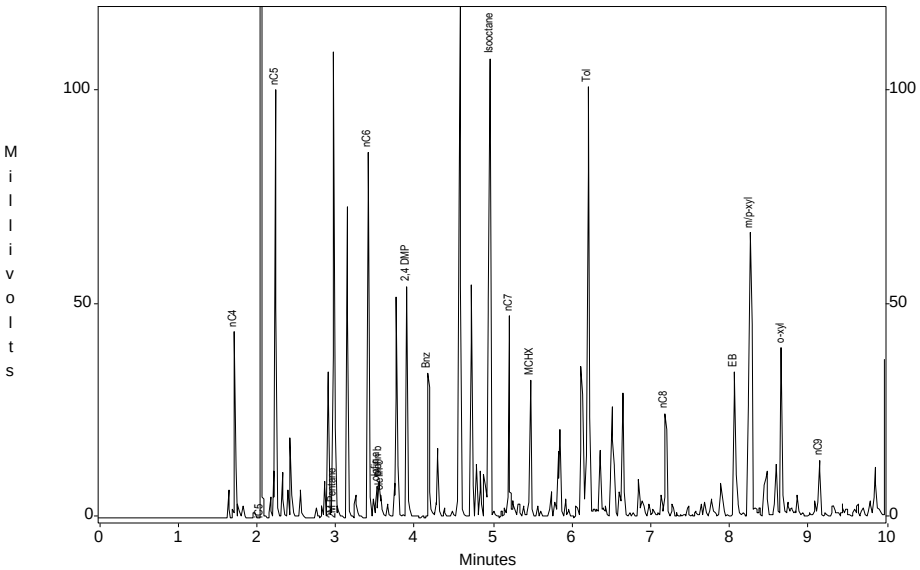
Channel A Results

Peak	Area	Height
nC4	50651	63731
iC5	157680	184877
nC5	97879	105440
MTBE	0	0
2M Pentane	96038	93081
nC6	78034	72593
olefin a	8851	6980
olefin b	10048	8523
olefin c	8730	5104
2,4 DMP	32830	27480
Bnz	44974	29567
Isooctane	95667	66365
nC7	51925	35843
MCHX	34154	24813
Tol	161559	92374
nC8	25025	16707
EB	49748	29337
m/p-xyl	151396	56966
o-xyl	55432	33074
nC9	13664	8739
1,2,4 TMB	81170	44444
nC10	8365	5247
nC11	19813	7352
Naph	17091	5157
nC12	11118	6892
IP13	6647	3052
IP14	4741	2513
nC13	10653	5832
IP15	3696	1888
nC14	13858	5130
IP16	3400	1888
nC15	7549	3973
nC16	6932	3307
IP18	3208	1135
nC17	5607	2618
Pristane	3054	1168
nC18	3634	1764
Phytane	2583	951
nC19	3004	1209
nC20	1940	705
nC21	1015	247
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	101	27
nC39	537	17
nC40	0	0

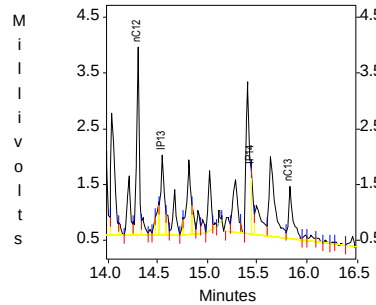
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP48B/050804
Acquired : Aug 09, 2005 09:41:27

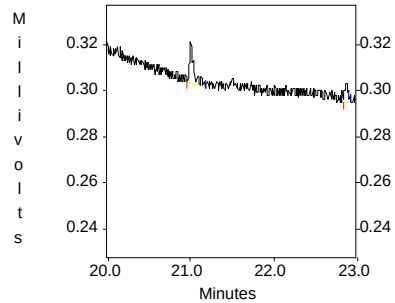
c:\ezchrom\chrom\05119\mp48bp -- Channel A



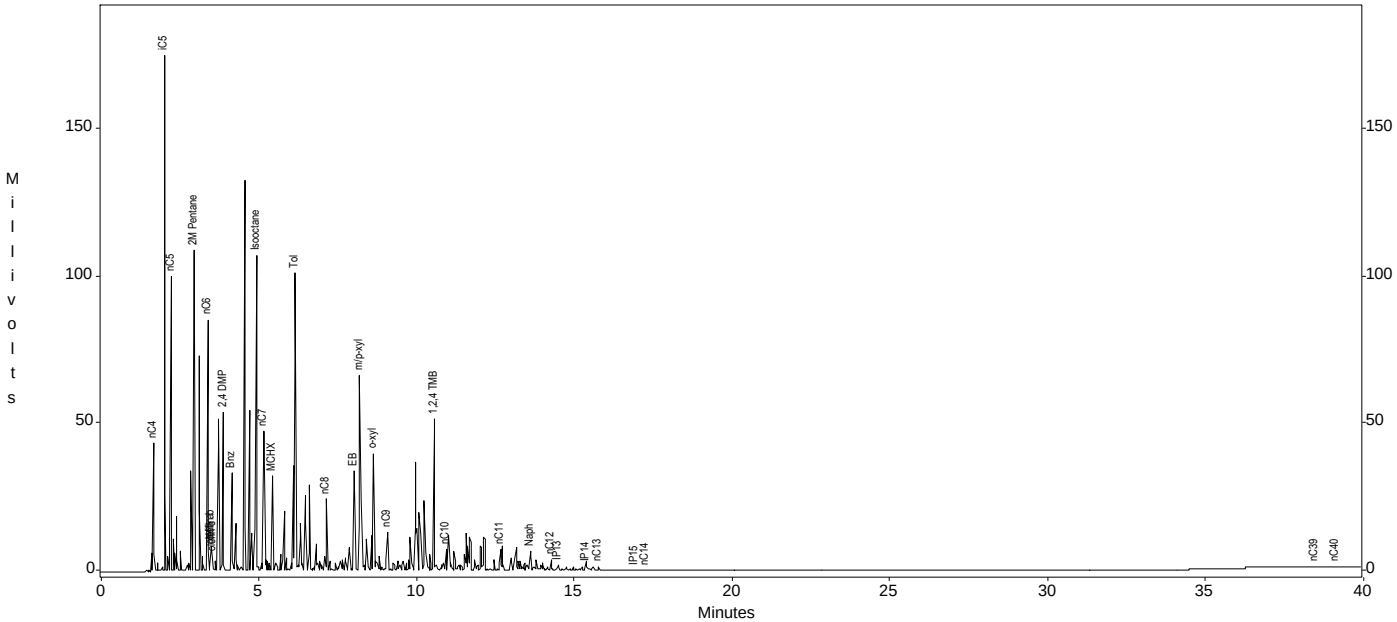
c:\ezchrom\chrom\05119\mp48bp -- Channel A



c:\ezchrom\chrom\05119\mp48bp -- Channel A



c:\ezchrom\chrom\05119\mp48bp -- Channel A



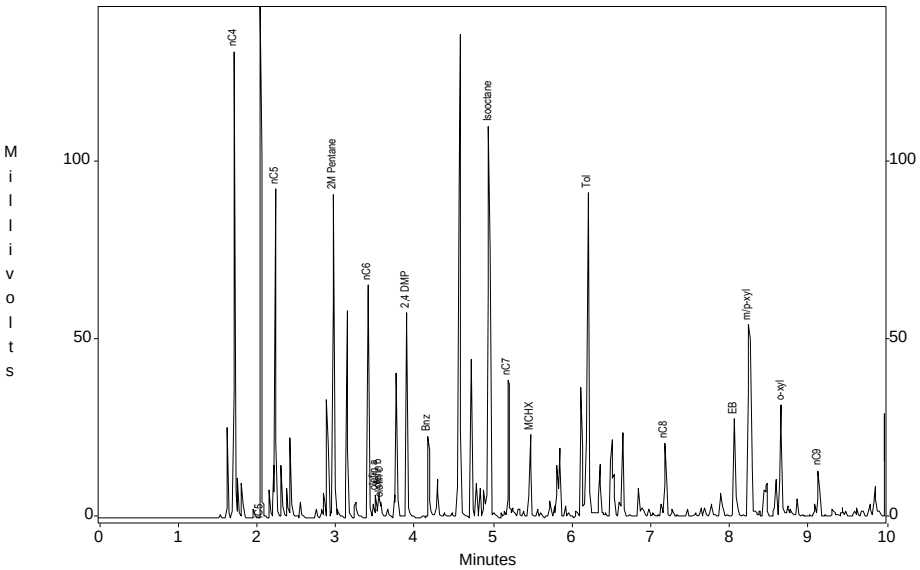
Channel A Results

Peak	Area	Height
nC4	35139	43479
iC5	146854	174964
nC5	91711	100042
MTBE	0	0
2M Pentane	112201	108947
nC6	93459	85413
olefin a	9321	7388
olefin b	9863	8364
olefin c	8729	5116
2,4 DMP	63194	54131
Bnz	50085	33501
Isooctane	177793	107431
nC7	68303	47235
MCHX	44373	31971
Tol	182392	100968
nC8	34590	24145
EB	52941	33898
m/p-xyl	181333	66568
o-xyl	67213	39722
nC9	19445	13070
1,2,4 TMB	96750	51393
nC10	11112	6898
nC11	17894	6726
Naph	20124	6279
nC12	5735	3388
IP13	3329	1422
IP14	1877	1182
nC13	2930	949
IP15	245	70
nC14	42	18
IP16	0	0
nC15	0	0
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	97	13
nC40	37	19

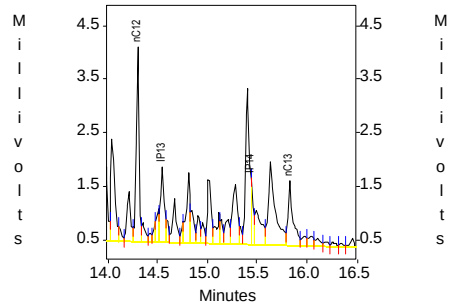
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP49C/050803
Acquired : Aug 09, 2005 10:29:23

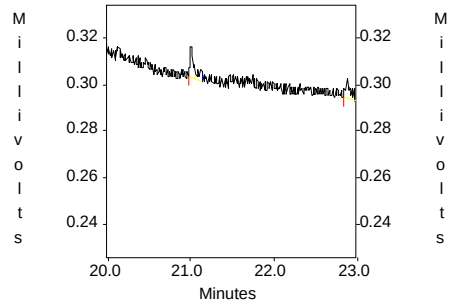
c:\ezchrom\chrom\05119\mp49cp -- Channel A



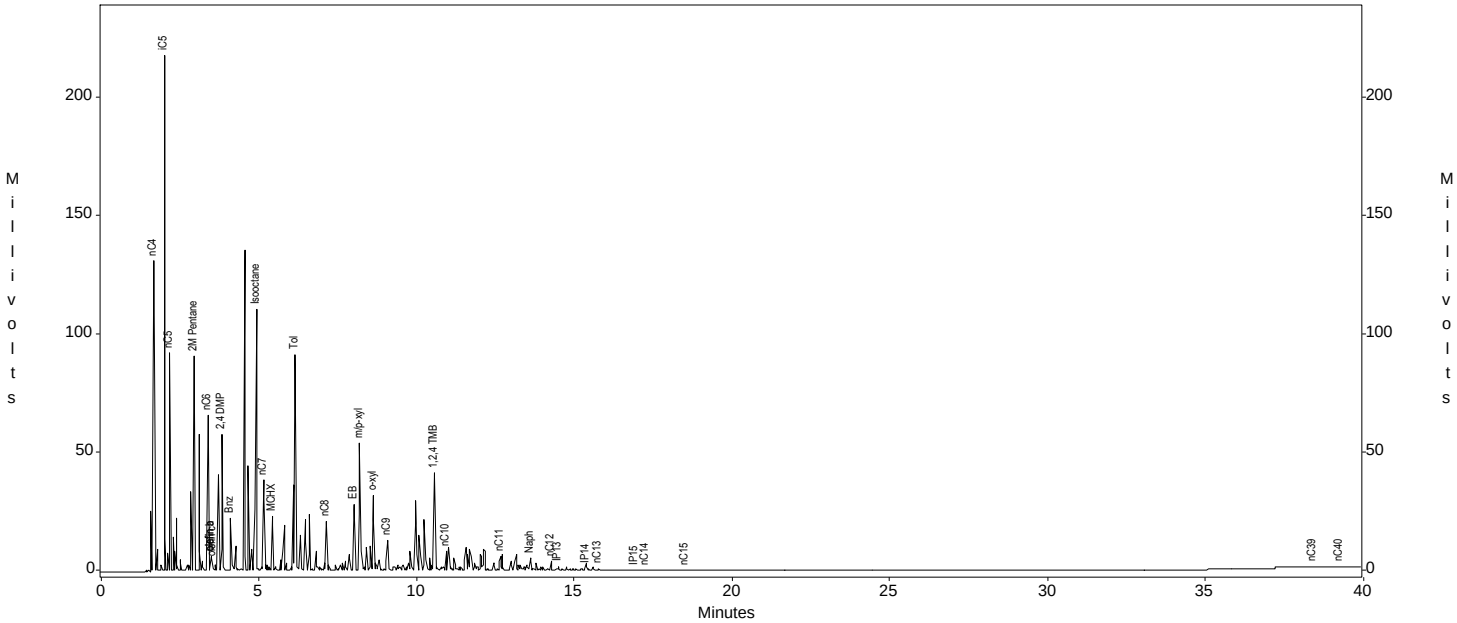
c:\ezchrom\chrom\05119\mp49cp -- Channel A



c:\ezchrom\chrom\05119\mp49cp -- Channel A



c:\ezchrom\chrom\05119\mp49cp -- Channel A



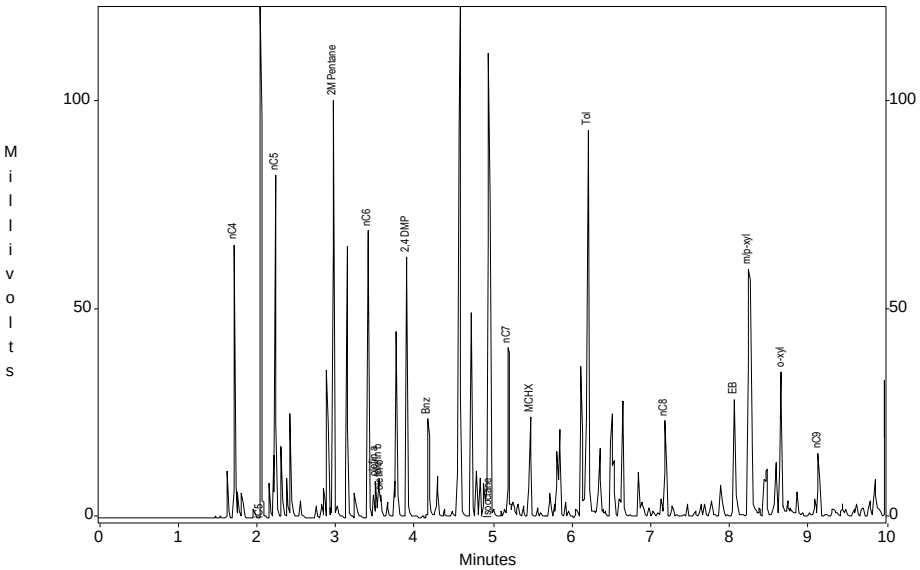
Channel A Results

Peak	Area	Height
nC4	95749	130848
iC5	175547	217529
nC5	82287	92326
MTBE	0	0
2M Pentane	91883	90853
nC6	69956	65592
olefin a	7669	6054
olefin b	7811	6572
olefin c	7134	4025
2,4 DMP	67278	57731
Bnz	36396	22726
Isooctane	183431	110194
nC7	53810	38705
MCHX	33118	23229
Tol	162688	91555
nC8	29580	20633
EB	46718	27825
m/p-xyl	138770	54150
o-xyl	51235	31793
nC9	19274	12766
1,2,4 TMB	75157	41132
nC10	12230	7897
nC11	17077	5902
Naph	17310	5241
nC12	6292	3630
IP13	3501	1413
IP14	1984	1256
nC13	4093	1205
IP15	266	76
nC14	38	19
IP16	0	0
nC15	28	5
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	322	17
nC40	23	6

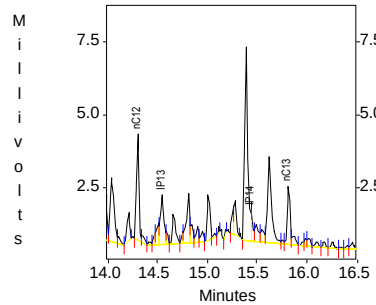
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP50C/050803
Acquired : Aug 09, 2005 11:18:37

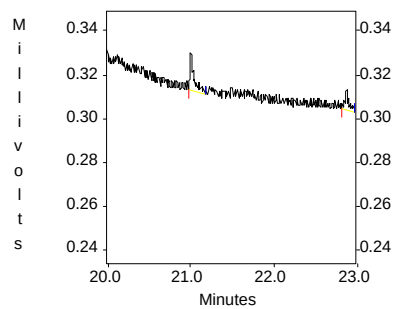
c:\ezchrom\chrom\05119\mp50cp -- Channel A



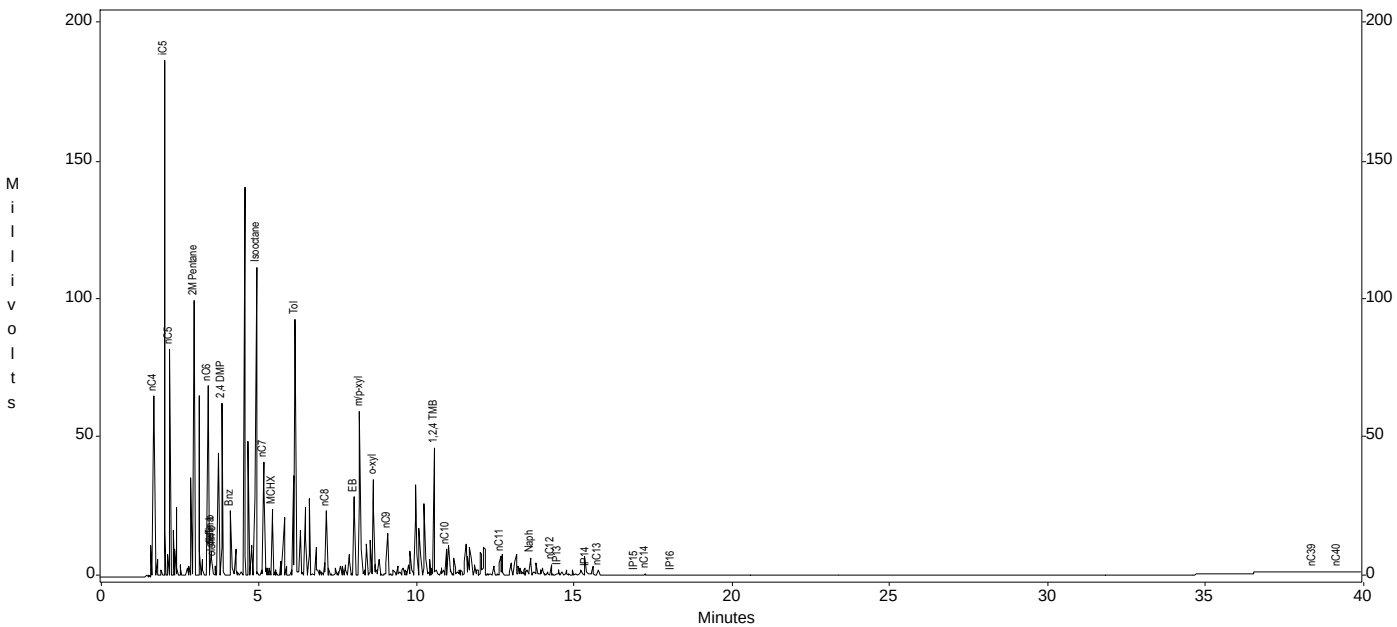
c:\ezchrom\chrom\05119\mp50cp -- Channel A



c:\ezchrom\chrom\05119\mp50cp -- Channel A



c:\ezchrom\chrom\05119\mp50cp -- Channel A



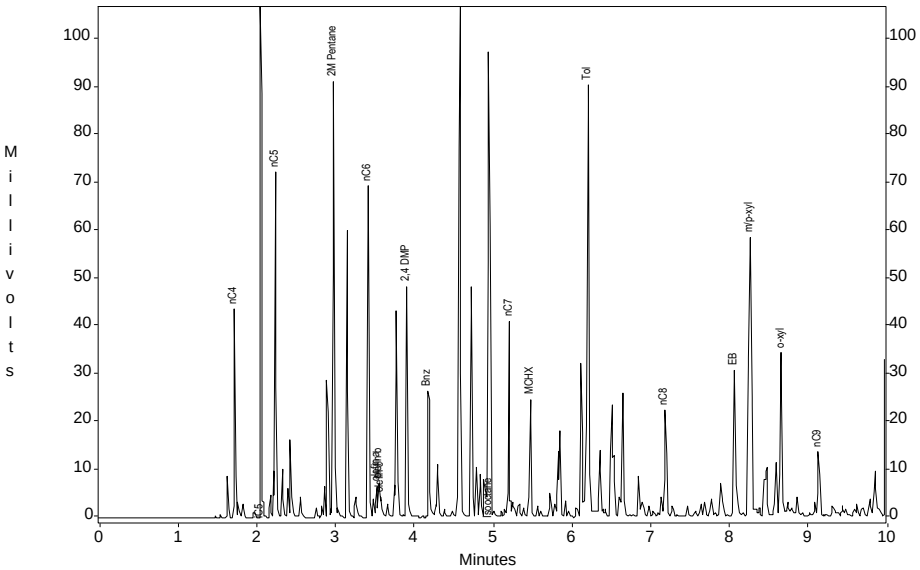
Channel A Results

Peak	Area	Height
nC4	51281	65375
iC5	154771	186328
nC5	75332	82135
MTBE	0	0
2M Pentane	102710	99958
nC6	73283	68642
olefin a	10985	8597
olefin b	10475	9035
olefin c	9089	5376
2,4 DMP	72422	62311
Bnz	36936	23548
Isooctane	188458	111580
nC7	59459	40919
MCHX	35458	24052
Tol	166197	93016
nC8	33330	23244
EB	44488	28259
m/p-xyl	154473	59451
o-xyl	58408	34627
nC9	22350	15182
1,2,4 TMB	85040	45779
nC10	14837	9609
nC11	19650	6948
Naph	18753	6269
nC12	5384	3615
IP13	3924	1684
IP14	1579	1038
nC13	3694	2019
IP15	1195	397
nC14	3249	482
IP16	224	20
nC15	0	0
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	118	15
nC40	16	8

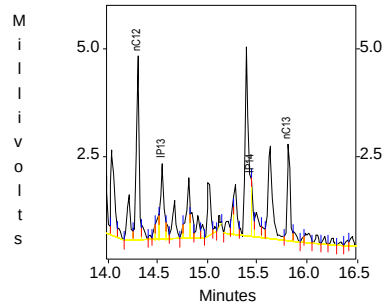
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP51D/050803
Acquired : Aug 09, 2005 12:07:35

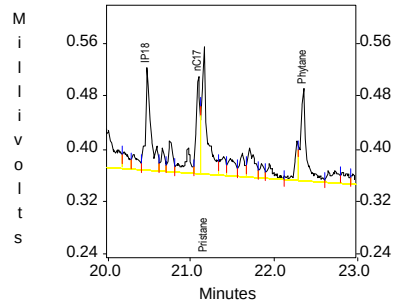
c:\ezchrom\chrom\05119\mp51dp -- Channel A



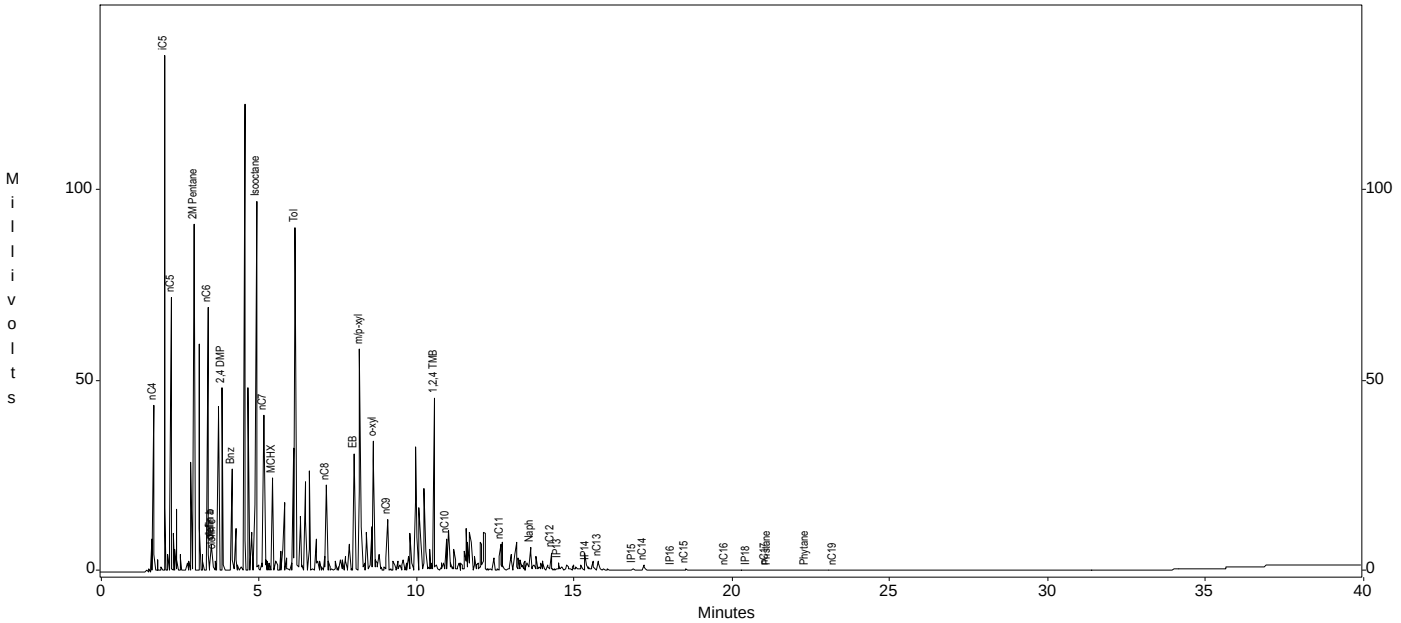
c:\ezchrom\chrom\05119\mp51dp -- Channel A



c:\ezchrom\chrom\05119\mp51dp -- Channel A



c:\ezchrom\chrom\05119\mp51dp -- Channel A



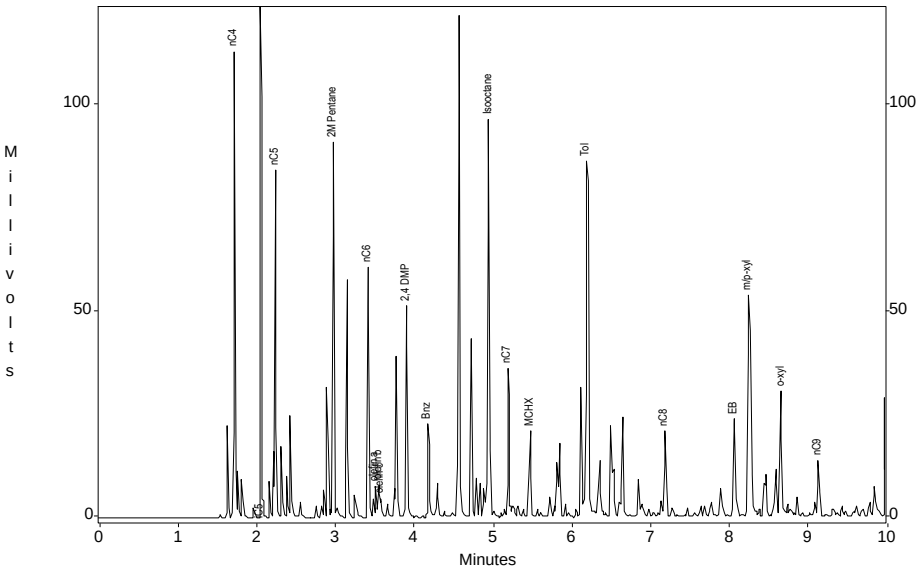
Channel A Results

Peak	Area	Height
nC4	35987	43501
iC5	116309	135285
nC5	67952	72063
MTBE	0	0
2M Pentane	92829	91102
nC6	74059	69025
olefin a	8101	6405
olefin b	8240	6997
olefin c	6916	4172
2,4 DMP	55412	48244
Bnz	40864	26446
Isooctane	153068	96934
nC7	58096	40954
MCHX	35075	24393
Tol	160675	90341
nC8	31532	22302
EB	47935	30701
m/p-xyl	155685	58258
o-xyl	57255	34097
nC9	19949	13365
1,2,4 TMB	83312	45030
nC10	12644	8230
nC11	18728	6531
Naph	18045	5813
nC12	7093	4234
IP13	3872	1727
IP14	2081	1356
nC13	4066	2212
IP15	1510	556
nC14	3570	1344
IP16	625	274
nC15	1873	476
nC16	1184	286
IP18	697	154
nC17	391	146
Pristane	864	194
nC18	0	0
Phytane	634	140
nC19	80	18
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	0	0

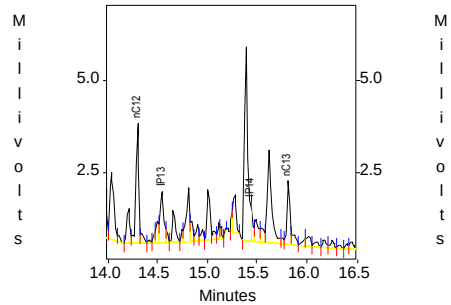
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP52C/050803
Acquired : Aug 09, 2005 13:44:30

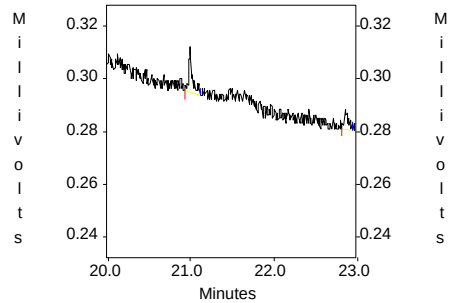
c:\ezchrom\chrom\05119\mp52cp -- Channel A



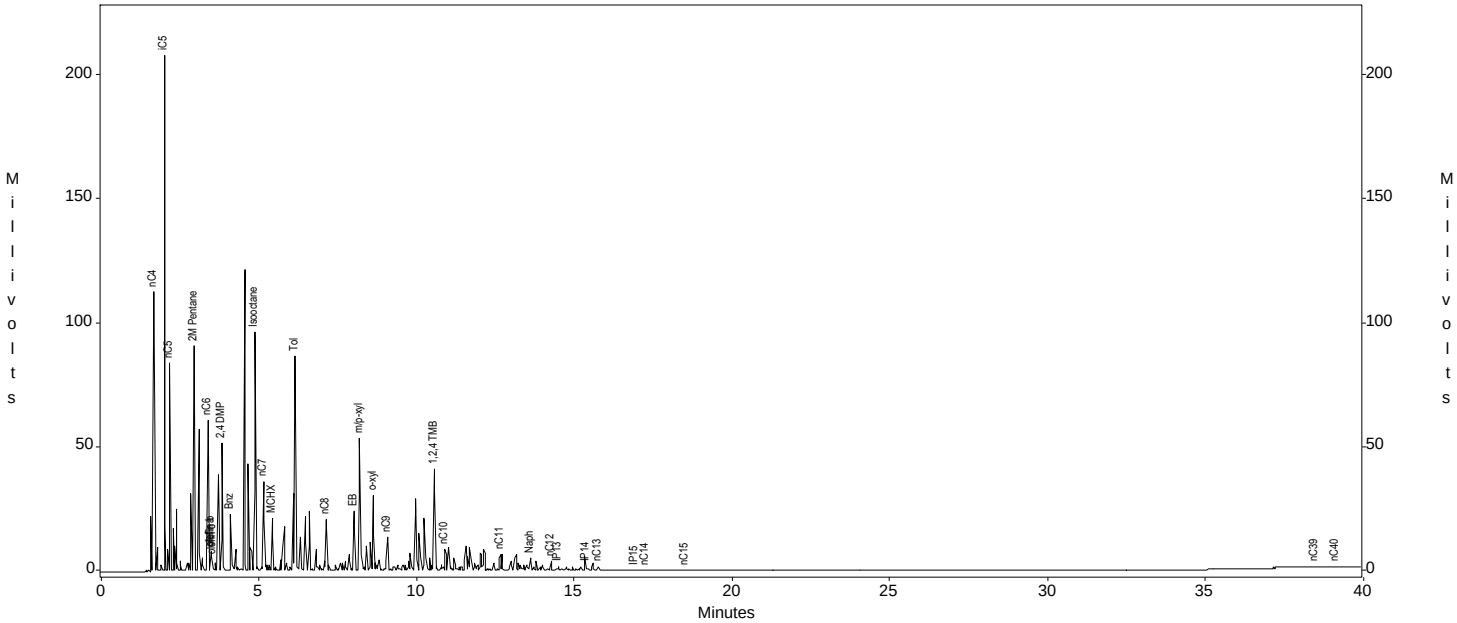
c:\ezchrom\chrom\05119\mp52cp -- Channel A



c:\ezchrom\chrom\05119\mp52cp -- Channel A



c:\ezchrom\chrom\05119\mp52cp -- Channel A



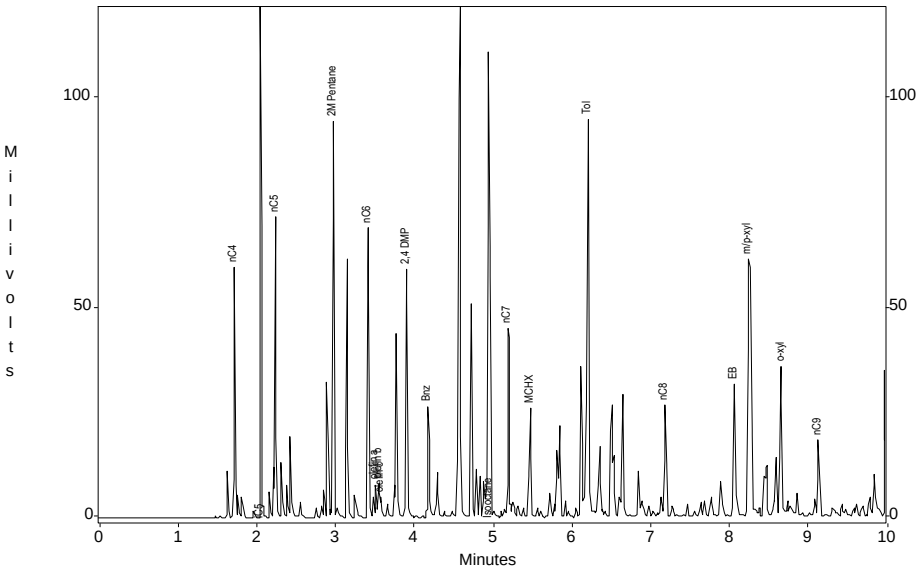
Channel A Results

Peak	Area	Height
nC4	86380	112726
iC5	174461	207984
nC5	77351	84164
MTBE	0	0
2M Pentane	92248	90911
nC6	64463	60671
olefin a	9586	7473
olefin b	8950	7699
olefin c	7592	4602
2,4 DMP	58945	51473
Bnz	36002	22583
Isooctane	151090	96485
nC7	52002	36018
MCHX	30305	21022
Tol	150727	86360
nC8	29727	20676
EB	41115	23930
m/p-xyl	134983	53648
o-xyl	51024	30421
nC9	20013	13446
1,2,4 TMB	73282	40660
nC10	13337	8625
nC11	17201	6141
Naph	15593	5049
nC12	5434	3254
IP13	3409	1423
IP14	1415	1041
nC13	3239	1707
IP15	1082	267
nC14	5462	395
IP16	0	0
nC15	24	7
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	279	18
nC40	37	14

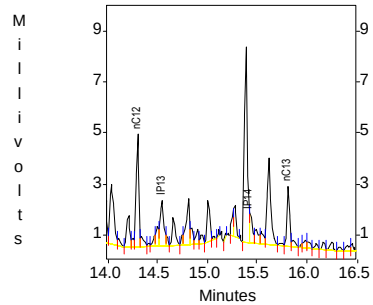
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP53C/050803
Acquired : Aug 09, 2005 14:32:38

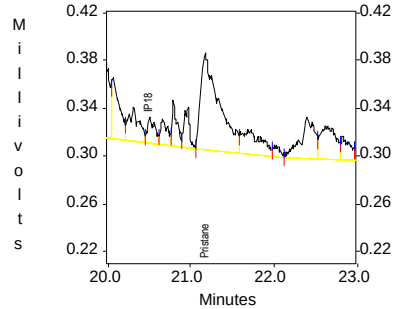
c:\ezchrom\chrom\05119\mp53cp -- Channel A



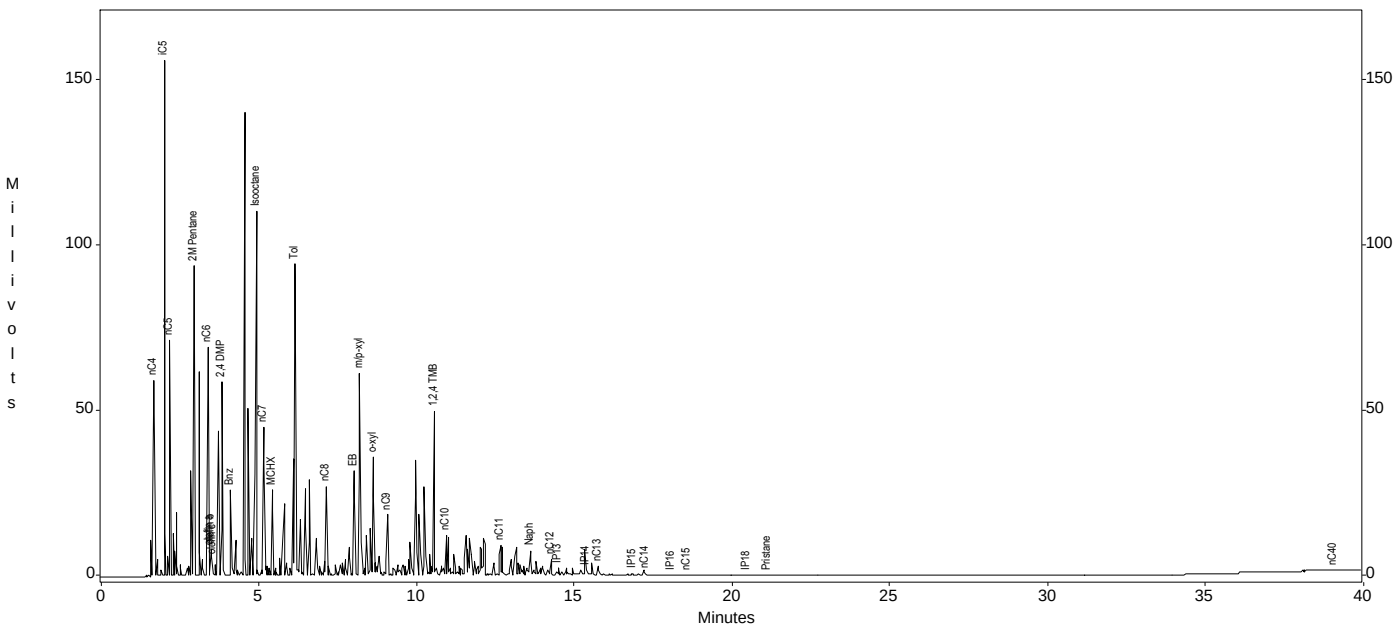
c:\ezchrom\chrom\05119\mp53cp -- Channel A



c:\ezchrom\chrom\05119\mp53cp -- Channel A



c:\ezchrom\chrom\05119\mp53cp -- Channel A



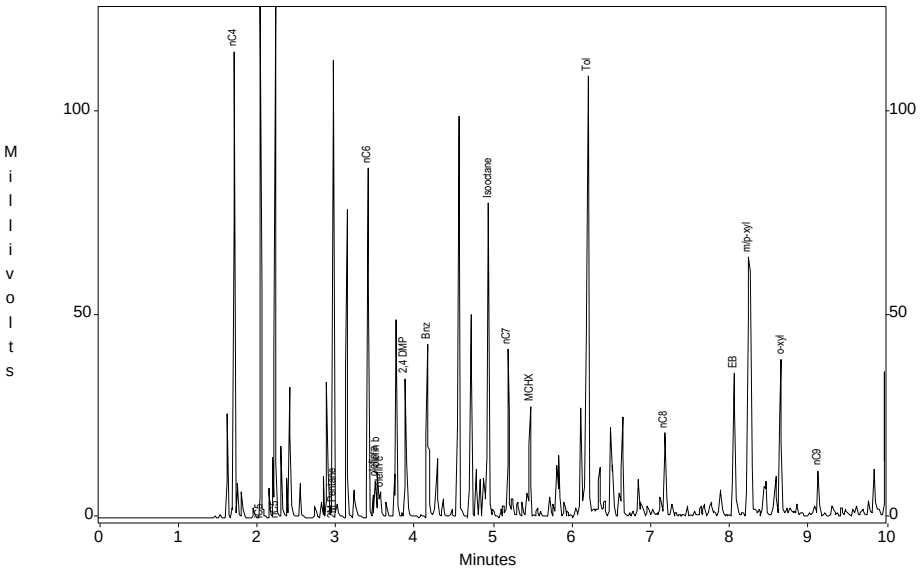
Channel A Results

Peak	Area	Height
nC4	47468	59455
iC5	131088	156009
nC5	66564	71516
MTBE	0	0
2M Pentane	95844	94238
nC6	74025	68982
olefin a	9762	7610
olefin b	9370	7988
olefin c	7701	4747
2,4 DMP	68869	58915
Bnz	40442	26213
Isooctane	184533	110554
nC7	64399	44810
MCHX	37144	25808
Tol	168221	94610
nC8	38110	26876
EB	53138	31548
m/p-xyl	165320	61397
o-xyl	60750	35906
nC9	26558	18298
1,2,4 TMB	89687	49243
nC10	18066	11960
nC11	22941	8767
Naph	21572	7066
nC12	6904	4414
IP13	4310	1812
IP14	1659	1142
nC13	4038	2364
IP15	892	384
nC14	2722	578
IP16	319	88
nC15	1016	194
nC16	0	0
IP18	128	21
nC17	0	0
Pristane	1202	81
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	23	12

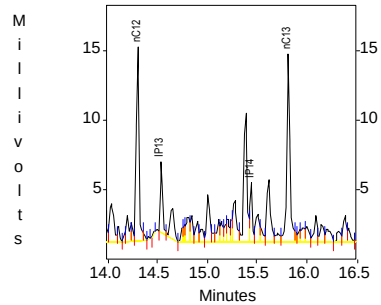
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP55C/050803
Acquired : Aug 09, 2005 16:12:27

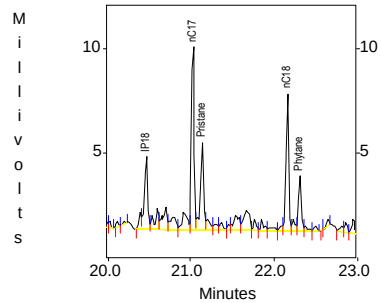
c:\ezchrom\chrom\05119\mp55cp -- Channel A



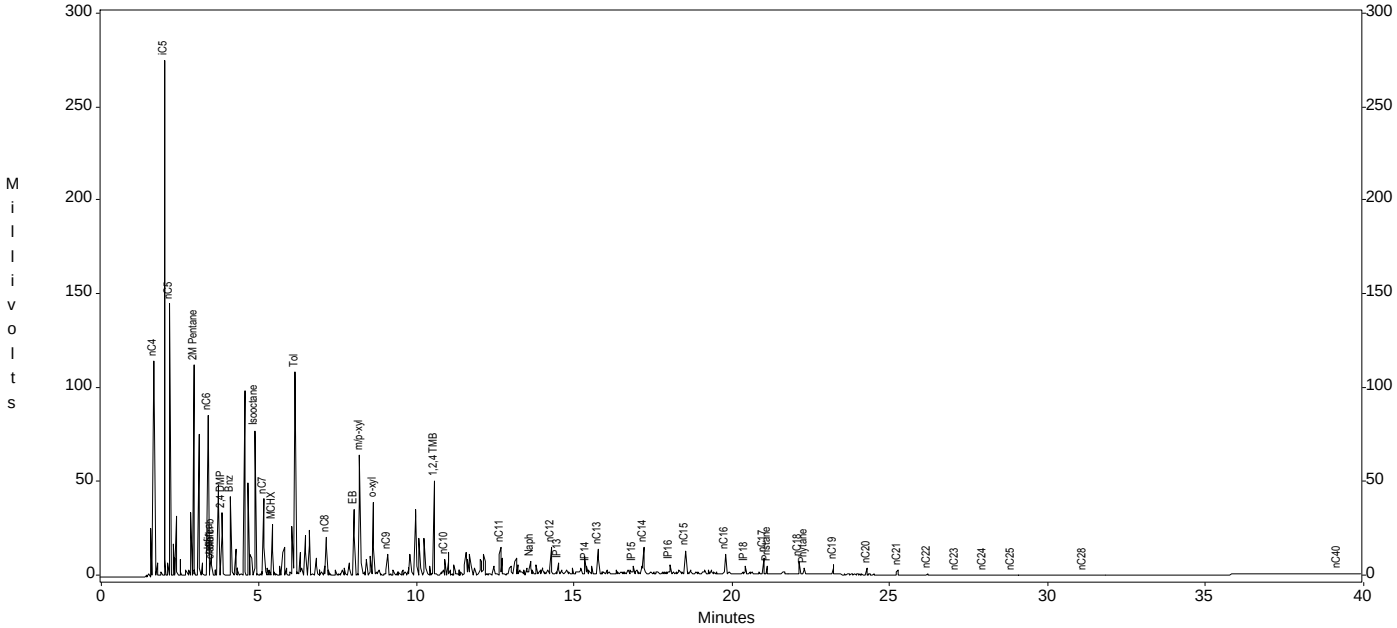
c:\ezchrom\chrom\05119\mp55cp -- Channel A



c:\ezchrom\chrom\05119\mp55cp -- Channel A



c:\ezchrom\chrom\05119\mp55cp -- Channel A



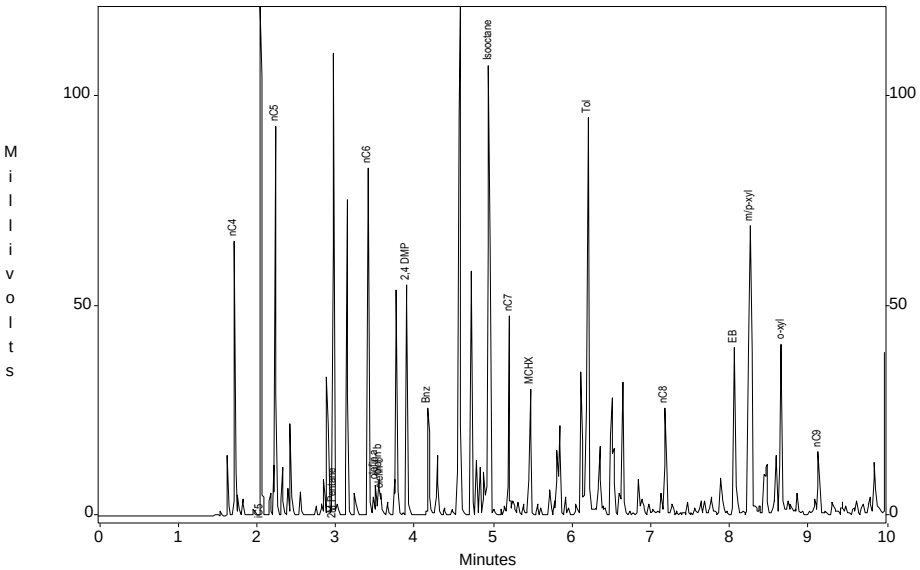
Channel A Results

Peak	Area	Height
nC4	84206	114504
iC5	217743	274942
nC5	123132	145499
MTBE	0	0
2M Pentane	115971	112633
nC6	93675	86148
olefin a	11138	9064
olefin b	12756	11187
olefin c	10364	6316
2,4 DMP	40146	34011
Bnz	60334	42585
Isooctane	114262	77315
nC7	61755	41555
MCHX	37875	27298
Tol	198043	107398
nC8	29882	20723
EB	55431	35339
m/p-xyl	176404	64014
o-xyl	65391	38819
nC9	17162	11326
1,2,4 TMB	94244	50233
nC10	13210	8594
nC11	31641	14851
Naph	22432	6807
nC12	23560	14074
IP13	8355	5202
IP14	7558	4326
nC13	28277	13711
IP15	7779	4306
nC14	28185	14087
IP16	10293	5041
nC15	22827	12405
nC16	21193	10172
IP18	9925	3565
nC17	16938	8838
Pristane	11125	4227
nC18	13188	6604
Phytane	6157	2700
nC19	12197	5338
nC20	7566	3813
nC21	4449	2383
nC22	2590	1338
nC23	1605	661
nC24	884	253
nC25	412	83
nC26	0	0
nC27	0	0
nC28	86	12
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	15	13

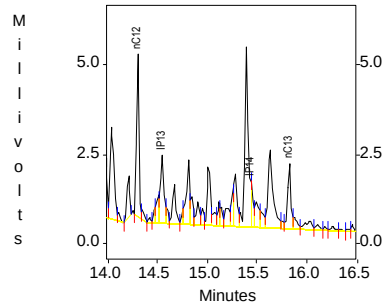
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP56C/050803
Acquired : Aug 09, 2005 17:02:01

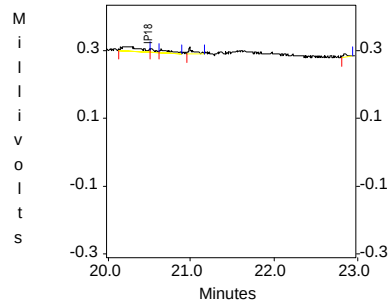
c:\ezchrom\chrom\05119\mp56cp -- Channel A



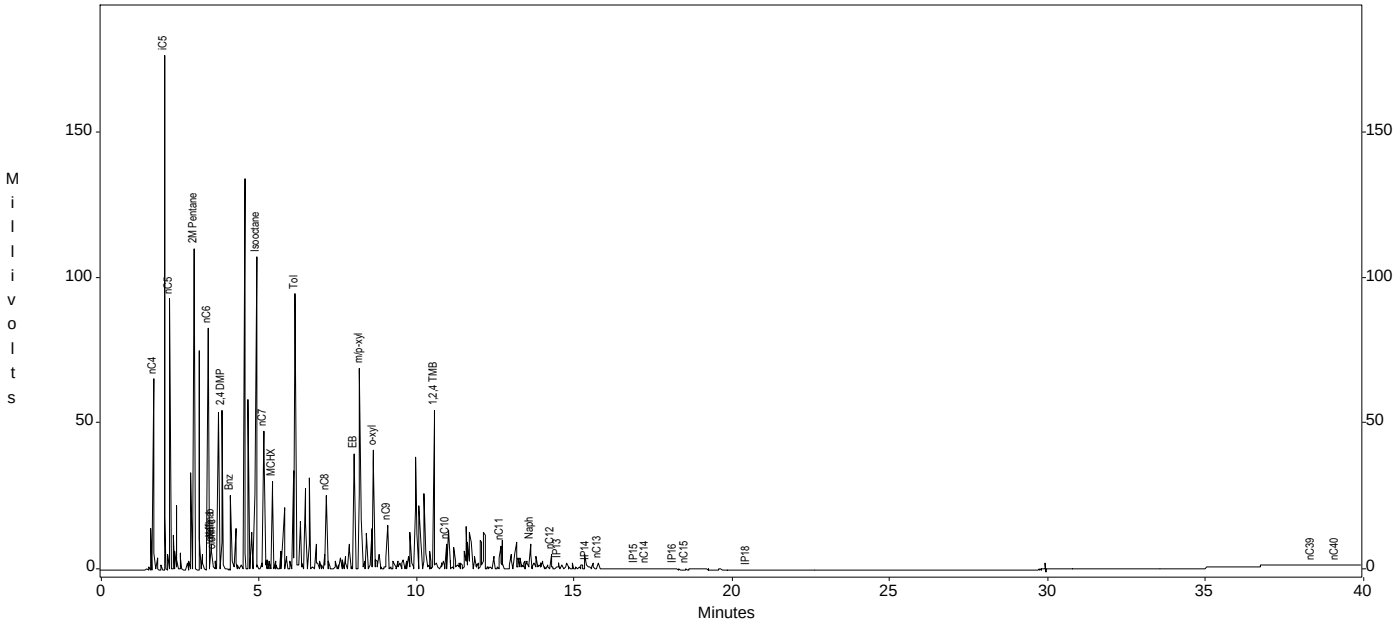
c:\ezchrom\chrom\05119\mp56cp -- Channel A



c:\ezchrom\chrom\05119\mp56cp -- Channel A



c:\ezchrom\chrom\05119\mp56cp -- Channel A



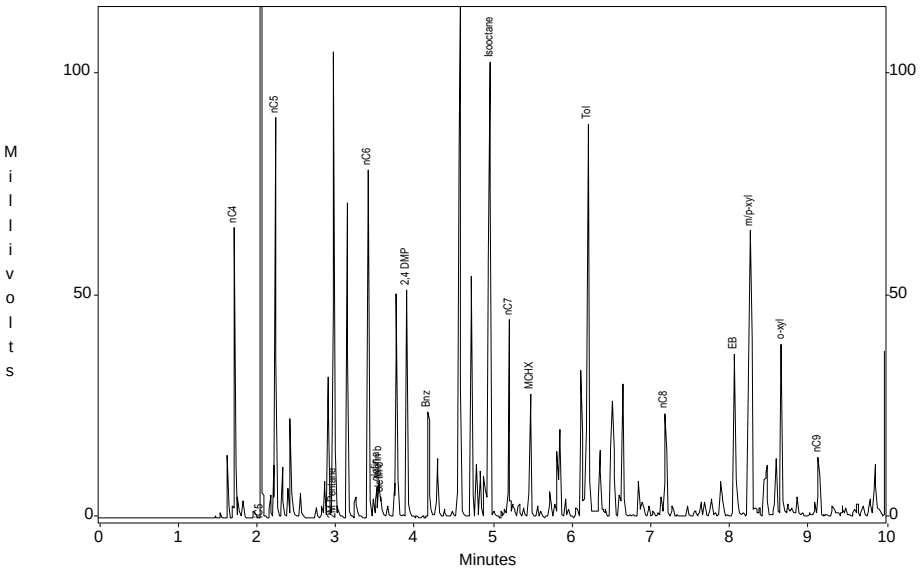
Channel A Results

Peak	Area	Height
nC4	52269	65554
iC5	149213	176599
nC5	85510	92919
MTBE	0	0
2M Pentane	114315	110386
nC6	90306	82900
olefin a	9217	7329
olefin b	10064	8587
olefin c	8722	5126
2,4 DMP	64069	55028
Bnz	39784	25546
Isooctane	177739	107107
nC7	68718	47664
MCHX	41954	29997
Tol	169262	94807
nC8	36014	25402
EB	61468	39741
m/p-xyl	190309	68768
o-xyl	69931	40724
nC9	21651	14885
1,2,4 TMB	106469	54305
nC10	13120	8499
nC11	21664	7921
Naph	23232	7971
nC12	6848	4566
IP13	4443	1899
IP14	1976	1272
nC13	3949	1825
IP15	749	185
nC14	2400	417
IP16	197	41
nC15	108	16
nC16	0	0
IP18	31	7
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	255	15
nC40	62	12

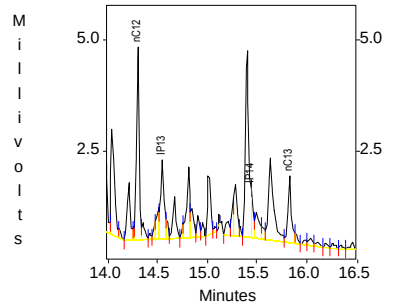
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP56CD/050803
Acquired : Aug 09, 2005 17:51:36

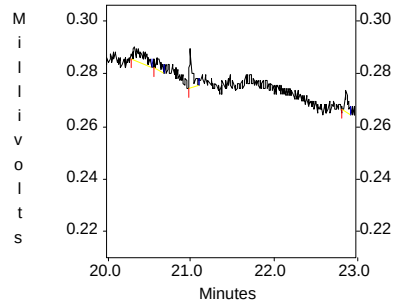
c:\ezchrom\chrom\05119\mp56cpd -- Channel A



c:\ezchrom\chrom\05119\mp56cpd -- Channel A



c:\ezchrom\chrom\05119\mp56cpd -- Channel A



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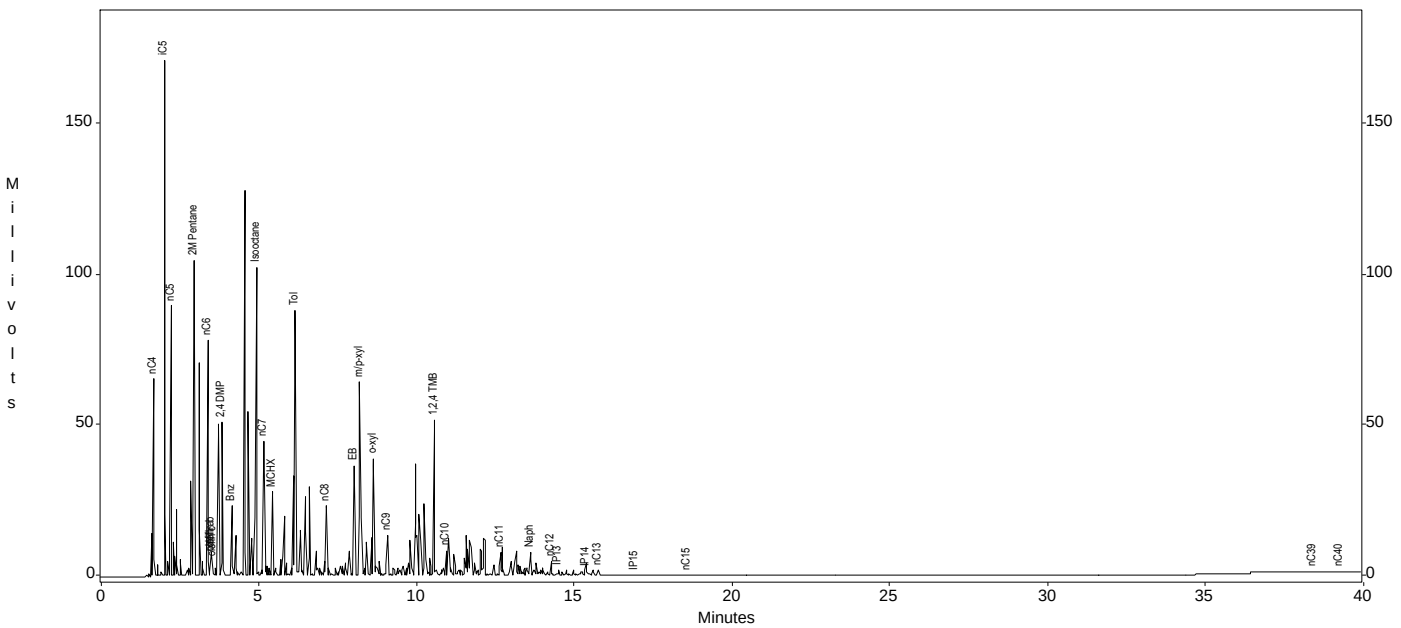


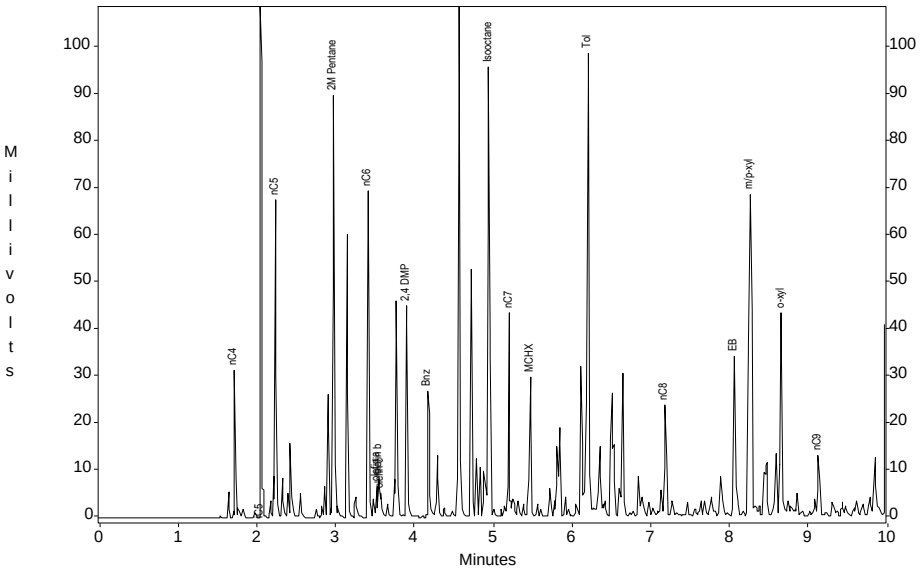
Channel A Results

Peak	Area	Height
nC4	50503	65304
iC5	143318	171015
nC5	81748	90097
MTBE	0	0
2M Pentane	107719	104607
nC6	84668	78272
olefin a	8651	6864
olefin b	9406	8003
olefin c	8271	4757
2,4 DMP	59645	51346
Bnz	37326	23636
Isooctane	165014	102575
nC7	63770	44609
MCHX	38901	27796
Tol	157381	88189
nC8	33449	23442
EB	56857	36675
m/p-xyl	176997	64223
o-xyl	65026	38886
nC9	20135	13539
1,2,4 TMB	99166	51525
nC10	12194	7891
nC11	20136	7353
Naph	21436	7152
nC12	6986	4293
IP13	4141	1751
IP14	1574	1111
nC13	3356	1487
IP15	693	133
nC14	0	0
IP16	0	0
nC15	58	9
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	244	16
nC40	24	16

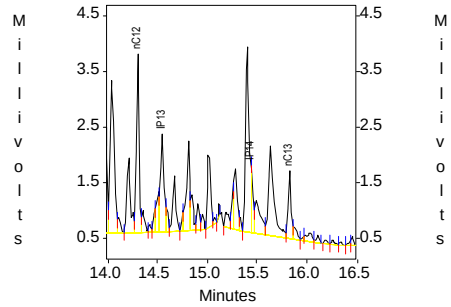
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP57C/050803
Acquired : Aug 09, 2005 18:40:20

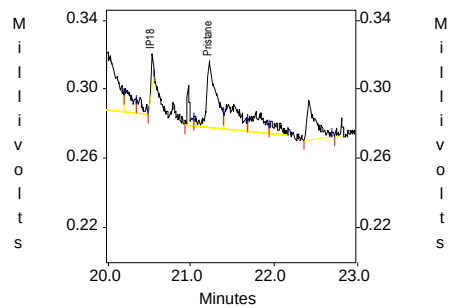
c:\ezchrom\chrom\05119\mp57cp -- Channel A



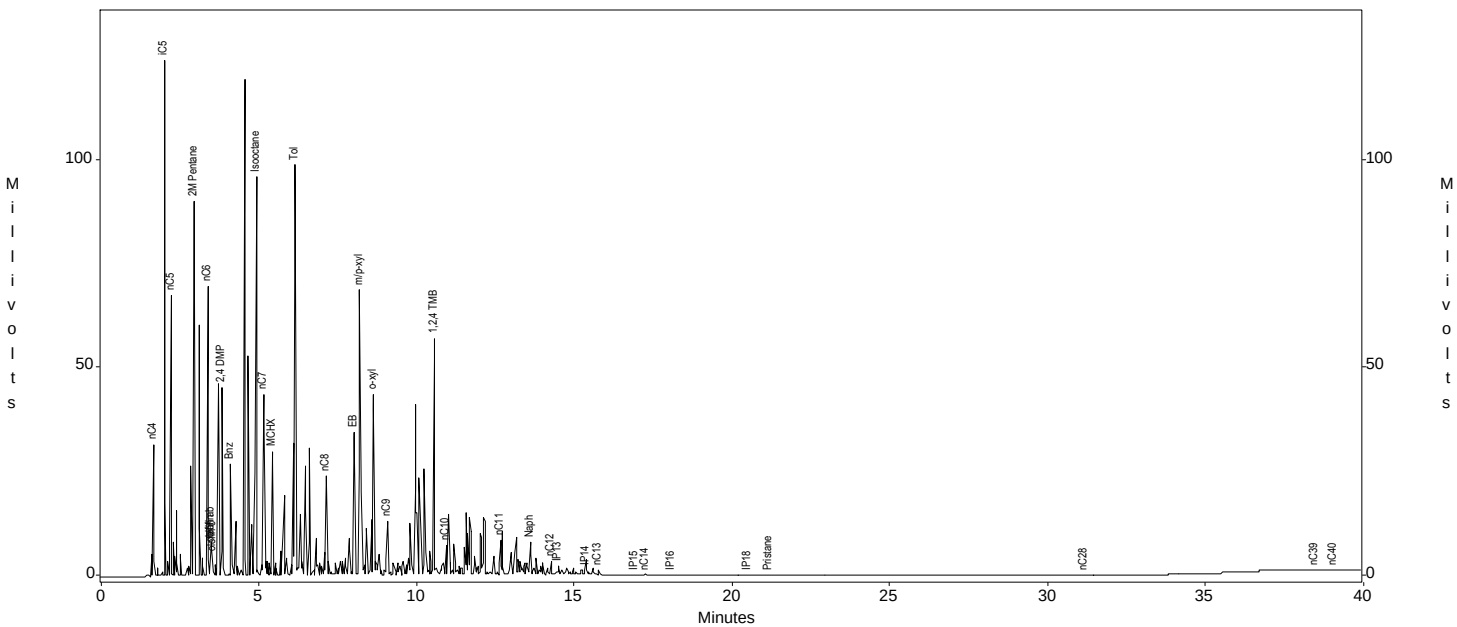
c:\ezchrom\chrom\05119\mp57cp -- Channel A



c:\ezchrom\chrom\05119\mp57cp -- Channel A



c:\ezchrom\chrom\05119\mp57cp -- Channel A



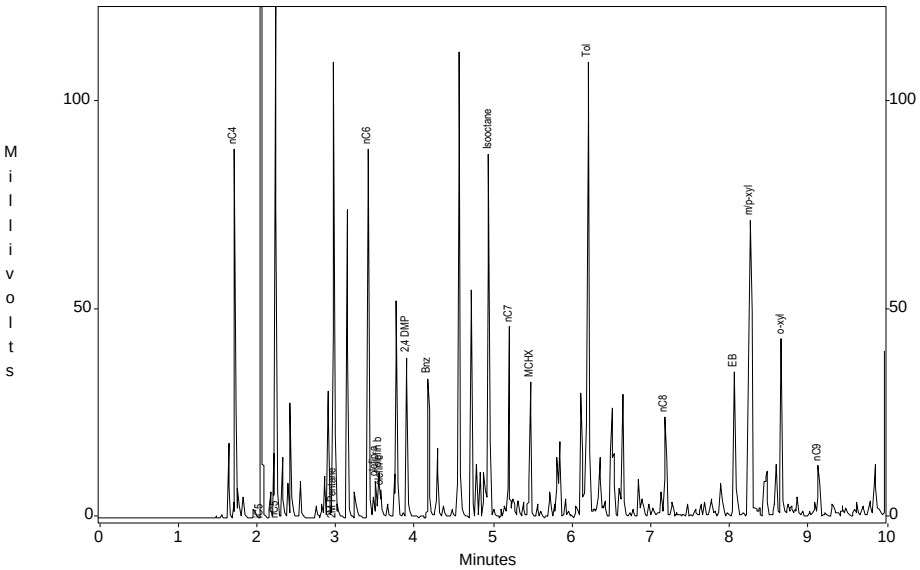
Channel A Results

Peak	Area	Height
nC4	25199	31554
iC5	105975	123641
nC5	63764	67554
MTBE	0	0
2M Pentane	92360	89900
nC6	75057	69518
olefin a	8451	6701
olefin b	9501	8148
olefin c	8427	4881
2,4 DMP	52506	45210
Bnz	41324	26704
Isooctane	151924	95621
nC7	63391	43391
MCHX	41844	29887
Tol	181633	98836
nC8	34446	23895
EB	53941	34116
m/p-xyl	193702	68411
o-xyl	73711	43351
nC9	19442	12883
1,2,4 TMB	113609	56551
nC10	10693	6709
nC11	19951	8247
Naph	23274	7651
nC12	5098	3223
IP13	4103	1772
IP14	2003	1231
nC13	2571	1227
IP15	736	184
nC14	767	268
IP16	297	80
nC15	0	0
nC16	0	0
IP18	44	23
nC17	0	0
Pristane	301	39
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	116	19
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	226	15
nC40	26	12

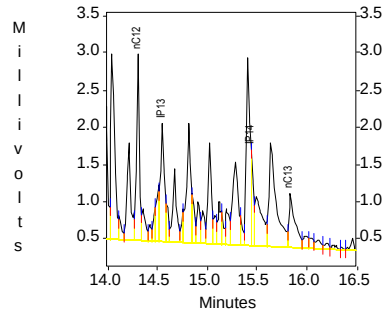
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP60C/050803
Acquired : Aug 09, 2005 19:37:29

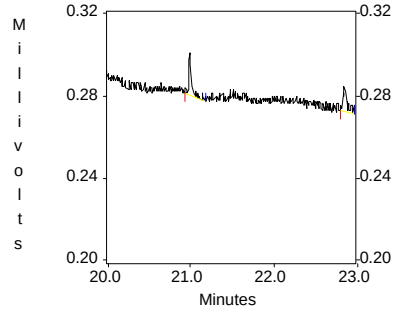
c:\ezchrom\chrom\05119\mp60cp -- Channel A



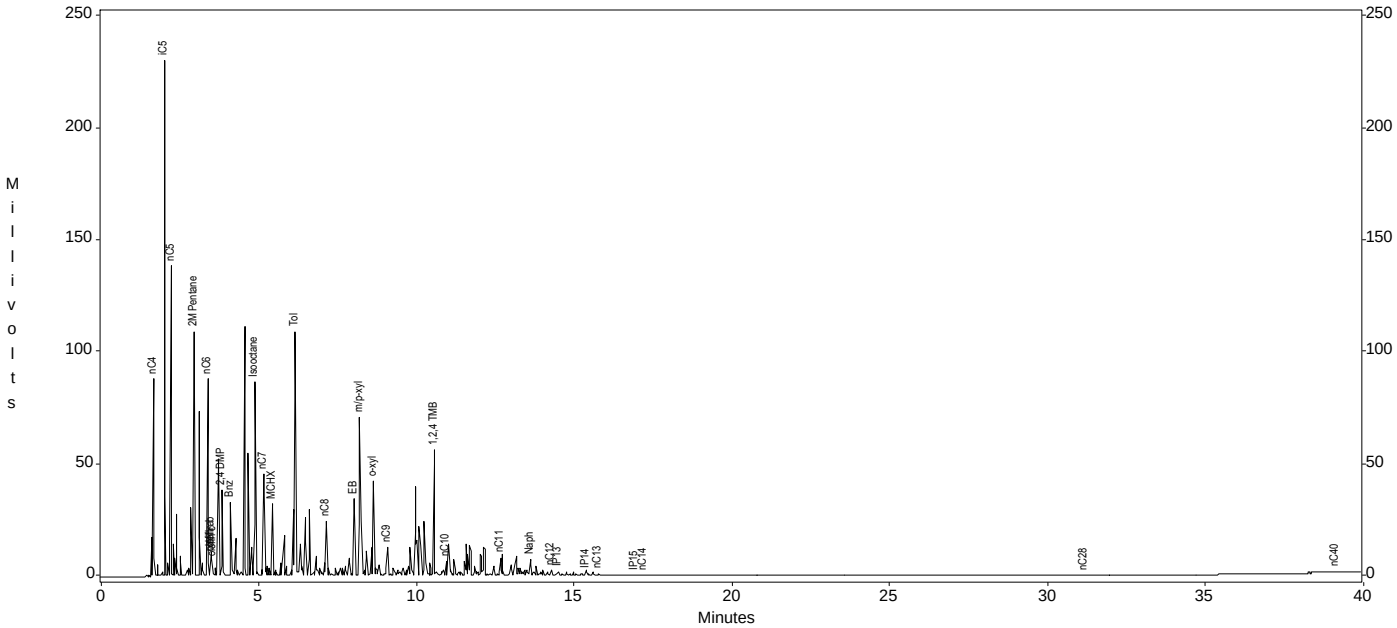
c:\ezchrom\chrom\05119\mp60cp -- Channel A



c:\ezchrom\chrom\05119\mp60cp -- Channel A



c:\ezchrom\chrom\05119\mp60cp -- Channel A



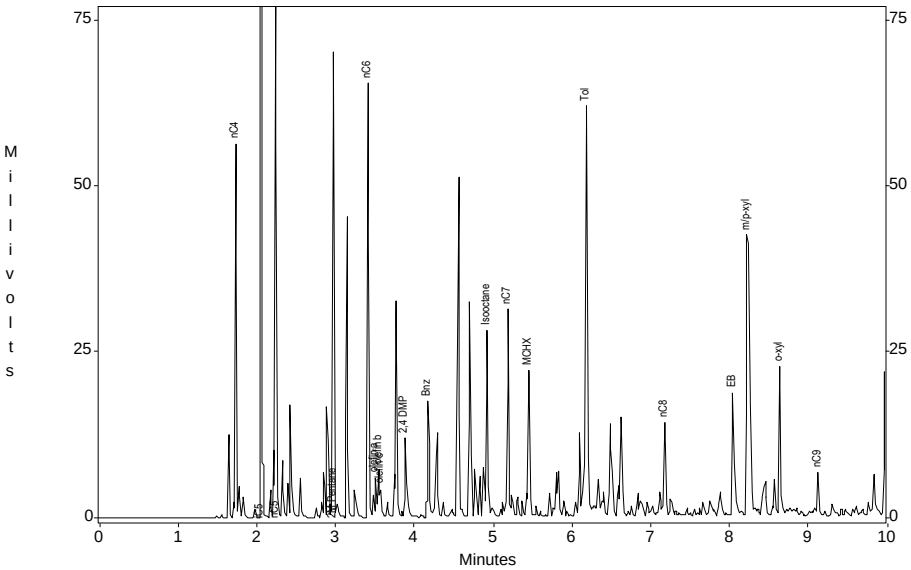
Channel A Results

Peak	Area	Height
nC4	64549	88410
iC5	191309	230367
nC5	123691	138697
MTBE	0	0
2M Pentane	115487	109502
nC6	98515	88419
olefin a	10835	8636
olefin b	12351	10725
olefin c	10589	6362
2,4 DMP	45277	38219
Bnz	49848	33109
Isooctane	133144	86982
nC7	68789	45639
MCHX	45019	32361
Tol	197732	107840
nC8	34559	23913
EB	54573	34772
m/p-xyl	200860	70881
o-xyl	73592	42530
nC9	18606	12197
1,2,4 TMB	109354	55990
nC10	9259	5948
nC11	18117	7790
Naph	21605	6775
nC12	4262	2500
IP13	3962	1576
IP14	2023	1279
nC13	2993	720
IP15	266	68
nC14	57	23
IP16	0	0
nC15	0	0
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	111	16
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	11	8

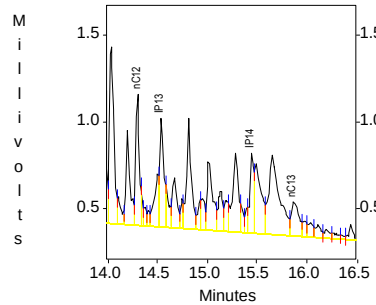
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP79C/050809
Acquired : Aug 12, 2005 09:34:14

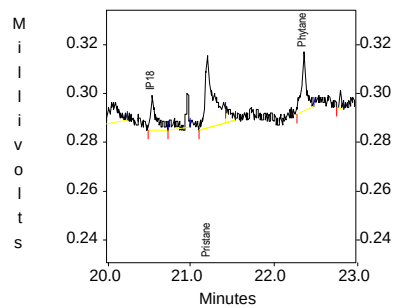
c:\ezchrom\chrom\05119\mp79c -- Channel A



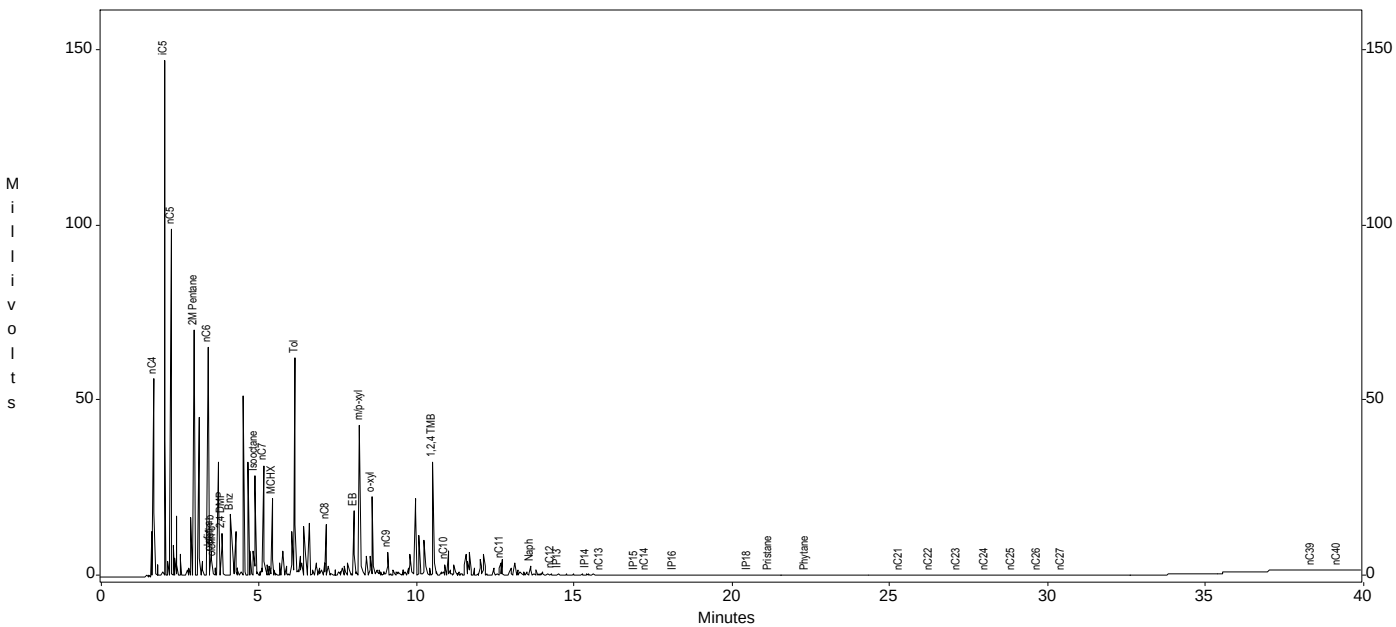
c:\ezchrom\chrom\05119\mp79c -- Channel A



c:\ezchrom\chrom\05119\mp79c -- Channel A



c:\ezchrom\chrom\05119\mp79c -- Channel A



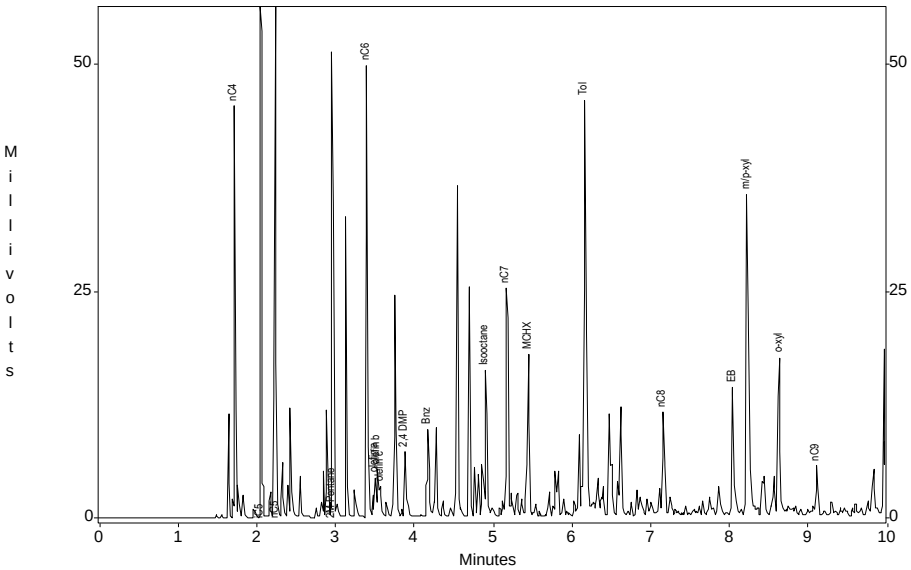
Channel A Results

Peak	Area	Height
nC4	48435	56224
iC5	132657	146941
nC5	94541	98806
MTBE	0	0
2M Pentane	71938	70073
nC6	69543	65438
olefin a	7338	5907
olefin b	8751	7279
olefin c	7195	4268
2,4 DMP	15680	12052
Bnz	27081	17458
Isooctane	35486	28298
nC7	44231	31403
MCHX	30622	22238
Tol	103308	62134
nC8	21869	14298
EB	33713	18605
m/p-xyl	102674	42542
o-xyl	37705	22594
nC9	10503	6627
1,2,4 TMB	55093	32208
nC10	5123	3087
nC11	8559	3739
Naph	7623	2307
nC12	1496	759
IP13	1645	621
IP14	1272	459
nC13	1033	192
IP15	142	42
nC14	24	10
IP16	52	14
nC15	0	0
nC16	0	0
IP18	62	14
nC17	0	0
Pristane	198	29
nC18	0	0
Phytane	94	24
nC19	0	0
nC20	0	0
nC21	92	15
nC22	63	11
nC23	83	18
nC24	470	26
nC25	88	23
nC26	87	23
nC27	90	16
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	183	15
nC40	43	14

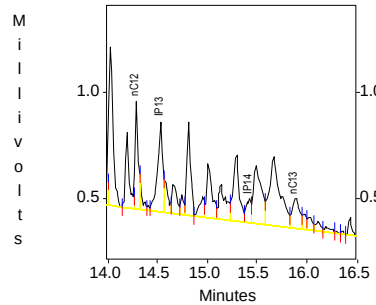
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : MP80C/050809
Acquired : Aug 12, 2005 11:14:42

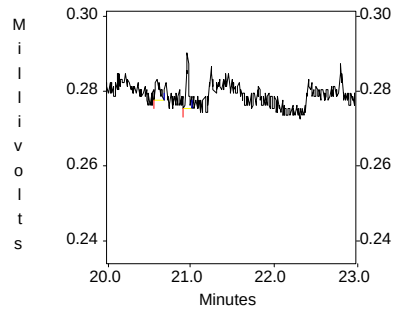
c:\ezchrom\chrom\05119\mp80c -- Channel A



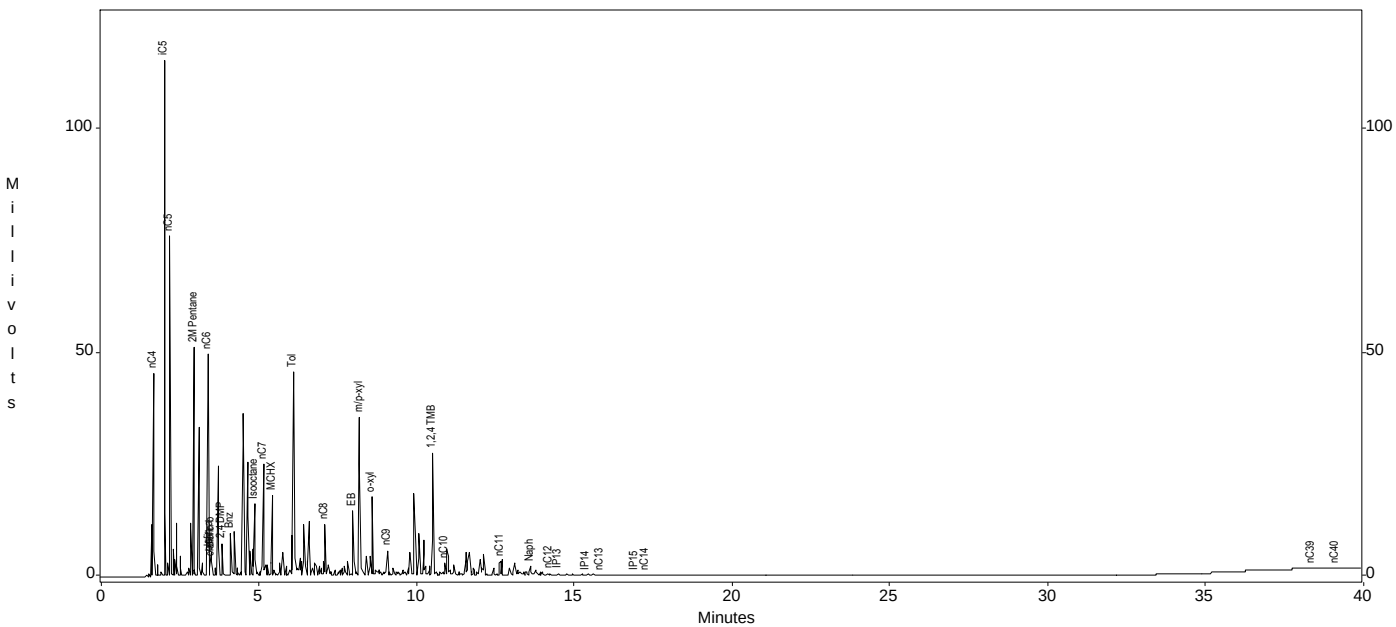
c:\ezchrom\chrom\05119\mp80c -- Channel A



c:\ezchrom\chrom\05119\mp80c -- Channel A



c:\ezchrom\chrom\05119\mp80c -- Channel A



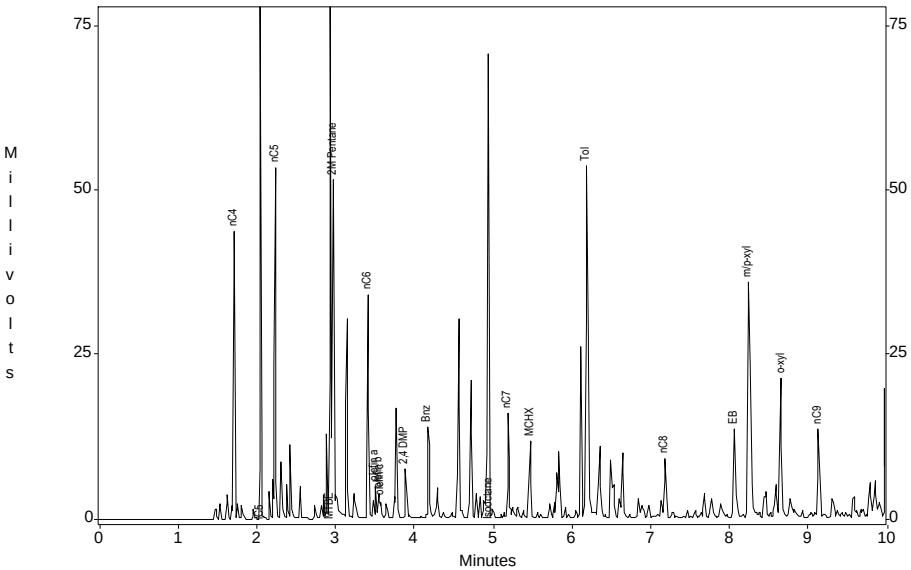
Channel A Results

Peak	Area	Height
nC4	37654	45389
iC5	102465	115222
nC5	74003	76081
MTBE	0	0
2M Pentane	54117	51180
nC6	53714	49686
olefin a	5456	4361
olefin b	6571	5342
olefin c	5797	3288
2,4 DMP	9667	7194
Bnz	16423	9661
Isooctane	21266	16221
nC7	34996	25138
MCHX	25033	17949
Tol	75709	45780
nC8	18136	11487
EB	27068	14248
m/p-xyl	57438	35468
o-xyl	30279	17415
nC9	8931	5428
1,2,4 TMB	45865	27357
nC10	4195	2498
nC11	7010	3097
Naph	5549	1733
nC12	971	508
IP13	1508	424
IP14	405	118
nC13	761	148
IP15	168	36
nC14	31	12
IP16	0	0
nC15	0	0
nC16	0	0
IP18	0	0
nC17	0	0
Pristane	0	0
nC18	0	0
Phytane	0	0
nC19	0	0
nC20	0	0
nC21	0	0
nC22	0	0
nC23	0	0
nC24	0	0
nC25	0	0
nC26	0	0
nC27	0	0
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	646	12
nC40	21	10

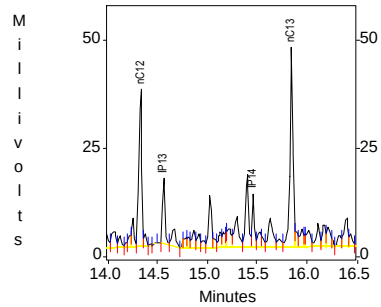
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 08, 2005 11:50:57

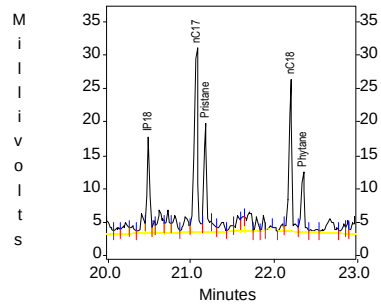
c:\ezchrom\chrom\05119\gadiwax2 -- Channel A



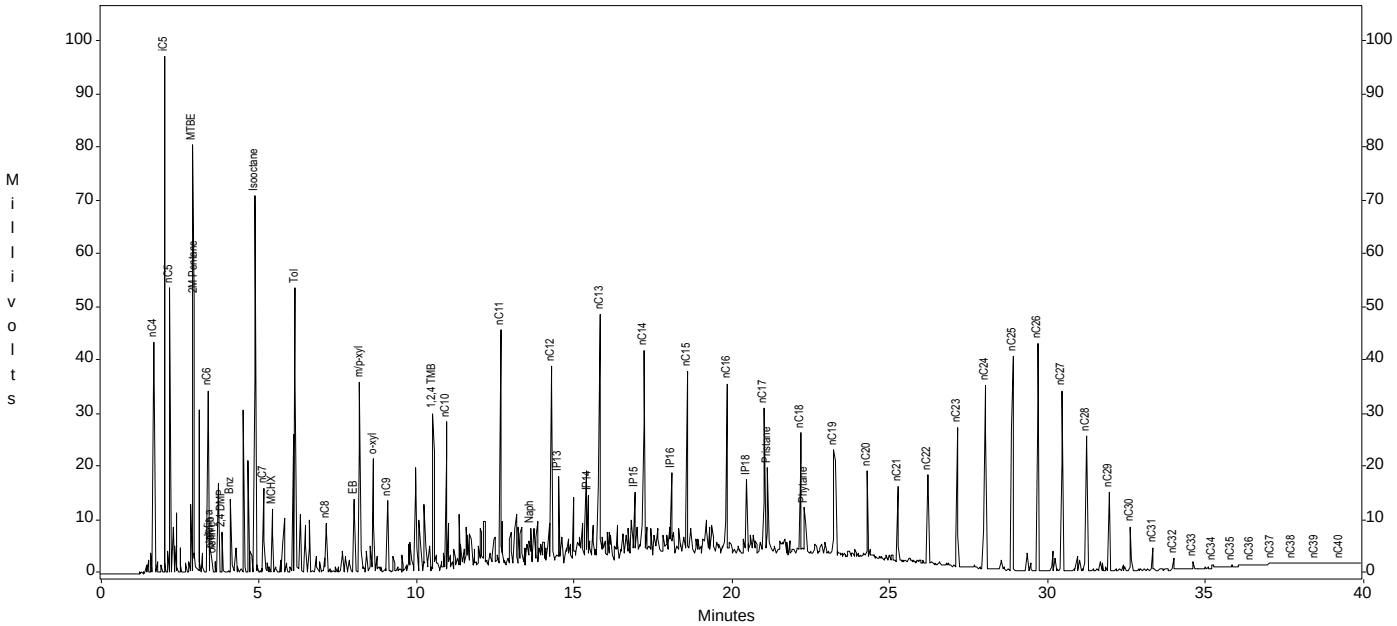
c:\ezchrom\chrom\05119\gadiwax2 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2 -- Channel A



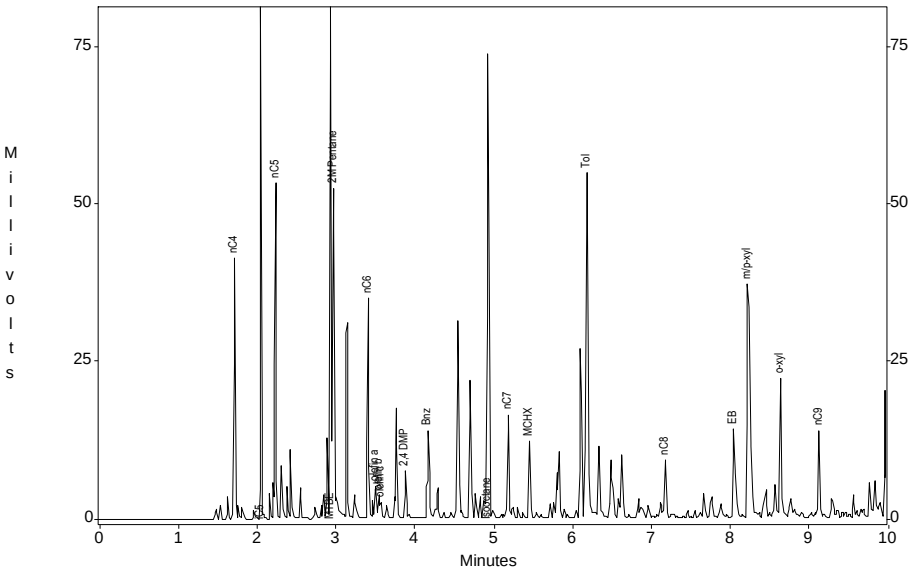
Channel A Results

Peak	Area	Height
nC4	31898	43578
iC5	76433	97054
nC5	45962	53412
MTBE	71202	80048
2M Pentane	54295	51269
nC6	35658	34073
olefin a	5919	4938
olefin b	4460	3684
olefin c	3890	2592
2,4 DMP	8373	7443
Bnz	21996	13880
Isooctane	100164	70771
nC7	22493	15899
MCHX	16380	11830
Tol	89948	53564
nC8	13247	9073
EB	25277	13664
m/p-xyl	59107	35726
o-xyl	35552	21305
nC9	19697	13475
1,2,4 TMB	53149	29448
nC10	44398	27619
nC11	77534	43934
Naph	18378	6647
nC12	70432	36548
IP13	26232	15169
IP14	22021	12418
nC13	99226	46569
IP15	23151	12950
nC14	87610	39206
IP16	35568	16256
nC15	83323	35000
nC16	78217	32471
IP18	34601	14399
nC17	66852	27710
Pristane	40702	16481
nC18	54399	22733
Phytane	22347	8927
nC19	51308	20071
nC20	32348	16143
nC21	27741	14045
nC22	35340	17080
nC23	58437	26124
nC24	91738	34512
nC25	113424	40249
nC26	119676	42709
nC27	94155	33748
nC28	60571	25207
nC29	33568	14870
nC30	17965	8061
nC31	8598	4248
nC32	4565	2256
nC33	2436	1199
nC34	1322	619
nC35	737	344
nC36	382	158
nC37	575	86
nC38	562	53
nC39	148	30
nC40	67	24

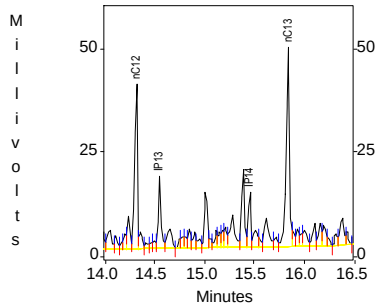
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 09, 2005 15:22:22

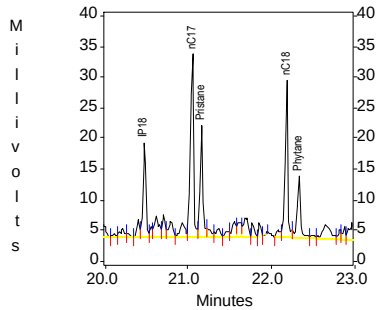
c:\ezchrom\chrom\05119\gadiwax2.3 -- Channel A



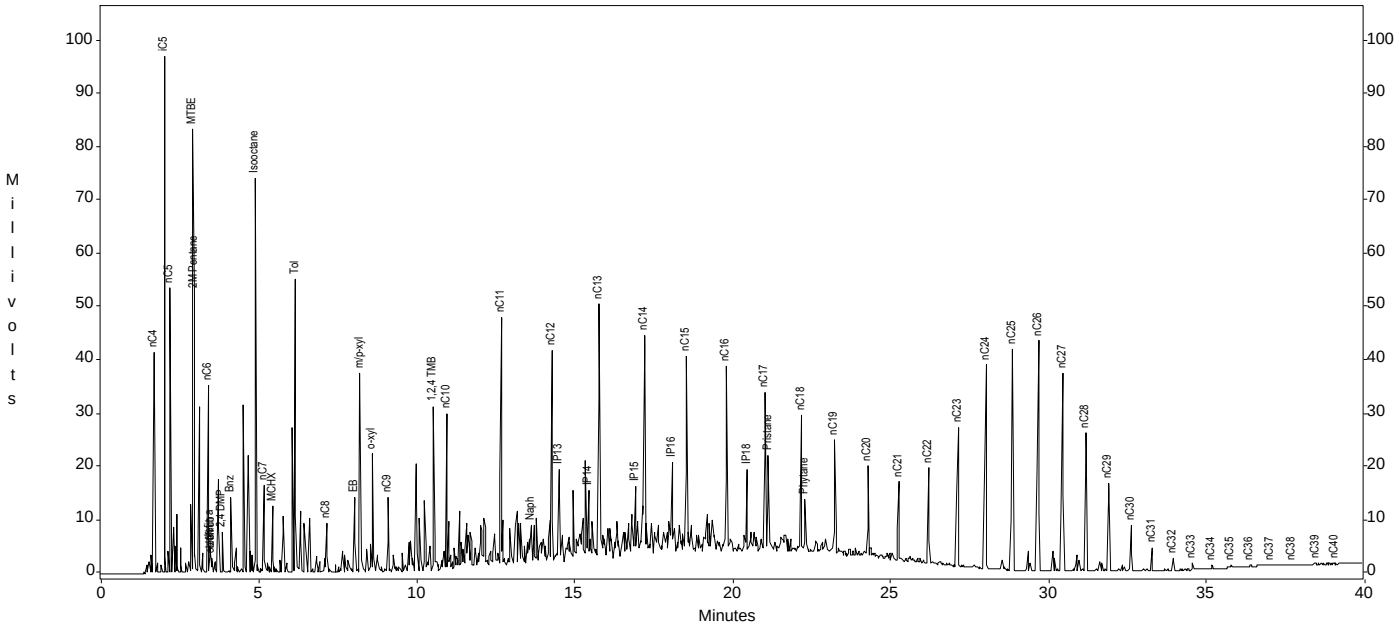
c:\ezchrom\chrom\05119\gadiwax2.3 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2.3 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2.3 -- Channel A



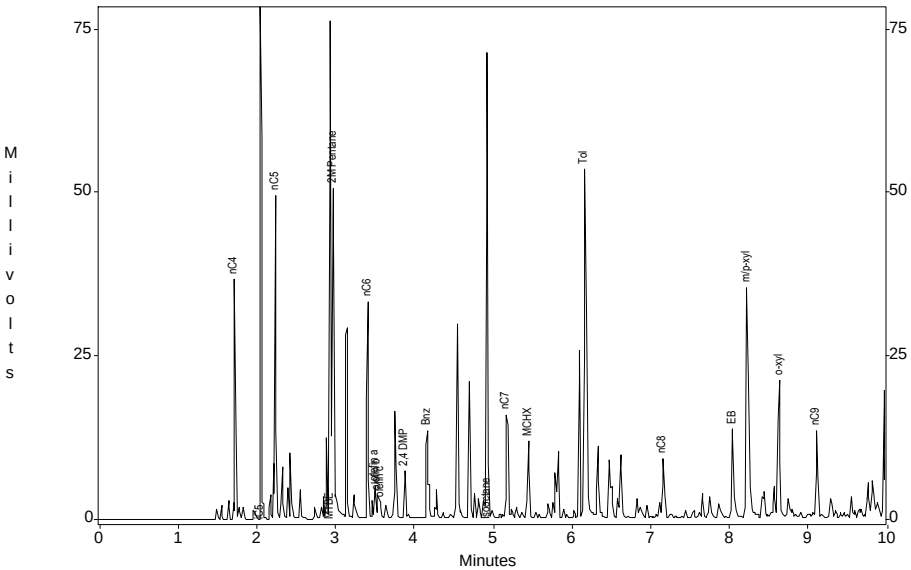
Channel A Results

Peak	Area	Height
nC4	31393	41528
iC5	77957	96902
nC5	47561	53332
MTBE	74167	82989
2M Pentane	55586	51991
nC6	36794	34881
olefin a	6057	5062
olefin b	4620	3748
olefin c	4067	2637
2,4 DMP	8673	7536
Bnz	22675	13988
Isooctane	104237	73891
nC7	23423	16325
MCHX	17015	12332
Tol	93346	54935
nC8	13160	9182
EB	26136	14170
m/p-xyl	62861	37196
o-xyl	37144	22241
nC9	20727	13969
1,2,4 TMB	56130	30607
nC10	46853	29220
nC11	82647	45975
Naph	20505	7211
nC12	78772	39882
IP13	34295	17469
IP14	23570	13218
nC13	107190	48234
IP15	19585	11860
nC14	83453	39395
IP16	36731	16693
nC15	76968	35926
nC16	81799	34607
IP18	36014	15340
nC17	72083	29906
Pristane	43204	18063
nC18	57206	25624
Phytane	28418	10200
nC19	57342	21622
nC20	38216	17401
nC21	31385	14869
nC22	38248	18066
nC23	63717	26241
nC24	98602	38244
nC25	120985	41426
nC26	126983	43110
nC27	99337	37048
nC28	63310	26026
nC29	34814	16424
nC30	16951	8372
nC31	8710	4374
nC32	4580	2197
nC33	2391	1171
nC34	1288	598
nC35	661	301
nC36	482	140
nC37	504	59
nC38	287	22
nC39	452	19
nC40	20	14

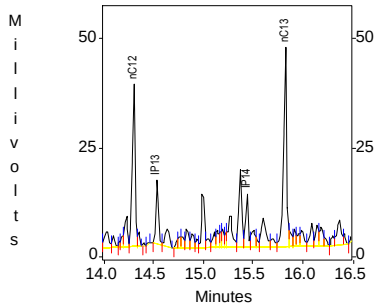
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Aug 12, 2005 10:24:57

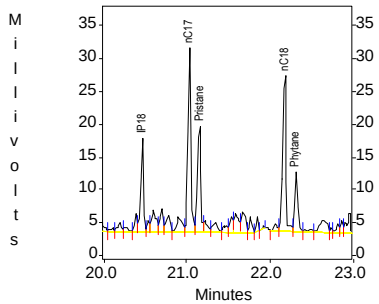
c:\ezchrom\chrom\05119\gadiwax2.4 -- Channel A



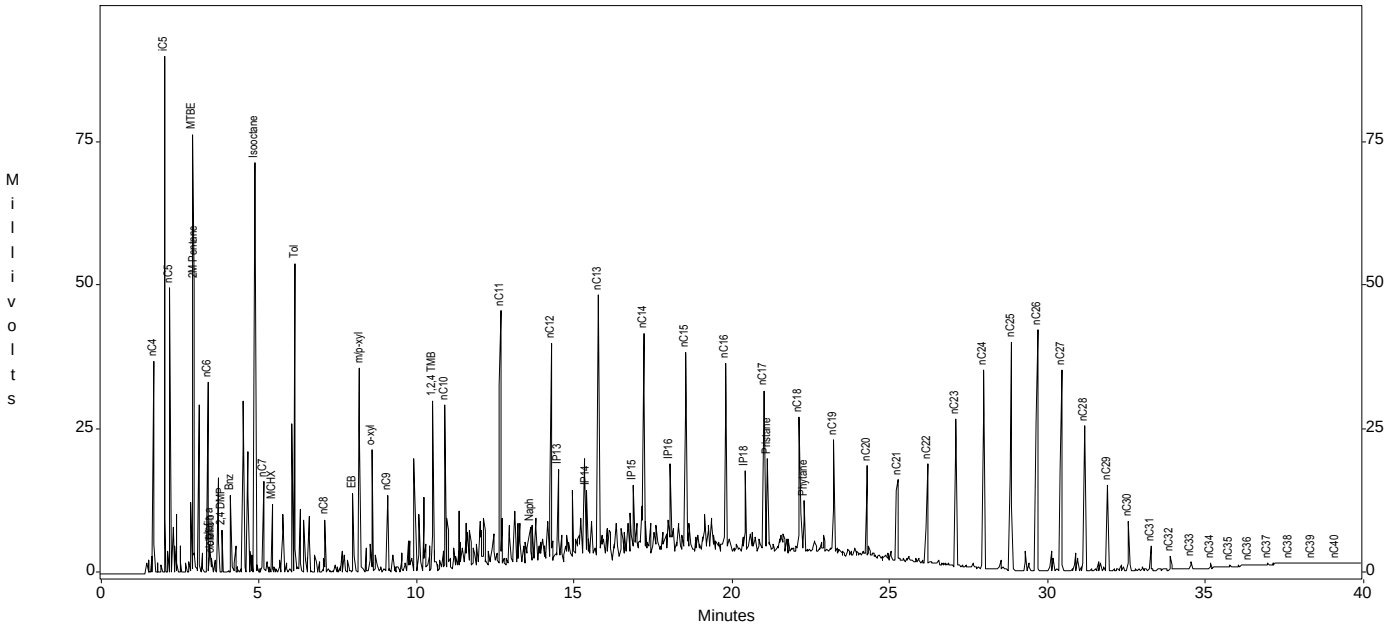
c:\ezchrom\chrom\05119\gadiwax2.4 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2.4 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2.4 -- Channel A



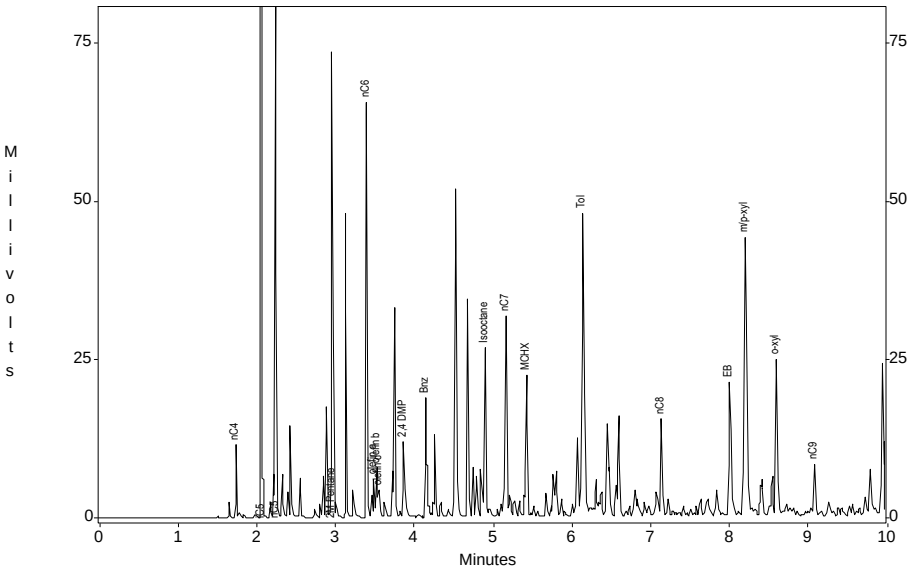
Channel A Results

Peak	Area	Height
nC4	28419	36786
iC5	73234	89753
nC5	45098	49608
MTBE	68974	76012
2M Pentane	54365	50110
nC6	35161	33080
olefin a	5804	4763
olefin b	4337	3563
olefin c	3955	2557
2,4 DMP	8311	7180
Bnz	21647	13337
Isooctane	99944	71246
nC7	22365	15732
MCHX	16292	11800
Tol	89524	53604
nC8	13218	9082
EB	25246	13558
m/p-xyl	57596	35406
o-xyl	35720	21226
nC9	19805	13448
1,2,4 TMB	53584	29234
nC10	44559	28557
nC11	78366	44006
Naph	18509	6324
nC12	71626	37714
IP13	26002	14932
IP14	21920	12249
nC13	98712	46018
IP15	18213	11367
nC14	77108	36846
IP16	35958	15332
nC15	71347	33990
nC16	75276	32824
IP18	33108	14201
nC17	66180	28037
Pristane	38302	16086
nC18	54463	23599
Phytane	22349	9147
nC19	50429	19917
nC20	32563	16024
nC21	29241	14064
nC22	35510	17501
nC23	58918	25556
nC24	92272	34512
nC25	114163	39515
nC26	120504	41919
nC27	94766	35030
nC28	61146	25321
nC29	33994	14958
nC30	16403	8275
nC31	8773	4266
nC32	4732	2292
nC33	2549	1252
nC34	1417	692
nC35	784	370
nC36	449	196
nC37	595	106
nC38	578	64
nC39	205	41
nC40	163	34

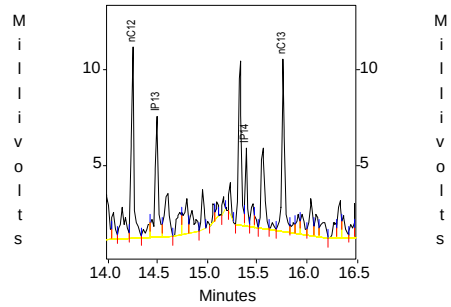
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : RW-4A/050830
Acquired : Sep 02, 2005 14:04:16

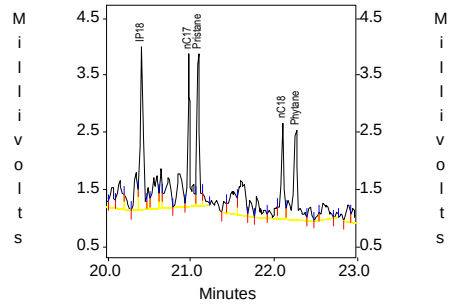
c:\ezchrom\chrom\05119\rw-4ap -- Channel A



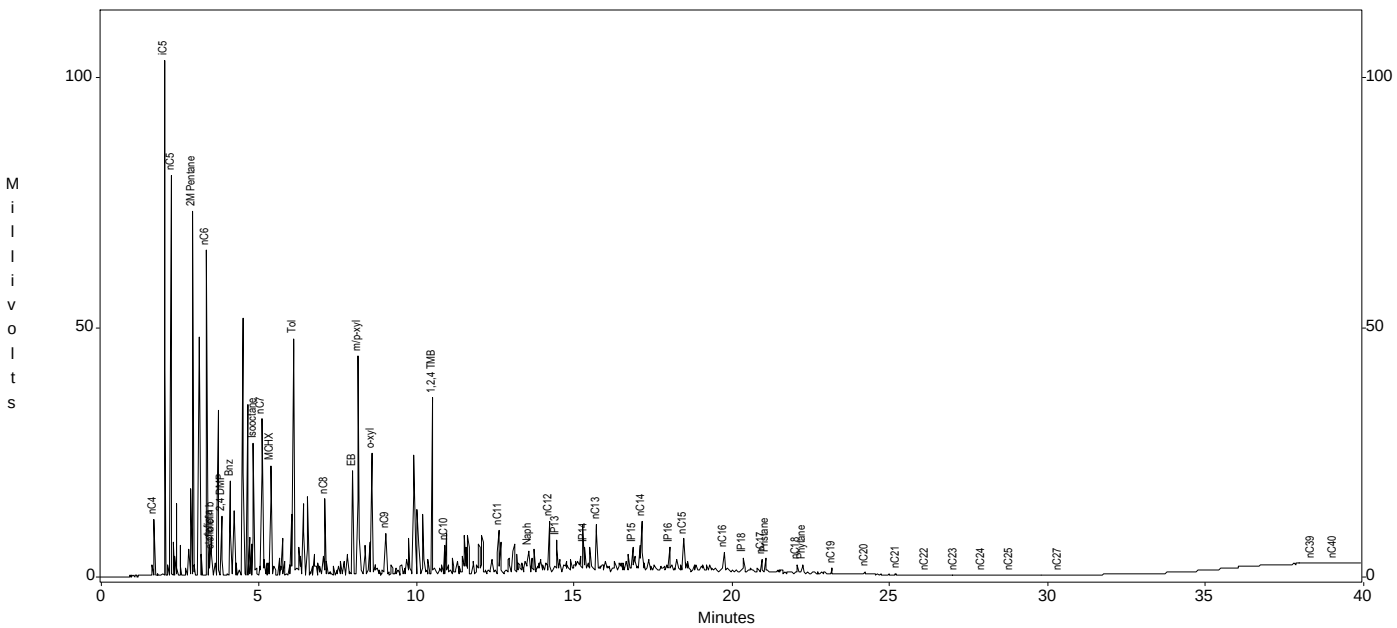
c:\ezchrom\chrom\05119\rw-4ap -- Channel A



c:\ezchrom\chrom\05119\rw-4ap -- Channel A



c:\ezchrom\chrom\05119\rw-4ap -- Channel A



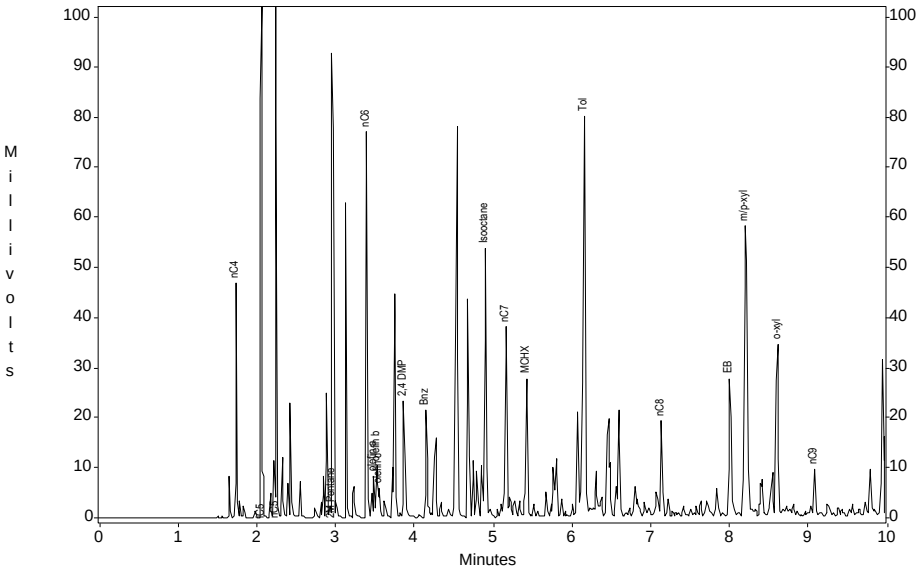
Channel A Results

Peak	Area	Height
nC4	8940	11487
iC5	85937	103412
nC5	71780	80524
MTBE	0	0
2M Pentane	72901	73206
nC6	69430	65439
olefin a	7306	6011
olefin b	8742	7718
olefin c	6826	4402
2,4 DMP	15490	11902
Bnz	27786	18831
Isooctane	32845	26713
nC7	46157	31547
MCHX	30313	22250
Tol	82630	47718
nC8	22379	15528
EB	36920	21112
m/p-xyl	110372	43887
o-xyl	40540	24566
nC9	12504	8351
1,2,4 TMB	62545	35528
nC10	8687	5634
nC11	19348	8460
Naph	19276	4264
nC12	18351	9953
IP13	13482	6285
IP14	6390	4088
nC13	17058	8927
IP15	8100	4799
nC14	19757	10038
IP16	9158	4598
nC15	12820	6494
nC16	9914	4007
IP18	7220	2862
nC17	6189	2656
Pristane	5823	2656
nC18	3934	1671
Phytane	5336	1552
nC19	3625	1087
nC20	1378	594
nC21	512	247
nC22	234	104
nC23	189	51
nC24	110	25
nC25	285	74
nC26	0	0
nC27	400	129
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	48	21
nC40	58	13

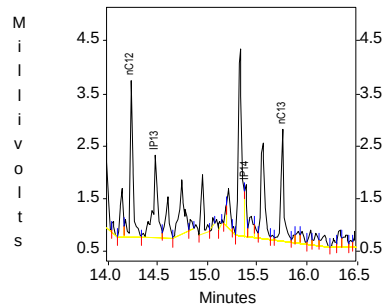
Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : RW-5/050830
Acquired : Sep 02, 2005 14:54:49

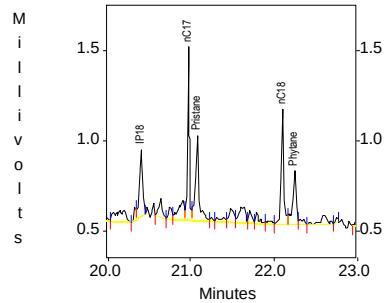
c:\ezchrom\chrom\05119\rw-5p -- Channel A



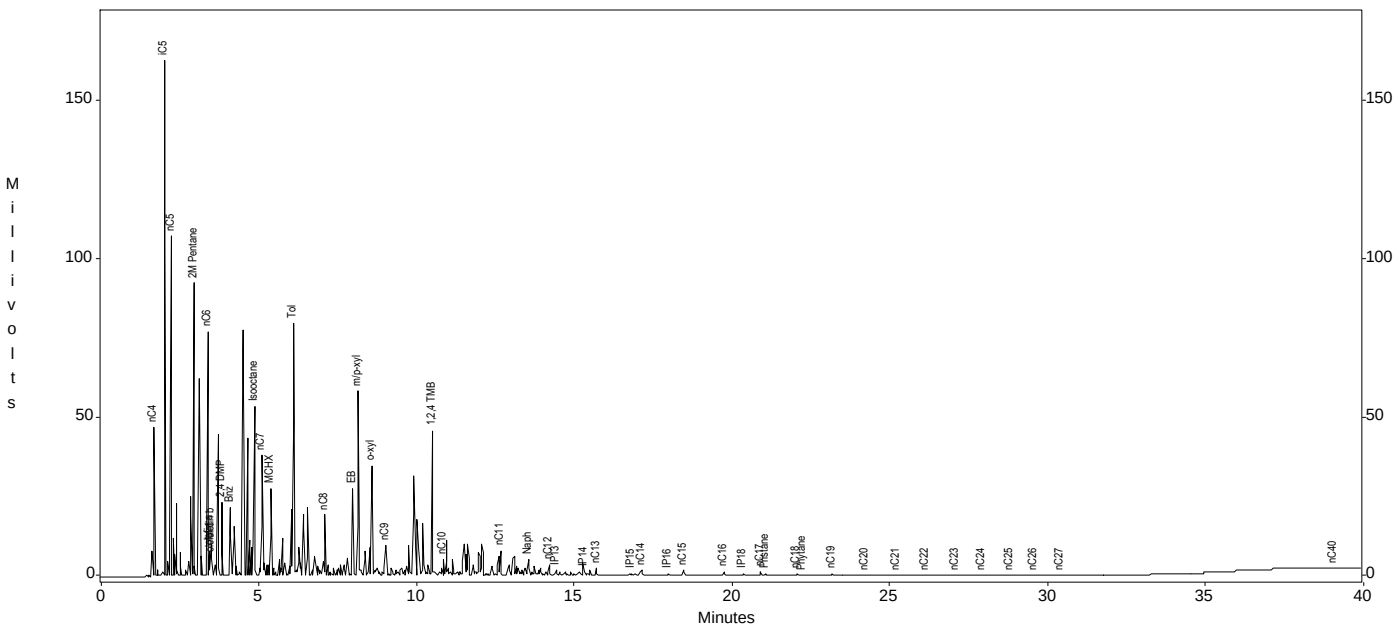
c:\ezchrom\chrom\05119\rw-5p -- Channel A



c:\ezchrom\chrom\05119\rw-5p -- Channel A



c:\ezchrom\chrom\05119\rw-5p -- Channel A



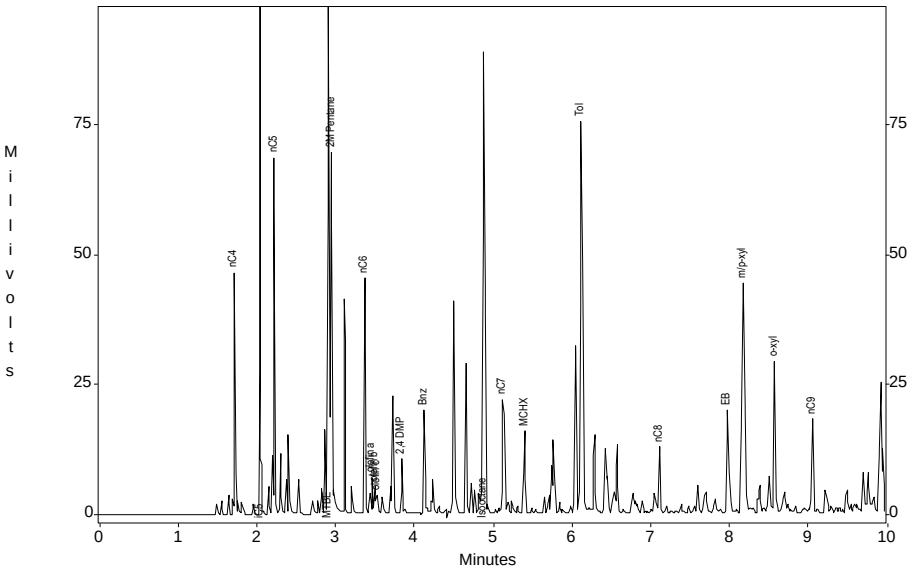
Channel A Results

Peak	Area	Height
nC4	34338	46886
iC5	130542	162835
nC5	91762	107259
MTBE	0	0
2M Pentane	94538	92787
nC6	83172	77065
olefin a	9757	8078
olefin b	11264	10127
olefin c	8792	5873
2,4 DMP	28153	23208
Bnz	31084	21452
Isooctane	71758	53525
nC7	57414	38130
MCHX	37922	27638
Tol	146265	80082
nC8	27452	19183
EB	47517	27701
m/p-xyl	155241	58129
o-xyl	57560	34587
nC9	14417	9605
1,2,4 TMB	85955	45770
nC10	7066	4804
nC11	13779	7464
Naph	14832	4928
nC12	5926	3010
IP13	5285	1593
IP14	1595	985
nC13	4523	2133
IP15	1160	593
nC14	5170	1969
IP16	1171	671
nC15	2638	1419
nC16	2609	1180
IP18	1029	374
nC17	1889	960
Pristane	1423	470
nC18	1372	637
Phytane	896	303
nC19	1525	455
nC20	726	288
nC21	434	143
nC22	203	63
nC23	112	29
nC24	67	16
nC25	89	14
nC26	68	11
nC27	83	17
nC28	0	0
nC29	0	0
nC30	0	0
nC31	0	0
nC32	0	0
nC33	0	0
nC34	0	0
nC35	0	0
nC36	0	0
nC37	0	0
nC38	0	0
nC39	0	0
nC40	39	13

Torkelson Geochemistry, Inc.

Hartford Working Group
Sample ID : Gas/Dies/Wax std
Acquired : Sep 02, 2005 09:56:36

c:\ezchrom\chrom\05119\gadiwax2.5 -- Channel A



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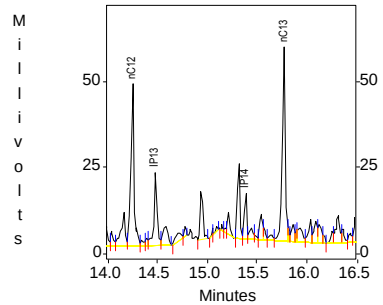
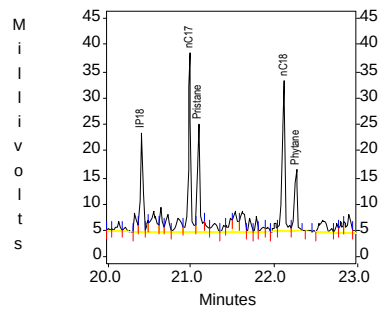
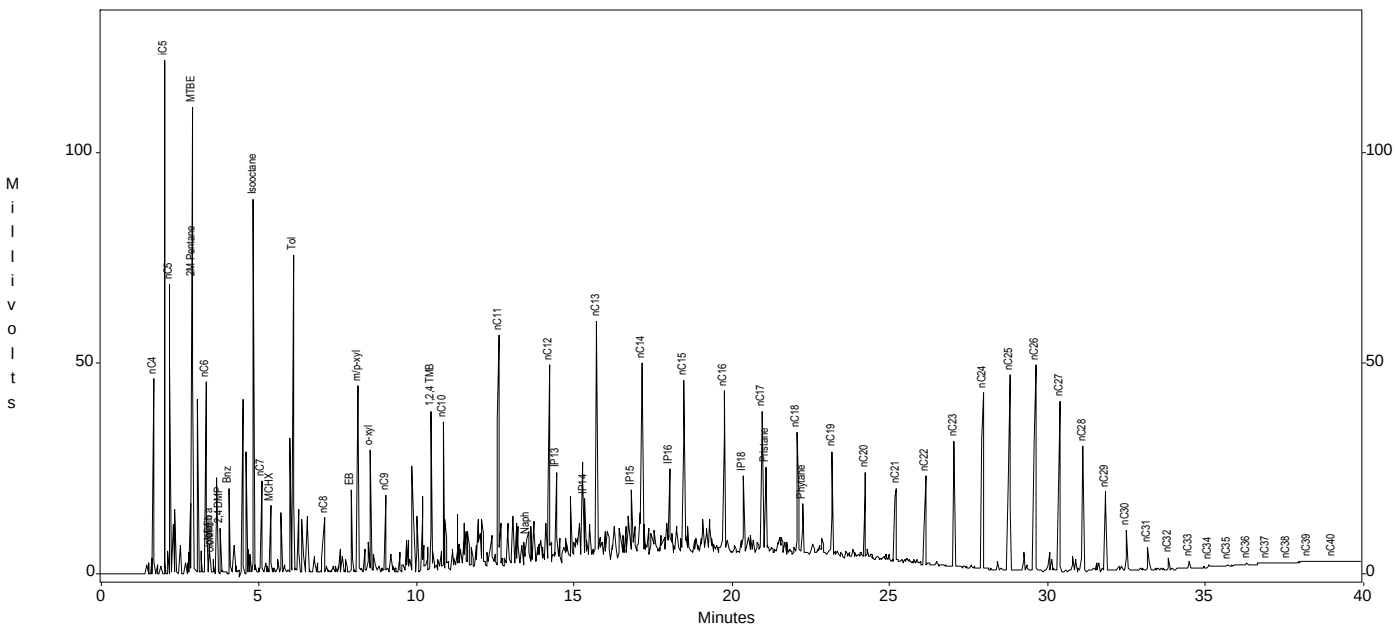


c:\ezchrom\chrom\05119\gadiwax2.5 -- Channel A



c:\ezchrom\chrom\05119\gadiwax2.5 -- Channel A



Channel A Results

Peak	Area	Height
nC4	34181	46376
iC5	96084	121777
nC5	57517	68370
MTBE	103545	110998
2M Pentane	72044	69647
nC6	48777	45840
olefin a	8903	7226
olefin b	6457	5559
olefin c	6680	4060
2,4 DMP	13301	11115
Bnz	32909	20723
Isooctane	140381	89438
nC7	35765	22585
MCHX	26227	16541
Tol	130677	75861
nC8	19200	13307
EB	35498	19996
m/p-xyl	108940	44527
o-xyl	47382	29171
nC9	26915	18244
1,2,4 TMB	71850	37921
nC10	58855	35028
nC11	107726	54668
Naph	25002	6026
nC12	106867	47305
IP13	44959	21303
IP14	22949	13502
nC13	124372	56314
IP15	28447	15847
nC14	109374	45814
IP16	45065	19835
nC15	105074	40880
nC16	96786	38829
IP18	41701	18575
nC17	83844	33943
Pristane	49848	20389
nC18	68022	28528
Phytane	25998	11676
nC19	61645	24475
nC20	40732	20428
nC21	37075	17416
nC22	45138	21003
nC23	74790	29909
nC24	116959	42060
nC25	144168	46521
nC26	151515	48961
nC27	118606	40495
nC28	75799	29492
nC29	41656	18558
nC30	20022	9598
nC31	11522	5224
nC32	5630	2682
nC33	3045	1557
nC34	1685	811
nC35	944	438
nC36	575	225
nC37	305	128
nC38	227	73
nC39	362	59
nC40	156	47

Torkelson Geochemistry, Inc.							
Physical Properties Measurements							
Sample	TGI Job	Density (gm/ml)	Viscosity (centipoise)	Surface Tension Air/Water (dynes/cm)	Interfacial Tension NAPL/Water (dynes/cm)	Surface Tension Air/NAPL (dynes/cm)	Temperature of Measurements (Fahrenheit)
HMW08/050803	05119	0.7687	0.72	57.0	20.5	21.0	60
HMW19/050804	05119	0.7415	0.54	54.6	18.4	20.8	60
HMW19D/050804	05119	0.7415	0.51	52.7	17.4	19.9	60
HMW20/050803	05119	0.7428	0.57	62.4	21.4	20.0	60
HMW22/050804	05119	0.7657	0.66	58.4	21.2	21.2	60
HMW44C/050804	05119	0.7641	0.73	60.2	22.1	20.9	60
HMW45C/050803	05119	0.8169	1.59	64.1	23.5	24.4	60
HMW46C/050803	05119	0.8067	1.39	61.3	17.9	23.8	60
HMW48C/050803	05119	0.8481	2.83	62.1	19.0	26.3	60
MP29C/050803	05119	0.8528	3.39	63.3	20.7	26.4	60
MP29D/050803	05119	0.7827	0.89	59.6	19.3	21.9	60
MP29DD/050803	05119	0.7832	0.87	66.2	19.5	21.7	60
MP35D/050803	05119	0.7763	0.59	53.3	21.9	21.6	60
MP37D/050803	05119	0.7528	0.56	56.9	20.4	21.1	60
MP39C/050804	05119	0.7481	0.52	58.8	21.4	19.8	60
MP45C/050803	05119	0.7616	0.64	56.9	17.4	21.5	60
MP47C/050803	05119	0.7569	0.66	62.0	21.1	20.0	60
MP48B/050804 MP29C/050803	05119	0.7464	0.55	61.2*	21.1*	20.0	60
MP49C/050803	05119	0.7335	0.51	61.5	16.5	20.0	60
MP50C/050803	05119	0.7410	0.53	68.5	19.2	19.4	60
MP51D/050803	05119	0.7508	0.57	52.2	23.0	19.9	60
MP52C/050803	05119	0.7360	0.53	51.0	19.6	19.8	60
MP53C/050803	05119	0.7480	0.56	53.8	20.6	19.7	60
MP55C/050803	05119	0.7705	0.79	64.3	22.5	20.8	60
MP56C/050803	05119	0.7456	0.55	68.0	19.7	19.7	60
MP56CD/050803	05119	0.7456	0.54	65.1	18.3	19.7	60
MP57C/050803	05119	0.7567	0.58	68.3	19.0	20.2	60
MP60C/050803	05119	0.7430	0.52	51.3	16.0	19.7	60
MP79C/050809	05119	0.7616	0.49	67.5	24.1	19.2	60
MP80C/050809	05119	0.7570	0.47	68.8	19.9	19.2	60
RW-4A/050830	05119	0.7834	0.90	57.8	19.9	21.8	60
RW-5/050830	05119	0.7511	0.58	62.3	21.4	20.2	60

Water from MP29C was used with NAPL from MW48B due to no water present in monitoring well MW48B.

APPENDIX B

BAILDOWN TEST DATA SHEETS

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	HMW-18
Project Location:	Hartford, IL	Start Date:	08/24/05
Project No.:	15-03095.14-006	End Date:	08/24/05
PERSONNEL			
Field Person:	N. Bolivar		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method: 3' Disposable Bailer	
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A	
Screened Interval:		Tube/Pump Intake Depth: N/A	
Borehole ID:	---	Pump Rate: N/A	
MONITORING INSTRUMENT INFORMATION			
Geotech Interphase Probe			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	10:51		35.39	33.76		1.63	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	11:04	0:43	35.02	34.22		0.80	
8/24/2005	11:05	1:00	35.01	34.11		0.90	
8/24/2005	11:06	2:00	34.99	34.03		0.96	
8/24/2005	11:07	3:42	34.99	33.96		1.03	
8/24/2005	11:08	4:06	35.00	33.92		1.08	
8/24/2005	11:09	5:18	35.01	33.87		1.14	
8/24/2005	11:10	6:11	35.03	33.86		1.17	
8/24/2005	11:11	7:02	35.04	33.84		1.20	
8/24/2005	11:12	8:03	35.06	33.84		1.22	
8/24/2005	11:13	9:05	35.07	33.83		1.24	
8/24/2005	11:14	10:12	35.09	33.83		1.26	
8/24/2005	11:15	11:36	35.10	33.82		1.28	
8/24/2005	11:16	12:06	35.11	33.82		1.29	
8/24/2005	11:17	13:06	35.12	33.82		1.30	
8/24/2005	11:18	14:18	35.13	33.81		1.32	
8/24/2005	11:19	15:06	35.13	33.81		1.32	
8/24/2005	11:20	16:12	35.14	33.81		1.33	
8/24/2005	11:21	17:06	35.15	33.81		1.34	
8/24/2005	11:22	18:12	35.16	33.81		1.35	
8/24/2005	11:23	19:24	35.16	33.81		1.35	
8/24/2005	11:25	21:12	35.17	33.80		1.37	
8/24/2005	11:27	23:06	35.18	33.80		1.38	
8/24/2005	11:29	25:12	35.19	33.80		1.39	
8/24/2005	11:31	27:30	35.21	33.80		1.41	
8/24/2005	11:32	28:12	35.22	33.80		1.42	
8/24/2005	11:34	30:18	35.22	33.80		1.42	

NOTES: Purged 1.3 gallon of product (light & transparent) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	HMW-18
Project Location:	Hartford, IL	Start Date:	08/24/05
Project No.:	15-03095.14-006	End Date:	08/24/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	11:36	32:24	35.23	33.80		1.43	
8/24/2005	11:38	34:18	35.24	33.79		1.45	
8/24/2005	11:40	36:06	35.24	33.79		1.45	
8/24/2005	11:42	38:18	35.25	33.79		1.46	
8/24/2005	11:44	40:06	35.26	33.79		1.47	
8/24/2005	11:46	42:18	35.26	33.79		1.47	
8/24/2005	11:48	44:24	35.26	33.79		1.47	
8/24/2005	11:53	49:06	35.28	33.79		1.49	
8/24/2005	11:58	54:18	35.28	33.79		1.49	
8/24/2005	12:03	59:24	35.29	33.78		1.51	
8/24/2005	12:08	64:12	35.30	33.78		1.52	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	HMW-22
Project Location:	Hartford, IL	Start Date:	09/01/05
Project No.:	15-03095.14-006	End Date:	09/01/05

PERSONNEL	
Field Person:	A. Dorn

WELL INFORMATION		PURGE INFORMATION
Stick-up:	N/A	Purging Method: 3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A
Screened Interval:		Tube/Pump Intake Depth: N/A
Borehole ID:		Pump Rate: N/A

MONITORING INSTRUMENT INFORMATION
Geotech Product Indicator

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/31/2005	11:48		34.59	32.72		1.87	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
9/1/2005	8:22	0:00	32.86	32.42		0.44	
9/1/2005	8:23	1:45	32.90	32.45		0.45	
9/1/2005	8:24	2:45	32.99	32.43		0.56	
9/1/2005	8:25	3:15	33.02	32.42		0.60	
9/1/2005	8:26	0:00	33.06	32.41		0.65	
9/1/2005	8:27	4:45	33.11	32.40		0.71	
9/1/2005	8:28	5:30	33.13	32.39		0.74	
9/1/2005	8:29	6:30	33.17	32.38		0.79	
9/1/2005	8:30	7:30	33.20	32.38		0.82	
9/1/2005	8:31	8:30	33.22	32.37		0.85	
9/1/2005	8:32	9:15	33.23	32.37		0.86	
9/1/2005	8:32	10:00	33.25	32.36		0.89	
9/1/2005	8:33	11:00	33.27	32.36		0.91	
9/1/2005	8:34	12:00	33.29	32.36		0.93	
9/1/2005	8:35	13:00	33.31	32.36		0.95	
9/1/2005	8:36	14:00	33.32	32.35		0.97	
9/1/2005	8:37	15:00	33.32	32.35		0.97	
9/1/2005	8:39	17:00	33.33	32.35		0.98	
9/1/2005	8:40	19:00	33.34	32.35		0.99	
9/1/2005	8:41	20:00	33.35	32.34		1.01	

NOTES: Purged 0.25 gallon of product (brown) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION		
Project Name:	Hartford Working Group	Well ID:
Project Location:	Hartford, IL	Start Date:
Project No.:	15-03095.14-006	End Date:

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	HMW-45C
Project Location:	Hartford, IL	Start Date:	08/24/05
Project No.:	15-03095.14-006	End Date:	09/02/05
PERSONNEL			
Field Person:	N. Bolivar, A. Dorn		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method: 3' Disposable Bailer	
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A	
Screened Interval:	33.90-43.40 ft bgs	Tube/Pump Intake Depth: N/A	
Borehole ID:	---	Pump Rate: N/A	
MONITORING INSTRUMENT INFORMATION			
Geotech Interphase Probe			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	14:01		34.15	33.85		0.30	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	14:14	0:42	33.93	33.90		0.03	
8/24/2005	14:15	1:00	33.93	33.90		0.03	
8/24/2005	14:16	2:27	33.94	33.90		0.04	
8/24/2005	14:17	3:10	33.94	33.90		0.04	
8/24/2005	14:18	4:12	33.94	33.90		0.04	
8/24/2005	14:19	5:11	33.94	33.90		0.04	
8/24/2005	14:20	6:13	33.94	33.90		0.04	
8/24/2005	14:21	7:22	33.94	33.90		0.04	
8/24/2005	14:22	8:20	33.95	33.90		0.05	
8/24/2005	14:23	9:25	33.95	33.90		0.05	
8/24/2005	14:24	10:30	33.95	33.89		0.06	
8/24/2005	14:25	11:40	33.95	33.89		0.06	
8/24/2005	14:26	12:30	33.95	33.90		0.05	
8/24/2005	14:27	13:20	33.95	33.90		0.05	
8/24/2005	14:29	15:50	33.95	33.90		0.05	
8/24/2005	14:32	18:44	33.95	33.90		0.05	
8/24/2005	14:33	20:18	33.95	33.89		0.06	
8/24/2005	14:36	22:40	33.95	33.89		0.06	
8/24/2005	14:39	26:10	33.94	33.89		0.05	
8/24/2005	14:42	28:46	33.95	33.89		0.06	
8/24/2005	14:45	31:28	33.94	33.89		0.05	
8/24/2005	14:48	34:26	33.94	33.89		0.05	
8/24/2005	14:53	39:32	33.94	33.88		0.06	
8/24/2005	14:58	44:27	33.94	33.88		0.06	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	HMW-45C
Project Location:	Hartford, IL	Start Date:	08/24/05
Project No.:	15-03095.14-006	End Date:	09/02/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/24/2005	15:03	49:35	33.94	33.88		0.06	
8/24/2005	15:08	54:26	33.94	33.88		0.06	
8/24/2005	15:13	59:28	33.94	33.87		0.07	
8/24/2005	15:18	64:30	33.93	33.87		0.06	
8/24/2005	15:23	69:40	33.93	33.87		0.06	
8/25/2005	8:05	952	33.93	33.86		0.07	
8/25/2005	8:06	953	33.93	33.86		0.07	
8/26/2005	8:40	2427	33.85	33.77		0.08	
8/30/2005	8:50	8179	33.68	33.67		0.01	
8/30/2005	16:38	8665	33.69	33.68		0.01	
8/31/2005	8:25	9612	33.73	33.72		0.01	
8/31/2005	15:40	10047	33.71	33.70		0.01	
9/1/2005	9:37	11124	33.75	33.73		0.02	
9/1/2005	15:38	11485	33.76	33.73		0.03	
9/2/2005	12:01	12708	33.76	33.73		0.03	

NOTE: Product is very light and transparent. Purged 3 gallons of product and 1/2 gallon of water prior to test.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-35D
Project Location:	Hartford, IL	Start Date:	08/30/05
Project No.:	15-03095.14-006	End Date:	08/30/05
PERSONNEL			
Field Person:	A. Dorn		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method:	3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type:	N/A
Screened Interval:		Tube/Pump Intake Depth:	N/A
Borehole ID:		Pump Rate:	N/A
MONITORING INSTRUMENT INFORMATION			
Yellow Jacket			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	9:32		34.08	32.4		1.68	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	9:49	1:30	34.52	33.62		0.90	
8/30/2005	9:51	3:08	33.64	32.52		1.12	
8/30/2005	9:52	4:40	33.68	32.53		1.15	
8/30/2005	9:53	5:40	33.69	32.51		1.18	
8/30/2005	9:54	6:50	33.78	32.49		1.29	
8/30/2005	9:56	8:00	33.81	32.48		1.33	
8/30/2005	9:57	9:20	33.83	32.48		1.35	
8/30/2005	9:58	10:30	33.85	32.48		1.37	
8/30/2005	9:59	12:00	33.90	32.46		1.44	
8/30/2005	10:02	14:00	33.91	32.45		1.46	
8/30/2005	10:04	16:00	33.91	32.45		1.46	
8/30/2005	10:06	19:00	33.92	32.45		1.47	
8/30/2005	10:11	23:15	33.94	32.44		1.50	
8/30/2005	10:15	27:00	33.97	32.44		1.53	
8/30/2005	10:18	30:00	33.98	32.43		1.55	
8/30/2005	10:23	35:00	34.00	32.43		1.57	
8/30/2005	10:28	40:00	34.01	32.43		1.58	
8/30/2005	10:33	45:00	34.00	32.43		1.57	

NOTES: Purged 1 gallon of product (light yellow/brown) and 1 gallon of water using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	
Project Location:	Hartford, IL	Start Date:	
Project No.:	15-03095.14-006	End Date:	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-39C
Project Location:	Hartford, IL	Start Date:	08/31/05
Project No.:	15-03095.14-006	End Date:	09/02/05

PERSONNEL	
Field Person:	A. Dorn

WELL INFORMATION		PURGE INFORMATION
Stick-up:	NA	Purging Method: 3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A
Screened Interval:		Tube/Pump Intake Depth: N/A
Borehole ID:	---	Pump Rate: N/A

MONITORING INSTRUMENT INFORMATION
Yellow Jacket

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/31/2005	9:10		35.72	34.21		1.51	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/31/2005	9:19	0:45	35.14	34.70		0.44	
8/31/2005	9:19	1:30	35.04	34.64		0.40	
8/31/2005	9:20	2:00	35.03	34.61		0.42	
8/31/2005	9:20	2:45	35.03	34.58		0.45	
8/31/2005	9:21	3:45	35.02	34.53		0.49	
8/31/2005	9:22	4:45	35.02	34.52		0.50	
8/31/2005	9:23	5:45	35.03	34.50		0.53	
8/31/2005	9:24	6:45	35.04	34.50		0.54	
8/31/2005	9:26	8:00	35.04	34.48		0.56	
8/31/2005	9:27	9:00	35.03	34.47		0.56	
8/31/2005	9:29	10:00	35.04	34.47		0.57	
8/31/2005	9:31	12:00	35.05	34.47		0.58	
8/31/2005	9:33	14:00	35.05	34.45		0.60	
8/31/2005	9:35	16:00	35.06	34.46		0.60	
8/31/2005	9:37	18:00	35.05	34.46		0.59	
8/31/2005	9:39	20:00	35.07	34.46		0.61	
8/31/2005	9:44	25:00	35.07	34.46		0.61	
8/31/2005	9:49	30:00	35.06	34.45		0.61	
8/31/2005	9:59	40:00	35.07	34.46		0.61	
8/31/2005	10:09	50:00	35.07	34.46		0.61	
8/31/2005	10:19	60	35.07	34.45		0.62	
8/31/2005	10:34	75	35.07	34.44		0.63	
8/31/2005	10:49	90	35.09	34.45		0.64	
8/31/2005	16:15	416	35.06	34.38		0.68	
9/1/2005	9:54	1475	35.14	34.40		0.74	
9/1/2005	16:06	1874	35.11	34.39		0.72	
9/2/2005	12:21	3089	35.13	34.39		0.74	

NOTES: Purged 0.5 gallon of product (light yellow/brown) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-45C
Project Location:	Hartford, IL	Start Date:	08/30/05
Project No.:	15-03095.14-006	End Date:	08/30/05

PERSONNEL	
Field Person:	A. Dorn

WELL INFORMATION		PURGE INFORMATION
Stick-up:	N/A	Purging Method: 3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A
Screened Interval:		Tube/Pump Intake Depth: N/A
Borehole ID:		Pump Rate: N/A

MONITORING INSTRUMENT INFORMATION
Yellow Jacket

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	0:00		33.64	31.22		2.42	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	11:28	0:05	32.50	31.58		0.92	
8/30/2005	11:29	1:40	32.63	31.53		1.10	
8/30/2005	11:30	2:15	32.70	31.51		1.19	
8/30/2005	11:31	3:00	32.73	31.49		1.24	
8/30/2005	11:32	3:40	32.81	31.48		1.33	
8/30/2005	11:33	4:15	32.86	31.46		1.40	
8/30/2005	11:34	5:15	32.89	31.45		1.44	
8/30/2005	11:35	6:30	32.94	31.44		1.50	
8/30/2005	11:36	7:45	33.01	31.42		1.59	
8/30/2005	11:37	9:00	33.04	31.41		1.63	
8/30/2005	11:38	10:15	33.08	31.39		1.69	
8/30/2005	11:40	12:15	33.13	31.38		1.75	
8/30/2005	11:42	14:00	33.18	31.36		1.82	
8/30/2005	11:44	16:00	33.22	31.34		1.88	
8/30/2005	11:47	19:00	33.28	31.33		1.95	
8/30/2005	11:50	22:00	33.32	31.32		2.00	
8/30/2005	11:53	25:15	33.36	31.31		2.05	
8/30/2005	11:58	30:00	33.40	31.29		2.11	
8/30/2005	12:03	35:30	33.44	31.28		2.16	
8/30/2005	12:08	40:00	33.45	31.26		2.19	
8/30/2005	12:13	45:00	33.49	31.27		2.22	

NOTES: Purged 2.0 gallon of product (yellow/brown) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-49C
Project Location:	Hartford, IL	Start Date:	08/31/05
Project No.:	15-03095.14-006	End Date:	09/02/05
PERSONNEL			
Field Person:	A. Dorn		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method: 3' Disposable Bailer	
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A	
Screened Interval:		Tube/Pump Intake Depth: N/A	
Borehole ID:		Pump Rate: N/A	
MONITORING INSTRUMENT INFORMATION			
Geotech Product Indicator			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/31/2005	11:48		34.59	32.72		1.87	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/31/2005	13:32	1:00	33.45	33.16		0.29	
8/31/2005	13:33	2:00	33.46	33.15		0.31	
8/31/2005	13:34	3:00	33.46	33.15		0.31	
8/31/2005	13:34	3:30	33.47	33.15		0.32	
8/31/2005	13:35	4:00	33.45	33.14		0.31	
8/31/2005	13:36	5:00	33.45	33.13		0.32	
8/31/2005	13:37	6:00	33.47	33.13		0.34	
8/31/2005	13:39	8:00	33.47	33.13		0.34	
8/31/2005	13:41	10:00	33.48	33.13		0.35	
8/31/2005	13:43	12:00	33.48	33.12		0.36	
8/31/2005	13:45	14:00	33.48	33.12		0.36	
8/31/2005	13:47	16:00	33.49	33.13		0.36	
8/31/2005	13:49	18:00	33.49	33.12		0.37	
8/31/2005	13:51	20:00	33.49	33.12		0.37	
8/31/2005	13:56	25:00	33.48	33.11		0.37	
8/31/2005	14:01	30:00	33.50	33.11		0.39	
8/31/2005	14:06	35:00	33.50	33.11		0.39	
8/31/2005	14:11	40:00	33.57	33.11		0.46	
8/31/2005	14:16	45:00	33.52	33.11		0.41	
8/31/2005	14:21	50:00	33.51	33.11		0.40	
8/31/2005	14:31	60:00	33.52	33.11		0.41	
8/31/2005	14:46	75	33.53	33.09		0.44	
8/31/2005	15:01	90	33.54	33.09		0.45	
9/1/2005	9:25	1194	33.23	31.93		1.30	
9/2/2005	12:30	2819	34.60	32.76		1.84	

NOTES: Purged 1 gallon of product (light yellow/brown) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-52C
Project Location:	Hartford, IL	Start Date:	08/23/05
Project No.:	15-03095.14-006	End Date:	09/02/05

PERSONNEL	
Field Person:	N. Bolivar

WELL INFORMATION		PURGE INFORMATION
Stick-up:	NA	Purging Method: 3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A
Screened Interval:		Tube/Pump Intake Depth: N/A
Borehole ID:	---	Pump Rate: N/A

MONITORING INSTRUMENT INFORMATION
Geotech Interphase Probe

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/23/2005	14:25		33.08	31.59		1.49	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/23/2005	14:45	0:50	32.41	31.91		0.50	
8/23/2005	14:46	1:38	32.39	31.87		0.52	
8/23/2005	14:47	2:20	32.40	31.86		0.54	
8/23/2005	14:47	2:58	32.40	31.86		0.54	
8/23/2005	14:48	3:55	32.40	31.85		0.55	
8/23/2005	14:49	4:10	32.40	31.84		0.56	
8/23/2005	14:49	4:44	32.40	31.84		0.56	
8/23/2005	14:50	5:16	32.40	31.84		0.56	
8/23/2005	14:51	6:10	32.40	31.84		0.56	
8/23/2005	14:52	7:16	32.40	31.83		0.57	
8/23/2005	14:53	8:10	32.40	31.83		0.57	
8/23/2005	14:54	9:10	32.41	31.82		0.59	
8/23/2005	14:55	10:13	32.41	31.82		0.59	
8/23/2005	14:56	11:15	32.41	31.82		0.59	
8/23/2005	14:57	12:20	32.41	31.82		0.59	
8/23/2005	14:58	13:16	32.41	31.82		0.59	
8/23/2005	15:00	15:08	32.42	31.82		0.60	
8/23/2005	15:02	17:10	32.42	31.82		0.60	
8/23/2005	15:04	19:08	32.42	31.81		0.61	
8/23/2005	15:06	21:08	32.42	31.81		0.61	
8/23/2005	15:10	25:07	32.42	31.81		0.61	
8/23/2005	15:15	20:08	32.42	31.81		0.61	
8/23/2005	15:20	35:08	32.43	31.81		0.62	
8/23/2005	15:25	40:02	32.43	31.80		0.63	
8/23/2005	15:30	45:10	32.43	31.80		0.63	
8/23/2005	15:35	50:08	32.43	31.80		0.63	

NOTES: Purged 1.2 gallon of product (light & transparent) using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-52C
Project Location:	Hartford, IL	Start Date:	08/23/05
Project No.:	15-03095.14-006	End Date:	09/02/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/23/2005	15:40	55:10	32.43	31.80		0.63	
8/23/2005	15:50	65	32.43	31.80		0.63	
8/23/2005	16:00	75	32.43	31.80		0.63	
8/23/2005	16:08	83	32.43	31.80		0.63	
8/23/2005	16:12	88	32.43	31.80		0.63	
8/23/2005	16:23	99	32.43	31.80		0.63	
8/23/2005	16:36	112	32.43	31.79		0.64	
8/23/2005	16:56	131	32.43	31.79		0.64	
8/23/2005	17:05	140	32.43	31.79		0.64	
8/24/2005	8:28	1063	32.53	31.81		0.72	
8/24/2005	8:30	1065	32.54	31.81		0.73	
8/24/2005	16:03	1516	32.48	31.78		0.70	
8/24/2005	16:06	1519	32.48	31.78		0.70	
8/25/2005	7:44	2457	32.51	31.79		0.72	
8/25/2005	7:47	2460	32.51	31.79		0.72	
8/26/2005	9:29	4002	32.46	31.74		0.72	
8/30/2005	9:08	9783	32.53	31.62		0.91	
8/30/2005	16:50	10245	32.59	31.64		0.95	
8/31/2005	8:50	11205	32.72	31.67		1.05	
8/31/2005	16:28	11663	32.63	31.62		1.01	
9/1/2005	10:01	12716	32.78	31.64		1.14	
9/1/2005	15:08	13023	32.72	31.63		1.09	
9/2/2005	11:46	14261	32.82	31.65		1.17	
9/2/2005	11:48	14263	32.82	31.65		1.17	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-79C
Project Location:	Hartford, IL	Start Date:	08/12/05
Project No.:	15-03095.14-006	End Date:	08/19/05
PERSONNEL			
Field Person:	N. Bolivar		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method: 3' Disposable Bailer	
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A	
Screened Interval:	35.10-37.10 ft bgs	Tube/Pump Intake Depth: N/A	
Borehole ID:	---	Pump Rate: N/A	
MONITORING INSTRUMENT INFORMATION			
Geotech Interphase Probe			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/12/2005	9:33		35.46	31.49		3.97	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/12/2005	9:54	3:48	33.00	32.65		0.35	
8/12/2005	9:55	4:56	32.96	32.58		0.38	
8/12/2005	9:56	6:24	32.97	32.53		0.44	
8/12/2005	9:58	7:58	32.96	32.51		0.45	
8/12/2005	9:59	9:36	32.96	32.49		0.47	
8/12/2005	10:00	10:42	32.96	32.48		0.48	
8/12/2005	10:02	12:09	32.96	32.47		0.49	
8/12/2005	10:03	13:46	32.97	32.46		0.51	
8/12/2005	10:06	16:00	32.97	32.45		0.52	
8/12/2005	10:07	17:19	32.97	32.44		0.53	
8/12/2005	10:08	18:21	32.98	32.44		0.54	
8/12/2005	10:10	20:15	32.98	32.44		0.54	
8/12/2005	10:16	25:42	32.98	32.41		0.57	
8/12/2005	10:18	28:14	32.99	32.41		0.58	
8/12/2005	10:21	31:29	33.01	32.40		0.61	
8/12/2005	10:24	34:09	33.02	32.40		0.62	
8/12/2005	10:27	37:26	33.02	32.40		0.62	
8/12/2005	10:31	41:27	33.02	32.39		0.63	
8/12/2005	10:35	45:32	33.02	32.39		0.63	
8/12/2005	10:41	50:41	33.02	32.39		0.63	
8/12/2005	10:43	53:02	33.03	32.39		0.64	
8/12/2005	10:45	55:08	33.03	32.39		0.64	
8/12/2005	12:33	180	33.14	32.30		0.84	
8/17/2005	9:57	7224	35.78	31.56		4.22	

NOTES: Purged 1.0 gallon of product (light & transparent) and ~500 ml of water prior to test using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-79C
Project Location:	Hartford, IL	Start Date:	08/12/05
Project No.:	15-03095.14-006	End Date:	08/19/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/17/2005	17:08	7655	35.89	31.47		4.42	
8/18/2005	9:00	8607	35.86	31.58		4.28	
8/19/2005	13:24	10311	36.07	31.64		4.43	
8/25/2005	1355	18982	36.45	31.15		5.30	
8/26/2005	854	20121	36.46	31.10		5.36	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-79C
Project Location:	Hartford, IL	Start Date:	08/30/05
Project No.:	15-03095.14-006	End Date:	09/02/05
PERSONNEL			
Field Person:	N. Bolivar, A. Dorn		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method: 3' Disposable Bailer	
Casing ID:	2" PVC	Pump Make, Size, or Type: N/A	
Screened Interval:	35.10-37.10 ft bgs	Tube/Pump Intake Depth: N/A	
Borehole ID:	---	Pump Rate: N/A	
MONITORING INSTRUMENT INFORMATION			
Yellow Jacket			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	13:50		36.61	30.84		5.77	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	14:05	0.42	33.71	33.54		0.17	
8/30/2005	14:05	0.75	33.52	33.37		0.15	
8/30/2005	14:06	1.08	33.41	33.18		0.23	
8/30/2005	14:06	1.42	33.30	33.06		0.24	
8/30/2005	14:07	1.75	33.19	32.94		0.25	
8/30/2005	14:07	2.75	33.07	32.73		0.34	
8/30/2005	14:08	3.75	32.97	32.57		0.40	
8/30/2005	14:09	4.75	32.95	32.49		0.46	
8/30/2005	14:10	6.25	32.91	32.42		0.49	
8/30/2005	14:12	7.5	32.87	32.38		0.49	
8/30/2005	14:14	9	32.91	32.34		0.57	
8/30/2005	14:16	11	32.91	32.33		0.58	
8/30/2005	14:18	13	32.91	32.30		0.61	
8/30/2005	14:20	15	32.92	32.29		0.63	
8/30/2005	14:23	17	32.93	32.27		0.66	
8/30/2005	14:26	20	32.93	32.25		0.68	
8/30/2005	14:29	23	32.93	32.23		0.70	
8/30/2005	14:32	26	32.94	32.23		0.71	
8/30/2005	14:36	30	32.95	32.22		0.73	
8/30/2005	14:41	35	32.94	32.20		0.74	
8/30/2005	14:46	40	32.94	32.21		0.73	
8/30/2005	14:51	45	32.94	32.21		0.73	
8/30/2005	14:56	50	32.95	32.20		0.75	
8/30/2005	15:06	60	32.96	32.19		0.77	
8/30/2005	15:16	70	32.97	32.19		0.78	

NOTES: Purged 2.5 gallon of product (yellow) and 0.5 gallon of water prior to test using a 3' disposable bailer.

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-79C
Project Location:	Hartford, IL	Start Date:	08/12/05
Project No.:	15-03095.14-006	End Date:	08/19/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/30/2005	15:31	85	32.98	32.19		0.79	
8/30/2005	15:41	95	33.00	32.19		0.81	
8/30/2005	17:05	179	33.09	32.16		0.93	
8/31/2005	8:40	994	33.91	31.92		1.99	
8/31/2005	16:03	1437	34.12	31.81		2.31	
9/1/2005	9:45	2779	34.94	31.69		3.25	
9/1/2005	15:25	3119	35.10	31.54		3.56	
9/2/2005	12:13	4367	35.37	31.40		3.97	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-80C
Project Location:	Hartford, IL	Start Date:	08/09/05
Project No.:	15-03095.14-006	End Date:	08/19/05
PERSONNEL			
Field Person:	N. Bolivar		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	N/A	Purging Method:	3' Disposable Bailer
Casing ID:	2" PVC	Pump Make, Size, or Type:	N/A
Screened Interval:	33.90-43.40 ft bgs	Tube/Pump Intake Depth:	N/A
Borehole ID:	---	Pump Rate:	N/A
MONITORING INSTRUMENT INFORMATION			
Geotech Interphase Probe			

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/9/2005	15:14		36.56	31.27		5.29	

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/9/2005	16:03	1:00	32.68	32.66		0.02	
8/9/2005	16:04	2:00	32.70	32.65		0.05	
8/9/2005	16:05	3:00	32.70	32.66		0.04	
8/9/2005	16:06	4:00	32.71	32.65		0.06	
8/9/2005		5:00	32.70	32.66		0.04	
8/9/2005		6:00	32.71	32.66		0.05	
8/9/2005		7:00	32.73	32.65		0.08	
8/9/2005		8:00	32.72	32.65		0.07	
8/9/2005		9:00	32.72	32.64		0.08	
8/9/2005		10:00	32.73	32.64		0.09	
8/9/2005		16:00	32.72	32.65		0.07	
8/9/2005		17:48	32.72	32.64		0.08	
8/9/2005		19:48	32.73	32.64		0.09	
8/9/2005		23:48	32.76	32.65		0.11	
8/9/2005		25:49	32.74	32.65		0.09	
8/9/2005		28:26	32.74	32.64		0.10	
8/9/2005		30:25	32.75	32.64		0.11	
8/9/2005		31:31	32.74	32.64		0.10	
8/9/2005		33:36	32.74	32.63		0.11	
8/9/2005		34:57	32.74	32.63		0.11	
8/9/2005		38:29	32.74	32.63		0.11	
8/9/2005		40:27	32.74	32.63		0.11	
8/9/2005		46:28	32.74	32.63		0.11	
8/9/2005		55:58	32.74	32.63		0.11	

BAIL-DOWN RECOVERY TEST FORM

PROJECT INFORMATION			
Project Name:	Hartford Working Group	Well ID:	MP-80C
Project Location:	Hartford, IL	Start Date:	08/09/05
Project No.:	15-03095.14-006	End Date:	08/19/05

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to LNAPL (FT BTOC)	Total Depth (FT-BTOC)	LNAPL Thickness (Feet)	Linear Feet of Water
8/9/2005		60	32.74	32.63		0.11	
8/9/2005		62	32.74	32.63		0.11	
8/9/2005		67	32.74	32.63		0.11	
8/9/2005		69	32.74	32.63		0.11	
8/9/2005		72	32.75	32.63		0.12	
8/9/2005		75	32.75	32.63		0.12	
8/9/2005		157	32.77	32.62		0.15	
8/9/2005	18:42	160	32.77	32.62		0.15	
8/10/2005	7:32	930	32.91	32.68		0.23	
8/10/2005	7:37	935	32.91	32.66		0.25	
8/10/2005	18:51	1609	32.93	32.66		0.27	
8/11/2005	9:00	2458	33.04	32.70		0.34	
8/11/2005	9:02	2460	33.04	32.70		0.34	
8/11/2005	16:29	2907	32.97	32.63		0.34	
8/12/2005	8:54	3892	33.04	32.64		0.40	
8/12/2005	12:24	4102	33.02	32.63		0.39	
8/17/2005	10:10	11168	33.33	32.72		0.61	
8/17/2005	16:54	11572	33.33	32.67		0.66	
8/18/2005	8:30	12386	33.42	32.73		0.69	
8/19/2005	13:16	14112	33.52	32.82		0.70	
8/25/2005	1417	22813	33.40	32.61		0.79	
8/26/2005	907	23943	33.31	32.57		0.74	

NOTE: Product is very light and transparent. Purged 3 gallons of product and 1/2 gallon of water prior to test.

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-44C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/23/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	27.20-42.10	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 4 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	12:42:00	0	31.63	29.14	41.55	2.49	9.92

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	13:00:00	0.0	31.22	29.28	41.55	1.94	10.33
9/23/2004		0.5	31.34	29.23	41.55	2.11	10.21
9/23/2004		1.0	31.40	29.20	41.55	2.20	10.15
9/23/2004		1.5	31.44	29.19	41.55	2.25	10.11
9/23/2004		2.0	31.46	29.18	41.55	2.28	10.09
9/23/2004		2.5	31.49	29.16	41.55	2.33	10.06
9/23/2004		3.0	31.51	29.16	41.55	2.35	10.04
9/23/2004		3.5	31.53	29.16	41.55	2.37	10.02
9/23/2004		4.0	31.55	29.16	41.55	2.39	10.00
9/23/2004		4.5	31.60	29.13	41.55	2.47	9.95
9/23/2004		5.0	31.61	29.13	41.55	2.48	9.94
9/23/2004		5.5	31.62	29.13	41.55	2.49	9.93
9/23/2004		6.0	31.64	29.13	41.55	2.51	9.91
9/23/2004		6.5	31.66	29.12	41.55	2.54	9.89
9/23/2004		7.0	31.66	29.12	41.55	2.54	9.89
9/23/2004		7.5	31.67	29.12	41.55	2.55	9.88
9/23/2004		8.0	31.68	29.11	41.55	2.57	9.87
9/23/2004		8.5	31.68	29.11	41.55	2.57	9.87
9/23/2004		9.0	31.69	29.11	41.55	2.58	9.86
9/23/2004		9.5	31.70	29.10	41.55	2.60	9.85
9/23/2004		10.0	31.70	29.10	41.55	2.60	9.85
End Of Test							

Notes: BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-44C(2)
Project Location:	Hartford, IL	Start Date:	9/24/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	27.20-42.10	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 1 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004	11:06:00	0	31.72	29.14	41.55	2.58	9.83

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004	11:41:00	0	31.22	29.31	41.55	1.91	10.33
9/24/2004		0.5	31.28	29.30	41.55	1.98	10.27
9/24/2004		1.0	31.33	29.28	41.55	2.05	10.22
9/24/2004		1.5	31.37	29.26	41.55	2.11	10.18
9/24/2004		2.0	31.41	29.25	41.55	2.16	10.14
9/24/2004		2.5	31.45	29.24	41.55	2.21	10.10
9/24/2004		3.0	31.49	29.23	41.55	2.26	10.06
9/24/2004		3.5	31.50	29.21	41.55	2.29	10.05
9/24/2004		4.0	31.55	29.19	41.55	2.36	10.00
9/24/2004		4.5	31.58	29.19	41.55	2.39	9.97
9/24/2004		5.0	31.59	29.19	41.55	2.40	9.96
9/24/2004		6.0	31.61	29.18	41.55	2.43	9.94
9/24/2004		7.0	31.64	29.17	41.55	2.47	9.91
9/24/2004		8.0	31.67	29.16	41.55	2.51	9.88
9/24/2004		9.0	31.68	29.16	41.55	2.52	9.87
9/24/2004		10.0	31.69	29.16	41.55	2.53	9.86
9/24/2004		12.0	31.70	29.15	41.55	2.55	9.85
9/24/2004		14.0	31.72	29.14	41.55	2.58	9.83
9/24/2004	11:57:00	16.0	31.72	29.14	41.55	2.58	9.83
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-46C
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	31.20-40.90	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	12:57:00	0	32.93	32.73	45.40	0.20	12.47

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	13:06:00	0.0	32.78	32.77	45.40	0.01	12.62
9/22/2004		0.5	32.78	32.76	45.40	0.02	12.62
9/22/2004		1.0	32.78	32.75	45.40	0.03	12.62
9/22/2004		1.5	32.78	32.75	45.40	0.03	12.62
9/22/2004		2.0	32.78	32.74	45.40	0.04	12.62
9/22/2004		2.5	32.77	32.73	45.40	0.04	12.63
9/22/2004		3.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		3.5	32.78	32.73	45.40	0.05	12.62
9/22/2004		4.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		4.5	32.78	32.73	45.40	0.05	12.62
9/22/2004		5.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		6.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		7.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		8.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		9.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		10.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		12.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		14.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		20.0	32.78	32.73	45.40	0.05	12.62
9/22/2004		30.0	32.77	32.73	45.40	0.04	12.63
9/22/2004		86.0	32.76	32.72	45.40	0.04	12.64
9/22/2004	16:38:00	214.0	32.75	32.71	45.40	0.04	12.65
9/23/2004	8:51:00	1187.0	32.70	32.68	45.40	0.02	12.70
9/23/2004		1361.0	32.69	32.63	45.40	0.06	12.71

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-46C
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	17:11:00	1687.0	32.59	32.56	45.40	0.03	12.81
9/24/2004	9:02:00	2638.0	32.56	32.53	45.40	0.03	12.84
End of Test							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-48B
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/23/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	20.50-29.20	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	11:37:00	0	15.11	15.06	29.22	0.05	14.11

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	11:41:00	0.0	15.61	15.60	29.22	0.01	13.61
9/22/2004		0.5	15.54	15.53	29.22	0.01	13.68
9/22/2004		1.0	15.48	15.46	29.22	0.02	13.74
9/22/2004		1.5	15.44	15.42	29.22	0.02	13.78
9/22/2004		2.0	15.39	15.38	29.22	0.01	13.83
9/22/2004		2.5	15.36	15.34	29.22	0.02	13.86
9/22/2004		3.0	15.34	15.31	29.22	0.03	13.88
9/22/2004		3.5	15.31	15.29	29.22	0.02	13.91
9/22/2004		4.0	15.30	15.28	29.22	0.02	13.92
9/22/2004		4.5	15.28	15.26	29.22	0.02	13.94
9/22/2004		5.0	15.25	15.22	29.22	0.03	13.97
9/22/2004		6.0	15.20	15.18	29.22	0.02	14.02
9/22/2004		7.0	15.19	15.15	29.22	0.04	14.03
9/22/2004		8.0	15.17	15.13	29.22	0.04	14.05
9/22/2004		9.0	15.15	15.12	29.22	0.03	14.07
9/22/2004		10.0	15.15	15.11	29.22	0.04	14.07
9/22/2004		11.0	15.14	15.10	29.22	0.04	14.08
9/22/2004		12.0	15.12	15.09	29.22	0.03	14.10
9/22/2004		13.0	15.12	15.08	29.22	0.04	14.10
9/22/2004		14.0	15.12	15.07	29.22	0.05	14.10
9/22/2004		15.0	15.11	15.07	29.22	0.04	14.11
9/22/2004		16.0	15.10	15.06	29.22	0.04	14.12
9/22/2004		17.0	15.09	15.05	29.22	0.04	14.13
9/22/2004		18.0	15.09	15.05	29.22	0.04	14.13

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-48B
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/23/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004		19.0	15.10	15.05	29.22	0.05	14.12
9/22/2004		20.0	15.10	15.04	29.22	0.06	14.12
9/22/2004	12:02:00	21.0	15.09	15.04	29.22	0.05	14.13
9/24/2004	8:42:00	1261.0	15.16	15.13	29.22	0.03	14.06
End of Test							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-48C
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	32.00-40.70	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 1 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	9:10:00	0	31.82	27.71	40.96	4.11	9.14

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	9:22:20	0.0	30.45	30.32	40.96	0.13	10.51
9/22/2004		0.5	30.08	29.96	40.96	0.12	10.88
9/22/2004		1.0	29.91	29.68	40.96	0.23	11.05
9/22/2004		1.5	29.68	29.50	40.96	0.18	11.28
9/22/2004		2.0	29.54	29.31	40.96	0.23	11.42
9/22/2004		2.5	29.38	29.15	40.96	0.23	11.58
9/22/2004		3.0	29.27	29.02	40.96	0.25	11.69
9/22/2004		3.5	29.16	28.93	40.96	0.23	11.80
9/22/2004		4.0	29.08	28.84	40.96	0.24	11.88
9/22/2004		4.5	29.05	28.78	40.96	0.27	11.91
9/22/2004		5.0	28.96	28.72	40.96	0.24	12.00
9/22/2004		5.5	28.92	28.67	40.96	0.25	12.04
9/22/2004		6.0	28.89	28.64	40.96	0.25	12.07
9/22/2004		6.5	28.87	28.61	40.96	0.26	12.09
9/22/2004		7.0	28.84	28.57	40.96	0.27	12.12
9/22/2004		8.0	28.82	28.53	40.96	0.29	12.14
9/22/2004		9.0	28.76	28.51	40.96	0.25	12.20
9/22/2004		10.0	28.75	28.47	40.96	0.28	12.21
9/22/2004		11.0	28.74	28.46	40.96	0.28	12.22
9/22/2004		12.0	28.72	28.43	40.96	0.29	12.24
9/22/2004		14.0	28.69	28.42	40.96	0.27	12.27
9/22/2004		16.0	28.69	28.41	40.96	0.28	12.27
9/22/2004		18.0	28.68	28.40	40.96	0.28	12.28
9/22/2004		20.0	28.67	28.39	40.96	0.28	12.29

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-48C
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004		22.0	28.66	28.39	40.96	0.27	12.30
9/22/2004		24.0	28.67	28.38	40.96	0.29	12.29
9/22/2004		26.0	28.64	28.38	40.96	0.26	12.32
9/22/2004		28.0	28.64	28.37	40.96	0.27	12.32
9/22/2004		30.0	28.64	28.37	40.96	0.27	12.32
9/22/2004		35.0	28.64	28.36	40.96	0.28	12.32
9/22/2004		40.0	28.67	28.38	40.96	0.29	12.29
9/22/2004		45.0	28.69	28.36	40.96	0.33	12.27
9/22/2004		50.0	28.68	28.37	40.96	0.31	12.28
9/22/2004		55.0	28.68	28.36	40.96	0.32	12.28
9/22/2004		60.0	28.68	28.36	40.96	0.32	12.28
9/22/2004		70.0	28.65	28.36	40.96	0.29	12.31
9/22/2004		80.0	28.67	28.35	40.96	0.32	12.29
9/22/2004		90.0	28.70	28.35	40.96	0.35	12.26
9/22/2004		100.0	28.69	28.34	40.96	0.35	12.27
9/22/2004		110.0	28.69	28.34	40.96	0.35	12.27
9/22/2004		120.0	28.68	28.34	40.96	0.34	12.28
9/22/2004		163.0	28.68	28.33	40.96	0.35	12.28
9/22/2004		261	28.68	28.30	40.96	0.38	12.28
9/22/2004		321	28.75	28.28	40.96	0.47	12.21
9/22/2004	16:51:20	449	28.72	28.23	40.96	0.49	12.24
9/23/2004	8:43:00	1401	29.14	28.25	40.96	0.89	11.82
9/23/2004	11:41:00	1579	28.96	28.20	40.96	0.76	12.00
9/23/2004	17:03:00	1901	29.18	28.13	40.96	1.05	11.78
9/24/2004	8:45:00	2843	29.58	28.18	40.96	1.40	11.38
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	21.60-28.30	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	9:01:00	0	23.28	22.80	28.37	0.48	5.09

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	9:08:00	0.0	23.37	23.35	28.37	0.02	5.00
9/23/2004		0.5	23.35	23.31	28.37	0.04	5.02
9/23/2004		1.0	23.34	23.29	28.37	0.05	5.03
9/23/2004		1.5	23.32	23.28	28.37	0.04	5.05
9/23/2004		2.0	23.31	23.27	28.37	0.04	5.06
9/23/2004		2.5	23.31	23.27	28.37	0.04	5.06
9/23/2004		3.0	23.29	23.25	28.37	0.04	5.08
9/23/2004		3.5	23.29	23.24	28.37	0.05	5.08
9/23/2004		4.0	23.29	23.24	28.37	0.05	5.08
9/23/2004		4.5	23.28	23.23	28.37	0.05	5.09
9/23/2004		5.0	23.27	23.23	28.37	0.04	5.10
9/23/2004		6.0	23.25	23.21	28.37	0.04	5.12
9/23/2004		7.0	23.24	23.20	28.37	0.04	5.13
9/23/2004		8.0	23.23	23.19	28.37	0.04	5.14
9/23/2004		9.0	23.22	23.19	28.37	0.03	5.15
9/23/2004		10.0	23.20	23.17	28.37	0.03	5.17
9/23/2004		12.0	23.19	23.15	28.37	0.04	5.18
9/23/2004		14.0	23.18	23.14	28.37	0.04	5.19
9/23/2004		16.0	23.16	23.13	28.37	0.03	5.21
9/23/2004		21.0	23.13	23.10	28.37	0.03	5.24
9/23/2004		26.0	23.10	23.07	28.37	0.03	5.27
9/23/2004		31.0	23.08	23.06	28.37	0.02	5.29
9/23/2004		36.0	23.06	23.03	28.37	0.03	5.31
9/23/2004		51.0	23.02	23.00	28.37	0.02	5.35

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004		62.0	22.99	22.98	28.37	0.01	5.38
9/23/2004		77.0	22.95	22.92	28.37	0.03	5.42
9/23/2004		150.0	22.87	22.85	28.37	0.02	5.50
9/23/2004		207.0	22.86	22.85	28.37	0.01	5.51
9/23/2004		292.0	22.80	22.79	28.37	0.01	5.57
9/23/2004		377.0	22.79	22.78	28.37	0.01	5.58
9/23/2004	17:00:00	472.0	22.77	22.76	28.37	0.01	5.60
9/24/2004	8:53:00	1425.0	22.87	22.86	28.37	0.01	5.50
End of Test							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29D
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/23/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	31.50-41.20	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 1 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	15:28:00	0	32.34	30.66	41.00	1.68	8.66

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004	15:37:00	0.0	31.18	30.95	41.00	0.23	9.82
9/22/2004		0.5	31.35	30.93	41.00	0.42	9.65
9/22/2004		1.0	31.49	30.94	41.00	0.55	9.51
9/22/2004		1.5	31.47	30.93	41.00	0.54	9.53
9/22/2004		2.0	31.48	30.92	41.00	0.56	9.52
9/22/2004		2.5	31.50	30.92	41.00	0.58	9.50
9/22/2004		3.0	31.52	30.90	41.00	0.62	9.48
9/22/2004		3.5	31.55	30.89	41.00	0.66	9.45
9/22/2004		4.0	31.56	30.88	41.00	0.68	9.44
9/22/2004		4.5	31.59	30.87	41.00	0.72	9.41
9/22/2004		5.0	31.65	30.86	41.00	0.79	9.35
9/22/2004		6.0	31.69	30.85	41.00	0.84	9.31
9/22/2004		7.0	31.75	30.84	41.00	0.91	9.25
9/22/2004		8.0	31.80	30.82	41.00	0.98	9.20
9/22/2004		9.0	31.84	30.81	41.00	1.03	9.16
9/22/2004		10.0	31.86	30.80	41.00	1.06	9.14
9/22/2004		12.0	31.90	30.78	41.00	1.12	9.10
9/22/2004		14.0	31.94	30.77	41.00	1.17	9.06
9/22/2004		16.0	31.99	30.76	41.00	1.23	9.01
9/22/2004		18.0	32.01	30.75	41.00	1.26	8.99
9/22/2004		20.0	32.06	30.74	41.00	1.32	8.94
9/22/2004		22.0	32.06	30.74	41.00	1.32	8.94
9/22/2004		24.0	32.08	30.73	41.00	1.35	8.92
9/22/2004		26.0	32.09	30.72	41.00	1.37	8.91

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29D
Project Location:	Hartford, IL	Start Date:	9/22/2004
Project No.:	15-03095	End Date:	9/23/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/22/2004		28.0	32.11	30.72	41.00	1.39	8.89
9/22/2004		30.0	32.13	30.72	41.00	1.41	8.87
9/22/2004		35.0	32.18	30.72	41.00	1.46	8.82
9/22/2004		40.0	32.20	30.70	41.00	1.50	8.80
9/22/2004		45.0	32.24	30.68	41.00	1.56	8.76
9/22/2004		50.0	32.26	30.67	41.00	1.59	8.74
9/22/2004		55.0	32.25	30.68	41.00	1.57	8.75
9/22/2004	16:55:00	78.0	32.34	30.65	41.00	1.69	8.66
9/23/2004	9:00:00	1043.0	32.13	30.74	41.00	1.39	8.87
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29D (2)
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/23/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	31.50-41.20	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 0.75 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	9:45:00	0	32.18	30.73	41.00	1.45	8.82

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	9:52:00	0.0	30.97	30.97	41.00	0.00	10.03
9/23/2004		0.5	30.97	30.93	41.00	0.04	10.03
9/23/2004		1.0	31.10	30.92	41.00	0.18	9.90
9/23/2004		1.5	31.50	30.91	41.00	0.59	9.50
9/23/2004		2.0	31.52	30.90	41.00	0.62	9.48
9/23/2004		2.5	31.57	30.90	41.00	0.67	9.43
9/23/2004		3.0	31.59	30.89	41.00	0.70	9.41
9/23/2004		3.5	31.62	30.88	41.00	0.74	9.38
9/23/2004		4.0	31.66	30.87	41.00	0.79	9.34
9/23/2004		4.5	31.70	30.85	41.00	0.85	9.30
9/23/2004		5.0	31.74	30.85	41.00	0.89	9.26
9/23/2004		6.0	31.81	30.82	41.00	0.99	9.19
9/23/2004		7.0	31.83	30.82	41.00	1.01	9.17
9/23/2004		8.0	31.87	30.81	41.00	1.06	9.13
9/23/2004		9.0	31.91	30.80	41.00	1.11	9.09
9/23/2004		10.0	31.94	30.78	41.00	1.16	9.06
9/23/2004		12.0	31.99	30.77	41.00	1.22	9.01
9/23/2004		14.0	32.02	30.75	41.00	1.27	8.98
9/23/2004		16.0	32.05	30.74	41.00	1.31	8.95
9/23/2004		18.0	32.08	30.74	41.00	1.34	8.92
9/23/2004		20.0	32.08	30.73	41.00	1.35	8.92
9/23/2004		22.0	32.09	30.72	41.00	1.37	8.91
9/23/2004		24.0	32.11	30.71	41.00	1.40	8.89
9/23/2004		26.0	32.13	30.71	41.00	1.42	8.87

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-29D (2)
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/23/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004		28.0	32.16	30.70	41.00	1.46	8.84
9/23/2004		30.0	32.17	30.70	41.00	1.47	8.83
9/23/2004		32.0	32.17	30.69	41.00	1.48	8.83
9/23/2004	10:26:00	34.0	32.19	30.69	41.00	1.50	8.81
End Of Test							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-39C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	29.00-43.70	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 1 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	10:45:00	0	34.59	32.94	44.33	1.65	9.74

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	10:55:00	0	33.93	33.74	44.33	0.19	10.40
9/23/2004		0.5	33.75	33.53	44.33	0.22	10.58
9/23/2004		1.0	33.73	33.46	44.33	0.27	10.60
9/23/2004		1.5	33.71	33.43	44.33	0.28	10.62
9/23/2004		2.0	33.68	33.40	44.33	0.28	10.65
9/23/2004		2.5	33.65	33.36	44.33	0.29	10.68
9/23/2004		3.0	33.64	33.34	44.33	0.30	10.69
9/23/2004		3.5	33.61	33.33	44.33	0.28	10.72
9/23/2004		4.0	33.60	33.33	44.33	0.27	10.73
9/23/2004		4.5	33.60	33.32	44.33	0.28	10.73
9/23/2004		5.0	33.59	33.30	44.33	0.29	10.74
9/23/2004		6.0	33.60	33.30	44.33	0.30	10.73
9/23/2004		7.0	33.59	33.29	44.33	0.30	10.74
9/23/2004		8.0	33.59	33.29	44.33	0.30	10.74
9/23/2004		9.0	33.59	33.28	44.33	0.31	10.74
9/23/2004		10.0	33.60	33.28	44.33	0.32	10.73
9/23/2004		12.0	33.61	33.28	44.33	0.33	10.72
9/23/2004		14.0	33.60	33.26	44.33	0.34	10.73
9/23/2004		16.0	33.61	33.26	44.33	0.35	10.72
9/23/2004		18.0	33.61	33.25	44.33	0.36	10.72
9/23/2004		20.0	33.62	33.26	44.33	0.36	10.71
9/23/2004		25.0	33.62	33.25	44.33	0.37	10.71
9/23/2004		30.0	33.63	33.26	44.33	0.37	10.70
9/23/2004		35.0	33.61	33.27	44.33	0.34	10.72

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-39C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004		54.0	33.61	33.25	44.33	0.36	10.72
9/23/2004		95.0	33.61	33.23	44.33	0.38	10.72
9/23/2004		180.0	33.56	33.20	44.33	0.36	10.77
9/23/2004		275.0	33.59	33.21	44.33	0.38	10.74
9/23/2004	17:15:00	380.0	33.58	33.21	44.33	0.37	10.75
9/24/2004	9:10:00	1335.0	33.69	33.19	44.33	0.50	10.64
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-45C
Project Location:	Hartford, IL	Start Date:	9/24/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	29.00-43.70	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 2 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004	12:57:00	0	32.23	30.26	44.17	1.97	11.94

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004	13:11:00	0.0	31.00	30.66	44.17	0.34	13.17
9/24/2004		0.5	31.01	30.65	44.17	0.36	13.16
9/24/2004		1.0	31.01	30.65	44.17	0.36	13.16
9/24/2004		1.5	30.99	30.65	44.17	0.34	13.18
9/24/2004		2.0	31.02	30.66	44.17	0.36	13.15
9/24/2004		2.5	31.02	30.65	44.17	0.37	13.15
9/24/2004		3.0	30.99	30.65	44.17	0.34	13.18
9/24/2004		3.5	31.00	30.65	44.17	0.35	13.17
9/24/2004		4.0	31.02	30.65	44.17	0.37	13.15
9/24/2004		4.5	31.03	30.64	44.17	0.39	13.14
9/24/2004		5.0	31.03	30.65	44.17	0.38	13.14
9/24/2004		6.0	31.02	30.65	44.17	0.37	13.15
9/24/2004		7.0	31.02	30.65	44.17	0.37	13.15
9/24/2004		8.0	31.03	30.64	44.17	0.39	13.14
9/24/2004		10.0	31.04	30.64	44.17	0.40	13.13
9/24/2004		12.0	31.05	30.64	44.17	0.41	13.12
9/24/2004		14.0	30.99	30.64	44.17	0.35	13.18
9/24/2004		16.0	31.03	30.63	44.17	0.40	13.14
9/24/2004		18.0	31.02	30.63	44.17	0.39	13.15
9/24/2004		20.0	31.04	30.63	44.17	0.41	13.13
9/24/2004		25.0	31.02	30.63	44.17	0.39	13.15
9/24/2004		30.0	31.05	30.62	44.17	0.43	13.12
9/24/2004		40.0	31.07	30.62	44.17	0.45	13.10
9/24/2004		50.0	31.08	30.61	44.17	0.47	13.09

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-45C
Project Location:	Hartford, IL	Start Date:	9/24/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004		60.0	31.04	30.61	44.17	0.43	13.13
9/24/2004		85.0	31.09	30.59	44.17	0.50	13.08
9/24/2004		115.0	31.14	30.58	44.17	0.56	13.03
9/24/2004	15:36:00	145.0	31.17	30.57	44.17	0.60	13.00
End of Test							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-47C
Project Location:	Hartford, IL	Start Date:	9/24/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Person:	B. Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	23.55-38.35	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 3 gals.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/24/2004	9:45:00	0	31.58	29.16	38.37	2.42	6.79

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	10:00:00	0	30.33	29.61	38.37	0.72	8.04
9/23/2004		0.5	30.34	29.57	38.37	0.77	8.03
9/23/2004		1.0	30.35	29.56	38.37	0.79	8.02
9/23/2004		1.5	30.37	29.56	38.37	0.81	8.00
9/23/2004		2.0	30.37	29.56	38.37	0.81	8.00
9/23/2004		2.5	30.41	29.55	38.37	0.86	7.96
9/23/2004		3.0	30.44	29.53	38.37	0.91	7.93
9/23/2004		3.5	30.44	29.53	38.37	0.91	7.93
9/23/2004		4.0	30.44	29.53	38.37	0.91	7.93
9/23/2004		4.5	30.46	29.52	38.37	0.94	7.91
9/23/2004		5.0	30.48	29.52	38.37	0.96	7.89
9/23/2004		6.0	30.51	29.51	38.37	1.00	7.86
9/23/2004		7.0	30.49	29.51	38.37	0.98	7.88
9/23/2004		8.0	30.49	29.51	38.37	0.98	7.88
9/23/2004		9.0	30.49	29.51	38.37	0.98	7.88
9/23/2004		10.0	30.51	29.50	38.37	1.01	7.86
9/23/2004		12.0	30.50	29.50	38.37	1.00	7.87
9/23/2004		14.0	30.52	29.49	38.37	1.03	7.85
9/23/2004		16.0	30.53	29.49	38.37	1.04	7.84
9/23/2004		18.0	30.53	29.49	38.37	1.04	7.84
9/23/2004		20.0	30.55	29.49	38.37	1.07	7.82
9/23/2004		25.0	30.53	29.49	38.37	1.04	7.84
9/23/2004		30.0	30.54	29.48	38.37	1.06	7.83
9/23/2004	10:40:00	40.0	30.56	29.47	38.37	1.09	7.81

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-47C
Project Location:	Hartford, IL	Start Date:	9/24/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	10:55:00	55.0	30.57	29.47	38.37	1.10	7.80
9/23/2004		82.0	32.84	29.28	38.37	3.56	5.53
9/23/2004	12:02:00	122.0	32.84	29.97	38.37	2.87	5.53
END OF TEST							

Notes: FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-48B
Project Location:	Hartford, IL	Start Date:	9/28/2004
Project No.:	15-03095	End Date:	9/29/2004
Field Personnel:	N. Bolivar and A. Smith		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	28.50-43.20	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/28/2004	14:17:00	0	30.66	29.83	30.78	0.83	0.12

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/28/2004	15:07:00	0.95	30.72	30.25	30.78	0.47	0.06
9/28/2004		1.38	30.72	30.25	30.78	0.47	0.06
9/28/2004		1.68	30.71	30.24	30.78	0.47	0.07
9/28/2004		1.97	30.71	30.24	30.78	0.47	0.07
9/28/2004		2.27	30.71	30.24	30.78	0.47	0.07
9/28/2004		2.63	30.70	30.24	30.78	0.46	0.08
9/28/2004		2.98	30.71	30.23	30.78	0.48	0.07
9/28/2004		3.35	30.69	30.23	30.78	0.46	0.09
9/28/2004		3.82	30.69	30.22	30.78	0.47	0.09
9/28/2004		4.17	30.69	30.22	30.78	0.47	0.09
9/28/2004		4.48	30.68	30.22	30.78	0.46	0.10
9/28/2004		5.90	30.67	30.20	30.78	0.47	0.11
9/28/2004		7.18	30.66	30.19	30.78	0.47	0.12
9/28/2004		8.57	30.64	30.18	30.78	0.46	0.14
9/28/2004		9.90	30.63	30.18	30.78	0.45	0.15
9/28/2004		11.25	30.61	30.17	30.78	0.44	0.17
9/28/2004		12.40	30.60	30.07	30.78	0.53	0.18
9/28/2004		13.53	30.58	30.16	30.78	0.42	0.20
9/28/2004		13.97	30.57	30.15	30.78	0.42	0.21
9/28/2004		15.22	30.56	30.15	30.78	0.41	0.22
9/28/2004		19.65	30.54	30.14	30.78	0.40	0.24
9/28/2004		24.93	30.51	30.12	30.78	0.39	0.27
9/28/2004		30.30	30.48	30.11	30.78	0.37	0.30
9/28/2004		35.68	30.46	30.10	30.78	0.36	0.32

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-55C
Project Location:	Hartford, IL	Start Date:	9/28/2004
Project No.:	15-03095	End Date:	9/29/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/28/2004		41.13	30.44	30.08	30.78	0.36	0.34
9/28/2004		46.42	30.42	30.08	30.78	0.34	0.36
9/28/2004		51.72	30.41	30.07	30.78	0.34	0.37
9/28/2004		57.23	30.40	30.07	30.78	0.33	0.38
9/28/2004	16:14:00	67.23	30.36	30.03	30.78	0.33	0.42
9/29/2004	8:35:00	981.00	30.36	30.00	30.78	0.36	0.42
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-53C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	29.30-44.00	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 1.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	15:49:00	0	32.46	30.76	44.71	1.70	12.25

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	16:00:00	0	31.46	31.08	44.71	0.38	13.25
9/23/2004		0.5	31.51	31.08	44.71	0.43	13.20
9/23/2004		1.0	31.51	31.08	44.71	0.43	13.20
9/23/2004		1.5	31.51	31.07	44.71	0.44	13.20
9/23/2004		2.0	31.52	31.07	44.71	0.45	13.19
9/23/2004		2.5	31.53	31.07	44.71	0.46	13.18
9/23/2004		3.0	31.54	31.07	44.71	0.47	13.17
9/23/2004		3.5	31.54	31.07	44.71	0.47	13.17
9/23/2004		4.0	31.53	31.07	44.71	0.46	13.18
9/23/2004		4.5	31.55	31.07	44.71	0.48	13.16
9/23/2004		5.0	31.55	31.06	44.71	0.49	13.16
9/23/2004		6.0	31.51	31.06	44.71	0.45	13.20
9/23/2004		7.0	31.56	31.06	44.71	0.50	13.15
9/23/2004		8.0	31.55	31.06	44.71	0.49	13.16
9/23/2004		9.0	31.59	31.06	44.71	0.53	13.12
9/23/2004		10.0	31.56	31.06	44.71	0.50	13.15
9/23/2004		12.0	31.59	31.06	44.71	0.53	13.12
9/23/2004		14.0	31.60	31.06	44.71	0.54	13.11
9/23/2004		16.0	31.61	31.05	44.71	0.56	13.10
9/23/2004		23.0	31.60	31.04	44.71	0.56	13.11
9/23/2004		28.0	31.63	31.05	44.71	0.58	13.08
9/23/2004		33.0	31.62	31.05	44.71	0.57	13.09
9/23/2004		38.0	31.63	31.04	44.71	0.59	13.08
9/23/2004		48.0	31.64	31.04	44.71	0.60	13.07

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-53C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	17:19:00	79.0	31.65	31.03	44.71	0.62	13.06
9/24/2004	9:22:00	1042.0	31.74	31.06	44.71	0.68	12.97
9/24/2004	14:29:00	1349.0	31.65	31.02	44.71	0.63	13.06
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	MP-55C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004
Field Personnel:	B.Hoekman & S. Peterson		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	28.50-43.20 ´	Tube/Pump Intake Depth:	N/A
Borehole ID:	8.5	Pump Rate:	N/A (Bailed ≈ 3 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	14:21:00	0	32.88	29.20	43.26	3.68	10.38

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004	14:13:00	0	30.97	29.86	43.26	1.11	12.29
9/23/2004		0.5	31.02	29.81	43.26	1.21	12.24
9/23/2004		1.0	31.04	29.79	43.26	1.25	12.22
9/23/2004		1.5	31.14	29.78	43.26	1.36	12.12
9/23/2004		2.0	31.18	29.77	43.26	1.41	12.08
9/23/2004		2.5	31.22	29.76	43.26	1.46	12.04
9/23/2004		3.0	31.23	29.74	43.26	1.49	12.03
9/23/2004		3.5	31.27	29.74	43.26	1.53	11.99
9/23/2004		4.0	31.29	29.73	43.26	1.56	11.97
9/23/2004		4.5	31.30	29.73	43.26	1.57	11.96
9/23/2004		5.0	31.32	29.72	43.26	1.60	11.94
9/23/2004		6.0	31.35	29.71	43.26	1.64	11.91
9/23/2004		7.0	31.36	29.70	43.26	1.66	11.90
9/23/2004		8.0	31.38	29.69	43.26	1.69	11.88
9/23/2004		9.0	31.39	29.69	43.26	1.70	11.87
9/23/2004		10.0	31.39	29.69	43.26	1.70	11.87
9/23/2004		12.0	31.42	29.68	43.26	1.74	11.84
9/23/2004		14.0	31.42	29.68	43.26	1.74	11.84
9/23/2004		16.0	31.45	29.67	43.26	1.78	11.81
9/23/2004		18.0	31.47	29.67	43.26	1.80	11.79
9/23/2004		20.0	31.47	29.67	43.26	1.80	11.79
9/23/2004		25.0	31.49	29.65	43.26	1.84	11.77
9/23/2004		30.0	31.53	29.65	43.26	1.88	11.73
9/23/2004		35.0	31.57	29.62	43.26	1.95	11.69

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Premcor	Well ID:	MP-55C
Project Location:	Hartford, IL	Start Date:	9/23/2004
Project No.:	15-03095	End Date:	9/24/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
9/23/2004		40.0	31.57	29.63	43.26	1.94	11.69
9/23/2004		63.0	31.64	29.59	43.26	2.05	11.62
9/23/2004		107.0	31.80	29.55	43.26	2.25	11.46
9/23/2004	17:24:00	172.0	32.02	29.48	43.26	2.54	11.24
9/24/2004	9:17:00	1125.0	32.88	29.29	43.26	3.59	10.38
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-18
Project Location:	Hartford, IL	Start Date:	3/2/2004
Project No.:	15-03095	End Date:	3/3/2004
Field Personnel:	N. Bolivar		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	NA	Tube/Pump Intake Depth:	N/A
Borehole ID:	NA	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	13:25:00	0	36.85	34.92	41.38	1.93	4.53

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	13:40:00	0.0	36.88	34.94	41.38	1.94	4.50
3/2/2004	13:44:00	1.2	36.87	35.21	41.38	1.66	4.51
3/2/2004	13:45:00	2.0	36.77	35.15	41.38	1.62	4.61
3/2/2004	13:46:00	3.1	36.75	35.12	41.38	1.63	4.63
3/2/2004	13:47:00	4.1	36.72	35.09	41.38	1.63	4.66
3/2/2004	13:48:00	5.3	36.71	35.08	41.38	1.63	4.67
3/2/2004	13:49:00	6.8	36.69	35.06	41.38	1.63	4.69
3/2/2004	13:50:00	7.2	36.68	35.05	41.38	1.63	4.70
3/2/2004	13:51:00	8.2	36.67	35.05	41.38	1.62	4.71
3/2/2004	13:52:00	9.2	36.66	35.04	41.38	1.62	4.72
3/2/2004	13:53:00	10.1	36.66	35.03	41.38	1.63	4.72
3/2/2004	13:54:00	11.8	36.65	35.03	41.38	1.62	4.73
3/2/2004	13:55:00	12.4	36.65	35.02	41.38	1.63	4.73
3/2/2004	13:56:00	13.4	36.65	35.02	41.38	1.63	4.73
3/2/2004	13:57:00	14.1	36.64	35.01	41.38	1.63	4.74
3/2/2004	13:58:00	15.0	36.64	35.01	41.38	1.63	4.74
3/2/2004	13:58:00	15.6	36.64	35.01	41.38	1.63	4.74
3/2/2004	13:59:00	16.1	36.64	35.01	41.38	1.63	4.74
3/2/2004	14:00:00	17.4	36.64	35.01	41.38	1.63	4.74
3/2/2004	14:02:00	19.3	36.64	35.01	41.38	1.63	4.74
3/2/2004	14:03:00	20.4	36.64	35.01	41.38	1.63	4.74
3/2/2004	14:04:00	21.5	36.64	35.01	41.38	1.63	4.74
3/2/2004	14:05:00	22.5	36.63	35.01	41.38	1.62	4.75
3/2/2004	14:08:00	25.0	36.63	35.01	41.38	1.62	4.75

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-18
Project Location:	Hartford, IL	Start Date:	3/2/2004
Project No.:	15-03095	End Date:	3/3/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	14:10:00	27.4	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:11:00	28.2	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:12:00	29.35	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:13:00	30.25	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:15:00	31.6	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:16:00	32.6	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:17:00	34.1	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:22:00	39.4	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:26:00	44.2	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:31:00	48.2	36.63	35.00	41.38	1.63	4.75
3/2/2004	14:37:00	54.3	36.63	34.99	41.38	1.64	4.75
3/2/2004	14:44:00	60	36.62	34.99	41.38	1.63	4.76
3/2/2004	14:55:00	71	36.62	34.99	41.38	1.63	4.76
3/2/2004	15:00:00	76	36.63	34.99	41.38	1.64	4.75
3/2/2004	15:05:00	81	36.63	34.99	41.38	1.64	4.75
3/2/2004	15:10:00	86	36.63	35.00	41.38	1.63	4.75
3/2/2004	15:16:00	92	36.62	35.00	41.38	1.62	4.76
3/2/2004	15:24:00	100	36.63	34.99	41.38	1.64	4.75
3/2/2004	16:59:00	195	36.65	35.00	41.38	1.65	4.73
3/2/2004	17:13:00	209	36.65	35.00	41.38	1.65	4.73
3/2/2004	17:18:00	214	36.65	35.01	41.38	1.64	4.73
3/2/2004	17:24:00	220	36.65	35.00	41.38	1.65	4.73
3/2/2004	17:29:00	225	36.66	35.00	41.38	1.66	4.72
3/3/2004	8:31:00	1127	36.68	34.97	41.38	1.71	4.70
3/3/2004	16:21:00	1597	36.62	34.89	41.38	1.73	4.76
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-18 (2)
Project Location:	Hartford, IL	Start Date:	3/4/2004
Project No.:	15-03095	End Date:	3/4/2004
Field Personnel:	N. Bolivar		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	NA	Tube/Pump Intake Depth:	N/A
Borehole ID:	NA	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	10:53:00	0	36.58	34.83	41.38	1.75	4.80

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	11:17:00	0.5	35.82	35.47	41.38	0.35	5.56
3/4/2004	11:18:00	1.4	35.76	35.36	41.38	0.40	5.62
3/4/2004	11:19:00	2.4	35.72	35.26	41.38	0.46	5.66
3/4/2004	11:20:00	3.3	35.70	35.22	41.38	0.48	5.68
3/4/2004	11:21:00	4.3	35.68	35.18	41.38	0.50	5.70
3/4/2004	11:22:00	5.2	35.67	35.16	41.38	0.51	5.71
3/4/2004	11:23:00	6.1	35.65	35.15	41.38	0.50	5.73
3/4/2004	11:24:00	7.1	35.64	35.13	41.38	0.51	5.74
3/4/2004	11:25:00	8.0	35.64	35.12	41.38	0.52	5.74
3/4/2004	11:26:00	9.7	35.64	35.11	41.38	0.53	5.74
3/4/2004	11:27:00	10.1	35.62	35.10	41.38	0.52	5.76
3/4/2004	11:28:00	11.1	35.62	35.10	41.38	0.52	5.76
3/4/2004	11:29:00	12.2	35.62	35.10	41.38	0.52	5.76
3/4/2004	11:31:00	13.5	35.62	35.09	41.38	0.53	5.76
3/4/2004	11:32:00	15.2	35.62	35.09	41.38	0.53	5.76
3/4/2004	11:33:00	16.4	35.62	35.08	41.38	0.54	5.76
3/4/2004	11:34:00	17.4	35.61	35.08	41.38	0.53	5.77
3/4/2004	11:35:00	18.4	35.61	35.08	41.38	0.53	5.77
3/4/2004	11:36:00	19.4	35.61	35.08	41.38	0.53	5.77
3/4/2004	11:38:00	21.1	35.61	35.07	41.38	0.54	5.77
3/4/2004	11:42:00	24.5	35.61	35.06	41.38	0.55	5.77
3/4/2004	11:43:00	25.5	35.61	35.07	41.38	0.54	5.77
3/4/2004	11:44:00	26.5	35.61	35.06	41.38	0.55	5.77
3/4/2004	11:45:00	27.4	35.60	35.06	41.38	0.54	5.78

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-18 (2)
Project Location:	Hartford, IL	Start Date:	3/4/2004
Project No.:	15-03095	End Date:	3/4/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	11:46:00	29.4	35.60	35.06	41.38	0.54	5.78
3/4/2004	11:48:00	30.6	35.60	35.06	41.38	0.54	5.78
3/4/2004	11:49:00	32.2	35.60	35.06	41.38	0.54	5.78
3/4/2004	11:52:00	35.4	35.61	35.06	41.38	0.55	5.77
3/4/2004	11:54:00	37.3	35.61	35.06	41.38	0.55	5.77
3/4/2004	11:55:00	39.2	35.67	35.06	41.38	0.61	5.71
3/4/2004	11:59:00	41.5	35.61	35.05	41.38	0.56	5.77
3/4/2004	12:00:00	43.3	35.61	35.05	41.38	0.56	5.77
3/4/2004	12:03:00	46.7	35.60	35.05	41.38	0.55	5.78
3/4/2004	12:08:00	51.4	35.60	35.04	41.38	0.56	5.78
3/4/2004	12:13:00	55.5	35.60	35.04	41.38	0.56	5.78
3/4/2004	12:15:00	58.1	35.60	35.04	41.38	0.56	5.78
3/4/2004	12:18:00	61.2	35.60	35.03	41.38	0.57	5.78
3/4/2004	12:21:00	63.5	35.60	35.03	41.38	0.57	5.78
3/4/2004	12:24:00	67.2	35.60	35.03	41.38	0.57	5.78
3/4/2004	12:31:00	74.2	35.61	35.02	41.38	0.59	5.77
3/4/2004	12:37:00	80.4	35.60	35.02	41.38	0.58	5.78
3/4/2004	12:42:00	84.6	35.60	35.02	41.38	0.58	5.78
3/4/2004	17:00:00	367	35.72	35.07	41.38	0.65	5.66
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-19
Project Location:	Hartford, IL	Start Date:	3/2/2004
Project No.:	15-03095	End Date:	3/3/2004
Field Personnel:	N. Bolivar		
WELL INFORMATION		**PURGE INFORMATION**	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	NA	Tube/Pump Intake Depth:	N/A
Borehole ID:	NA	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	15:43:00	0	36.25	34.85	40.85	1.40	4.60

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	15:47:00	0.0	36.25	34.85	41.38	1.40	5.13
3/2/2004	15:48:00	1.0	36.23	35.11	41.38	1.12	5.15
3/2/2004	15:48:00	1.5	36.19	35.06	41.38	1.13	5.19
3/2/2004	15:49:00	2.4	36.17	35.02	41.38	1.15	5.21
3/2/2004	15:50:00	3.3	36.15	34.99	41.38	1.16	5.23
3/2/2004	15:51:00	4.2	36.14	34.97	41.38	1.17	5.24
3/2/2004	15:52:00	5.6	36.13	34.95	41.38	1.18	5.25
3/2/2004	15:53:00	6.6	36.13	34.94	41.38	1.19	5.25
3/2/2004	15:54:00	7.1	36.13	34.93	41.38	1.20	5.25
3/2/2004	15:55:00	7.5	36.12	34.92	41.38	1.20	5.26
3/2/2004	15:56:00	9.1	36.13	34.92	41.38	1.21	5.25
3/2/2004	15:56:00	9.5	36.13	34.92	41.38	1.21	5.25
3/2/2004	15:57:00	10.4	36.13	34.92	41.38	1.21	5.25
3/2/2004	15:59:00	12.5	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:00:00	13.6	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:01:00	14.9	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:02:00	15.1	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:03:00	16.0	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:03:00	16.5	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:04:00	17.5	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:05:00	18.4	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:06:00	19.4	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:07:00	20.3	36.13	34.91	41.38	1.22	5.25
3/2/2004	16:09:00	21.4	36.13	34.91	41.38	1.22	5.25

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-19
Project Location:	Hartford, IL	Start Date:	3/2/2004
Project No.:	15-03095	End Date:	3/3/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/2/2004	16:12:00	25.5	36.14	34.90	41.38	1.24	5.24
3/2/2004	16:13:00	26.5	36.14	34.90	41.38	1.24	5.24
3/2/2004	16:14:00	27.5	36.14	34.90	41.38	1.24	5.24
3/2/2004	16:15:00	28.5	36.14	34.90	41.38	1.24	5.24
3/2/2004	16:16:00	29.4	36.14	34.90	41.38	1.24	5.24
3/2/2004	16:22:00	35.4	36.15	34.89	41.38	1.26	5.23
3/2/2004	16:27:00	40.4	36.16	34.89	41.38	1.27	5.22
3/2/2004	16:32:00	45.3	36.16	34.89	41.38	1.27	5.22
3/2/2004	16:37:00	49	36.16	34.89	41.38	1.27	5.22
3/2/2004	16:42:00	55.4	36.17	34.89	41.38	1.28	5.21
3/2/2004	16:47:00	60	36.17	34.89	41.38	1.28	5.21
3/2/2004	17:36:00	109.4	36.21	34.89	41.38	1.32	5.17
3/2/2004	17:44:00	117.2	36.21	34.89	41.38	1.32	5.17
3/3/2004	8:52:00	1025.4	36.23	34.85	41.38	1.38	5.15
3/3/2004	16:02:00	1455	36.16	34.77	41.38	1.39	5.22
END OF TEST							

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-19 (2)
Project Location:	Hartford, IL	Start Date:	3/4/2004
Project No.:	15-03095	End Date:	3/4/2004
Field Personnel:	N. Bolivar		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	NA	Tube/Pump Intake Depth:	N/A
Borehole ID:	NA	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	14:12:00	0	35.94	34.64	40.85	1.30	4.91

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	14:32:00	0.0	35.43	35.01	41.38	0.42	5.95
3/4/2004	14:32:00	1.0	35.41	34.96	41.38	0.45	5.97
3/4/2004	14:33:00	1.4	35.39	34.92	41.38	0.47	5.99
3/4/2004	14:33:00	2.2	35.38	34.89	41.38	0.49	6.00
3/4/2004	14:34:00	2.5	35.37	34.87	41.38	0.50	6.01
3/4/2004	14:35:00	3.3	35.36	34.86	41.38	0.50	6.02
3/4/2004	14:35:00	4.2	35.35	34.86	41.38	0.49	6.03
3/4/2004	14:36:00	5.5	35.35	34.83	41.38	0.52	6.03
3/4/2004	14:37:00	5.9	35.35	34.82	41.38	0.53	6.03
3/4/2004	14:38:00	6.3	35.34	34.81	41.38	0.53	6.04
3/4/2004	14:38:00	7.1	35.34	34.81	41.38	0.53	6.04
3/4/2004	14:39:00	7.6	35.34	34.81	41.38	0.53	6.04
3/4/2004	14:40:00	8.4	35.34	34.80	41.38	0.54	6.04
3/4/2004	14:40:00	9.2	35.34	34.80	41.38	0.54	6.04
3/4/2004	14:41:00	10.2	35.35	34.79	41.38	0.56	6.03
3/4/2004	14:42:00	11.1	35.35	34.79	41.38	0.56	6.03
3/4/2004	14:44:00	12.3	35.36	34.78	41.38	0.58	6.02
3/4/2004	14:45:00	14.2	35.38	34.78	41.38	0.60	6.00
3/4/2004	14:46:00	15.3	35.38	34.78	41.38	0.60	6.00
3/4/2004	14:48:00	16.2	35.39	34.77	41.38	0.62	5.99
3/4/2004	14:48:00	17.2	35.39	34.77	41.38	0.62	5.99
3/4/2004	14:49:00	18.2	35.40	34.77	41.38	0.63	5.98
3/4/2004	14:50:00	19.1	35.40	34.77	41.38	0.63	5.98
3/4/2004	14:51:00	19.5	35.41	34.77	41.38	0.64	5.97

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-19 (2)
Project Location:	Hartford, IL	Start Date:	3/4/2004
Project No.:	15-03095	End Date:	3/4/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/4/2004	14:52:00	21.1	35.41	34.76	41.38	0.65	5.97
3/4/2004	14:53:00	22.2	35.42	34.76	41.38	0.66	5.96
3/4/2004	14:54:00	22.4	35.42	34.76	41.38	0.66	5.96
3/4/2004	14:55:00	23.5	35.43	34.76	41.38	0.67	5.95
3/4/2004	14:56:00	24.3	35.43	34.76	41.38	0.67	5.95
3/4/2004	14:56:00	25.2	35.44	34.76	41.38	0.68	5.94
3/4/2004	14:57:00	26.7	35.44	34.75	41.38	0.69	5.94
3/4/2004	14:59:00	28.2	35.45	34.75	41.38	0.70	5.93
3/4/2004	15:00:00	29.1	35.45	34.75	41.38	0.70	5.93
3/4/2004	15:03:00	31.3	35.46	34.74	41.38	0.72	5.92
3/4/2004	15:05:00	33.3	35.46	34.74	41.38	0.72	5.92
3/4/2004	15:07:00	35.5	35.47	34.73	41.38	0.74	5.91
3/4/2004	15:10:00	38.3	35.47	34.73	41.38	0.74	5.91
3/4/2004	15:12:00	41.2	35.48	34.72	41.38	0.76	5.90
3/4/2004	15:14:00	43.2	35.49	34.72	41.38	0.77	5.89
3/4/2004	15:17:00	45.4	35.49	34.71	41.38	0.78	5.89
3/4/2004	15:20:00	48.6	35.50	34.71	41.38	0.79	5.88
3/4/2004	15:23:00	51.4	35.51	34.71	41.38	0.80	5.87
3/4/2004	15:27:00	56.3	35.52	34.70	41.38	0.82	5.86
3/4/2004	15:32:00	60.3	35.53	34.69	41.38	0.84	5.85
3/4/2004	15:35:00	64.1	35.53	34.69	41.38	0.84	5.85
3/4/2004	15:41:00	70.2	35.55	34.68	41.38	0.87	5.83
3/4/2004	15:45:00	74.1	35.55	34.68	41.38	0.87	5.83
3/4/2004	15:59:00	88.1	35.59	34.68	41.38	0.91	5.79
3/4/2004	16:32:00	119.5	35.64	34.65	41.38	0.99	5.74
3/4/2004	16:33:00	121.5	35.63	34.65	41.38	0.98	5.75
3/4/2004	16:34:00	122.4	35.63	34.65	41.38	0.98	5.75

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-20
Project Location:	Hartford, IL	Start Date:	3/3/2004
Project No.:	15-03095	End Date:	3/3/2004
Field Personnel:	N. Bolivar		

WELL INFORMATION		PURGE INFORMATION	
Stick-up:	Flush Mount	Purging Method:	Bailer
Casing ID:	2"	Pump Make, Size, or Type:	N/A
Screened Interval:	NA	Tube/Pump Intake Depth:	N/A
Borehole ID:	NA	Pump Rate:	N/A (Bailed ≈ 0.5 gal.)

PRE-TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/3/2004	10:18:00	0	34.43	32.75	NM	1.68	NM

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/3/2004	11:17:00	0.0	33.94	32.93	NM	1.01	NM
3/3/2004	11:18:00	1.4	34.00	32.91	NM	1.09	NM
3/3/2004	11:19:00	2.4	34.03	32.89	NM	1.14	NM
3/3/2004	11:20:00	3.4	34.06	32.88	NM	1.18	NM
3/3/2004	11:21:00	4.4	34.08	32.87	NM	1.21	NM
3/3/2004	11:22:00	5.4	34.11	32.87	NM	1.24	NM
3/3/2004	11:23:00	6.4	34.13	32.85	NM	1.28	NM
3/3/2004	11:24:00	7.4	34.15	32.85	NM	1.30	NM
3/3/2004	11:25:00	8.4	34.16	32.84	NM	1.32	NM
3/3/2004	11:26:00	9.4	34.17	32.83	NM	1.34	NM
3/3/2004	11:27:00	10.5	34.17	32.83	NM	1.34	NM
3/3/2004	11:28:00	11.5	34.18	32.82	NM	1.36	NM
3/3/2004	11:29:00	12.4	34.19	32.82	NM	1.37	NM
3/3/2004	11:30:00	13.3	34.20	32.82	NM	1.38	NM
3/3/2004	11:31:00	14.3	34.20	32.81	NM	1.39	NM
3/3/2004	11:32:00	15.1	34.21	32.81	NM	1.40	NM
3/3/2004	11:33:00	16.2	34.21	32.81	NM	1.40	NM
3/3/2004	11:34:00	17.2	34.22	32.80	NM	1.42	NM
3/3/2004	11:35:00	18.4	34.23	32.80	NM	1.43	NM
3/3/2004	11:36:00	19.5	34.24	32.79	NM	1.45	NM
3/3/2004	11:37:00	20.5	34.24	32.79	NM	1.45	NM
3/3/2004	11:38:00	21.4	34.24	32.79	NM	1.45	NM
3/3/2004	11:39:00	22.6	34.25	32.78	NM	1.47	NM
3/3/2004	11:41:00	27.4	34.26	32.78	NM	1.48	NM

BAIL-DOWN RECOVERY TEST FORM

ILR000128249 -- Madison County -- LPC1190505040
The Hartford Area Hydrocarbon Plume Site
The Hartford Working Group / Hartford, Illinois

PROJECT INFORMATION			
Project Name:	Hartford Work Group	Well ID:	HMW-20
Project Location:	Hartford, IL	Start Date:	3/3/2004
Project No.:	15-03095	End Date:	3/3/2004

TEST INFORMATION

Date	Time (24 Hour)	Time Elapsed (Minutes)	Depth to Water (FT-BTOC)	Depth to FPH (FT-BTOC)	Total Depth (FT-BTOC)	FPH Thickness (Feet)	Linear Feet of Water in Well
3/3/2004	11:43:00	26.6	34.26	32.77	NM	1.49	NM
3/3/2004	11:44:00	27.1	34.27	32.77	NM	1.50	NM
3/3/2004	11:45:00	28.3	34.27	32.77	NM	1.50	NM
3/3/2004	11:46:00	29.3	34.27	32.77	NM	1.50	NM
3/3/2004	11:47:00	31.1	34.28	32.76	NM	1.52	NM
3/3/2004	11:49:00	32.9	34.28	32.76	NM	1.52	NM
3/3/2004	11:50:00	33.1	34.28	32.76	NM	1.52	NM
3/3/2004	11:51:00	34.5	34.29	32.75	NM	1.54	NM
3/3/2004	11:52:00	35.5	34.29	32.75	NM	1.54	NM
3/3/2004	11:54:00	37.25	34.30	32.75	NM	1.55	NM
3/3/2004	11:55:00	38.2	34.30	32.75	NM	1.55	NM
3/3/2004	11:56:00	39.3	34.30	32.75	NM	1.55	NM
3/3/2004	11:58:00	41.2	34.30	32.75	NM	1.55	NM
3/3/2004	12:00:00	43.4	34.30	32.74	NM	1.56	NM
3/3/2004	12:02:00	46.7	34.30	32.74	NM	1.56	NM
3/3/2004	12:06:00	49.2	34.31	32.73	NM	1.58	NM
3/3/2004	12:08:00	51.3	34.31	32.73	NM	1.58	NM
3/3/2004	12:10:00	54.6	34.31	32.73	NM	1.58	NM
3/3/2004	12:13:00	56.3	34.31	32.73	NM	1.58	NM
3/3/2004	12:16:00	59.3	34.32	32.73	NM	1.59	NM
3/3/2004	12:19:00	62.2	34.32	32.73	NM	1.59	NM
3/3/2004	12:29:00	72.1	34.32	32.72	NM	1.60	NM
3/3/2004	12:37:00	80.5	34.33	32.72	NM	1.61	NM
3/3/2004	12:48:00	91.1	34.33	32.71	NM	1.62	NM
3/3/2004	13:15:00	118.1	34.32	32.69	NM	1.63	NM

Notes:
BGS = Below ground surface
FPH = Free phase hydrocarbon
BTOC = Below top of casing
N/A = Not applicable

APPENDIX C

PTS ANALYTICAL REPORT

CORE PHOTOGRAPHY AND PHYSICAL PROPERTIES DATA

Hartford Working Group

Project No: 15-03095.14-006

Borings: HCSB-1, HCSB-2, and HCSB-3

PTS File No.: 35565 **September 2005**

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ENVIRONMENTAL SERVICES

October 31, 2005

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3140 Finley Road
Downers Grove, IL 60515

Re: Physical Properties Data and Core Photography
Hartford Working Group; 15-03095.14-006
PTS File No: 35565

Dear Mr. Martin:

Please find enclosed final data for Physical Properties Analyses conducted upon material from your Hartford Working Group; 15-03095.14-006 project. All analyses were performed by applicable ASTM, EPA, or API methodologies. An electronic version of the report has previously been sent to your attention and the electronic data is enclosed on compact disk along with the core image archive (Core PhotoLog). The remaining core is currently in frozen storage and will be retained indefinitely pending additional analyses. We await your instructions. You may contact me regarding long term storage, disposal or return of the core.

PTS Laboratories, Inc. appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 907-3607.

Sincerely,
PTS Laboratories, Inc.

Michael Mark Brady, P.G.
Project Manager

Encl.

8100 Secura Way – Santa Fe Springs, CA 90670
Phone 562.907.3607 Fax 562.907.3610
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PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Drng. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4;3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-1/9.5-11.5'/050923	9.5-11.5(A)	1.9	3	10.0, 10.15, 10.6, 11.1	10.45		9.6, 10.3, 10.8	
HCSB-1/11.5-13.5'/050923	11.5-13.5(B)	2.0	2	12.1	12.25			
HCSB-1/16.5-18.5'/050926	16.5-18.5(C)	2.1	3	17.15	17.7		17.0, 17.4	
HCSB-1/18.5-20.5'/050926	18.5-20.5(D)	2.1	3	19.1, 19.4, 20.2	19.8	19.6	20.05	
HCSB-1/20.5-22.5'/050926	20.5-22.5(E)	2.2	3	21.9, 22.4				
HCSB-1/27-29'/050926	27.0-29.0(F)	2.0	2	27.3, 27.8, 28.4	28.2			
HCSB-1/29-31'/050926	29.0-31.0(G)	1.7	2	29.75, 30.15	30.3	29.65	30.0	
HCSB-1/31-33'/050926	31.0-33.0(H)	1.7	2	31.15, 31.6, 32.25	31.3	32.1	32.4	
HCSB-1/33-35'/050926	33.0-35.0(I)	1.7	2	33.3	33.5			
HCSB-1/35-37'/050926	35.0-37.0(J)	0.85	1	37.6				
HCSB-1/37-39'/050926	37.0-39.0(K)	1.0	1					
HCSB-1/39-41'/050926	39.0-41.0(L)	1.4	2	39.2, 39.4, 39.7		40.2	40.3	
HCSB-1/41-43'/050926	41.0-43.0(M)	1.6	2	41.6	41.6			
HCSB-1/43-45'/050926	43.0-45.0(N)	1.45	2					
HCSB-2/9-11'/000923	9.0-11.0(A)	2.0	2					
HCSB-2/11-13'/000923	11.0-13.0(B)	2.0	2					
HCSB-2/17-19'/000923	17.0-19.0©	2.0	2	17.7	17.5			
HCSB-2/19-21'/000923	19.0-21.0(D)	2.0	2					
HCSB-2/27-29'/000923	27.0-29.0(E)	1.7	2	28.5				
HCSB-2/29-31'/000923	29.0-31.0(F)	1.6	2	29.3	29.1			
HCSB-2/31-33'/000923	31.0-33.0(G)	1.6	2	31.2, 31.5, 31.7, 32.1	31.9	31.4		
HCSB-2/33-35'/000923	33.0-35.0(H)	1.8	2	33.2, 33.35, 33.8	33.5	33.7		
HCSB-2/35-37'/000923	35.0-37.0(I)	1.9	2	35.5, 35.65, 36.2	35.8			
HCSB-2/37-39'/000923	37.0-39.0(J)	1.9	2	37.6				

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Dmg. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4:3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-2/39-41'/000923	39.0-41.0(K)	1.8	2					
HCSB-2/41-43'/000923	41.0-43.0(L)	1.9	2					
HCSB-3/17.5-19.5'/050928	17.5-19.5(A)	1.35	2					
HCSB-3/19.5-21.5'/050928	19.5-21.5(B)	1.7	3					
HCSB-3/30.0-32.0'/050928	30.0-32.0(C)	1.9	2	30.2, 30.8, 31.4	30.35, 31.6	31.2		
HCSB-3/32.0-34.0'/050928	32.0-34.0(D)	1.9	2	32.2, 32.6, 32.8	32.4			
HCSB-3/34.0-36.0'/050928	34.0-36.0(E)	1.7	2	34.4	34.4			
HCSB-3/36.0-38.0'/050928	36.0-38.0(F)	1.3	2	35.0				
HCSB-3/38.0-40.0'/050928	38.0-40.0(G)	1.0	1	38.1	38.4			
HCSB-3/40.0-42.0'/050928	40.0-42.0(H)	1.85	2					
HCSB-4/28.5-30.5'/050927	28.5-30.5(A)	2.0	3	29.5, 30.1	29.1			
HCSB-4/30.5-32.5'/052927	30.5-32.5(B)	1.9	1	31.0	30.8			
HCSB-4/32.5-34.5'/052927	32.5-34.5©	1.7	3					
HCSB-4/34.5-36.5'/052927	34.5-36.5(D)	0.7	1	35.0	33.9			
HCSB-4/36.5-38.5'/052927	36.5-38.5(E)	1.9	3	38.5	37.0			
HCSB-4/38.5-40.5'/052927	38.5-40.5(F)	1.7	2					
HCSB-4/40.5-42.5'/052927	40.5-42.5(G)	2.0	2	41.2				
HCSB-4/49-51'/052927	49-51(H)	1.5	2					
HCSB-4/51-53'/052927	51-53(I)	1.6	2					
HCSB-5/16-18'/050920	16-18(A)	2.0	2	17.5				
HCSB-5/18-20'/050920	18-20(B)	1.15	2					
HCSB-5/20-22'/050920	20-22(C)	2.2	3	20.8	20.5			

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Drng. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4:3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-5/22-24'/050920	22-24(D)	2.2	3	23.5, 23.65, 23.85	23.0	23.75	24.0	
HCSB-5/24-26'/050920	24-26(E)	1.7	2					
HCSB-5/29-31'/050920	29-31(F)	2.0	2					
HCSB-5/31-32.5'/050921	31-32.5(G)	0.5	1	31.1	31.3			
HCSB-5/32.5-34.5'/050921	32.5-34.5(H)	1.7	3	32.8, 33.3, 33.7, 34.0	33.0			
HCSB-5/34.5-36.5'/050921	34.5-36.5(I)	1.4	1	34.8, 35.1, 35.6, 35.8	35.25	35.5	35.35	
HCSB-5/36.5-38.5'/050922	36.5-38.5(J)	0.8	2	37.0	36.8			
HCSB-5/38.5-40.5'/050922	38.5-40.5(K)	1.4	2	38.5, 39.1, 39.5	38.9	39.25	39.25	
HCSB-5/40.5-42.5'/050922	40.5-42.5(L)	1.35	2	41.1	40.9			
HCSB-5/42.5-44.0'/050922	42.5-44.0(M)	1.5	2					
HCSB-5/44.0-45.5'/050922	44.0-45.5(N)	1.95	2					
HCSB-5/45.5-47.5'/050922	45.5-47.5(O)	1.4	3					
HCSB-5/47.5-49.5'/050922	47.5-49.5(P)	1.6	2					
TOTALS:	59 cores	116.0	123	73	31	10	12	

Laboratory Test Program Notes
Sample locations to be selected from core photography by Hartford Working Group.
RUSH - Electronic data to be delivered to Clayton/Hartford Working Group by November 1, 2005

Fluid Properties and IFT on product and water (0 pair).
Pair 1
Water ID:
Product ID:

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

			API RP 40 /						
		METHODS:	ASTM D2216	API RP 40		API RP 40		API RP 40	
		SAMPLE	MOISTURE	DENSITY		POROSITY, %Vb (2)		PORE FLUID	
SAMPLE	DEPTH,	ORIENTATION	CONTENT	BULK	GRAIN		AIR	SATURATIONS, % Pv (3)	
ID.	ft.	(1)	(% wt)	(g/cc)	(g/cc)	TOTAL	FILLED	WATER	NAPL
HCSB-1/9.5-11.5'/050923	10.0	H	30.6	1.31	2.56	49.0	8.3	78.4	4.7
HCSB-1/9.5-11.5'/050923	10.15	H	30.1	1.26	2.58	51.2	12.4	70.9	4.8
HCSB-1/9.5-11.5'/050923	10.6	H	26.9	1.27	2.59	50.9	16.1	65.8	2.5
HCSB-1/9.5-11.5'/050923	11.1	H	26.4	1.32	2.62	49.7	14.7	69.5	0.9
HCSB-1/11.5-13.5'/050923	12.1	H	19.3	1.23	2.63	53.2	28.7	42.1	3.9
HCSB-1/16.5-18.5'/050926	17.15	H	46.0	1.10	2.65	58.4	7.2	85.0	2.6
HCSB-1/18.5-20.5'/050926	19.1	H	25.8	1.27	2.62	51.5	18.3	62.5	2.0
HCSB-1/18.5-20.5'/050926	19.4	H	24.8	1.33	2.62	49.3	15.9	65.6	2.2
HCSB-1/20.5-22.5'/050926	20.2	H	30.4	1.34	2.62	49.0	7.7	81.8	2.4
HCSB-1/20.5-22.5'/050926	21.9	H	36.5	1.24	2.64	53.2	7.8	85.3	ND<0.1
HCSB-1/20.5-22.5'/050926	22.4	H	37.7	1.21	2.65	54.1	7.9	84.5	0.9
HCSB-1/27-29'/050926	27.3	H	36.1	1.29	2.64	51.2	4.2	89.7	2.0
HCSB-1/27-29'/050926	27.8	H	26.9	1.40	2.65	47.1	8.9	79.8	1.3
HCSB-1/27-29'/050926	28.4	H	21.2	1.55	2.65	41.4	8.0	78.9	1.8
HCSB-1/29-31'/050926	29.75	H	13.3	1.53	2.66	42.7	21.9	44.2	4.6
HCSB-1/29-31'/050926	30.15	H	8.9	1.52	2.65	42.5	28.0	27.4	6.7
HCSB-1/31-33'/050926	31.15	H	11.5	1.43	2.65	46.2	26.6	15.2	27.2
HCSB-1/31-33'/050926	31.6	H	14.1	1.51	2.65	43.1	17.4	19.4	40.2
HCSB-1/31-33'/050926	32.25	H	17.7	1.50	2.66	43.7	14.7	44.6	21.8
HCSB-1/33-35'/050926	33.3	H	20.0	1.46	2.65	45.1	15.4	63.0	2.7
HCSB-1/35-37'/050926	37.6	H	20.0	1.46	2.65	44.9	14.9	61.9	4.9
HCSB-1/39-41'/050926	39.2	H	14.5	1.72	2.65	35.2	9.6	66.8	5.8
HCSB-1/39-41'/050926	39.4	H	12.3	1.76	2.65	33.6	11.3	60.6	5.8
HCSB-1/39-41'/050926	39.7	H	10.9	1.78	2.66	33.2	13.0	52.5	8.3
HCSB-1/41-43'/050926	41.6	H	17.0	1.58	2.65	40.4	13.0	64.9	2.8
HCSB-2/17-19'/000923	17.7	H	32.7	1.30	2.65	50.9	7.9	83.3	1.1
HCSB-2/27-29'/000923	28.5	H	36.8	1.25	2.62	52.4	6.2	87.0	1.1
HCSB-2/29-31'/000923	29.3	H	26.5	1.44	2.63	45.3	7.1	84.4	ND<0.1
HCSB-2/31-33'/000923	31.2	H	6.5	1.51	2.64	42.7	32.4	21.6	2.6
HCSB-2/31-33'/000923	31.5	H	7.6	1.44	2.64	45.6	34.6	23.8	0.3
HCSB-2/31-33'/000923	31.75	H	7.2	1.42	2.63	46.2	35.6	20.4	2.5
HCSB-2/31-33'/000923	32.15	H	18.8	1.46	2.64	44.7	16.2	55.1	8.5
HCSB-2/33-35'/000923	32.2	H	16.6	1.48	2.64	44.0	18.7	52.2	5.2
HCSB-2/33-35'/000923	33.35	H	20.2	1.47	2.64	44.3	14.0	63.0	5.3
HCSB-2/33-35'/000923	33.8	H	20.1	1.42	2.64	46.1	17.1	58.4	4.5
HCSB-2/35-37'/000923	35.5	H	20.1	1.54	2.64	41.7	10.2	70.8	4.8
HCSB-2/35-37'/000923	35.65	H	21.1	1.49	2.64	43.5	11.3	68.0	6.0
HCSB-2/35-37'/000923	36.2	H	20.2	1.51	2.64	42.8	11.9	68.2	4.0
HCSB-2/37-39'/000923	37.6	H	22.3	1.46	2.61	43.9	10.6	69.2	6.8

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	MOISTURE CONTENT (% wt)	DENSITY BULK (g/cc)	DENSITY GRAIN (g/cc)	POROSITY, %Vb (2) TOTAL	POROSITY, %Vb (2) AIR FILLED	PORE FLUID SATURATIONS, % Pv (3) WATER	PORE FLUID SATURATIONS, % Pv (3) NAPL
HCSB-3/30.0-32.0'/050928	30.2	H	26.2	1.40	2.65	47.4	9.9	74.6	4.6
HCSB-3/30.0-32.0'/050928	30.8	H	9.6	1.49	2.65	43.7	28.9	31.3	2.5
HCSB-3/30.0-32.0'/050928	31.4	H	15.4	1.59	2.66	40.3	14.3	58.7	5.8
HCSB-3/32.0-34.0'/050928	32.2	H	8.3	1.50	2.65	43.1	30.1	27.1	3.2
HCSB-3/32.0-34.0'/050928	32.6	H	15.4	1.50	2.65	43.2	19.5	50.0	4.9
HCSB-3/32.0-34.0'/050928	32.8	H	16.2	1.50	2.65	43.3	18.2	51.5	6.6
HCSB-3/34.0-36.0'/050928	34.4	H	21.8	1.51	2.65	43.2	9.2	69.5	9.2
HCSB-3/36.0-38.0'/050928	35.0	H	20.5	1.54	2.65	41.9	9.3	69.1	8.6
HCSB-3/38.0-40.0'/050928	38.1	H	16.8	1.63	2.64	38.4	10.3	67.2	6.1
HCSB-4/28.5-30.5'/050927	29.5	H	27.9	1.35	2.61	48.3	10.5	78.0	0.3
HCSB-4/28.5-30.5'/050927	30.1	H	17.3	1.49	2.64	43.5	17.1	58.1	2.6
HCSB-4/30.5-32.5'/052927	31.0	H	26.3	1.31	2.50	47.6	11.8	66.0	9.2
HCSB-4/34.5-36.5'/052927	35.0	H	17.2	1.49	2.65	43.8	17.2	53.7	7.0
HCSB-4/36.5-38.5'/052927	38.55	H	20.9	1.50	2.64	43.3	10.9	68.0	6.9
HCSB-4/40.5-42.5'/052927	41.2	H	32.2	1.31	2.63	50.4	7.1	78.0	8.0
HCSB-5/16-18'/050920	17.5	H	24.2	1.44	2.64	45.6	10.4	76.2	1.0
HCSB-5/20-22'/050920	20.8	H	34.1	1.27	2.64	52.0	7.1	76.1	10.2
HCSB-5/22-24'/050920	23.45	H	30.7	1.32	2.64	50.2	8.2	74.5	9.2
HCSB-5/22-24'/050920	23.6	H	21.1	1.38	2.64	47.6	17.0	55.4	8.8
HCSB-5/22-24'/050920	23.9	H	22.2	1.44	2.65	45.8	12.8	64.7	7.3
HCSB-5/31-32.5'/050921	31.1	H	12.1	1.54	2.65	41.8	21.8	38.1	9.7
HCSB-5/32.5-34.5'/050921	32.8	H	17.3	1.46	2.65	44.9	18.5	51.6	7.2
HCSB-5/32.5-34.5'/050921	33.3	H	20.4	1.45	2.66	45.6	14.7	59.5	8.2
HCSB-5/32.5-34.5'/050921	33.7	H	21.6	1.45	2.64	45.2	13.0	65.2	6.0
HCSB-5/32.5-34.5'/050921	34.0	H	18.0	1.49	2.65	43.6	15.7	57.5	6.5
HCSB-5/34.5-36.5'/050921	34.8	H	20.0	1.44	2.66	45.8	16.0	59.7	5.4
HCSB-5/34.5-36.5'/050921	35.1	H	20.4	1.47	2.65	44.7	13.8	63.8	5.4
HCSB-5/34.5-36.5'/050921	35.6	H	18.9	1.50	2.66	43.7	14.4	61.3	5.8
HCSB-5/34.5-36.5'/050921	35.8	H	19.8	1.45	2.65	45.2	15.6	60.7	4.9
HCSB-5/36.5-38.5'/050922	37.0	H	21.3	1.52	2.65	42.7	9.8	74.3	2.8
HCSB-5/38.5-40.5'/050922	38.5	H	17.6	1.59	2.64	39.6	11.0	70.4	1.8
HCSB-5/38.5-40.5'/050922	39.1	H	19.4	1.48	2.65	44.1	14.6	61.6	5.3
HCSB-5/38.5-40.5'/050922	39.5	H	18.8	1.54	2.66	42.3	13.1	68.0	1.0
HCSB-5/40.5-42.5'/050922	41.1	H	11.4	1.82	2.65	31.5	10.1	59.3	8.5

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

METHODS:			API RP40	API RP40	API RP40	ASTM D425M, DEAN-STARK			
						PORE FLUID SATURATIONS, % Pv			
						Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	BULK DENSITY, (g/cc)	GRAIN DENSITY, (g/cc)	TOTAL POROSITY, %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HCSB-1/9.5-11.5'/050923	9.6	V	1.41	2.66	46.9	82.6	3.6	60.4	3.6
NOTE: No LNAPL produced. Produced water clear with faint hydrocarbon odor.									
HCSB-1/9.5-11.5'/050923	10.3	V	1.32	2.57	48.7	68.9	3.5	29.7	3.2
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/9.5-11.5'/050923	10.8	V	1.27	2.65	52.3	55.6	1.1	31.7	0.9
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/16.5-18.5'/050926	17.0	V	1.29	2.67	51.5	87.2	1.7	67.7	1.5
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/16.5-18.5'/050926	17.4	V	1.14	2.68	57.6	90.8	0.4	83.7	0.4
NOTE: No LNAPL produced. Produced water clear with no odor.									
HCSB-1/18.5-20.5'/050926	20.05	V	1.36	2.63	48.3	78.4	2.5	43.5	2.1
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/27-29'/050926	30.0	V	1.62	2.66	39.1	76.2	4.8	44.9	4.8
NOTE: No LNAPL produced. Produced water clear with no odor.									
HCSB-1/29-31'/050926	32.4	V	1.48	2.65	44.2	32.2	30.4	10.7	6.0
NOTE: Produced LNAPL (gasoline) amber in color and floating on top of clear water.									
HCSB-1/39-41'/050926	40.3	V	1.53	2.65	42.4	50.3	9.1	7.8	5.1
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									

N/A = Not Analyzed. Vb = Bulk Volume, Pv = Pore Volume. (1) H = horizontal, V = vertical
Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation as received prior to centrifuging at 1000xG
Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after centrifuging at 1000xG
Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

METHODS:			API RP40	API RP40	API RP40	ASTM D425M, DEAN-STARK			
						PORE FLUID SATURATIONS, % Pv			
						Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	BULK DENSITY, (g/cc)	GRAIN DENSITY, (g/cc)	TOTAL POROSITY, %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HCSB-5/22-24'/050920	24.0	V	1.36	2.66	48.7	76.1	5.9	46.9	4.9
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									
HCSB-5/34.5-36.5'/050921	35.35	V	1.45	2.64	45.2	57.5	6.8	5.7	6.0
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									
HCSB-5/38.5-40.5'/050922	39.35	V	1.47	2.65	44.7	60.1	4.0	7.8	2.8
NOTE: Produced LNAPL (gasoline) light yellow in color and floating on top of clear water.									

N/A = Not Analyzed. Vb = Bulk Volume, Pv = Pore Volume. (1) H = horizontal, V = vertical
Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation as received prior to centrifuging at 1000xG
Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after centrifuging at 1000xG
Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA - AIR/WATER CAPILLARY PRESSURE

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENT. (1)	MOISTURE CONTENT (% wt)	DENSITY BULK (g/cc)	DENSITY GRAIN (g/cc)	POROSITY, %Vb (2) TOTAL	POROSITY, %Vb (2) AIR FILLED	PORE FLUID SATURATIONS, % Pv (3) WATER	PORE FLUID SATURATIONS, % Pv (3) NAPL
HCSB-1/18.5-20.5'/050926	19.6	V	23.2	1.31	2.64	50.6	19.4	54.9	6.9
HCSB-1/29-31'/050926	29.65	V	17.4	1.48	2.67	44.6	17.7	52.9	7.4
HCSB-1/31-33'/050926	32.1	V	11.6	1.41	2.65	46.9	28.4	23.1	16.3
HCSB-1/39-41'/050926	40.2	V	10.5	1.80	2.68	32.9	13.1	53.6	6.7
HCSB-2/31-33'/000923	31.4	V	15.1	1.57	2.65	40.9	16.5	55.7	3.9
HCSB-2/33-35'/000923	33.7	V	17.9	1.41	2.65	46.6	20.3	50.7	5.8
HCSB-3/30.0-32.0'/050928	31.2	V	7.0	1.37	2.65	48.4	38.3	19.9	1.0
HCSB-5/22-24'/050920	23.75	V	23.3	1.35	2.66	49.3	16.5	57.2	9.4
HCSB-5/34.5-36.5'/050921	35.5	V	19.7	1.39	2.65	47.6	19.3	53.3	6.0
HCSB-5/38.5-40.5'/050922	39.25	V	17.9	1.42	2.65	46.3	19.5	52.8	5.0

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detect

CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/18.5-20.5'/050926 at 19.6 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	32.2
0.086	6.02	0.198	100.0	32.2
0.193	13.5	0.446	100.0	32.2
0.343	24.1	0.793	99.8	32.1
0.535	37.6	1.24	98.8	31.8
0.771	54.2	1.78	98.2	31.6
1.05	73.8	2.43	97.4	31.3
1.37	96.3	3.17	96.4	31.0
2.14	151	4.95	94.6	30.5
3.08	217	7.13	90.5	29.1
4.40	310	10.2	82.7	26.6
5.86	412	13.6	73.2	23.5
6.94	488	16.1	68.4	21.9
8.56	602	19.8	61.9	19.8
19.3	1355	44.6	47.0	14.9

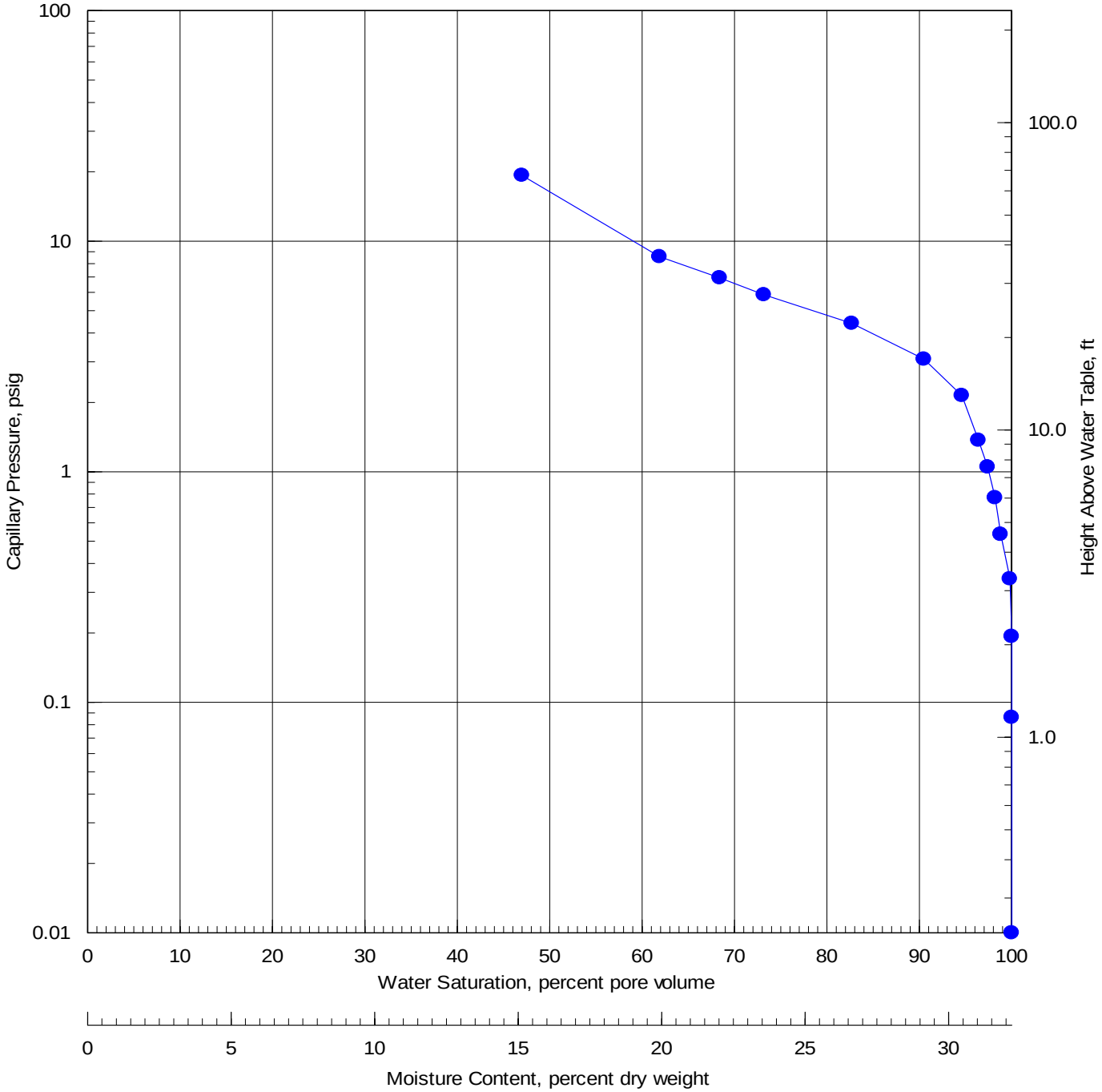
Specific Permeability to Air, md:	292
Permeability to Water, md:	39.8
Saturated Hydraulic Conductivity, cm/sec:	3.89E-05

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/18.5-20.5'/050926
Depth, ft: 19.6



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/29-31'/050926 at 29.65 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	24.0
0.091	6.38	0.210	100.0	24.0
0.204	14.3	0.472	99.8	23.9
0.363	25.5	0.840	99.4	23.8
0.567	39.9	1.31	98.3	23.5
0.816	57.4	1.89	97.2	23.1
1.11	78.1	2.57	95.6	22.6
1.45	102	3.36	92.5	21.7
2.27	159	5.25	82.8	18.8
3.26	230	7.56	75.7	16.6
4.66	328	10.8	68.5	14.4
6.20	436	14.4	62.4	12.6
7.35	516	17.0	59.1	11.6
9.07	638	21.0	55.5	10.5
20.4	1435	47.2	46.9	7.9

Specific Permeability to Air, md:	565
Permeability to Water, md:	227
Saturated Hydraulic Conductivity, cm/sec:	2.23E-04

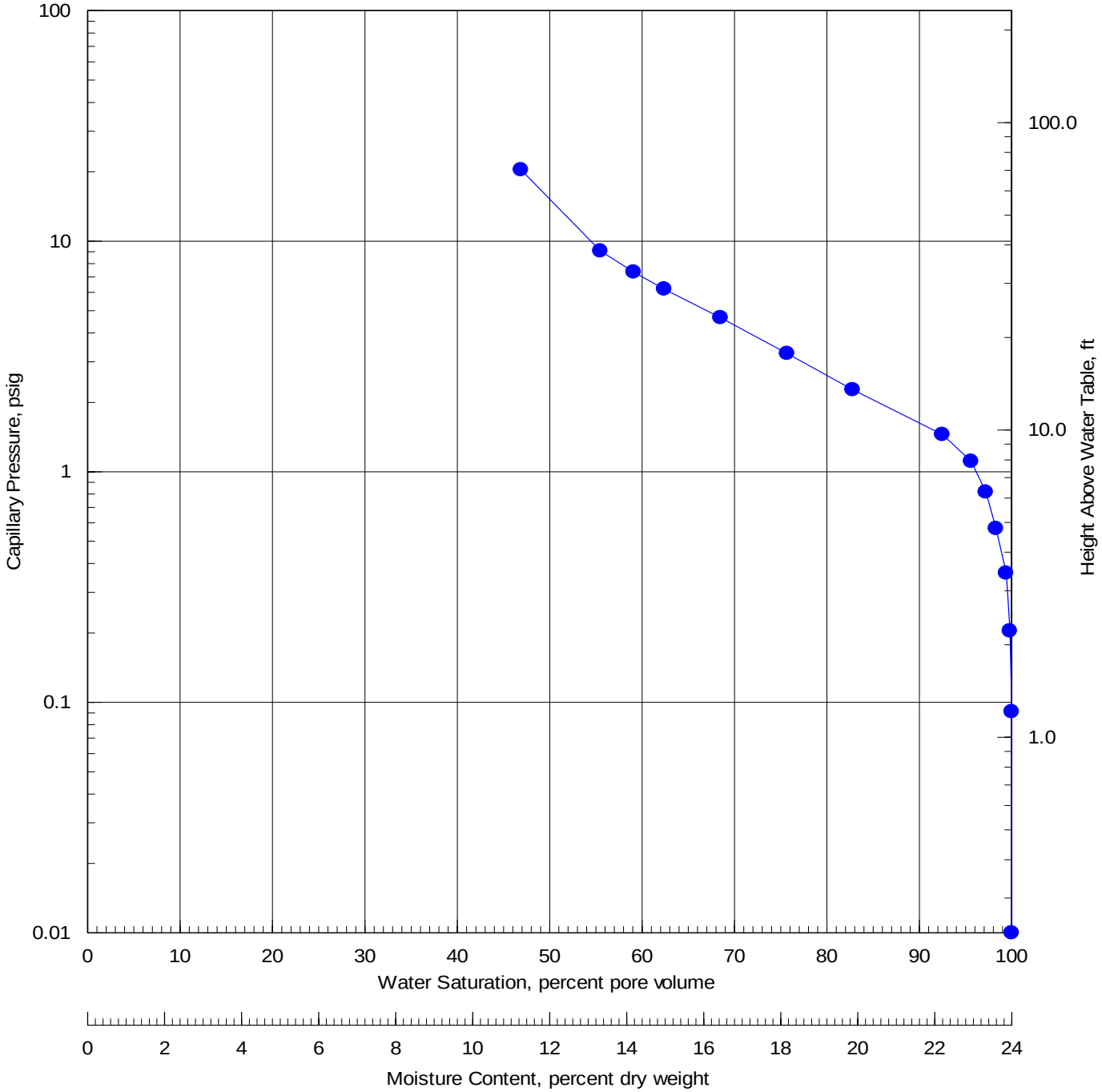
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HHCSB-1/29-31'/050926
Depth, ft: 29.65



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/31-33'/050926 at 32.1 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	21.9
0.094	6.61	0.218	100.0	21.9
0.212	14.9	0.490	100.0	21.9
0.376	26.5	0.871	99.4	21.7
0.588	41.3	1.36	96.4	20.8
0.847	59.5	1.96	82.5	16.8
1.15	81.0	2.67	64.4	11.5
1.51	106	3.48	56.6	9.2
2.35	165	5.44	45.2	5.8
3.39	238	7.84	40.3	4.4
4.84	340	11.2	37.0	3.5
6.43	452	14.9	34.9	2.9
7.62	536	17.6	33.7	2.5
9.41	661	21.8	32.5	2.1
21.2	1488	49.0	30.7	1.6

Specific Permeability to Air, md:	3995
Permeability to Water, md:	1043
Saturated Hydraulic Conductivity, cm/sec:	1.02E-03

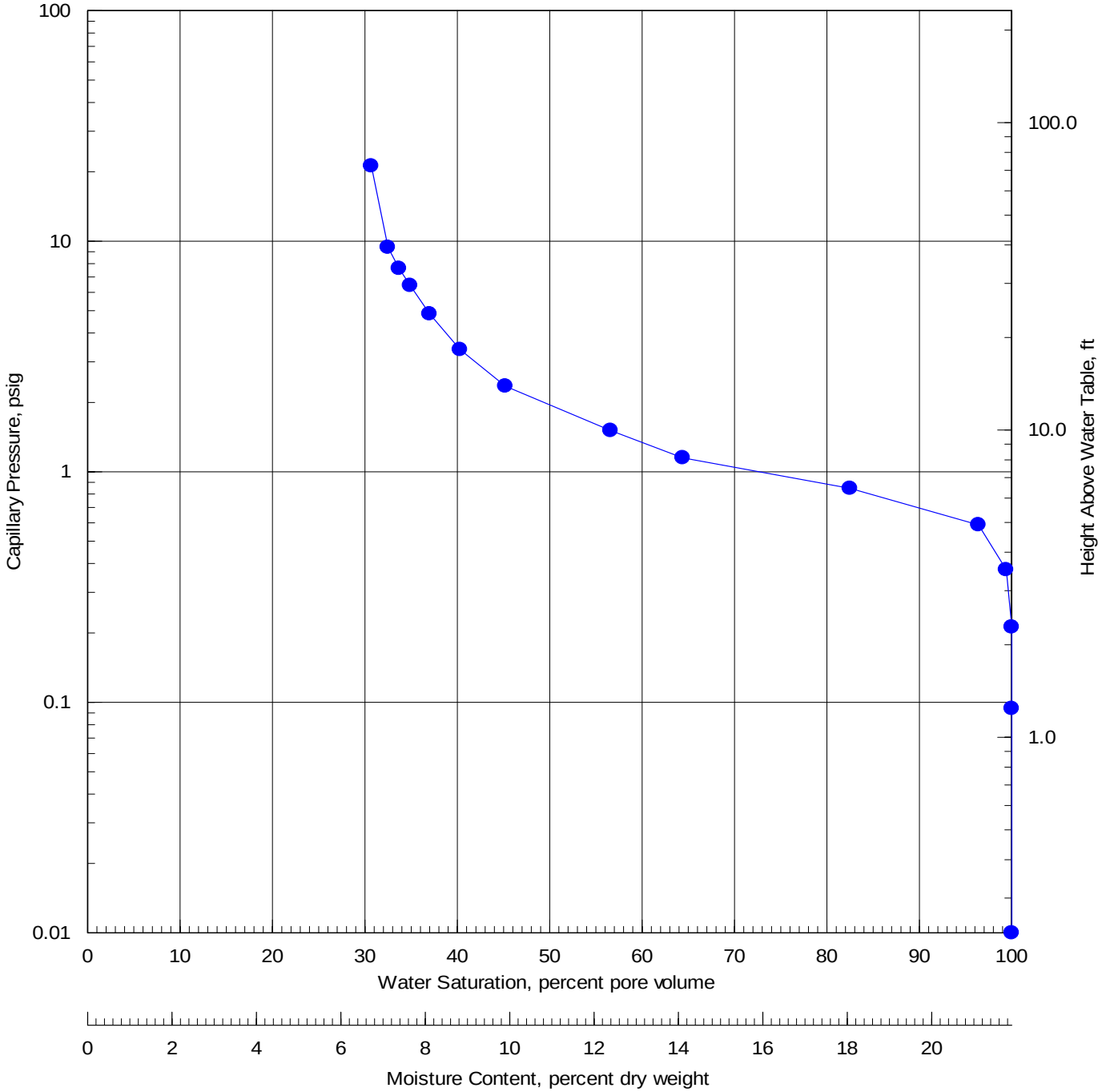
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/31-33'/050926
Depth, ft: 32.1



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/39-41'/050926 at 40.2 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	12.1
0.089	6.26	0.206	100.0	12.1
0.200	14.1	0.464	98.9	11.9
0.356	25.1	0.825	93.5	10.9
0.557	39.1	1.29	86.0	9.5
0.802	56.4	1.86	79.1	8.2
1.09	76.7	2.53	73.6	7.2
1.43	100	3.30	69.7	6.5
2.23	157	5.15	62.8	5.2
3.21	225	7.42	59.3	4.6
4.58	322	10.6	57.0	4.2
6.09	428	14.1	55.8	3.9
7.22	507	16.7	55.0	3.8
8.91	626	20.6	54.2	3.7
20.0	1409	46.4	51.9	3.2

Specific Permeability to Air, md:	2500
Permeability to Water, md:	2009
Saturated Hydraulic Conductivity, cm/sec:	1.97E-03

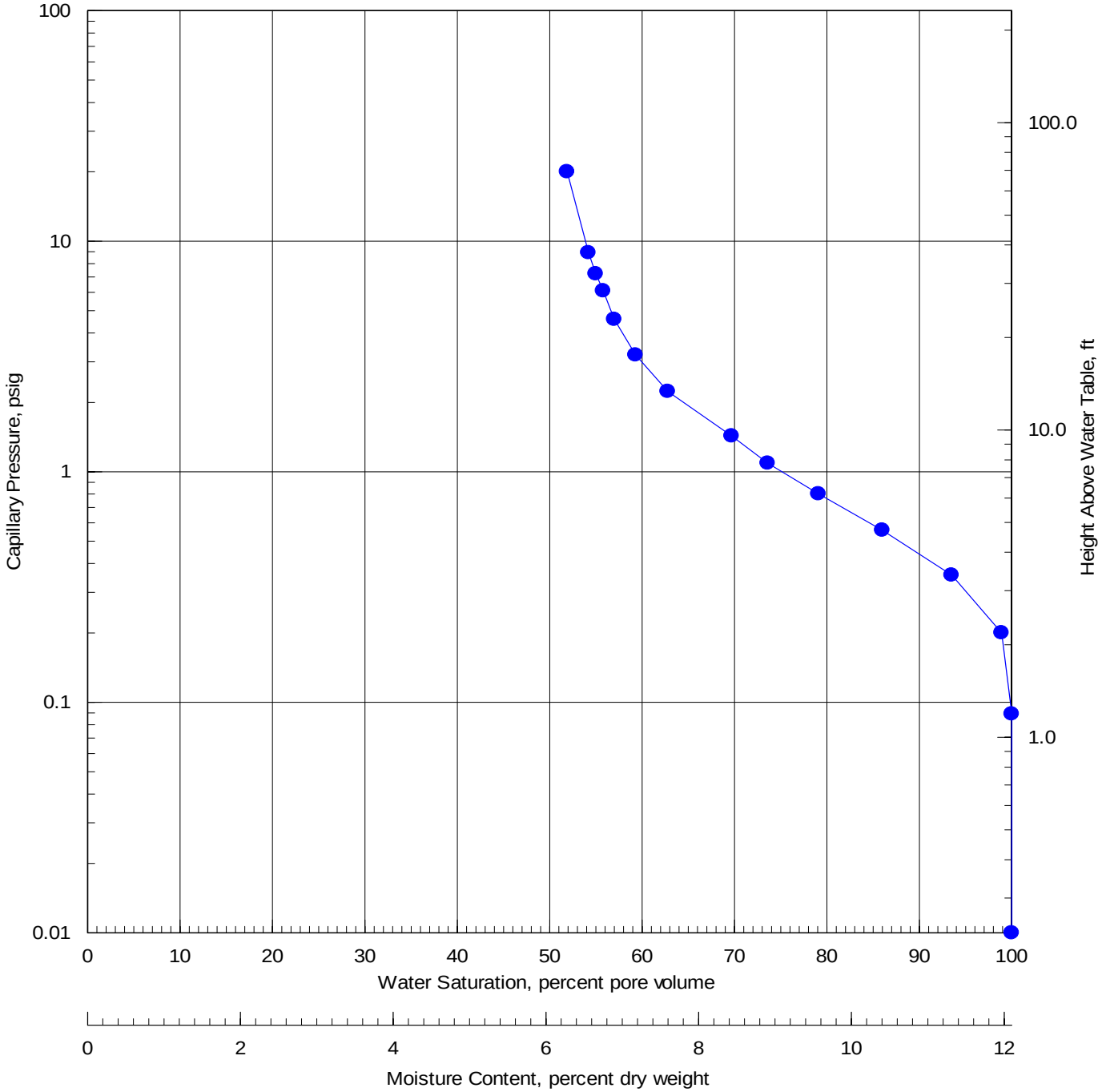
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/39-41'/050926
Depth, ft: 40.2



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-2/31-33'/000923 at 31.4 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	20.0
0.088	6.19	0.204	100.0	20.0
0.198	13.9	0.459	100.0	20.0
0.352	24.8	0.815	99.4	19.8
0.550	38.7	1.27	98.1	19.5
0.793	55.7	1.83	95.7	18.8
1.08	75.9	2.50	88.8	17.0
1.41	99.1	3.26	84.9	16.0
2.20	155	5.10	78.3	14.3
3.17	223	7.34	72.7	12.8
4.53	318	10.5	68.3	11.6
6.02	424	13.9	64.6	10.7
7.13	502	16.5	62.1	10.0
8.81	619	20.4	59.7	9.4
19.8	1393	45.9	50.3	6.9

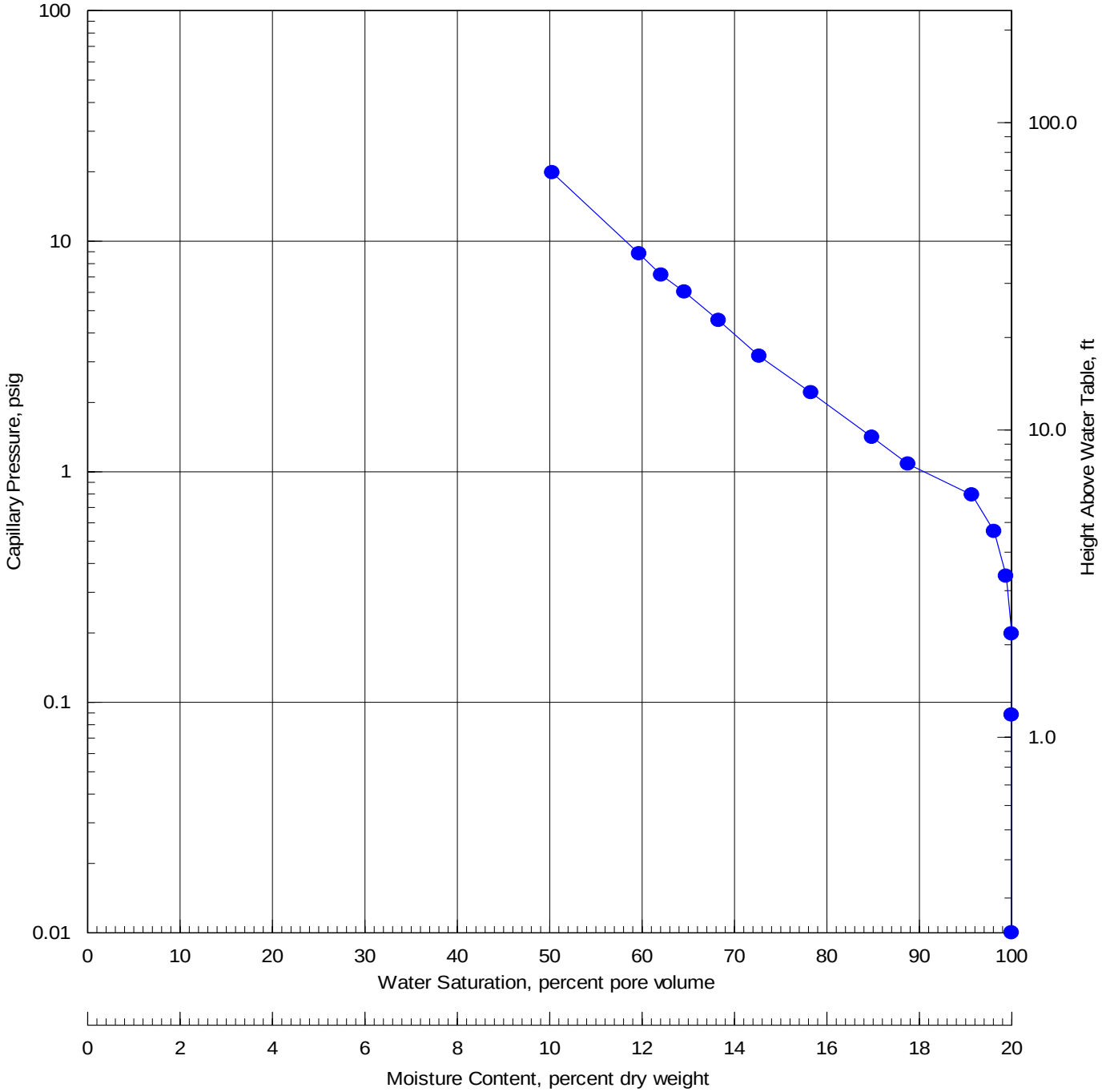
Specific Permeability to Air, md:	545
Permeability to Water, md:	90.8
Saturated Hydraulic Conductivity, cm/sec:	8.88E-05

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-2/31-33'/000923
Depth, ft: 31.4



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-2/33-35'/000923 at 33.7 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	22.0
0.078	5.50	0.181	100.0	22.0
0.176	12.4	0.407	100.0	22.0
0.313	22.0	0.724	97.8	21.3
0.489	34.4	1.13	94.1	20.2
0.704	49.5	1.63	81.6	16.5
0.958	67.3	2.22	67.6	12.3
1.25	88.0	2.89	58.8	9.7
1.95	137	4.52	46.3	5.9
2.81	198	6.51	40.4	4.1
4.02	283	9.30	37.0	3.1
5.35	376	12.4	34.4	2.3
6.33	445	14.7	33.1	1.9
7.82	550	18.1	32.3	1.7
17.6	1237	40.7	31.6	1.5

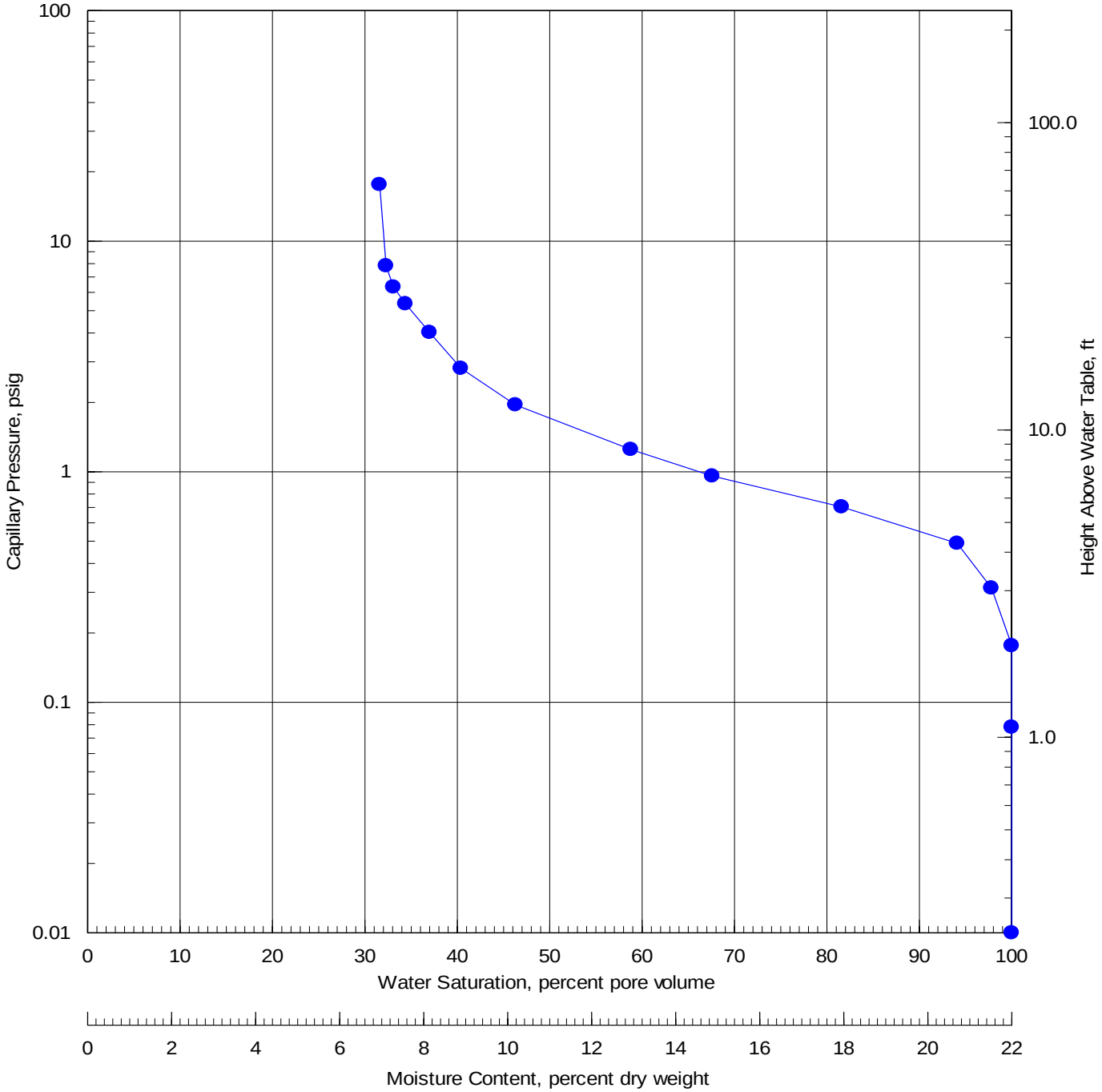
Specific Permeability to Air, md:	3961
Permeability to Water, md:	1370
Saturated Hydraulic Conductivity, cm/sec:	1.32E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-2/33-35'/000923
Depth, ft: 33.7



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-3/30.0-32.0'/050928 at 31.2 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	21.3
0.093	6.56	0.216	100.0	21.3
0.210	14.8	0.486	99.4	21.1
0.373	26.2	0.863	98.1	20.8
0.583	41.0	1.35	93.3	19.4
0.839	59.0	1.94	76.7	14.6
1.14	80.3	2.64	65.4	11.4
1.49	105	3.45	58.5	9.4
2.33	164	5.40	47.8	6.3
3.36	236	7.77	41.9	4.6
4.80	337	11.1	39.6	3.9
6.38	449	14.8	37.7	3.4
7.56	531	17.5	37.1	3.2
9.33	656	21.6	35.8	2.9
21.0	1476	48.6	33.3	2.1

Specific Permeability to Air, md:	3954
Permeability to Water, md:	2110
Saturated Hydraulic Conductivity, cm/sec:	2.05E-03

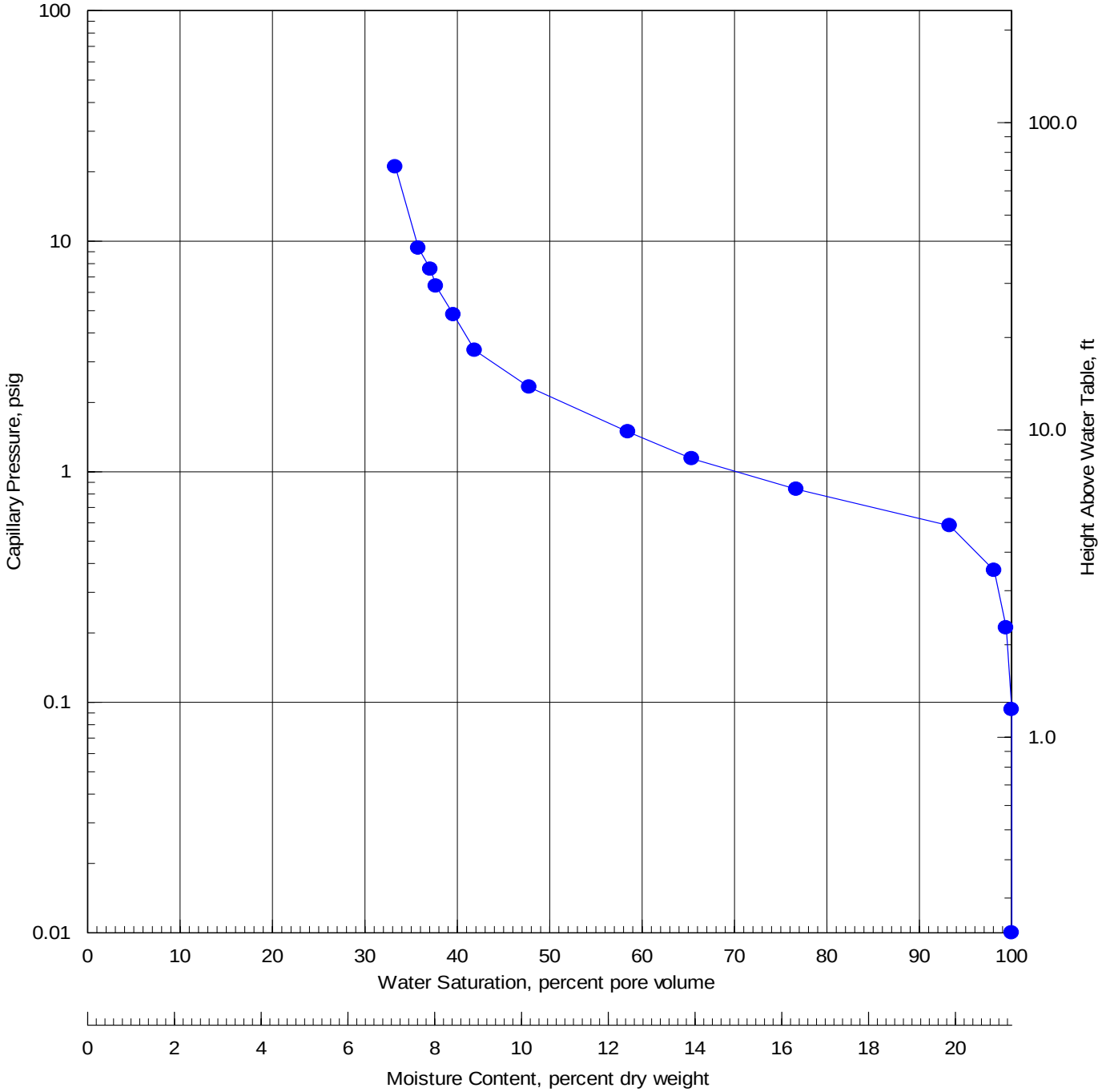
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-3/30.0-32.0'/050928
Depth, ft: 31.2



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/22-24'/050920 at 23.75 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	26.9
0.081	5.72	0.188	100.0	26.9
0.183	12.9	0.423	100.0	26.9
0.325	22.9	0.753	99.0	26.6
0.508	35.7	1.18	96.4	25.7
0.732	51.5	1.69	86.3	22.6
1.00	70.0	2.31	78.9	20.2
1.30	91.5	3.01	73.8	18.6
2.03	143	4.70	66.8	16.4
2.93	206	6.77	61.7	14.8
4.18	294	9.67	58.5	13.7
5.56	391	12.9	56.3	13.1
6.59	463	15.2	55.0	12.7
8.13	572	18.8	53.4	12.1
18.3	1286	42.3	48.3	10.5

Specific Permeability to Air, md:	1896
Permeability to Water, md:	1528
Saturated Hydraulic Conductivity, cm/sec:	1.48E-03

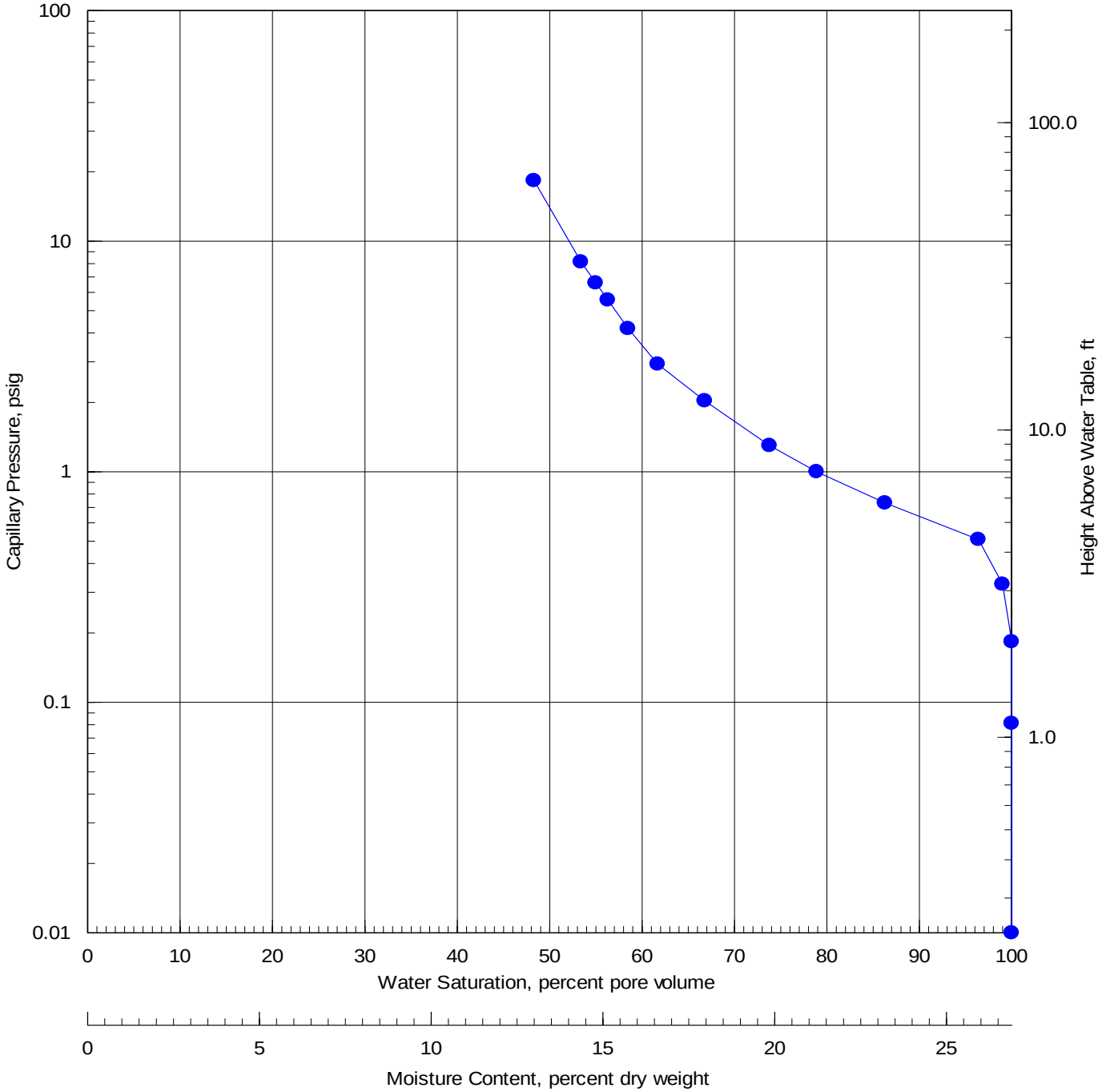
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/22-24'/050920
Depth, ft: 23.75



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/34.5-36.5'/050921 at 35.5 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	23.2
0.093	6.53	0.215	100.0	23.2
0.209	14.7	0.484	97.0	22.3
0.372	26.1	0.860	92.8	21.1
0.581	40.8	1.34	86.1	19.2
0.836	58.8	1.93	75.9	16.2
1.14	80.0	2.63	52.4	9.4
1.49	104	3.44	45.1	7.3
2.83	199	6.55	35.5	4.5
3.34	235	7.74	33.1	3.8
4.55	320	10.5	30.0	2.9
6.62	465	15.3	28.2	2.4
7.52	529	17.4	27.6	2.2
9.29	653	21.5	27.0	2.1
20.9	1469	48.4	25.8	1.7

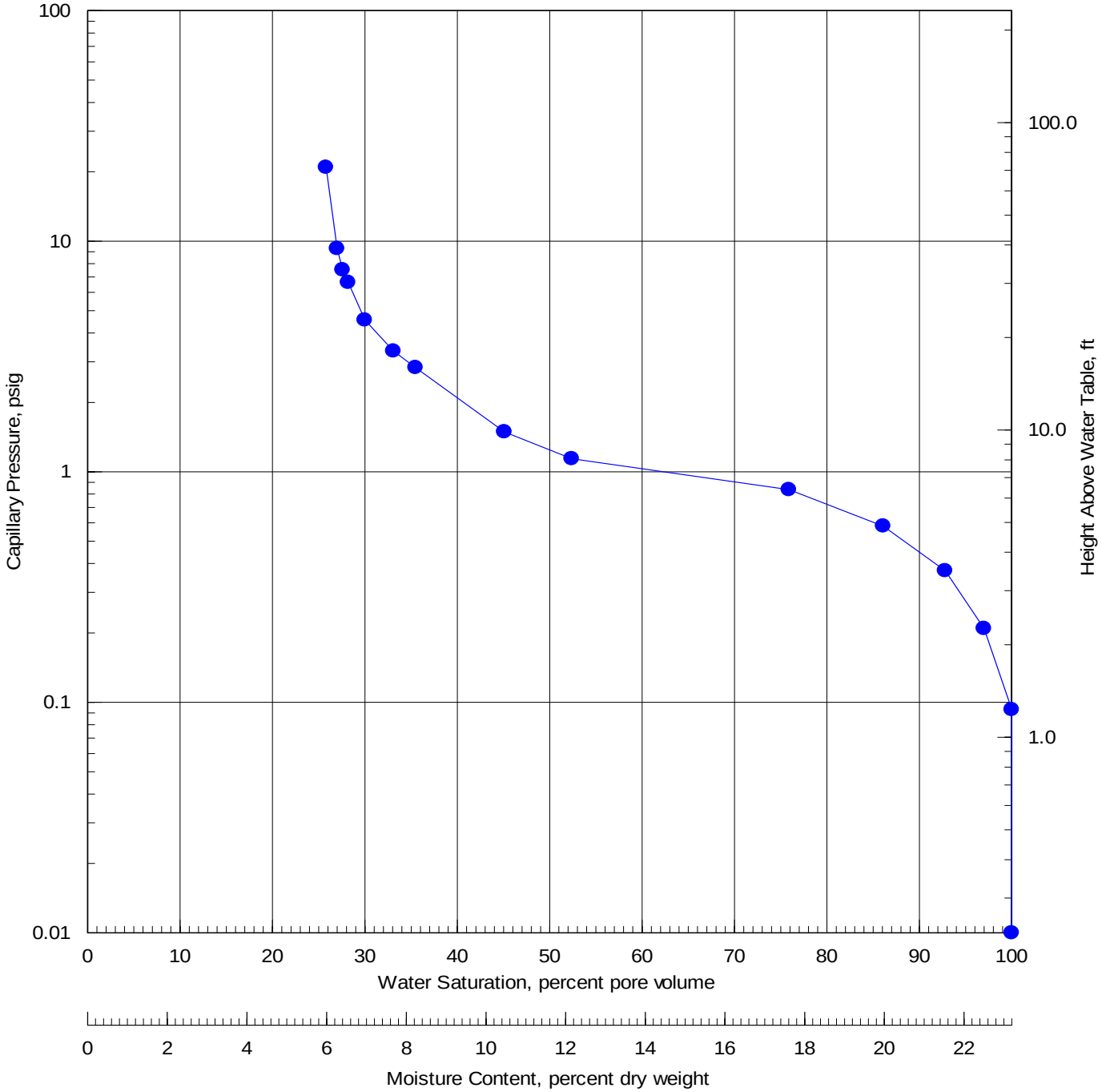
Specific Permeability to Air, md:	3756
Permeability to Water, md:	1407
Saturated Hydraulic Conductivity, cm/sec:	1.37E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/34.5-36.5'/050921
Depth, ft: 35.5



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/38.5-40.5'/050922 at 39.25 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	22.7
0.087	6.14	0.202	100.0	22.7
0.196	13.8	0.454	100.0	22.7
0.349	24.5	0.808	98.5	22.3
0.545	38.3	1.26	94.3	21.0
0.785	55.2	1.82	86.1	18.5
1.07	75.2	2.47	63.3	11.7
1.40	98.2	3.23	54.4	9.1
2.66	187	6.15	41.1	5.1
3.14	221	7.27	38.5	4.4
4.28	301	9.90	34.9	3.3
6.22	437	14.4	32.8	2.6
7.07	497	16.4	32.2	2.5
8.73	614	20.2	31.6	2.3
19.6	1380	45.4	29.7	1.7

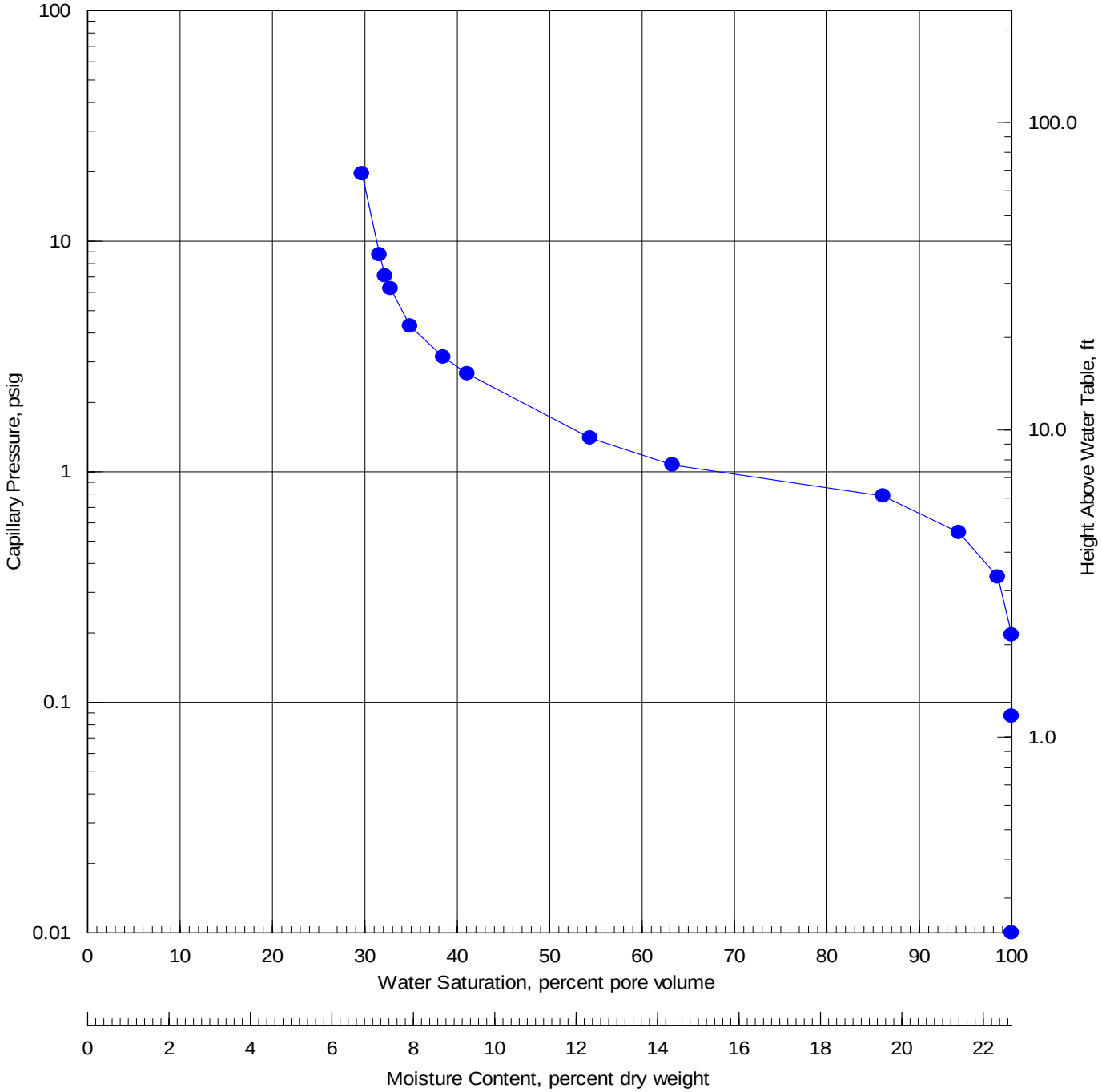
Specific Permeability to Air, md:	3658
Permeability to Water, md:	1191
Saturated Hydraulic Conductivity, cm/sec:	1.15E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/38.5-40.5'/050922
Depth, ft: 39.25



DATE **PTS FILE#** 35565 **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-5/16-18'/050920	9-20-05	11:35	16-18' (A)																		1
HCSB-5/18-20'/050920	9-20-05	11:50	18-20' (B)																		
HCSB-5/20-22'/050920	9-20-05	12:57	20-22' (C)																		
HCSB-5/22-24'/050920	9-20-05	13:21	22-24' (D)																		
HCSB-5/24-26'/050920	9-20-05	14:30	24-26' (E)																		
HCSB-5/29-31'/050920	9-20-05	16:00	29-31' (F)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/20/05 TIME: 16:30	DATE: 9/21/05 TIME: 11:30	DATE TIME	DATE TIME

DATE **PTS FILE#** 35565 **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOHo

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: 24 HOURS / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-5/31-32.5'/050921	9-21-05	9:50	31-32.5' (G)																		1
3 HCSB-5/32.5-34.5'/050921	9-21-05	10:30	32.5-34.5' (H)																		
HCSB-5/34.5-36.5'/050921	9-21-05	12:45	34.5-36.5' (I)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-21-05 TIME: 1403 P.M.	DATE: 9/22/05 TIME: 10:50	DATE TIME	DATE TIME

DATE PTS FILE# 35565 **CHAIN OF CUSTODY RECORD** PAGE 1 OF 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road, Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14.006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

ANALYSIS REQUEST

PO#

SPECIAL HANDLING: 24 HOURS / 5 DAYS / 72 HOURS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
✓ HCSB5/36.5-38.5'/050922	9-22-05	9:15	36.5-38.5 (J)																		1
✓ HCSB-5/38.5-40.5'/050922	9-22-05	9:30	38.5-40.5' (K)																		
✓ HCSB-5/40.5-42.5'/050922	9-22-05	10:30	40.5-42.5' (L)																		
✓ HCSB-5/42.5-44.0/050922	9-22-05	11:00	42.5-44.0 (M)																		
✓ HCSB-5/44.0-45.5/050922	9-22-05	11:45	44.0-45.5' (N)																		
✓ HCSB-5/45.5-47.5/050922	9-22-05	13:45	45.5-47.5' (O)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-22-05 TIME: 1430PM	DATE: 9/23/05 TIME: 10:20	DATE TIME	DATE TIME

DATE 9 PTS FILE# 35565 **CHAIN OF CUSTODY RECORD** PAGE 1 OF 2

3 Coolers

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS, 72 HOURS, 5 DAYS, NORMAL, OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB-5/47.5-49.5'/050922	9-22-05	1415 P.M	47.5-49.5' (P)																						1
HCSB-3/9-11'/050923	9-23-05	7:40AM	9'-11.0' (A)																						
HCSB-2/11-13'/050923	9-23-05	8:00AM	11.0-13.0' (B)																						
HCSB-2/17-19'/050923	9-23-05	8:15AM	17.0-19.0 (C)																						
HCSB-2/19-21'/050923	9-23-05	8:30AM	19.0-21.0 (D)																						
HCSB-2/27-29'/050923	9-23-05	8:45AM	27.0-29.0 (E)																						
HCSB-2/29-31'/050923	9-23-05	9:00AM	29.0-31.0 (F)																						
HCSB-2/31-33'/050923	9-23-05	9:25AM	31.0-33.0 (G)																						
HCSB-2/33-35'/050923	9-23-05	9:40AM	33.0-35.0 (H)																						
HCSB-2/35-37'/050923	9-23-05	10:00AM	35.0-37.0 (I)																						
HCSB-2/37-39'/050923	9-23-05	10:30AM	37.0-39.0 (J)																						

COMMENTS

Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
	Reg Guillen		
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/23/05 TIME: 1600	DATE: 9-26-05 TIME: 11:30	DATE TIME	DATE TIME

3 coolers

DATE PTS FILE# 35565 CHAIN OF CUSTODY RECORD PAGE 2 OF 2

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 745-3200

PROJECT NUMBER: 15-03595.14-006

FAX NUMBER: 630 745-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS (circled) 5 DAYS; 72 HOURS NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB2/39-41'/050923	9-23-05	11:00AM	39.0-41.0'(K)																						1
HCSB2/41-43'/050923	9-23-05	11:30AM	41.0-43.0'(L)																						
HCSB1/9.5-11.5'/050923	9-23-05	15:30PM	9.5-11.5'(A)																						
HCSB1/11.5-13.5'/050923	9-23-05	15:50PM	11.5-13.5'(B)																						

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/23/05 TIME: 16:00	DATE: 9-26-09 TIME: 11:30	DATE TIME	DATE TIME

2 coolers.

DATE PTS FILE# CHAIN OF CUSTODY RECORD PAGE 1 OF 2

COMPANY: Northfield Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin 630 795-3200

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-1130

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER:

SITE LOCATION: Village of Northfield, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: (24 HOURS) 5 DAYS; 72 HOURS NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-1/16-18.5/050926	9-26-05	8:45	16.5-18.5' (C)																		1
HCSB-1/18.5-20/050926	9-26-05	9:00	18.5-20.5' (D)																		
HCSB-1/20.5-22.5/050926	9-26-05	9:15	20.5-22.5' (E)																		
HCSB-1/27-29/050926	9-26-05	9:30	27.0-29.0' (F)																		
HCSB-1/29-31/050926	9-26-05	10:15	29.0-31.0 (G)																		
HCSB-1/31-33/050926	9-26-05	10:45	31.0-33.0 (H)																		
HCSB-1/33-35/050926	9-26-05	11:00	33.0-35.0 (I)																		
HCSB-1/35-37/050926	9-26-05	11:30	35.0-37.0 (J)																		
HCSB-1/37-39'/050926	9-26-05	11:45	37.0-39.0 (K)																		
HCSB-1/39-41'/050926	9-26-05	12:45	39.0-41.0 (L)																		
HCSB-1/41-43'/050926	9-26-05	1330	41.0-43.0 (M)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS LABS	COMPANY:	COMPANY:
DATE: 9/26/05 TIME: 1600 p.m.	DATE: 9/27/05 TIME: 17:30	DATE: TIME:	DATE: TIME:

2 coolers

CHAIN OF CUSTODY RECORD

DATE | PTS FILE# | PAGE 2 OF 2

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - Void

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.0304.5.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: 24 HOURS (circled) | 5 DAYS | 72 HOURS | NORMAL | OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO | SEALED YES/NO | OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB-1/43-45'/050926	9-26-05	1400	43.0-45.0' (N)																						1

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS LABS	COMPANY:	COMPANY:
DATE: 9/26/05 TIME: 1600PM	DATE: 9/27/05 TIME: 17:00	DATE: TIME:	DATE: TIME:

CHAIN OF CUSTODY RECORD

DATE PTS FILE# PAGE 1 OF 1 (2 coolers)

COMPANY: Northfield Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-02L

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Northfield, IL.

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: ~~24 HOURS~~ 5 DAYS; 72 HOURS; NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-4/28.5-30.5'/050927	9-27-05	9:30	28.5-30.5 (A)																		1
HCSB-4/30.5-32.5'/050927	9-27-05	10:15	30.5-32.5' (B)																		
HCSB-4/32.5-34.5'/050927	9-27-05	10:30	32.5-34.5' (C)																		
HCSB-4/34.5-36.5'/050927	9-27-05	11:00	34.5-36.5' (D)																		
HCSB-4/36.5-38.5'/050927	9-27-05	11:30	36.5-38.5' (E)																		
HCSB-4/38.5-40.5'/050927	9-27-05	11:45	38.5-40.5' (F)																		
HCSB-4/40.5-42.5'/050927	9-27-05	1300	40.5-42.5' (G)																		
HCSB-4/49-51'/050927	9-27-05	1330	49.0-51.0' (H)																		
HCSB-4/51-53'/050927	9-27-05	1430	51.0-53.0' (I)																		

COMMENTS: Contact Brad Martin at Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/27/05 TIME: 1600	DATE: 9/28/05 TIME: 15:00	DATE TIME	DATE TIME

2 coolers.

DATE 35565 **PTS FILE#** **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL.

SAMPLER SIGNATURE: [signature]

PO#

SPECIAL HANDLING: 24 HOURS (circled) / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES	COMMENTS
HCSB-3/17.5-19.5'/050928	9-28-05	9:00	17.5-19.5' (A)																		1	Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.
HCSB-3/19.5-21.5'/050928	9-28-05	9:20	19.5-21.5' (B)																			
HCSB-3/30.0-32.0'/050928	9-28-05	9:45	30.0-32.0' (C)																			
HCSB-3/32.0-34.0'/050928	9-28-05	10:15	32.0-34.0' (D)																			
HCSB-3/34.0-36.0'/050928	9-28-05	10:25	34.0-36.0' (E)																			
HCSB-3/36.0-38.0'/050928	9-28-05	10:45	36.0-38.0' (F)																			
HCSB-3/38.0-40.0'/050928	9-28-05	11:15	38.0-40.0' (G)																			
HCSB-3/40.0-42.0'/050928	9-28-05	11:45	40.0-42.0' (H)																			

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
[signature]	[signature]		
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-28-05 TIME: 1600	DATE: 9-29-05 TIME: 13:00	DATE TIME	DATE TIME

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-1/9.5-11.5'/050923	10.45	Silt	0.034	0.00	0.00	0.08	16.13	72.04	11.75	83.79
HCSB-1/11.5-13.5'/050923	12.25	Silt	0.035	0.00	0.00	0.00	8.57	77.01	14.42	91.43
HCSB-1/16.5-18.5'/050926	17.7	Silt	0.011	0.00	0.00	0.10	19.92	46.46	33.52	79.98
HCSB-1/18.5-20.5'/050926	19.8	Silt	0.047	0.00	0.00	0.00	20.95	66.59	12.46	79.05
HCSB-1/27-29'/050926	28.2	Silt	0.037	0.00	0.00	0.04	33.98	47.69	18.29	65.98
HCSB-1/29-31'/050926	30.3	Fine sand	0.239	0.00	0.00	2.57	87.75	7.41	2.26	9.68
HCSB-1/31-33'/050926	31.3	Fine sand	0.297	0.00	0.00	12.95	83.23	2.71	1.11	3.82
HCSB-1/33-35'/050926	33.5	Fine sand	0.338	0.00	0.00	31.23	60.87	6.04	1.87	7.90
HCSB-1/41-43'/050926	41.6	Medium sand	0.605	1.47	6.72	66.74	24.54	(2)	(2)	0.53
HCSB-2/17-19'/000923	17.5	Silt	0.006	0.00	0.00	0.00	0.00	53.95	46.05	100.00
HCSB-2/29-31'/000923	29.1	Silt	0.005	0.00	0.00	0.00	0.00	50.69	49.31	100.00
HCSB-2/31-33'/000923	31.9	Fine sand	0.245	0.00	0.00	2.35	91.04	4.25	2.36	6.61
HCSB-2/33-35'/000923	33.5	Fine sand	0.284	0.00	0.00	13.20	78.68	5.58	2.54	8.12
HCSB-2/35-37'/000923	35.8	Fine sand	0.311	0.00	0.00	16.47	81.69	1.42	0.43	1.84
HCSB-3/30-32'/050928	30.35	Silt	0.044	0.00	0.00	0.06	34.68	49.03	16.23	65.27

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-3/30-32'/050928	31.6	Medium sand	0.383	0.00	0.00	44.54	50.47	3.42	1.57	4.99
HCSB-3/32-34'/050928	32.4	Fine sand	0.282	0.00	0.00	13.65	77.78	5.45	3.12	8.57
HCSB-3/34-36'/050928	34.4	Fine sand	0.358	0.00	0.00	39.86	55.30	3.51	1.33	4.84
HCSB-3/38-40'/050928	38.4	Medium sand	0.408	0.69	3.89	43.64	50.82	(2)	(2)	0.97
HCSB-4/28.5-30.5'/050927	29.1	Silt	0.042	0.00	0.00	0.00	18.71	66.79	14.50	81.28
HCSB-4/30.5-32.5'/052927	30.8	Fine sand	0.084	0.00	0.00	3.36	51.15	37.23	8.26	45.49
HCSB-4/34.5-36.5'/052927	33.9	Fine sand	0.278	0.00	0.00	4.74	95.26	0.00	0.00	0.00
HCSB-4/36.5-38.5'/052927	37.0	Fine sand	0.287	0.00	0.00	8.59	89.84	1.19	0.38	1.57
HCSB-5/20-22'/050920	20.5	Silt	0.046	0.00	0.00	0.00	21.75	65.18	13.07	78.25
HCSB-5/22-24'/050920	23.0	Silt	0.057	0.00	0.00	0.00	32.18	54.93	12.89	67.82
HCSB-5/31-32.5'/050921	31.3	Fine sand	0.260	0.00	0.00	9.12	83.55	5.49	1.85	7.33
HCSB-5/32.5-34.5'050921	33.0	Fine sand	0.307	0.00	0.00	21.66	73.87	3.06	1.41	4.47
HCSB-5/34.5-36.5'/050921	35.25	Fine sand	0.319	0.00	0.00	18.90	78.04	2.06	1.00	3.05
HCSB-5/36.5-38.5'/050922	36.8	Fine sand	0.315	0.00	0.00	14.39	83.30	1.59	0.71	2.30

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

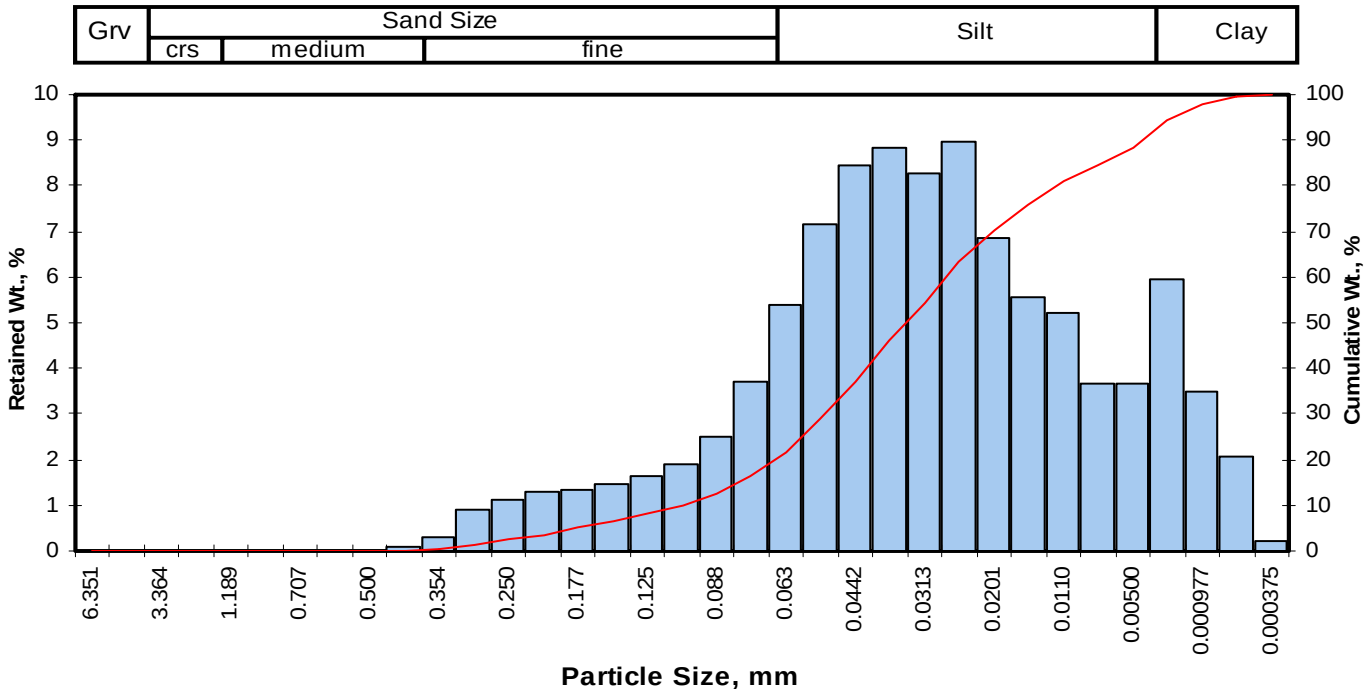
Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-5/38.5-40.5'/050922	38.9	Medium sand	0.392	0.00	0.00	45.16	52.99	1.39	0.46	1.85
HCSB-5/40.5-42.5'/050922	40.9	Coarse sand	1.528	28.11	16.13	35.84	19.57	(2)	(2)	0.35

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/9.5-11.5'/050923
Project No:	15-03095.14-006	**Depth, ft:**	10.45



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.08	0.08	0.08
0.0139	0.354	1.50	45	0.29	0.29	0.37
0.0117	0.297	1.75	50	0.89	0.89	1.26
0.0098	0.250	2.00	60	1.12	1.12	2.38
0.0083	0.210	2.25	70	1.28	1.28	3.66
0.0070	0.177	2.50	80	1.35	1.35	5.01
0.0059	0.149	2.75	100	1.48	1.48	6.49
0.0049	0.125	3.00	120	1.62	1.62	8.11
0.0041	0.105	3.25	140	1.88	1.88	9.99
0.0035	0.088	3.50	170	2.50	2.50	12.49
0.0029	0.074	3.75	200	3.72	3.72	16.21
0.0025	0.063	4.00	230	5.40	5.40	21.61
0.0021	0.053	4.25	270	7.14	7.14	28.75
0.00174	0.0442	4.50	325	8.46	8.46	37.21
0.00146	0.0372	4.75	400	8.82	8.82	46.03
0.00123	0.0313	5.00	450	8.28	8.28	54.31
0.000986	0.0250	5.32	500	8.98	8.98	63.29
0.000790	0.0201	5.64	635	6.84	6.84	70.13
0.000615	0.0156	6.00		5.55	5.55	75.68
0.000435	0.0110	6.50		5.21	5.21	80.89
0.000308	0.00781	7.00		3.68	3.68	84.57
0.000197	0.00500	7.65		3.68	3.68	88.25
0.000077	0.00195	9.00		5.95	5.95	94.20
0.000038	0.000977	10.00		3.49	3.49	97.69
0.000019	0.000488	11.00		2.09	2.09	99.78
0.000015	0.000375	11.38		0.22	0.22	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.50	0.0070	0.177
10	3.25	0.0041	0.105
16	3.74	0.0030	0.075
25	4.12	0.0023	0.058
40	4.58	0.0016	0.042
50	4.87	0.0013	0.034
60	5.20	0.0011	0.027
75	5.96	0.0006	0.016
84	6.92	0.0003	0.008
90	8.04	0.0001	0.004
95	9.23	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.87	4.87	4.87
Median, in.	0.0013	0.0013	0.0013
Median, mm	0.034	0.034	0.034
Mean, phi	4.76	5.33	5.18
Mean, in.	0.0015	0.0010	0.0011
Mean, mm	0.037	0.025	0.028
Sorting	1.890	1.593	1.817
Skewness	0.890	0.288	0.292
Kurtosis	0.205	1.112	1.502

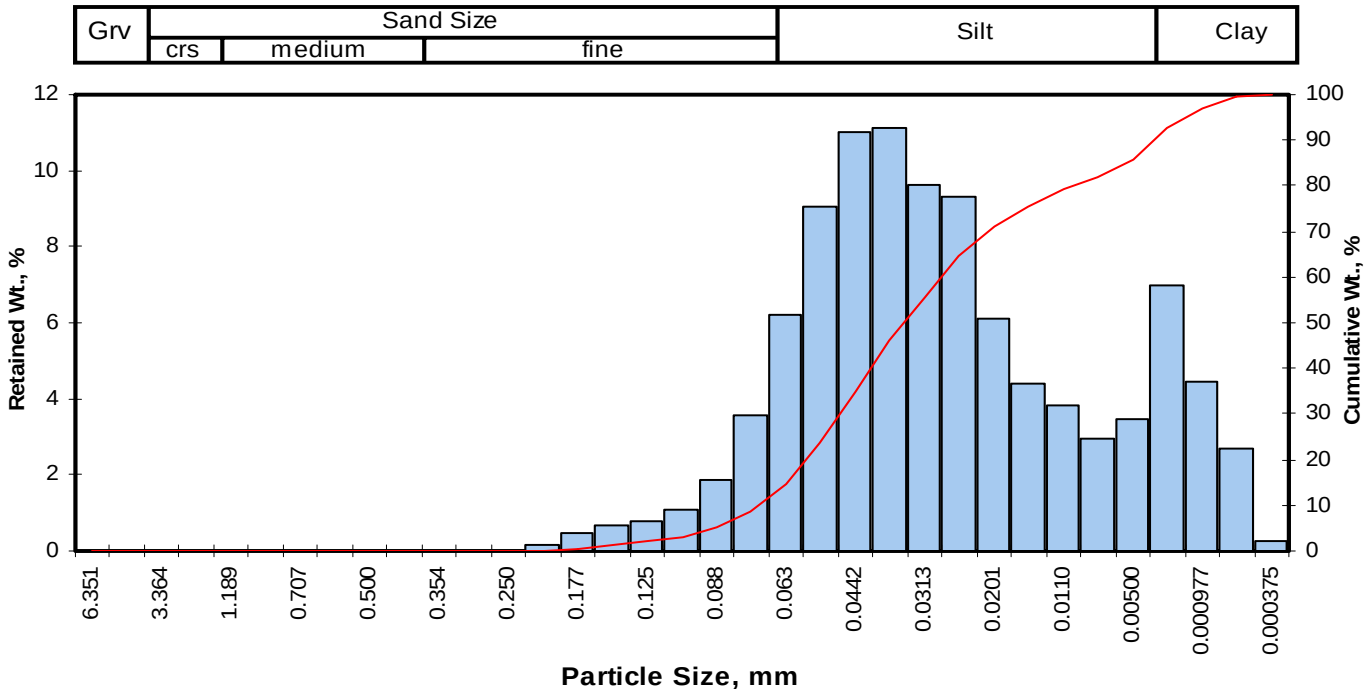
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.08
Fine Sand	200	16.13
Silt	>0.005 mm	72.04
Clay	<0.005 mm	11.75
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/11.5-13.5'/050923
Project No:	15-03095.14-006	**Depth, ft:**	12.25



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.02	0.02	0.02
0.0083	0.210	2.25	70	0.18	0.18	0.20
0.0070	0.177	2.50	80	0.44	0.44	0.64
0.0059	0.149	2.75	100	0.66	0.66	1.30
0.0049	0.125	3.00	120	0.80	0.80	2.10
0.0041	0.105	3.25	140	1.07	1.07	3.17
0.0035	0.088	3.50	170	1.84	1.84	5.01
0.0029	0.074	3.75	200	3.56	3.56	8.57
0.0025	0.063	4.00	230	6.22	6.22	14.79
0.0021	0.053	4.25	270	9.06	9.06	23.84
0.00174	0.0442	4.50	325	11.00	11.00	34.84
0.00146	0.0372	4.75	400	11.10	11.10	45.93
0.00123	0.0313	5.00	450	9.62	9.62	55.55
0.000986	0.0250	5.32	500	9.29	9.29	64.84
0.000790	0.0201	5.64	635	6.10	6.10	70.93
0.000615	0.0156	6.00		4.38	4.38	75.31
0.000435	0.0110	6.50		3.84	3.84	79.15
0.000308	0.00781	7.00		2.94	2.94	82.09
0.000197	0.00500	7.65		3.49	3.49	85.58
0.000077	0.00195	9.00		6.99	6.99	92.56
0.000038	0.000977	10.00		4.47	4.47	97.03
0.000019	0.000488	11.00		2.69	2.69	99.72
0.000015	0.000375	11.38		0.28	0.28	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.50	0.0035	0.088
10	3.81	0.0028	0.071
16	4.03	0.0024	0.061
25	4.28	0.0020	0.052
40	4.62	0.0016	0.041
50	4.86	0.0014	0.035
60	5.15	0.0011	0.028
75	5.97	0.0006	0.016
84	7.35	0.0002	0.006
90	8.50	0.0001	0.003
95	9.55	0.0001	0.001

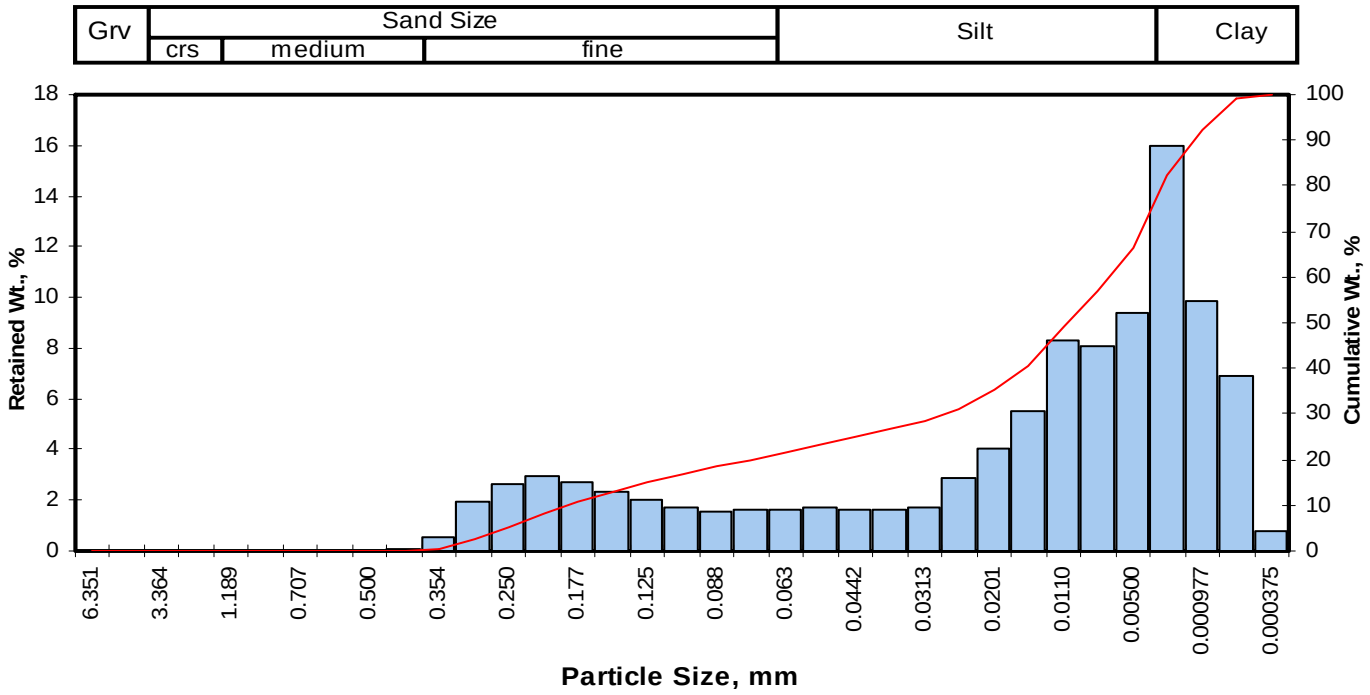
Measure	Trask	Inman	Folk-Ward
Median, phi	4.86	4.86	4.86
Median, in.	0.0014	0.0014	0.0014
Median, mm	0.035	0.035	0.035
Mean, phi	4.89	5.69	5.41
Mean, in.	0.0013	0.0008	0.0009
Mean, mm	0.034	0.019	0.023
Sorting	1.801	1.660	1.746
Skewness	0.830	0.505	0.528
Kurtosis	0.260	0.821	1.459
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	8.57
Silt	>0.005 mm	77.01
Clay	<0.005 mm	14.42
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/16.5-18.5'/050926
Project No:	15-03095.14-006	**Depth, ft:**	17.7



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.10	0.10	0.10
0.0139	0.354	1.50	45	0.51	0.51	0.61
0.0117	0.297	1.75	50	1.93	1.93	2.54
0.0098	0.250	2.00	60	2.62	2.62	5.16
0.0083	0.210	2.25	70	2.93	2.93	8.09
0.0070	0.177	2.50	80	2.70	2.70	10.78
0.0059	0.149	2.75	100	2.34	2.34	13.12
0.0049	0.125	3.00	120	1.98	1.98	15.10
0.0041	0.105	3.25	140	1.72	1.72	16.82
0.0035	0.088	3.50	170	1.59	1.59	18.41
0.0029	0.074	3.75	200	1.61	1.61	20.02
0.0025	0.063	4.00	230	1.66	1.66	21.68
0.0021	0.053	4.25	270	1.67	1.67	23.35
0.00174	0.0442	4.50	325	1.62	1.62	24.97
0.00146	0.0372	4.75	400	1.60	1.60	26.57
0.00123	0.0313	5.00	450	1.73	1.73	28.30
0.000986	0.0250	5.32	500	2.84	2.84	31.14
0.000790	0.0201	5.64	635	4.03	4.03	35.17
0.000615	0.0156	6.00		5.53	5.53	40.69
0.000435	0.0110	6.50		8.34	8.34	49.03
0.000308	0.00781	7.00		8.07	8.07	57.10
0.000197	0.00500	7.65		9.39	9.39	66.48
0.000077	0.00195	9.00		16.00	15.99	82.48
0.000038	0.000977	10.00		9.88	9.88	92.35
0.000019	0.000488	11.00		6.88	6.88	99.23
0.000015	0.000375	11.38		0.77	0.77	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.98	0.0099	0.253
10	2.43	0.0073	0.186
16	3.13	0.0045	0.114
25	4.50	0.0017	0.044
40	5.95	0.0006	0.016
50	6.56	0.0004	0.011
60	7.20	0.0003	0.007
75	8.37	0.0001	0.003
84	9.15	0.0001	0.002
90	9.76	0.0000	0.001
95	10.38	0.0000	0.001

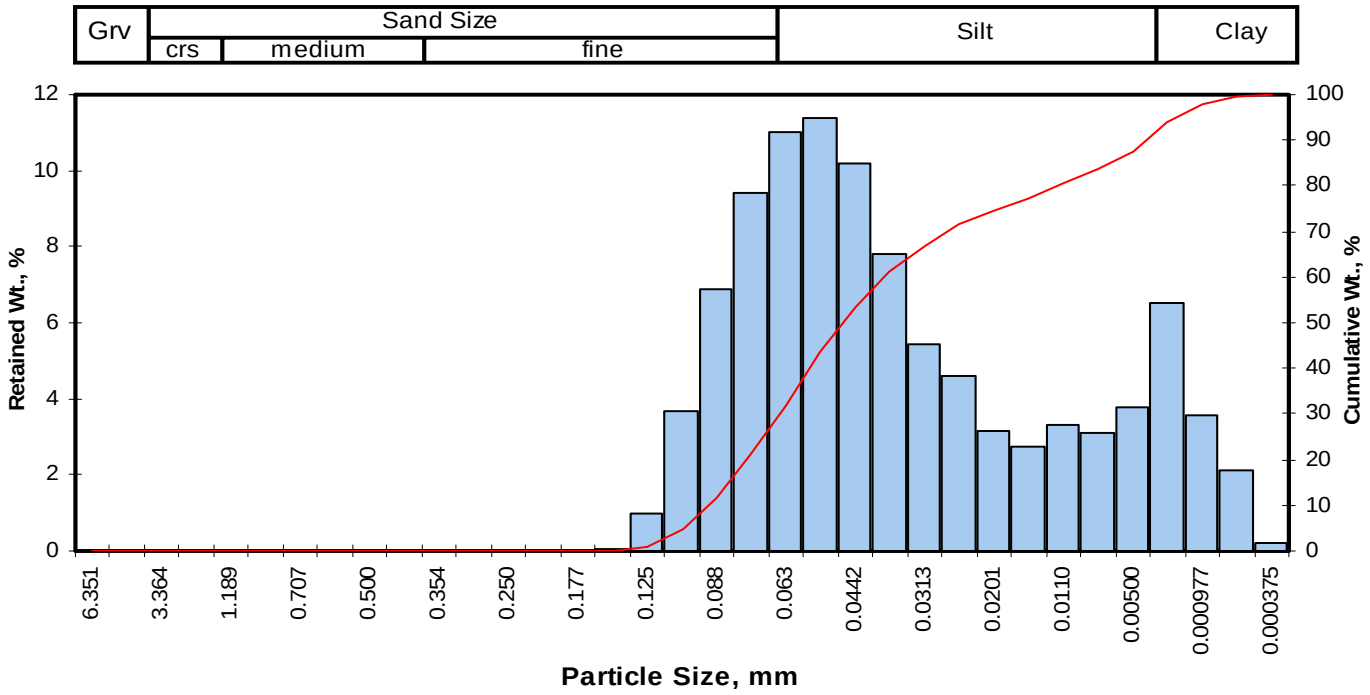
Measure	Trask	Inman	Folk-Ward
Median, phi	6.56	6.56	6.56
Median, in.	0.0004	0.0004	0.0004
Median, mm	0.011	0.011	0.011
Mean, phi	5.41	6.14	6.28
Mean, in.	0.0009	0.0006	0.0005
Mean, mm	0.024	0.014	0.013
Sorting	3.813	3.012	2.779
Skewness	1.090	-0.139	-0.114
Kurtosis	0.111	0.394	0.891
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.10
Fine Sand	200	19.92
Silt	>0.005 mm	46.46
Clay	<0.005 mm	33.52
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/18.5-20.5'/050926
Project No:	15-03095.14-006	**Depth, ft:**	19.8



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.05	0.05	0.05
0.0049	0.125	3.00	120	0.97	0.97	1.02
0.0041	0.105	3.25	140	3.67	3.67	4.69
0.0035	0.088	3.50	170	6.86	6.86	11.55
0.0029	0.074	3.75	200	9.41	9.41	20.95
0.0025	0.063	4.00	230	11.00	10.99	31.94
0.0021	0.053	4.25	270	11.40	11.39	43.34
0.00174	0.0442	4.50	325	10.20	10.19	53.53
0.00146	0.0372	4.75	400	7.84	7.84	61.37
0.00123	0.0313	5.00	450	5.45	5.45	66.82
0.000986	0.0250	5.32	500	4.61	4.61	71.42
0.000790	0.0201	5.64	635	3.17	3.17	74.59
0.000615	0.0156	6.00		2.76	2.76	77.35
0.000435	0.0110	6.50		3.31	3.31	80.66
0.000308	0.00781	7.00		3.11	3.11	83.77
0.000197	0.00500	7.65		3.77	3.77	87.54
0.000077	0.00195	9.00		6.51	6.51	94.04
0.000038	0.000977	10.00		3.59	3.59	97.63
0.000019	0.000488	11.00		2.14	2.14	99.77
0.000015	0.000375	11.38		0.23	0.23	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.26	0.0041	0.104
10	3.44	0.0036	0.092
16	3.62	0.0032	0.081
25	3.84	0.0027	0.070
40	4.18	0.0022	0.055
50	4.41	0.0018	0.047
60	4.71	0.0015	0.038
75	5.69	0.0008	0.019
84	7.04	0.0003	0.008
90	8.16	0.0001	0.004
95	9.27	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.41	4.41	4.41
Median, in.	0.0018	0.0018	0.0018
Median, mm	0.047	0.047	0.047
Mean, phi	4.49	5.33	5.02
Mean, in.	0.0018	0.0010	0.0012
Mean, mm	0.045	0.025	0.031
Sorting	1.899	1.711	1.765
Skewness	0.782	0.535	0.576
Kurtosis	0.285	0.755	1.330

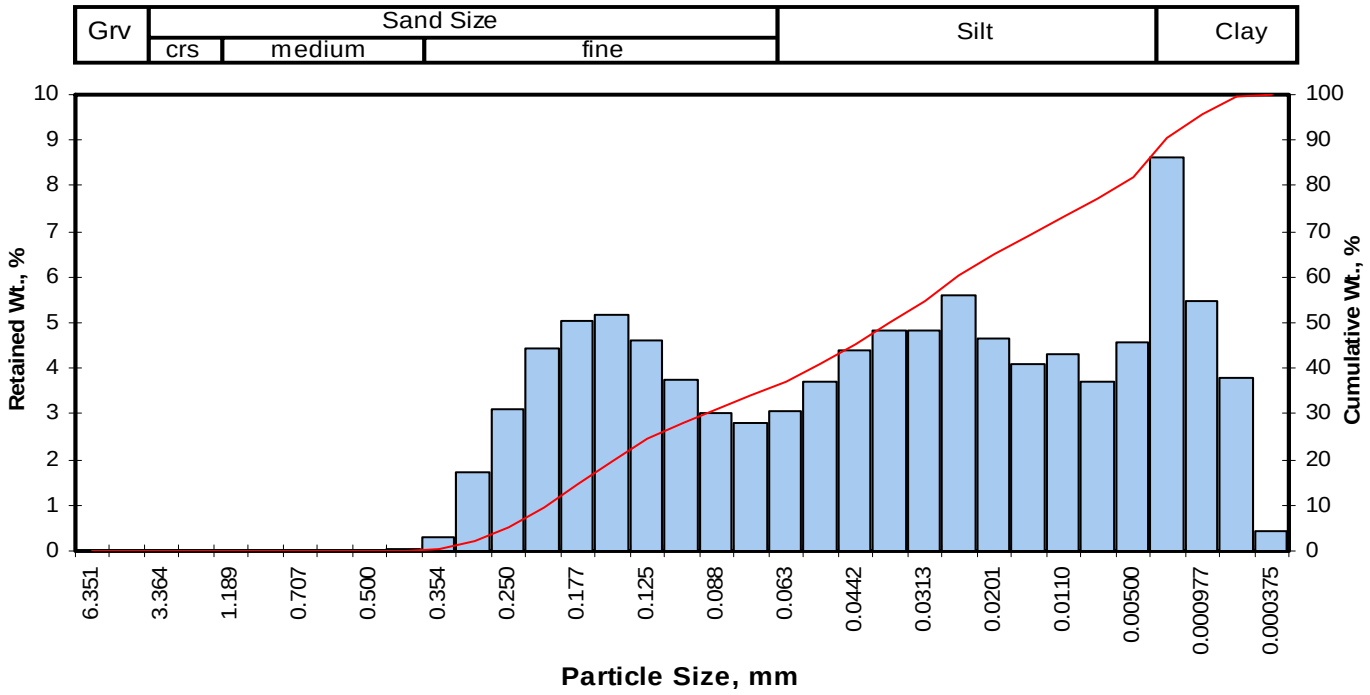
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	20.95
Silt	>0.005 mm	66.59
Clay	<0.005 mm	12.46
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/27-29'/050926
Project No:	15-03095.14-006	**Depth, ft:**	28.2



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.04	0.04	0.04
0.0139	0.354	1.50	45	0.32	0.32	0.36
0.0117	0.297	1.75	50	1.74	1.74	2.10
0.0098	0.250	2.00	60	3.11	3.11	5.21
0.0083	0.210	2.25	70	4.42	4.42	9.63
0.0070	0.177	2.50	80	5.06	5.06	14.69
0.0059	0.149	2.75	100	5.16	5.16	19.85
0.0049	0.125	3.00	120	4.60	4.60	24.45
0.0041	0.105	3.25	140	3.75	3.75	28.20
0.0035	0.088	3.50	170	3.03	3.03	31.23
0.0029	0.074	3.75	200	2.79	2.79	34.02
0.0025	0.063	4.00	230	3.07	3.07	37.09
0.0021	0.053	4.25	270	3.69	3.69	40.78
0.00174	0.0442	4.50	325	4.40	4.40	45.18
0.00146	0.0372	4.75	400	4.82	4.82	50.00
0.00123	0.0313	5.00	450	4.81	4.81	54.81
0.000986	0.0250	5.32	500	5.62	5.62	60.43
0.000790	0.0201	5.64	635	4.66	4.66	65.09
0.000615	0.0156	6.00		4.08	4.08	69.17
0.000435	0.0110	6.50		4.30	4.30	73.47
0.000308	0.00781	7.00		3.69	3.69	77.16
0.000197	0.00500	7.65		4.55	4.55	81.71
0.000077	0.00195	9.00		8.61	8.61	90.32
0.000038	0.000977	10.00		5.47	5.47	95.79
0.000019	0.000488	11.00		3.79	3.79	99.58
0.000015	0.000375	11.38		0.42	0.42	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.98	0.0100	0.253
10	2.27	0.0082	0.208
16	2.56	0.0067	0.169
25	3.04	0.0048	0.122
40	4.20	0.0021	0.055
50	4.75	0.0015	0.037
60	5.30	0.0010	0.025
75	6.71	0.0004	0.010
84	8.01	0.0002	0.004
90	8.95	0.0001	0.002
95	9.86	0.0000	0.001

Measure	Trask	Inman	Folk-Ward
Median, phi	4.75	4.75	4.75
Median, in.	0.0015	0.0015	0.0015
Median, mm	0.037	0.037	0.037
Mean, phi	3.93	5.28	5.11
Mean, in.	0.0026	0.0010	0.0011
Mean, mm	0.066	0.026	0.029
Sorting	3.569	2.721	2.553
Skewness	0.919	0.196	0.247
Kurtosis	0.273	0.447	0.879
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

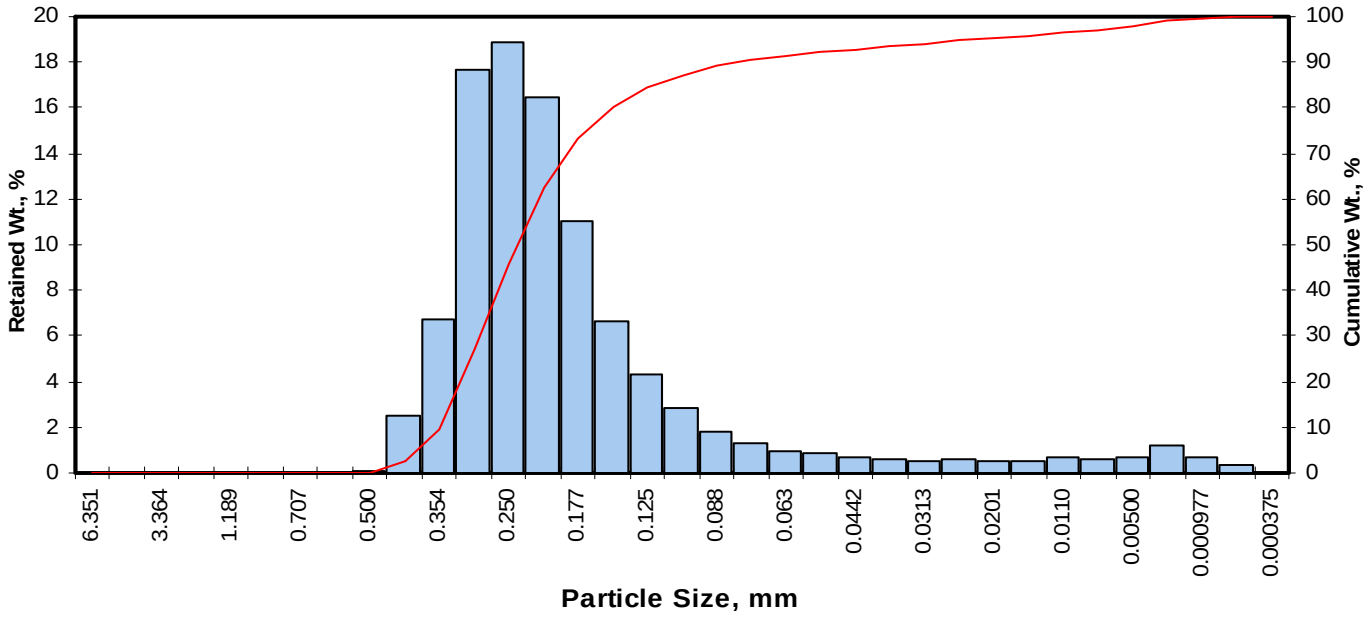
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.04
Fine Sand	200	33.98
Silt	>0.005 mm	47.69
Clay	<0.005 mm	18.29
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/29-31'/050926
Project No:	15-03095.14-006	**Depth, ft:**	30.3

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.10	0.09	0.09
0.0166	0.420	1.25	40	2.48	2.48	2.57
0.0139	0.354	1.50	45	6.73	6.73	9.30
0.0117	0.297	1.75	50	17.70	17.69	26.99
0.0098	0.250	2.00	60	18.90	18.89	45.87
0.0083	0.210	2.25	70	16.50	16.49	62.36
0.0070	0.177	2.50	80	11.00	10.99	73.36
0.0059	0.149	2.75	100	6.68	6.68	80.03
0.0049	0.125	3.00	120	4.33	4.33	84.36
0.0041	0.105	3.25	140	2.87	2.87	87.23
0.0035	0.088	3.50	170	1.84	1.84	89.06
0.0029	0.074	3.75	200	1.26	1.26	90.32
0.0025	0.063	4.00	230	0.98	0.98	91.30
0.0021	0.053	4.25	270	0.82	0.82	92.12
0.00174	0.0442	4.50	325	0.71	0.71	92.83
0.00146	0.0372	4.75	400	0.63	0.63	93.46
0.00123	0.0313	5.00	450	0.55	0.55	94.01
0.000986	0.0250	5.32	500	0.61	0.61	94.62
0.000790	0.0201	5.64	635	0.55	0.55	95.17
0.000615	0.0156	6.00		0.56	0.56	95.73
0.000435	0.0110	6.50		0.68	0.68	96.41
0.000308	0.00781	7.00		0.62	0.62	97.03
0.000197	0.00500	7.65		0.71	0.71	97.74
0.000077	0.00195	9.00		1.21	1.21	98.95
0.000038	0.000977	10.00		0.66	0.66	99.61
0.000019	0.000488	11.00		0.36	0.36	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.34	0.0155	0.395
10	1.51	0.0138	0.351
16	1.59	0.0130	0.331
25	1.72	0.0119	0.303
40	1.92	0.0104	0.264
50	2.06	0.0094	0.239
60	2.21	0.0085	0.216
75	2.56	0.0067	0.169
84	2.98	0.0050	0.127
90	3.69	0.0031	0.078
95	5.54	0.0008	0.021

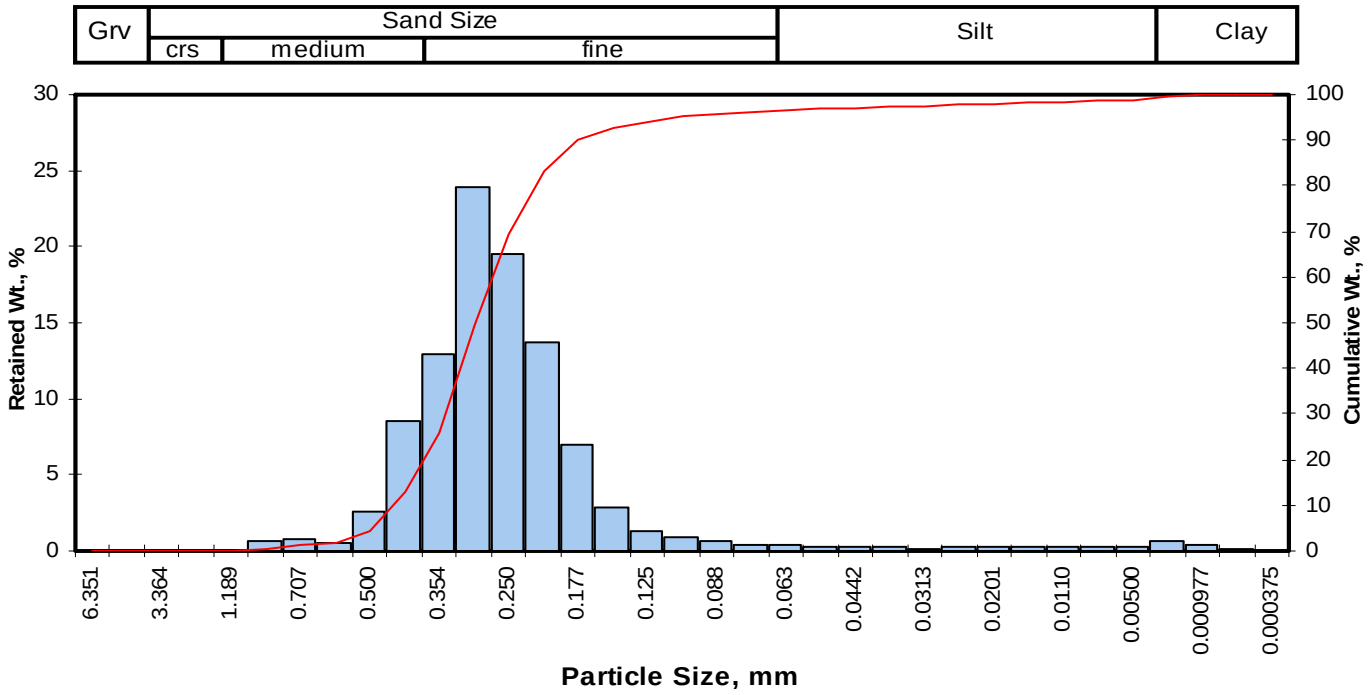
Measure	Trask	Inman	Folk-Ward
Median, phi	2.06	2.06	2.06
Median, in.	0.0094	0.0094	0.0094
Median, mm	0.239	0.239	0.239
Mean, phi	2.08	2.29	2.21
Mean, in.	0.0093	0.0081	0.0085
Mean, mm	0.236	0.205	0.216
Sorting	1.338	0.692	0.983
Skewness	0.947	0.324	0.490
Kurtosis	0.245	2.034	2.050
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.57
Fine Sand	200	87.75
Silt	>0.005 mm	7.41
Clay	<0.005 mm	2.26
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/31-33'/050926
Project No:	15-03095.14-006	**Depth, ft:**	31.3



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.61	0.61	0.61
0.0278	0.707	0.50	25	0.73	0.73	1.34
0.0234	0.595	0.75	30	0.47	0.47	1.81
0.0197	0.500	1.00	35	2.58	2.58	4.39
0.0166	0.420	1.25	40	8.57	8.57	12.95
0.0139	0.354	1.50	45	12.90	12.89	25.85
0.0117	0.297	1.75	50	23.90	23.89	49.74
0.0098	0.250	2.00	60	19.60	19.59	69.33
0.0083	0.210	2.25	70	13.70	13.69	83.02
0.0070	0.177	2.50	80	7.00	7.00	90.01
0.0059	0.149	2.75	100	2.82	2.82	92.83
0.0049	0.125	3.00	120	1.34	1.34	94.17
0.0041	0.105	3.25	140	0.91	0.91	95.08
0.0035	0.088	3.50	170	0.65	0.65	95.73
0.0029	0.074	3.75	200	0.45	0.45	96.18
0.0025	0.063	4.00	230	0.34	0.34	96.52
0.0021	0.053	4.25	270	0.28	0.28	96.80
0.00174	0.0442	4.50	325	0.24	0.24	97.04
0.00146	0.0372	4.75	400	0.21	0.21	97.25
0.00123	0.0313	5.00	450	0.19	0.19	97.44
0.000986	0.0250	5.32	500	0.21	0.21	97.65
0.000790	0.0201	5.64	635	0.20	0.20	97.85
0.000615	0.0156	6.00		0.21	0.21	98.06
0.000435	0.0110	6.50		0.26	0.26	98.32
0.000308	0.00781	7.00		0.25	0.25	98.57
0.000197	0.00500	7.65		0.32	0.32	98.89
0.000077	0.00195	9.00		0.66	0.66	99.55
0.000038	0.000977	10.00		0.35	0.35	99.90
0.000019	0.000488	11.00		0.10	0.10	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.02	0.0194	0.494
10	1.16	0.0176	0.446
16	1.31	0.0159	0.404
25	1.48	0.0141	0.358
40	1.65	0.0126	0.319
50	1.75	0.0117	0.297
60	1.88	0.0107	0.271
75	2.10	0.0092	0.233
84	2.29	0.0081	0.205
90	2.50	0.0070	0.177
95	3.23	0.0042	0.107

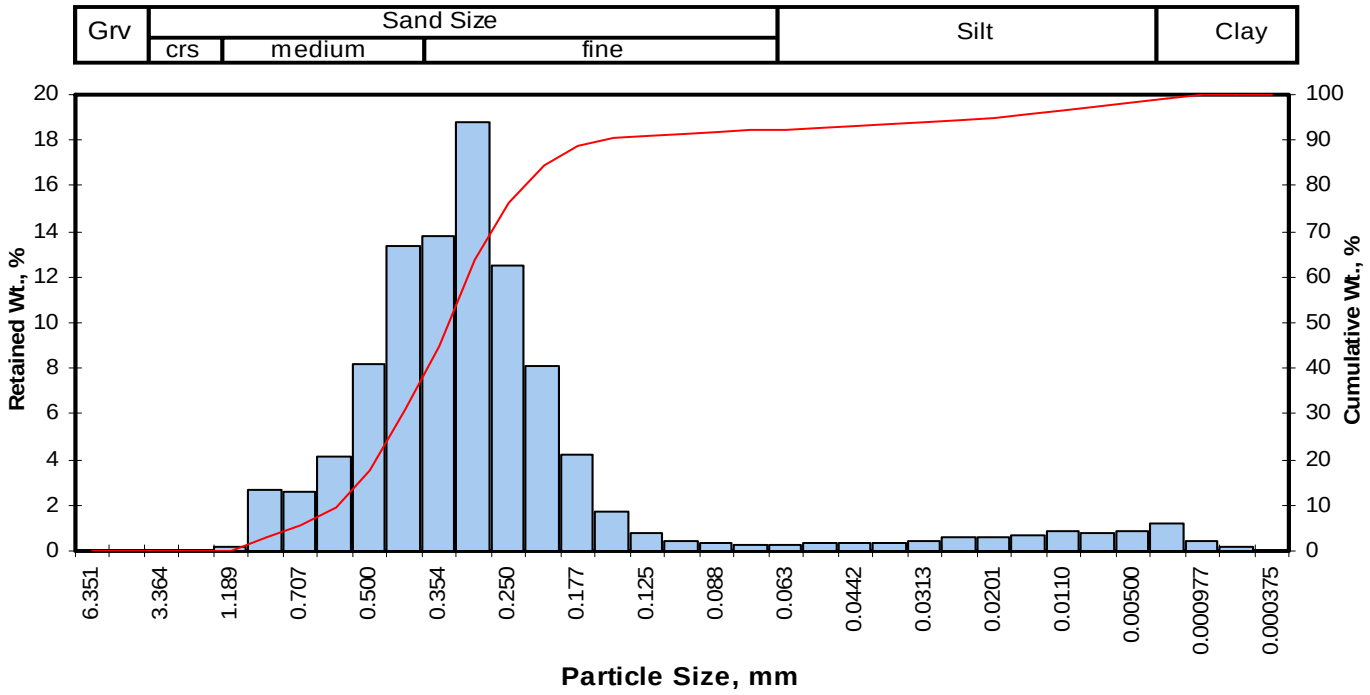
Measure	Trask	Inman	Folk-Ward
Median, phi	1.75	1.75	1.75
Median, in.	0.0117	0.0117	0.0117
Median, mm	0.297	0.297	0.297
Mean, phi	1.76	1.80	1.78
Mean, in.	0.0116	0.0113	0.0114
Mean, mm	0.295	0.288	0.291
Sorting	1.240	0.488	0.579
Skewness	0.973	0.090	0.212
Kurtosis	0.232	1.264	1.460
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	12.95
Fine Sand	200	83.23
Silt	>0.005 mm	2.71
Clay	<0.005 mm	1.11
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/33-35'/050926
Project No:	15-03095.14-006	**Depth, ft:**	33.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.21	0.21	0.21
0.0331	0.841	0.25	20	2.71	2.71	2.92
0.0278	0.707	0.50	25	2.56	2.56	5.48
0.0234	0.595	0.75	30	4.17	4.17	9.65
0.0197	0.500	1.00	35	8.18	8.18	17.83
0.0166	0.420	1.25	40	13.40	13.40	31.23
0.0139	0.354	1.50	45	13.80	13.80	45.02
0.0117	0.297	1.75	50	18.80	18.80	63.82
0.0098	0.250	2.00	60	12.50	12.50	76.32
0.0083	0.210	2.25	70	8.09	8.09	84.41
0.0070	0.177	2.50	80	4.20	4.20	88.61
0.0059	0.149	2.75	100	1.75	1.75	90.36
0.0049	0.125	3.00	120	0.74	0.74	91.10
0.0041	0.105	3.25	140	0.42	0.42	91.52
0.0035	0.088	3.50	170	0.31	0.31	91.83
0.0029	0.074	3.75	200	0.27	0.27	92.10
0.0025	0.063	4.00	230	0.30	0.30	92.40
0.0021	0.053	4.25	270	0.31	0.31	92.71
0.00174	0.0442	4.50	325	0.33	0.33	93.04
0.00146	0.0372	4.75	400	0.38	0.38	93.42
0.00123	0.0313	5.00	450	0.41	0.41	93.82
0.000986	0.0250	5.32	500	0.57	0.57	94.39
0.000790	0.0201	5.64	635	0.61	0.61	95.00
0.000615	0.0156	6.00		0.67	0.67	95.67
0.000435	0.0110	6.50		0.86	0.86	96.53
0.000308	0.00781	7.00		0.76	0.76	97.29
0.000197	0.00500	7.65		0.84	0.84	98.13
0.000077	0.00195	9.00		1.20	1.20	99.33
0.000038	0.000977	10.00		0.46	0.46	99.79
0.000019	0.000488	11.00		0.19	0.19	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.45	0.0288	0.730
10	0.76	0.0232	0.590
16	0.94	0.0205	0.520
25	1.13	0.0179	0.456
40	1.41	0.0148	0.377
50	1.57	0.0133	0.338
60	1.70	0.0121	0.308
75	1.97	0.0100	0.255
84	2.24	0.0083	0.212
90	2.70	0.0061	0.154
95	5.64	0.0008	0.020

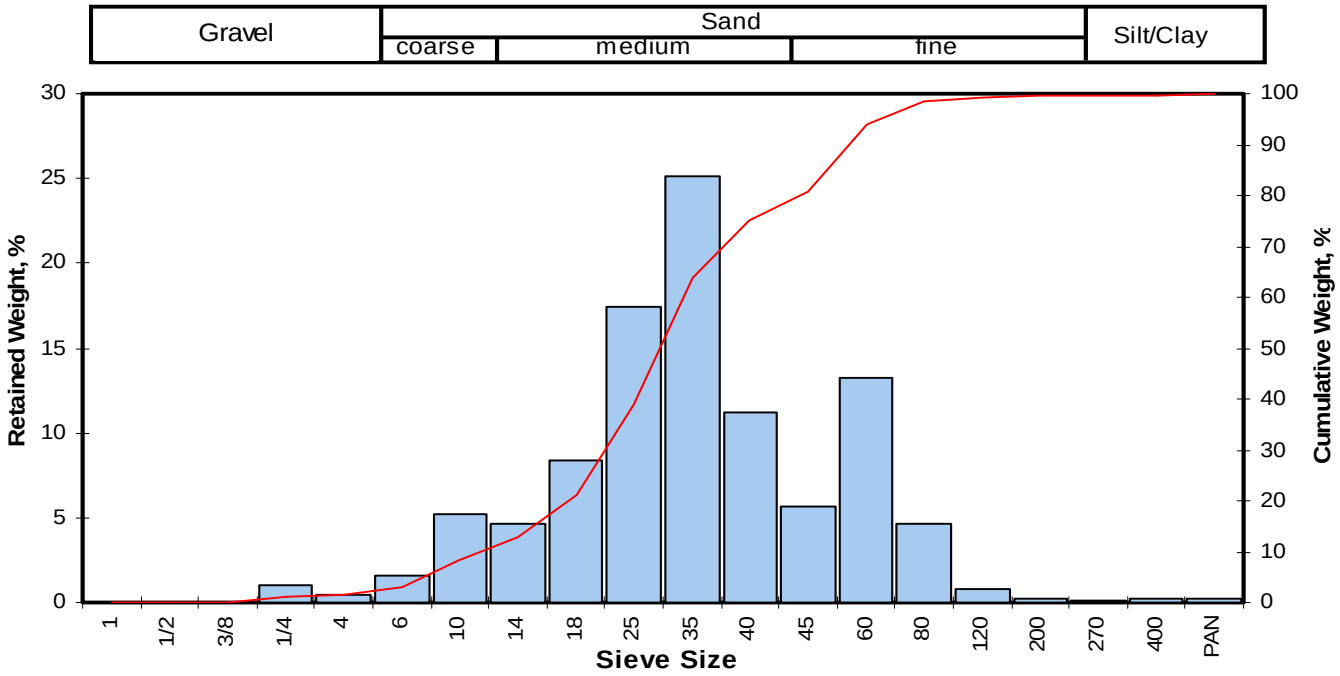
Measure	Trask	Inman	Folk-Ward
Median, phi	1.57	1.57	1.57
Median, in.	0.0133	0.0133	0.0133
Median, mm	0.338	0.338	0.338
Mean, phi	1.49	1.59	1.58
Mean, in.	0.0140	0.0131	0.0131
Mean, mm	0.355	0.332	0.334
Sorting	1.338	0.647	1.109
Skewness	1.009	0.038	0.304
Kurtosis	0.230	3.009	2.530
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	31.23
Fine Sand	200	60.87
Silt	>0.005 mm	6.04
Clay	<0.005 mm	1.87
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/41-43'/050926
Project No:	15-03095.14-006	**Depth, ft:**	41.6



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	0.54	1.06	1.06
0.1873	4.757	-2.25	4	0.21	0.41	1.47
0.1324	3.364	-1.75	6	0.79	1.54	3.01
0.0787	2.000	-1.00	10	2.65	5.18	8.19
0.0557	1.414	-0.50	14	2.36	4.61	12.80
0.0394	1.000	0.00	18	4.30	8.40	21.20
0.0278	0.707	0.50	25	8.95	17.49	38.69
0.0197	0.500	1.00	35	12.84	25.09	63.77
0.0166	0.420	1.25	40	5.71	11.16	74.93
0.0139	0.354	1.50	45	2.90	5.67	80.60
0.0098	0.250	2.00	60	6.76	13.21	93.81
0.0070	0.177	2.50	80	2.36	4.61	98.42
0.0049	0.125	3.00	120	0.41	0.80	99.22
0.0029	0.074	3.75	200	0.13	0.25	99.47
0.0021	0.053	4.25	270	0.06	0.12	99.59
0.0015	0.037	4.75	400	0.09	0.18	99.77
			PAN	0.12	0.23	100.00
TOTALS				51.18	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-1.46	0.1084	2.754
10	-0.80	0.0687	1.745
16	-0.31	0.0488	1.239
25	0.11	0.0365	0.927
40	0.53	0.0273	0.694
50	0.73	0.0238	0.605
60	0.92	0.0207	0.527
75	1.25	0.0165	0.420
84	1.63	0.0127	0.323
90	1.86	0.0109	0.276
95	2.13	0.0090	0.229

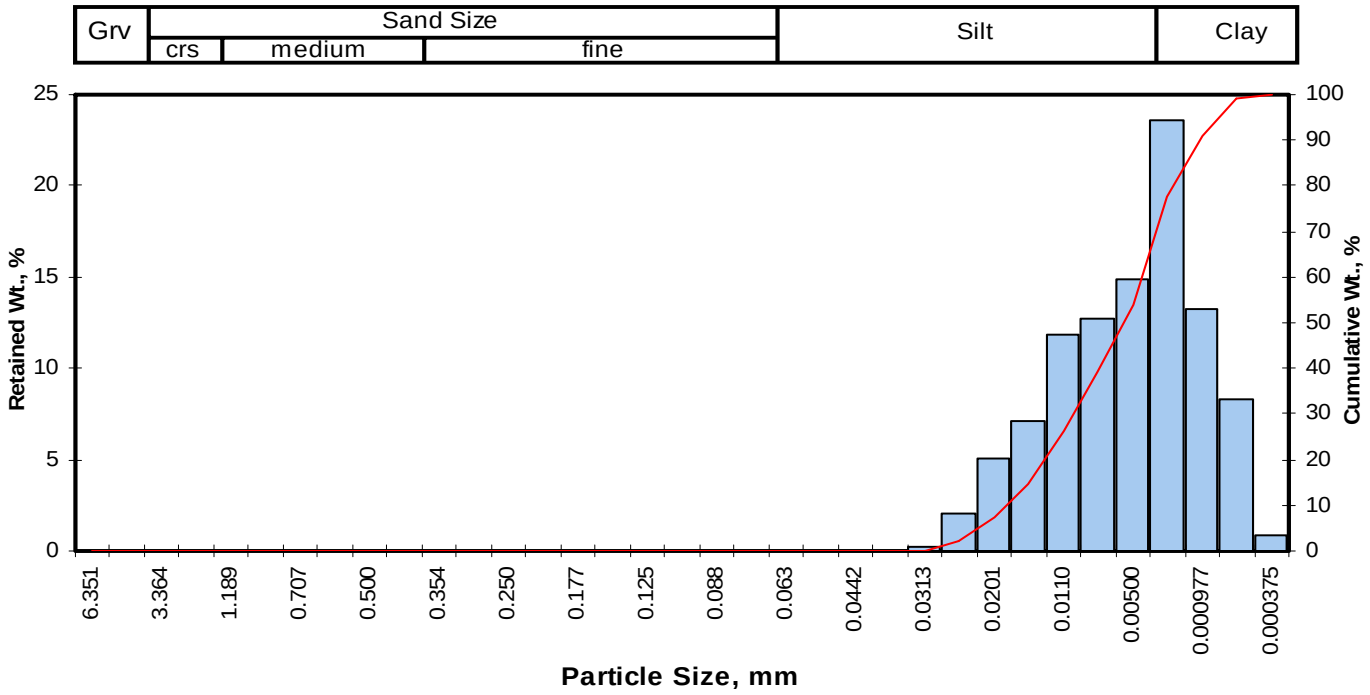
Measure	Trask	Inman	Folk-Ward
Median, phi	0.73	0.73	0.73
Median, in.	0.0238	0.0238	0.0238
Median, mm	0.605	0.605	0.605
Mean, phi	0.57	0.66	0.68
Mean, in.	0.0265	0.0249	0.0245
Mean, mm	0.674	0.633	0.623
Sorting	1.487	0.969	1.029
Skewness	1.031	-0.068	-0.143
Kurtosis	0.173	0.853	1.286
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	1.47
Coarse Sand	10	6.72
Medium Sand	40	66.74
Fine Sand	200	24.54
Silt/Clay	<200	0.53
	Total	100

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/17-19'/000923
Project No:	15-03095.14-006	**Depth, ft:**	17.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.00	0.00	0.00
0.0049	0.125	3.00	120	0.00	0.00	0.00
0.0041	0.105	3.25	140	0.00	0.00	0.00
0.0035	0.088	3.50	170	0.00	0.00	0.00
0.0029	0.074	3.75	200	0.00	0.00	0.00
0.0025	0.063	4.00	230	0.00	0.00	0.00
0.0021	0.053	4.25	270	0.00	0.00	0.00
0.00174	0.0442	4.50	325	0.00	0.00	0.00
0.00146	0.0372	4.75	400	0.00	0.00	0.00
0.00123	0.0313	5.00	450	0.21	0.21	0.21
0.000986	0.0250	5.32	500	2.07	2.07	2.28
0.000790	0.0201	5.64	635	5.02	5.02	7.30
0.000615	0.0156	6.00		7.14	7.14	14.44
0.000435	0.0110	6.50		11.90	11.90	26.34
0.000308	0.00781	7.00		12.70	12.70	39.05
0.000197	0.00500	7.65		14.90	14.90	53.95
0.000077	0.00195	9.00		23.60	23.60	77.55
0.000038	0.000977	10.00		13.20	13.20	90.75
0.000019	0.000488	11.00		8.35	8.35	99.10
0.000015	0.000375	11.38		0.90	0.90	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	5.49	0.0009	0.022
10	5.78	0.0007	0.018
16	6.07	0.0006	0.015
25	6.44	0.0005	0.011
40	7.04	0.0003	0.008
50	7.47	0.0002	0.006
60	7.99	0.0002	0.004
75	8.85	0.0001	0.002
84	9.49	0.0001	0.001
90	9.94	0.0000	0.001
95	10.51	0.0000	0.001

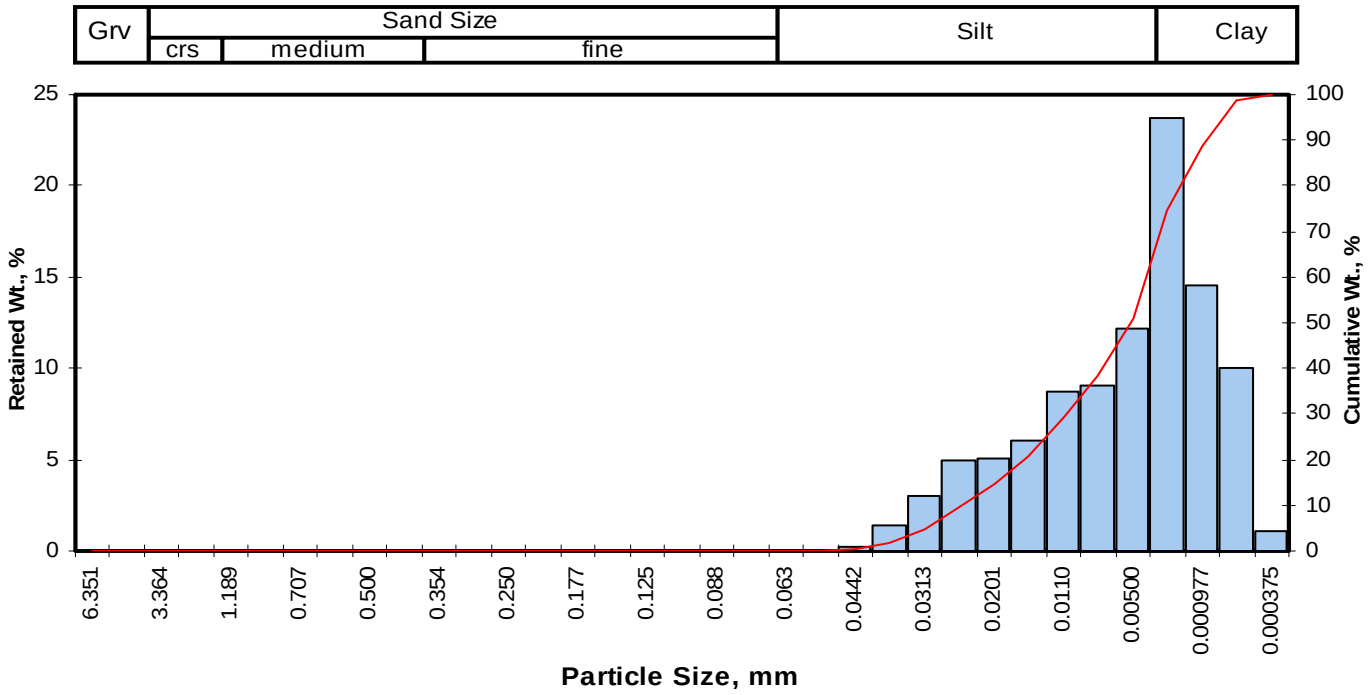
Measure	Trask	Inman	Folk-Ward
Median, phi	7.47	7.47	7.47
Median, in.	0.0002	0.0002	0.0002
Median, mm	0.006	0.006	0.006
Mean, phi	7.19	7.78	7.68
Mean, in.	0.0003	0.0002	0.0002
Mean, mm	0.007	0.005	0.005
Sorting	2.306	1.712	1.616
Skewness	0.886	0.177	0.194
Kurtosis	0.271	0.465	0.853
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	0.00
Silt	>0.005 mm	53.95
Clay	<0.005 mm	46.05
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/29-31'/000923
Project No:	15-03095.14-006	**Depth, ft:**	29.1



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.00	0.00	0.00
0.0049	0.125	3.00	120	0.00	0.00	0.00
0.0041	0.105	3.25	140	0.00	0.00	0.00
0.0035	0.088	3.50	170	0.00	0.00	0.00
0.0029	0.074	3.75	200	0.00	0.00	0.00
0.0025	0.063	4.00	230	0.00	0.00	0.00
0.0021	0.053	4.25	270	0.00	0.00	0.00
0.00174	0.0442	4.50	325	0.22	0.22	0.22
0.00146	0.0372	4.75	400	1.39	1.39	1.61
0.00123	0.0313	5.00	450	2.99	2.99	4.60
0.000986	0.0250	5.32	500	4.96	4.96	9.56
0.000790	0.0201	5.64	635	5.10	5.10	14.66
0.000615	0.0156	6.00		6.01	6.01	20.67
0.000435	0.0110	6.50		8.75	8.75	29.42
0.000308	0.00781	7.00		9.07	9.07	38.49
0.000197	0.00500	7.65		12.20	12.20	50.69
0.000077	0.00195	9.00		23.70	23.70	74.39
0.000038	0.000977	10.00		14.50	14.50	88.89
0.000019	0.000488	11.00		9.99	9.99	98.88
0.000015	0.000375	11.38		1.12	1.12	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	5.03	0.0012	0.031
10	5.35	0.0010	0.025
16	5.72	0.0007	0.019
25	6.25	0.0005	0.013
40	7.08	0.0003	0.007
50	7.61	0.0002	0.005
60	8.18	0.0001	0.003
75	9.04	0.0001	0.002
84	9.66	0.0000	0.001
90	10.11	0.0000	0.001
95	10.61	0.0000	0.001

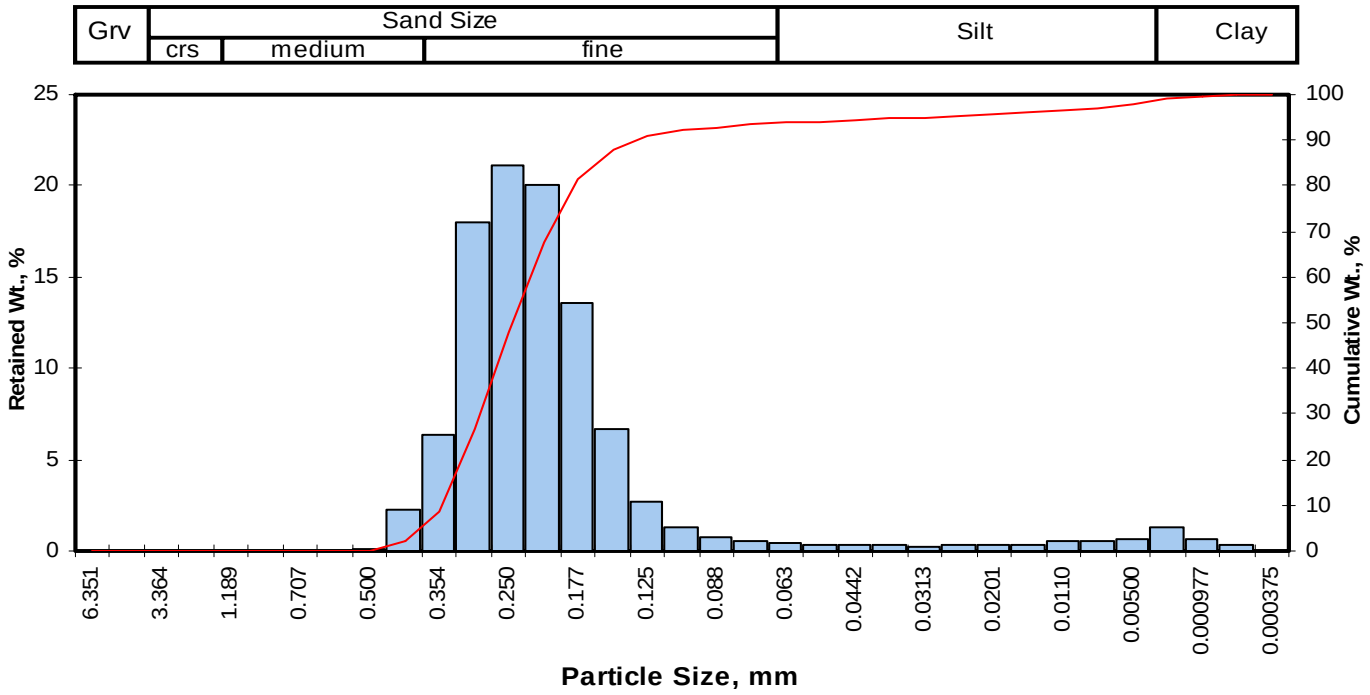
Measure	Trask	Inman	Folk-Ward
Median, phi	7.61	7.61	7.61
Median, in.	0.0002	0.0002	0.0002
Median, mm	0.005	0.005	0.005
Mean, phi	7.05	7.69	7.66
Mean, in.	0.0003	0.0002	0.0002
Mean, mm	0.008	0.005	0.005
Sorting	2.634	1.971	1.832
Skewness	0.975	0.042	0.059
Kurtosis	0.238	0.417	0.819
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	0.00
Silt	>0.005 mm	50.69
Clay	<0.005 mm	49.31
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/31-33'/000923
Project No:	15-03095.14-006	**Depth, ft:**	31.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.10	0.10	0.10
0.0166	0.420	1.25	40	2.25	2.25	2.35
0.0139	0.354	1.50	45	6.34	6.34	8.69
0.0117	0.297	1.75	50	18.00	18.00	26.69
0.0098	0.250	2.00	60	21.10	21.10	47.80
0.0083	0.210	2.25	70	20.00	20.00	67.80
0.0070	0.177	2.50	80	13.60	13.60	81.40
0.0059	0.149	2.75	100	6.69	6.69	88.10
0.0049	0.125	3.00	120	2.71	2.71	90.81
0.0041	0.105	3.25	140	1.24	1.24	92.05
0.0035	0.088	3.50	170	0.78	0.78	92.83
0.0029	0.074	3.75	200	0.56	0.56	93.39
0.0025	0.063	4.00	230	0.42	0.42	93.81
0.0021	0.053	4.25	270	0.34	0.34	94.15
0.00174	0.0442	4.50	325	0.30	0.30	94.45
0.00146	0.0372	4.75	400	0.28	0.28	94.73
0.00123	0.0313	5.00	450	0.25	0.25	94.98
0.000986	0.0250	5.32	500	0.30	0.30	95.28
0.000790	0.0201	5.64	635	0.31	0.31	95.59
0.000615	0.0156	6.00		0.35	0.35	95.94
0.000435	0.0110	6.50		0.49	0.49	96.43
0.000308	0.00781	7.00		0.52	0.52	96.95
0.000197	0.00500	7.65		0.69	0.69	97.64
0.000077	0.00195	9.00		1.29	1.29	98.93
0.000038	0.000977	10.00		0.69	0.69	99.62
0.000019	0.000488	11.00		0.35	0.35	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.35	0.0154	0.391
10	1.52	0.0137	0.349
16	1.60	0.0130	0.330
25	1.73	0.0119	0.302
40	1.91	0.0105	0.267
50	2.03	0.0097	0.245
60	2.15	0.0089	0.225
75	2.38	0.0076	0.192
84	2.60	0.0065	0.165
90	2.93	0.0052	0.132
95	5.02	0.0012	0.031

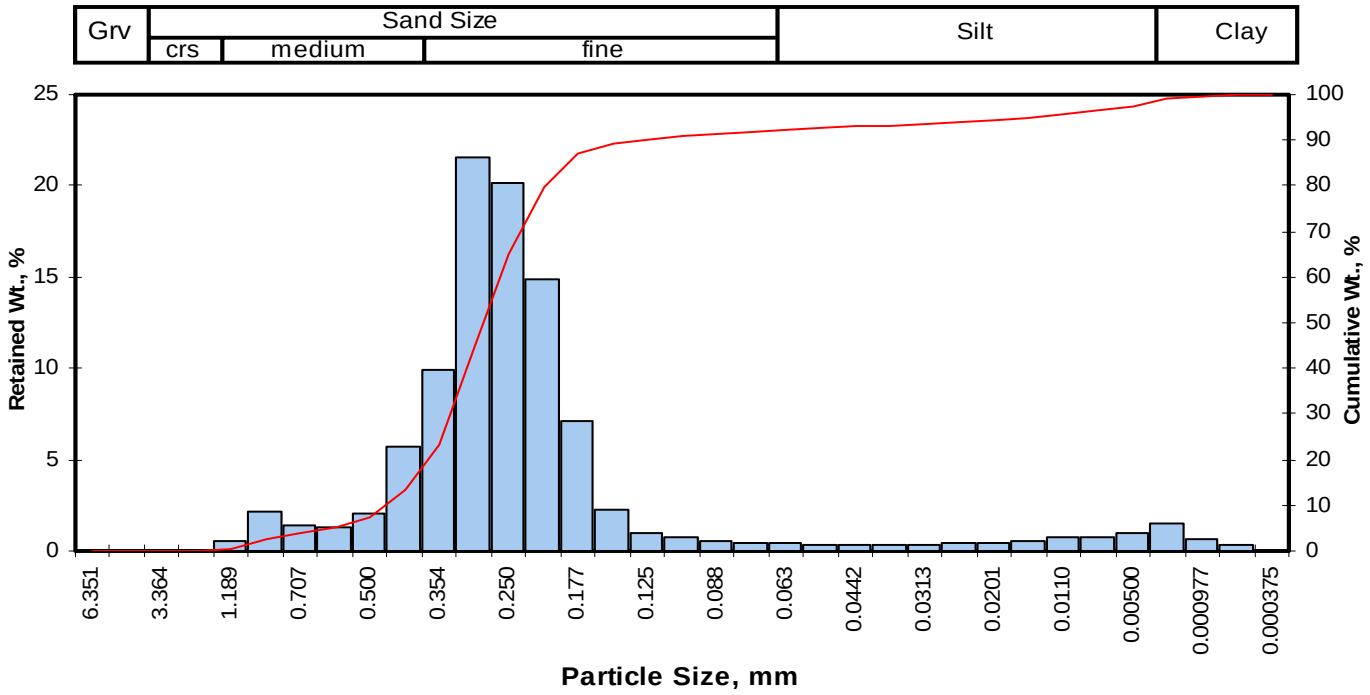
Measure	Trask	Inman	Folk-Ward
Median, phi	2.03	2.03	2.03
Median, in.	0.0097	0.0097	0.0097
Median, mm	0.245	0.245	0.245
Mean, phi	2.02	2.10	2.08
Mean, in.	0.0097	0.0092	0.0093
Mean, mm	0.247	0.233	0.237
Sorting	1.255	0.498	0.805
Skewness	0.982	0.144	0.389
Kurtosis	0.254	2.687	2.293
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.35
Fine Sand	200	91.04
Silt	>0.005 mm	4.25
Clay	<0.005 mm	2.36
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/33-35'/000923
Project No:	15-03095.14-006	**Depth, ft:**	33.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.53	0.53	0.53
0.0331	0.841	0.25	20	2.14	2.14	2.67
0.0278	0.707	0.50	25	1.40	1.40	4.07
0.0234	0.595	0.75	30	1.31	1.31	5.38
0.0197	0.500	1.00	35	2.09	2.09	7.47
0.0166	0.420	1.25	40	5.73	5.73	13.20
0.0139	0.354	1.50	45	9.90	9.90	23.10
0.0117	0.297	1.75	50	21.60	21.60	44.70
0.0098	0.250	2.00	60	20.20	20.20	64.90
0.0083	0.210	2.25	70	14.90	14.90	79.79
0.0070	0.177	2.50	80	7.12	7.12	86.91
0.0059	0.149	2.75	100	2.25	2.25	89.16
0.0049	0.125	3.00	120	0.94	0.94	90.10
0.0041	0.105	3.25	140	0.75	0.75	90.85
0.0035	0.088	3.50	170	0.58	0.58	91.43
0.0029	0.074	3.75	200	0.45	0.45	91.88
0.0025	0.063	4.00	230	0.40	0.40	92.28
0.0021	0.053	4.25	270	0.36	0.36	92.64
0.00174	0.0442	4.50	325	0.33	0.33	92.97
0.00146	0.0372	4.75	400	0.33	0.33	93.30
0.00123	0.0313	5.00	450	0.32	0.32	93.62
0.000986	0.0250	5.32	500	0.42	0.42	94.04
0.000790	0.0201	5.64	635	0.45	0.45	94.49
0.000615	0.0156	6.00		0.52	0.52	95.01
0.000435	0.0110	6.50		0.74	0.74	95.75
0.000308	0.00781	7.00		0.77	0.77	96.52
0.000197	0.00500	7.65		0.94	0.94	97.46
0.000077	0.00195	9.00		1.53	1.53	98.99
0.000038	0.000977	10.00		0.67	0.67	99.66
0.000019	0.000488	11.00		0.31	0.31	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.68	0.0246	0.625
10	1.11	0.0182	0.463
16	1.32	0.0158	0.400
25	1.52	0.0137	0.348
40	1.70	0.0122	0.309
50	1.82	0.0112	0.284
60	1.94	0.0103	0.261
75	2.17	0.0088	0.222
84	2.40	0.0075	0.190
90	2.97	0.0050	0.127
95	5.99	0.0006	0.016

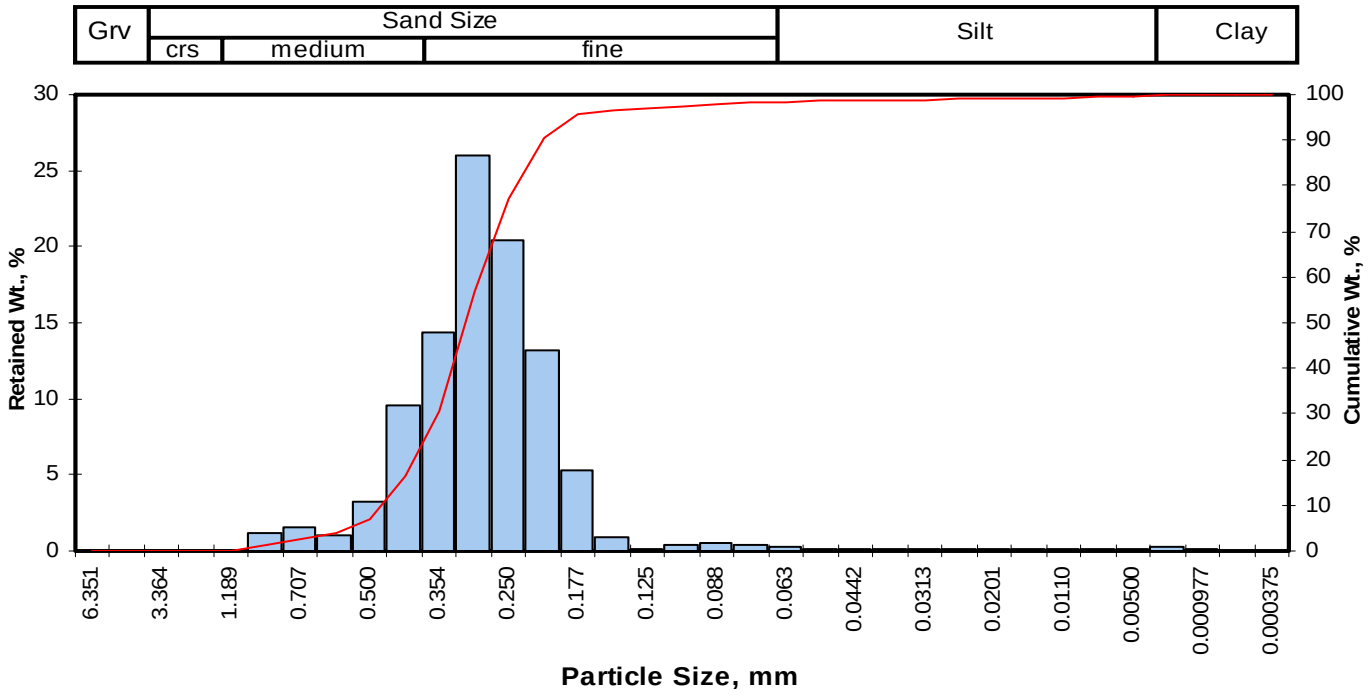
Measure	Trask	Inman	Folk-Ward
Median, phi	1.82	1.82	1.82
Median, in.	0.0112	0.0112	0.0112
Median, mm	0.284	0.284	0.284
Mean, phi	1.81	1.86	1.84
Mean, in.	0.0112	0.0109	0.0110
Mean, mm	0.285	0.276	0.278
Sorting	1.252	0.538	1.074
Skewness	0.979	0.081	0.326
Kurtosis	0.188	3.934	3.363
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	13.20
Fine Sand	200	78.68
Silt	>0.005 mm	5.58
Clay	<0.005 mm	2.54
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/35-37'/000923
Project No:	15-03095.14-006	**Depth, ft:**	35.8



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	1.12	1.12	1.12
0.0278	0.707	0.50	25	1.57	1.57	2.69
0.0234	0.595	0.75	30	1.05	1.05	3.74
0.0197	0.500	1.00	35	3.18	3.18	6.91
0.0166	0.420	1.25	40	9.56	9.55	16.47
0.0139	0.354	1.50	45	14.30	14.29	30.76
0.0117	0.297	1.75	50	26.00	25.98	56.74
0.0098	0.250	2.00	60	20.50	20.48	77.22
0.0083	0.210	2.25	70	13.20	13.19	90.41
0.0070	0.177	2.50	80	5.31	5.31	95.72
0.0059	0.149	2.75	100	0.97	0.97	96.69
0.0049	0.125	3.00	120	0.19	0.19	96.88
0.0041	0.105	3.25	140	0.43	0.43	97.31
0.0035	0.088	3.50	170	0.51	0.51	97.82
0.0029	0.074	3.75	200	0.34	0.34	98.16
0.0025	0.063	4.00	230	0.20	0.20	98.36
0.0021	0.053	4.25	270	0.15	0.15	98.51
0.00174	0.0442	4.50	325	0.14	0.14	98.65
0.00146	0.0372	4.75	400	0.12	0.12	98.77
0.00123	0.0313	5.00	450	0.10	0.10	98.86
0.000986	0.0250	5.32	500	0.10	0.10	98.96
0.000790	0.0201	5.64	635	0.09	0.09	99.05
0.000615	0.0156	6.00		0.09	0.09	99.14
0.000435	0.0110	6.50		0.13	0.13	99.27
0.000308	0.00781	7.00		0.13	0.13	99.40
0.000197	0.00500	7.65		0.17	0.17	99.57
0.000077	0.00195	9.00		0.31	0.31	99.88
0.000038	0.000977	10.00		0.11	0.11	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.85	0.0219	0.555
10	1.08	0.0186	0.473
16	1.24	0.0167	0.424
25	1.40	0.0149	0.379
40	1.59	0.0131	0.332
50	1.69	0.0122	0.311
60	1.79	0.0114	0.289
75	1.97	0.0100	0.255
84	2.13	0.0090	0.229
90	2.24	0.0083	0.211
95	2.47	0.0071	0.181

Measure	Trask	Inman	Folk-Ward
Median, phi	1.69	1.69	1.69
Median, in.	0.0122	0.0122	0.0122
Median, mm	0.311	0.311	0.311
Mean, phi	1.66	1.68	1.68
Mean, in.	0.0125	0.0123	0.0123
Mean, mm	0.317	0.311	0.311
Sorting	1.220	0.445	0.468
Skewness	0.999	-0.005	-0.019
Kurtosis	0.238	0.815	1.155
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

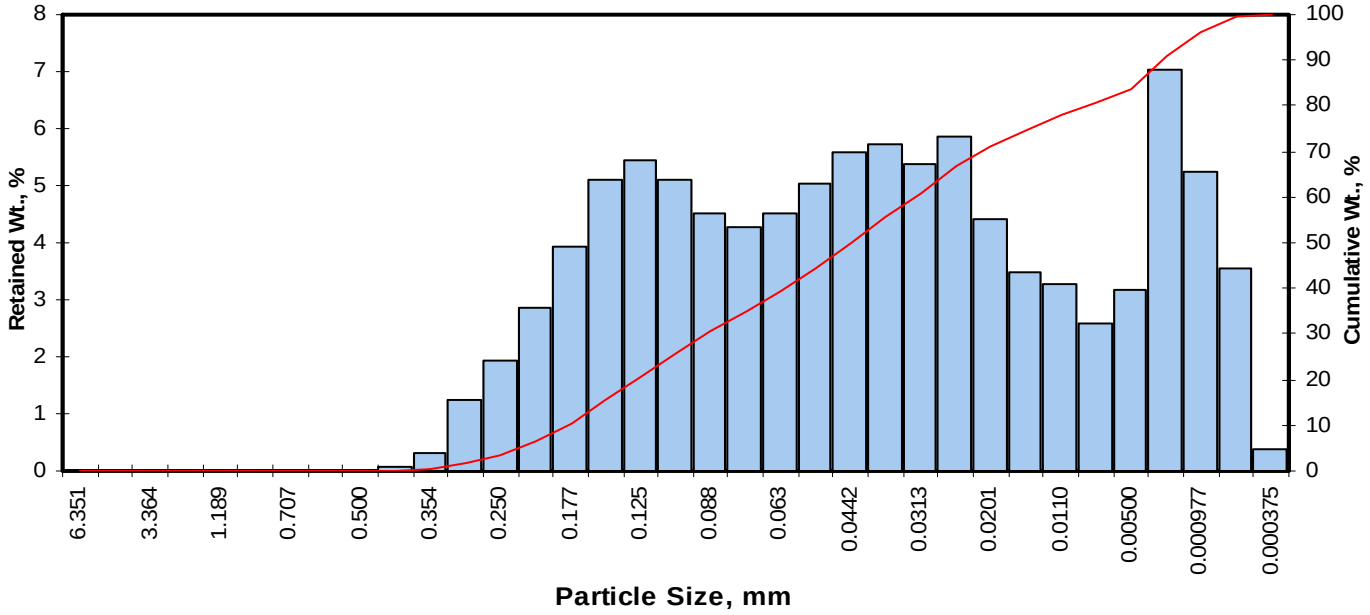
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	16.47
Fine Sand	200	81.69
Silt	>0.005 mm	1.42
Clay	<0.005 mm	0.43
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/30-32'/050928
Project No:	15-03095.14-006	**Depth, ft:**	30.35

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.06	0.06	0.06
0.0139	0.354	1.50	45	0.30	0.30	0.36
0.0117	0.297	1.75	50	1.23	1.23	1.59
0.0098	0.250	2.00	60	1.92	1.92	3.51
0.0083	0.210	2.25	70	2.86	2.86	6.37
0.0070	0.177	2.50	80	3.94	3.94	10.31
0.0059	0.149	2.75	100	5.09	5.09	15.40
0.0049	0.125	3.00	120	5.45	5.45	20.85
0.0041	0.105	3.25	140	5.10	5.10	25.95
0.0035	0.088	3.50	170	4.51	4.51	30.46
0.0029	0.074	3.75	200	4.27	4.27	34.73
0.0025	0.063	4.00	230	4.50	4.50	39.24
0.0021	0.053	4.25	270	5.04	5.04	44.28
0.00174	0.0442	4.50	325	5.58	5.58	49.86
0.00146	0.0372	4.75	400	5.74	5.74	55.60
0.00123	0.0313	5.00	450	5.39	5.39	60.99
0.000986	0.0250	5.32	500	5.85	5.85	66.84
0.000790	0.0201	5.64	635	4.40	4.40	71.24
0.000615	0.0156	6.00		3.49	3.49	74.73
0.000435	0.0110	6.50		3.27	3.27	78.00
0.000308	0.00781	7.00		2.58	2.58	80.59
0.000197	0.00500	7.65		3.18	3.18	83.77
0.000077	0.00195	9.00		7.05	7.05	90.82
0.000038	0.000977	10.00		5.25	5.25	96.07
0.000019	0.000488	11.00		3.54	3.54	99.61
0.000015	0.000375	11.38		0.39	0.39	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.13	0.0090	0.228
10	2.48	0.0071	0.179
16	2.78	0.0057	0.146
25	3.20	0.0043	0.109
40	4.04	0.0024	0.061
50	4.51	0.0017	0.044
60	4.95	0.0013	0.032
75	6.04	0.0006	0.015
84	7.69	0.0002	0.005
90	8.84	0.0001	0.002
95	9.80	0.0000	0.001

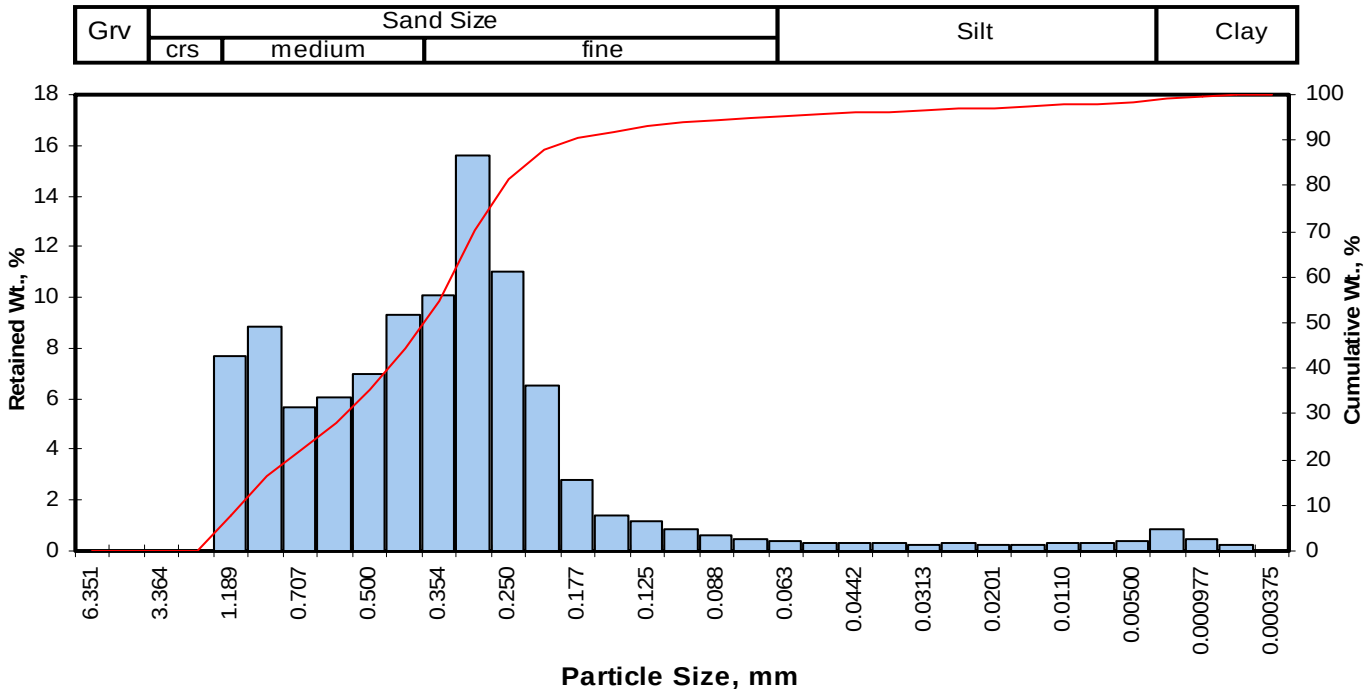
Measure	Trask	Inman	Folk-Ward
Median, phi	4.51	4.51	4.51
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.044	0.044	0.044
Mean, phi	4.01	5.23	4.99
Mean, in.	0.0024	0.0010	0.0012
Mean, mm	0.062	0.027	0.031
Sorting	2.673	2.456	2.390
Skewness	0.923	0.296	0.338
Kurtosis	0.264	0.561	1.107
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.06
Fine Sand	200	34.68
Silt	>0.005 mm	49.03
Clay	<0.005 mm	16.23
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/30-32'/050928
Project No:	15-03095.14-006	**Depth, ft:**	31.6



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	7.66	7.66	7.66
0.0331	0.841	0.25	20	8.82	8.82	16.49
0.0278	0.707	0.50	25	5.66	5.66	22.15
0.0234	0.595	0.75	30	6.07	6.07	28.22
0.0197	0.500	1.00	35	7.01	7.01	35.23
0.0166	0.420	1.25	40	9.30	9.30	44.54
0.0139	0.354	1.50	45	10.10	10.10	54.64
0.0117	0.297	1.75	50	15.60	15.61	70.25
0.0098	0.250	2.00	60	11.00	11.00	81.25
0.0083	0.210	2.25	70	6.48	6.48	87.73
0.0070	0.177	2.50	80	2.81	2.81	90.55
0.0059	0.149	2.75	100	1.43	1.43	91.98
0.0049	0.125	3.00	120	1.13	1.13	93.11
0.0041	0.105	3.25	140	0.87	0.87	93.98
0.0035	0.088	3.50	170	0.59	0.59	94.57
0.0029	0.074	3.75	200	0.44	0.44	95.01
0.0025	0.063	4.00	230	0.39	0.39	95.40
0.0021	0.053	4.25	270	0.34	0.34	95.74
0.00174	0.0442	4.50	325	0.30	0.30	96.04
0.00146	0.0372	4.75	400	0.28	0.28	96.32
0.00123	0.0313	5.00	450	0.25	0.25	96.57
0.000986	0.0250	5.32	500	0.28	0.28	96.85
0.000790	0.0201	5.64	635	0.26	0.26	97.11
0.000615	0.0156	6.00		0.26	0.26	97.37
0.000435	0.0110	6.50		0.32	0.32	97.69
0.000308	0.00781	7.00		0.32	0.32	98.01
0.000197	0.00500	7.65		0.42	0.42	98.43
0.000077	0.00195	9.00		0.85	0.85	99.28
0.000038	0.000977	10.00		0.47	0.47	99.75
0.000019	0.000488	11.00		0.23	0.23	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.51	0.0561	1.425
10	-0.12	0.0427	1.085
16	0.22	0.0337	0.857
25	0.62	0.0257	0.652
40	1.13	0.0180	0.458
50	1.39	0.0151	0.383
60	1.59	0.0131	0.333
75	1.86	0.0109	0.276
84	2.11	0.0091	0.232
90	2.45	0.0072	0.183
95	3.75	0.0029	0.075

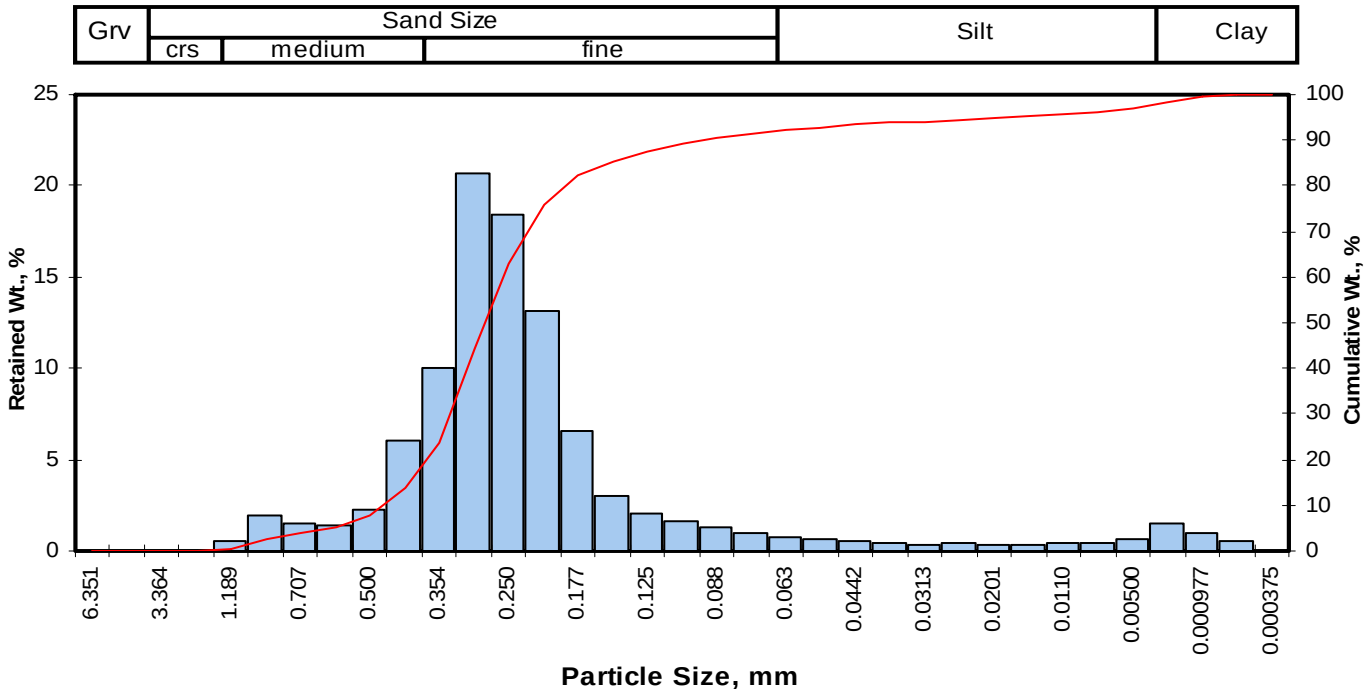
Measure	Trask	Inman	Folk-Ward
Median, phi	1.39	1.39	1.39
Median, in.	0.0151	0.0151	0.0151
Median, mm	0.383	0.383	0.383
Mean, phi	1.11	1.16	1.24
Mean, in.	0.0183	0.0176	0.0167
Mean, mm	0.464	0.446	0.424
Sorting	1.537	0.942	1.116
Skewness	1.108	-0.235	-0.063
Kurtosis	0.208	1.260	1.406
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	44.54
Fine Sand	200	50.47
Silt	>0.005 mm	3.42
Clay	<0.005 mm	1.57
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/32-34'/050928
Project No:	15-03095.14-006	**Depth, ft:**	32.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.51	0.51	0.51
0.0331	0.841	0.25	20	1.96	1.96	2.47
0.0278	0.707	0.50	25	1.46	1.46	3.93
0.0234	0.595	0.75	30	1.40	1.40	5.33
0.0197	0.500	1.00	35	2.27	2.27	7.60
0.0166	0.420	1.25	40	6.05	6.05	13.65
0.0139	0.354	1.50	45	9.99	9.99	23.64
0.0117	0.297	1.75	50	20.70	20.70	44.34
0.0098	0.250	2.00	60	18.40	18.40	62.74
0.0083	0.210	2.25	70	13.10	13.10	75.84
0.0070	0.177	2.50	80	6.60	6.60	82.44
0.0059	0.149	2.75	100	3.05	3.05	85.49
0.0049	0.125	3.00	120	2.04	2.04	87.53
0.0041	0.105	3.25	140	1.66	1.66	89.19
0.0035	0.088	3.50	170	1.27	1.27	90.46
0.0029	0.074	3.75	200	0.97	0.97	91.43
0.0025	0.063	4.00	230	0.79	0.79	92.22
0.0021	0.053	4.25	270	0.63	0.63	92.85
0.00174	0.0442	4.50	325	0.52	0.52	93.37
0.00146	0.0372	4.75	400	0.44	0.44	93.81
0.00123	0.0313	5.00	450	0.36	0.36	94.17
0.000986	0.0250	5.32	500	0.38	0.38	94.55
0.000790	0.0201	5.64	635	0.35	0.35	94.90
0.000615	0.0156	6.00		0.36	0.36	95.26
0.000435	0.0110	6.50		0.46	0.46	95.72
0.000308	0.00781	7.00		0.48	0.48	96.20
0.000197	0.00500	7.65		0.68	0.68	96.88
0.000077	0.00195	9.00		1.51	1.51	98.39
0.000038	0.000977	10.00		1.00	1.00	99.39
0.000019	0.000488	11.00		0.56	0.56	99.95
0.000015	0.000375	11.38		0.05	0.05	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.69	0.0244	0.619
10	1.10	0.0184	0.467
16	1.31	0.0159	0.404
25	1.52	0.0138	0.350
40	1.70	0.0121	0.308
50	1.83	0.0111	0.282
60	1.96	0.0101	0.257
75	2.23	0.0084	0.213
84	2.63	0.0064	0.162
90	3.41	0.0037	0.094
95	5.74	0.0007	0.019

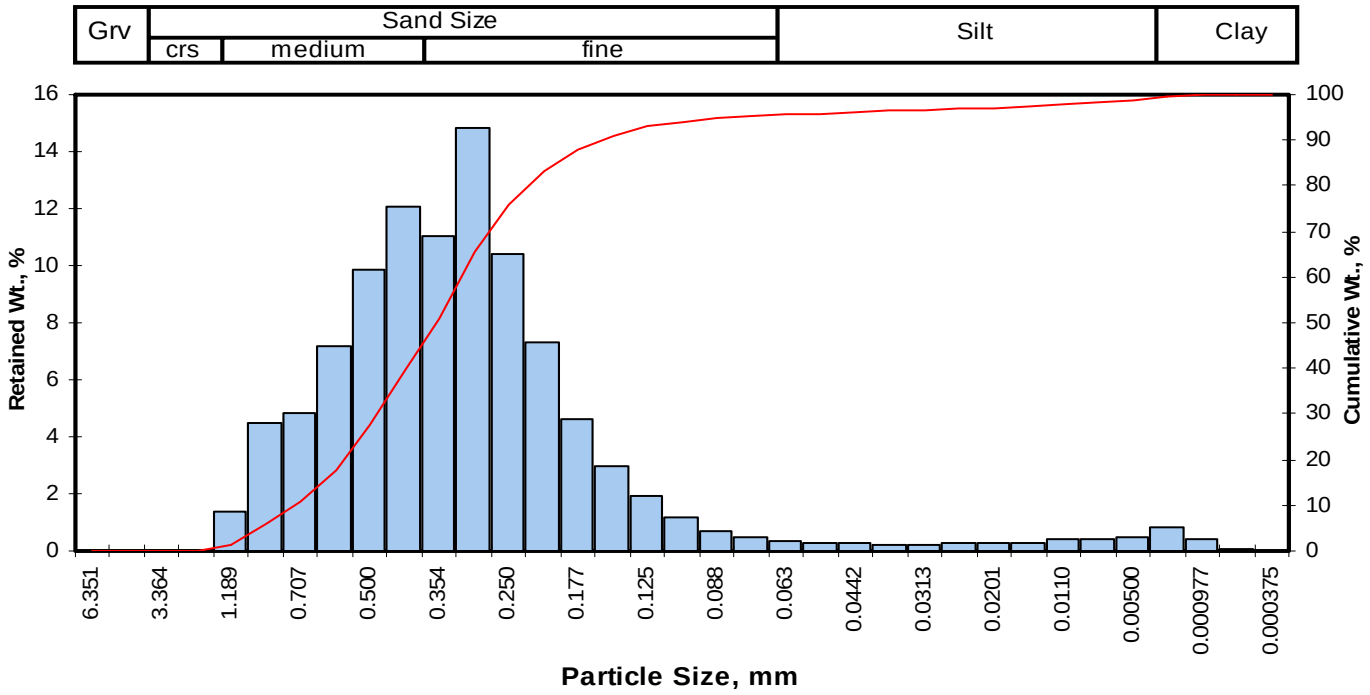
Measure	Trask	Inman	Folk-Ward
Median, phi	1.83	1.83	1.83
Median, in.	0.0111	0.0111	0.0111
Median, mm	0.282	0.282	0.282
Mean, phi	1.83	1.97	1.92
Mean, in.	0.0111	0.0101	0.0104
Mean, mm	0.281	0.256	0.264
Sorting	1.282	0.660	1.095
Skewness	0.967	0.215	0.382
Kurtosis	0.184	2.829	2.885
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	13.65
Fine Sand	200	77.78
Silt	>0.005 mm	5.45
Clay	<0.005 mm	3.12
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/34-36'/050928
Project No:	15-03095.14-006	**Depth, ft:**	34.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	1.37	1.37	1.37
0.0331	0.841	0.25	20	4.46	4.46	5.83
0.0278	0.707	0.50	25	4.84	4.84	10.67
0.0234	0.595	0.75	30	7.19	7.19	17.86
0.0197	0.500	1.00	35	9.89	9.89	27.76
0.0166	0.420	1.25	40	12.10	12.10	39.86
0.0139	0.354	1.50	45	11.00	11.00	50.86
0.0117	0.297	1.75	50	14.80	14.80	65.66
0.0098	0.250	2.00	60	10.40	10.40	76.07
0.0083	0.210	2.25	70	7.33	7.33	83.40
0.0070	0.177	2.50	80	4.62	4.62	88.02
0.0059	0.149	2.75	100	2.96	2.96	90.98
0.0049	0.125	3.00	120	1.92	1.92	92.90
0.0041	0.105	3.25	140	1.15	1.15	94.05
0.0035	0.088	3.50	170	0.66	0.66	94.71
0.0029	0.074	3.75	200	0.45	0.45	95.16
0.0025	0.063	4.00	230	0.37	0.37	95.53
0.0021	0.053	4.25	270	0.31	0.31	95.84
0.00174	0.0442	4.50	325	0.26	0.26	96.10
0.00146	0.0372	4.75	400	0.24	0.24	96.34
0.00123	0.0313	5.00	450	0.23	0.23	96.57
0.000986	0.0250	5.32	500	0.27	0.27	96.84
0.000790	0.0201	5.64	635	0.27	0.27	97.11
0.000615	0.0156	6.00		0.30	0.30	97.41
0.000435	0.0110	6.50		0.40	0.40	97.81
0.000308	0.00781	7.00		0.38	0.38	98.19
0.000197	0.00500	7.65		0.48	0.48	98.67
0.000077	0.00195	9.00		0.85	0.85	99.52
0.000038	0.000977	10.00		0.38	0.38	99.90
0.000019	0.000488	11.00		0.10	0.10	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.16	0.0353	0.897
10	0.47	0.0285	0.724
16	0.69	0.0245	0.622
25	0.93	0.0207	0.525
40	1.25	0.0165	0.420
50	1.48	0.0141	0.358
60	1.65	0.0125	0.318
75	1.97	0.0100	0.254
84	2.28	0.0081	0.206
90	2.67	0.0062	0.157
95	3.66	0.0031	0.079

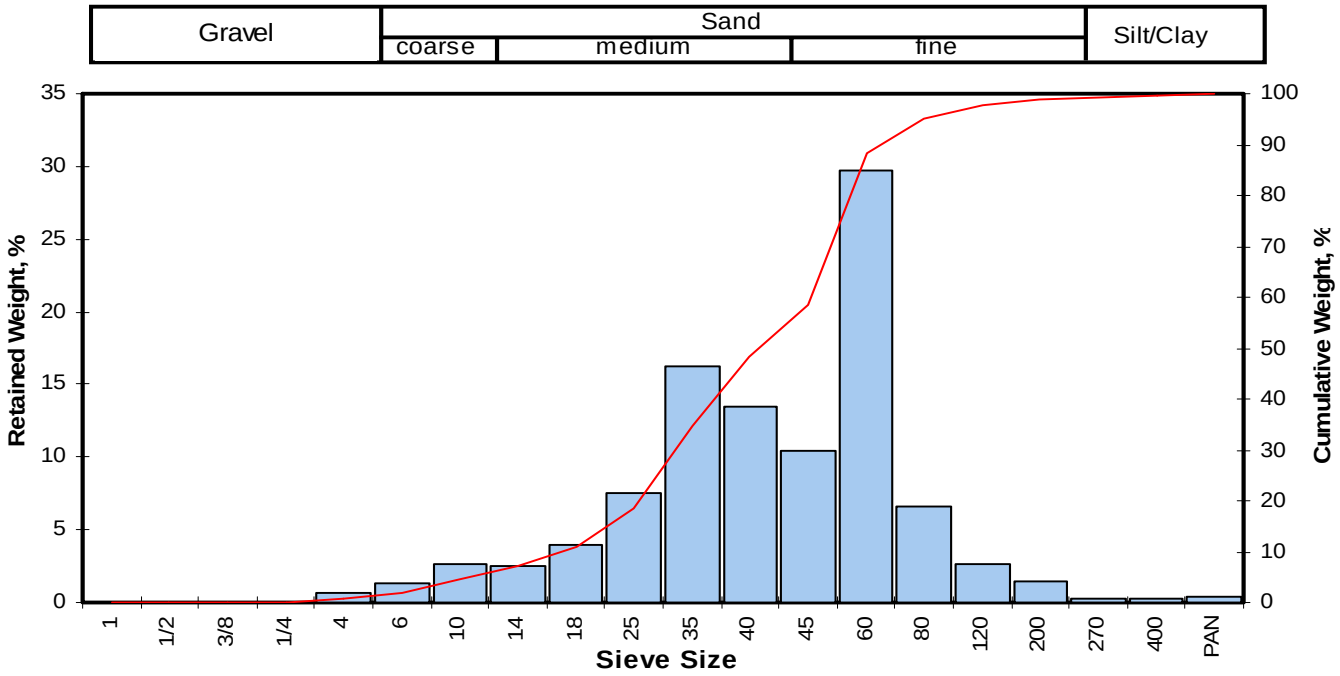
Measure	Trask	Inman	Folk-Ward
Median, phi	1.48	1.48	1.48
Median, in.	0.0141	0.0141	0.0141
Median, mm	0.358	0.358	0.358
Mean, phi	1.36	1.48	1.48
Mean, in.	0.0153	0.0141	0.0141
Mean, mm	0.390	0.358	0.358
Sorting	1.436	0.799	0.930
Skewness	1.020	0.004	0.125
Kurtosis	0.238	1.194	1.376
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	39.86
Fine Sand	200	55.30
Silt	>0.005 mm	3.51
Clay	<0.005 mm	1.33
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/38-40'/050928
Project No:	15-03095.14-006	**Depth, ft:**	38.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.34	0.69	0.69
0.1324	3.364	-1.75	6	0.64	1.29	1.97
0.0787	2.000	-1.00	10	1.29	2.60	4.57
0.0557	1.414	-0.50	14	1.23	2.48	7.05
0.0394	1.000	0.00	18	1.95	3.93	10.98
0.0278	0.707	0.50	25	3.71	7.48	18.46
0.0197	0.500	1.00	35	8.09	16.30	34.76
0.0166	0.420	1.25	40	6.68	13.46	48.22
0.0139	0.354	1.50	45	5.19	10.46	58.67
0.0098	0.250	2.00	60	14.78	29.78	88.45
0.0070	0.177	2.50	80	3.25	6.55	95.00
0.0049	0.125	3.00	120	1.28	2.58	97.58
0.0029	0.074	3.75	200	0.72	1.45	99.03
0.0021	0.053	4.25	270	0.14	0.28	99.31
0.0015	0.037	4.75	400	0.16	0.32	99.64
			PAN	0.18	0.36	100.00
TOTALS				49.63	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.91	0.0742	1.884
10	-0.12	0.0429	1.090
16	0.34	0.0312	0.792
25	0.70	0.0242	0.615
40	1.10	0.0184	0.467
50	1.29	0.0161	0.408
60	1.52	0.0137	0.348
75	1.77	0.0115	0.292
84	1.93	0.0104	0.263
90	2.12	0.0091	0.230
95	2.50	0.0070	0.177

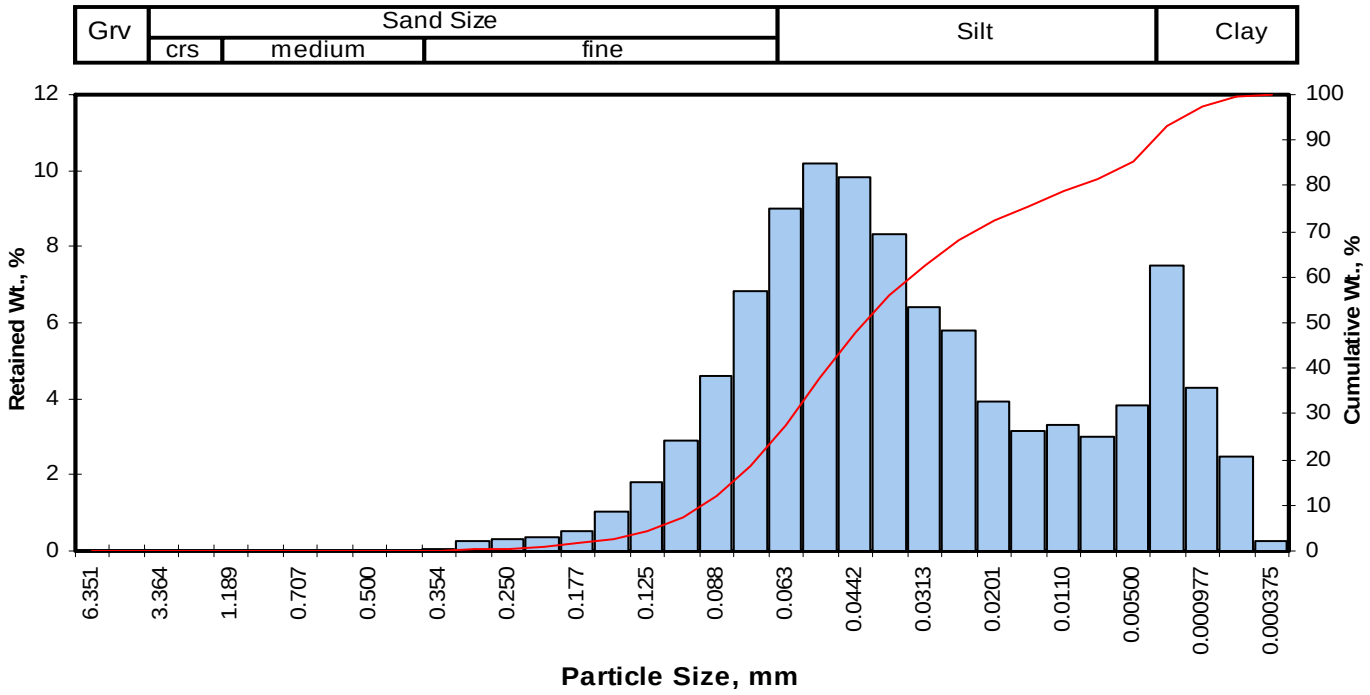
Measure	Trask	Inman	Folk-Ward
Median, phi	1.29	1.29	1.29
Median, in.	0.0161	0.0161	0.0161
Median, mm	0.408	0.408	0.408
Mean, phi	1.14	1.13	1.18
Mean, in.	0.0179	0.0180	0.0173
Mean, mm	0.454	0.457	0.440
Sorting	1.451	0.795	0.915
Skewness	1.039	-0.204	-0.248
Kurtosis	0.188	1.148	1.303
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.69
Coarse Sand	10	3.89
Medium Sand	40	43.64
Fine Sand	200	50.82
Silt/Clay	<200	0.97
	Total	100

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/28.5-30.5'/050927
Project No:	15-03095.14-006	**Depth, ft:**	29.1



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.06	0.05	0.06
0.0117	0.297	1.75	50	0.26	0.26	0.32
0.0098	0.250	2.00	60	0.32	0.32	0.64
0.0083	0.210	2.25	70	0.36	0.36	1.00
0.0070	0.177	2.50	80	0.54	0.54	1.54
0.0059	0.149	2.75	100	1.06	1.06	2.60
0.0049	0.125	3.00	120	1.80	1.80	4.40
0.0041	0.105	3.25	140	2.90	2.90	7.30
0.0035	0.088	3.50	170	4.58	4.58	11.88
0.0029	0.074	3.75	200	6.84	6.84	18.72
0.0025	0.063	4.00	230	8.98	8.98	27.69
0.0021	0.053	4.25	270	10.20	10.20	37.89
0.00174	0.0442	4.50	325	9.84	9.84	47.73
0.00146	0.0372	4.75	400	8.32	8.32	56.05
0.00123	0.0313	5.00	450	6.40	6.40	62.45
0.000986	0.0250	5.32	500	5.82	5.82	68.27
0.000790	0.0201	5.64	635	3.95	3.95	72.22
0.000615	0.0156	6.00		3.15	3.15	75.36
0.000435	0.0110	6.50		3.31	3.31	78.67
0.000308	0.00781	7.00		2.99	2.99	81.66
0.000197	0.00500	7.65		3.84	3.84	85.50
0.000077	0.00195	9.00		7.49	7.49	92.99
0.000038	0.000977	10.00		4.28	4.28	97.27
0.000019	0.000488	11.00		2.47	2.47	99.74
0.000015	0.000375	11.38		0.26	0.26	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.05	0.0047	0.121
10	3.40	0.0037	0.095
16	3.65	0.0031	0.080
25	3.92	0.0026	0.066
40	4.30	0.0020	0.051
50	4.57	0.0017	0.042
60	4.90	0.0013	0.033
75	5.96	0.0006	0.016
84	7.39	0.0002	0.006
90	8.46	0.0001	0.003
95	9.47	0.0001	0.001

Measure	Trask	Inman	Folk-Ward
Median, phi	4.57	4.57	4.57
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.042	0.042	0.042
Mean, phi	4.61	5.52	5.20
Mean, in.	0.0016	0.0009	0.0011
Mean, mm	0.041	0.022	0.027
Sorting	2.023	1.871	1.908
Skewness	0.772	0.510	0.519
Kurtosis	0.270	0.715	1.294
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

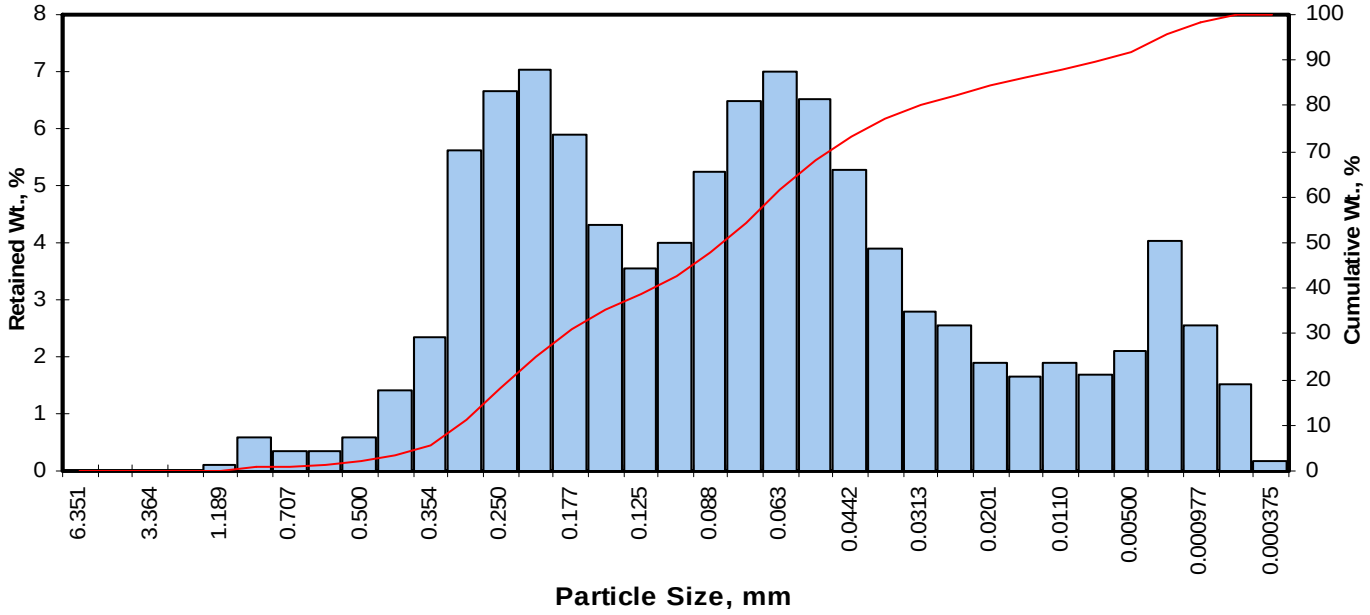
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	18.71
Silt	>0.005 mm	66.79
Clay	<0.005 mm	14.50
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/30.5-32.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	30.8

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.11	0.11	0.11
0.0331	0.841	0.25	20	0.57	0.57	0.68
0.0278	0.707	0.50	25	0.33	0.33	1.01
0.0234	0.595	0.75	30	0.35	0.35	1.36
0.0197	0.500	1.00	35	0.60	0.60	1.96
0.0166	0.420	1.25	40	1.40	1.40	3.36
0.0139	0.354	1.50	45	2.33	2.33	5.69
0.0117	0.297	1.75	50	5.63	5.63	11.32
0.0098	0.250	2.00	60	6.65	6.65	17.97
0.0083	0.210	2.25	70	7.04	7.04	25.01
0.0070	0.177	2.50	80	5.89	5.89	30.90
0.0059	0.149	2.75	100	4.31	4.31	35.21
0.0049	0.125	3.00	120	3.54	3.54	38.75
0.0041	0.105	3.25	140	4.01	4.01	42.76
0.0035	0.088	3.50	170	5.25	5.25	48.01
0.0029	0.074	3.75	200	6.50	6.50	54.51
0.0025	0.063	4.00	230	7.00	7.00	61.51
0.0021	0.053	4.25	270	6.52	6.52	68.03
0.00174	0.0442	4.50	325	5.27	5.27	73.30
0.00146	0.0372	4.75	400	3.89	3.89	77.19
0.00123	0.0313	5.00	450	2.78	2.78	79.97
0.000986	0.0250	5.32	500	2.55	2.55	82.52
0.000790	0.0201	5.64	635	1.90	1.90	84.42
0.000615	0.0156	6.00		1.66	1.66	86.08
0.000435	0.0110	6.50		1.88	1.88	87.96
0.000308	0.00781	7.00		1.69	1.69	89.65
0.000197	0.00500	7.65		2.09	2.09	91.74
0.000077	0.00195	9.00		4.04	4.04	95.78
0.000038	0.000977	10.00		2.54	2.54	98.32
0.000019	0.000488	11.00		1.52	1.52	99.84
0.000015	0.000375	11.38		0.16	0.16	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.43	0.0147	0.372
10	1.69	0.0122	0.310
16	1.93	0.0104	0.263
25	2.25	0.0083	0.210
40	3.08	0.0047	0.118
50	3.58	0.0033	0.084
60	3.95	0.0026	0.065
75	4.61	0.0016	0.041
84	5.57	0.0008	0.021
90	7.11	0.0003	0.007
95	8.74	0.0001	0.002

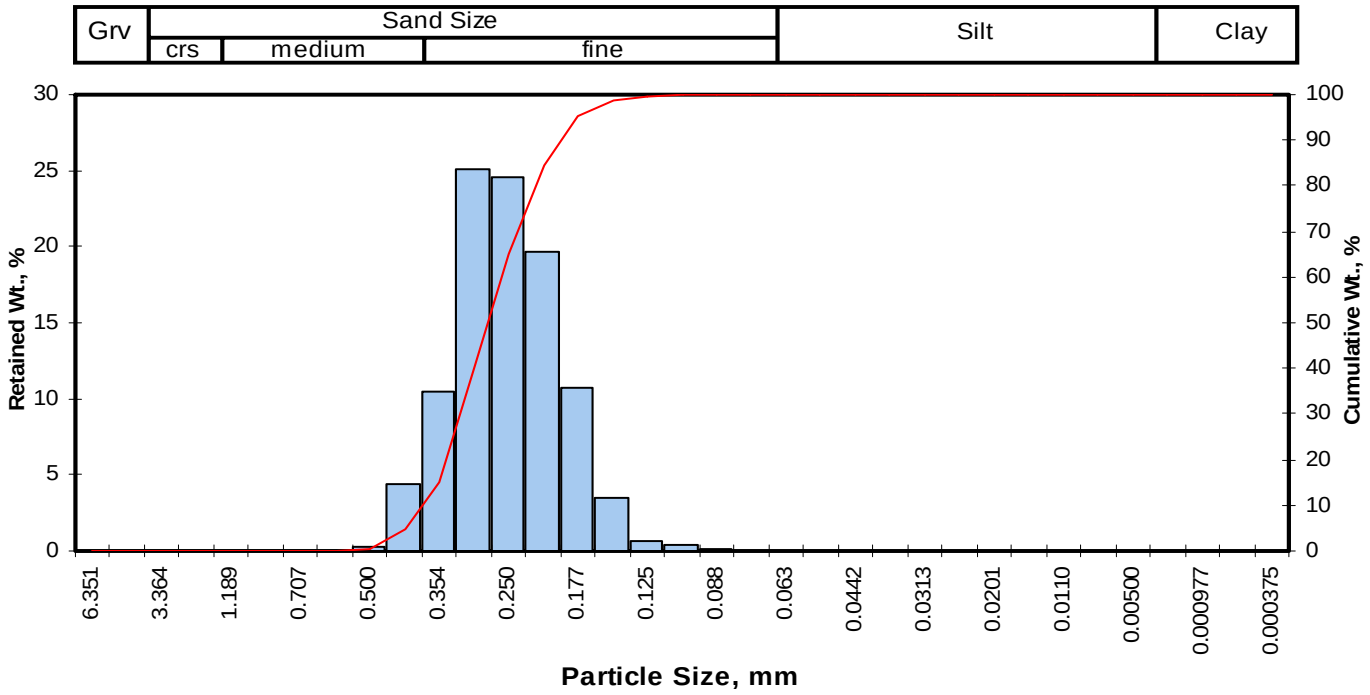
Measure	Trask	Inman	Folk-Ward
Median, phi	3.58	3.58	3.58
Median, in.	0.0033	0.0033	0.0033
Median, mm	0.084	0.084	0.084
Mean, phi	2.99	3.75	3.69
Mean, in.	0.0049	0.0029	0.0030
Mean, mm	0.126	0.074	0.077
Sorting	2.265	1.822	2.019
Skewness	1.107	0.094	0.253
Kurtosis	0.280	1.007	1.270
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	3.36
Fine Sand	200	51.15
Silt	>0.005 mm	37.23
Clay	<0.005 mm	8.26
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/34.5-36.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	33.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.28	0.28	0.28
0.0166	0.420	1.25	40	4.46	4.46	4.74
0.0139	0.354	1.50	45	10.50	10.49	15.23
0.0117	0.297	1.75	50	25.10	25.08	40.32
0.0098	0.250	2.00	60	24.60	24.59	64.90
0.0083	0.210	2.25	70	19.70	19.69	84.59
0.0070	0.177	2.50	80	10.80	10.79	95.38
0.0059	0.149	2.75	100	3.45	3.45	98.83
0.0049	0.125	3.00	120	0.67	0.67	99.50
0.0041	0.105	3.25	140	0.40	0.40	99.90
0.0035	0.088	3.50	170	0.10	0.10	100.00
0.0029	0.074	3.75	200	0.00	0.00	100.00
0.0025	0.063	4.00	230	0.00	0.00	100.00
0.0021	0.053	4.25	270	0.00	0.00	100.00
0.00174	0.0442	4.50	325	0.00	0.00	100.00
0.00146	0.0372	4.75	400	0.00	0.00	100.00
0.00123	0.0313	5.00	450	0.00	0.00	100.00
0.000986	0.0250	5.32	500	0.00	0.00	100.00
0.000790	0.0201	5.64	635	0.00	0.00	100.00
0.000615	0.0156	6.00		0.00	0.00	100.00
0.000435	0.0110	6.50		0.00	0.00	100.00
0.000308	0.00781	7.00		0.00	0.00	100.00
0.000197	0.00500	7.65		0.00	0.00	100.00
0.000077	0.00195	9.00		0.00	0.00	100.00
0.000038	0.000977	10.00		0.00	0.00	100.00
0.000019	0.000488	11.00		0.00	0.00	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.26	0.0165	0.419
10	1.38	0.0152	0.385
16	1.51	0.0138	0.352
25	1.60	0.0130	0.330
40	1.75	0.0117	0.298
50	1.85	0.0109	0.278
60	1.95	0.0102	0.259
75	2.13	0.0090	0.229
84	2.24	0.0083	0.211
90	2.38	0.0076	0.193
95	2.49	0.0070	0.178

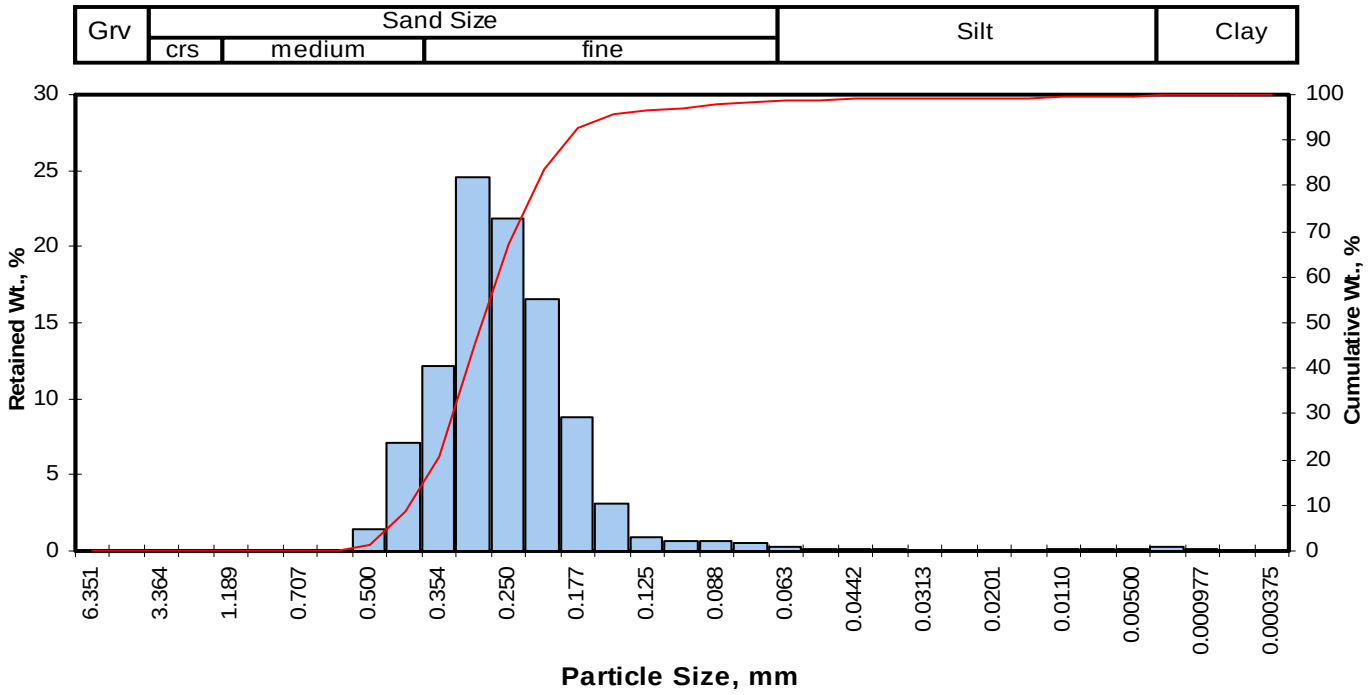
Measure	Trask	Inman	Folk-Ward
Median, phi	1.85	1.85	1.85
Median, in.	0.0109	0.0109	0.0109
Median, mm	0.278	0.278	0.278
Mean, phi	1.84	1.88	1.87
Mean, in.	0.0110	0.0107	0.0108
Mean, mm	0.280	0.273	0.274
Sorting	1.202	0.367	0.371
Skewness	0.990	0.072	0.057
Kurtosis	0.264	0.680	0.953
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	4.74
Fine Sand	200	95.26
Silt	>0.005 mm	0.00
Clay	<0.005 mm	0.00
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/36.5-38.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	37.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.02	0.02	0.02
0.0197	0.500	1.00	35	1.43	1.43	1.45
0.0166	0.420	1.25	40	7.14	7.14	8.59
0.0139	0.354	1.50	45	12.20	12.21	20.80
0.0117	0.297	1.75	50	24.60	24.62	45.42
0.0098	0.250	2.00	60	21.80	21.81	67.23
0.0083	0.210	2.25	70	16.50	16.51	83.74
0.0070	0.177	2.50	80	8.81	8.82	92.56
0.0059	0.149	2.75	100	3.08	3.08	95.64
0.0049	0.125	3.00	120	0.91	0.91	96.55
0.0041	0.105	3.25	140	0.62	0.62	97.17
0.0035	0.088	3.50	170	0.70	0.70	97.87
0.0029	0.074	3.75	200	0.56	0.56	98.43
0.0025	0.063	4.00	230	0.32	0.32	98.75
0.0021	0.053	4.25	270	0.16	0.16	98.91
0.00174	0.0442	4.50	325	0.09	0.09	99.00
0.00146	0.0372	4.75	400	0.08	0.08	99.08
0.00123	0.0313	5.00	450	0.06	0.06	99.14
0.000986	0.0250	5.32	500	0.06	0.06	99.20
0.000790	0.0201	5.64	635	0.05	0.05	99.25
0.000615	0.0156	6.00		0.05	0.05	99.30
0.000435	0.0110	6.50		0.09	0.09	99.38
0.000308	0.00781	7.00		0.10	0.10	99.48
0.000197	0.00500	7.65		0.14	0.14	99.62
0.000077	0.00195	9.00		0.27	0.27	99.89
0.000038	0.000977	10.00		0.10	0.10	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.12	0.0181	0.459
10	1.28	0.0162	0.412
16	1.40	0.0149	0.378
25	1.54	0.0135	0.343
40	1.69	0.0122	0.309
50	1.80	0.0113	0.287
60	1.92	0.0104	0.265
75	2.12	0.0091	0.230
84	2.26	0.0082	0.209
90	2.43	0.0073	0.186
95	2.70	0.0061	0.154

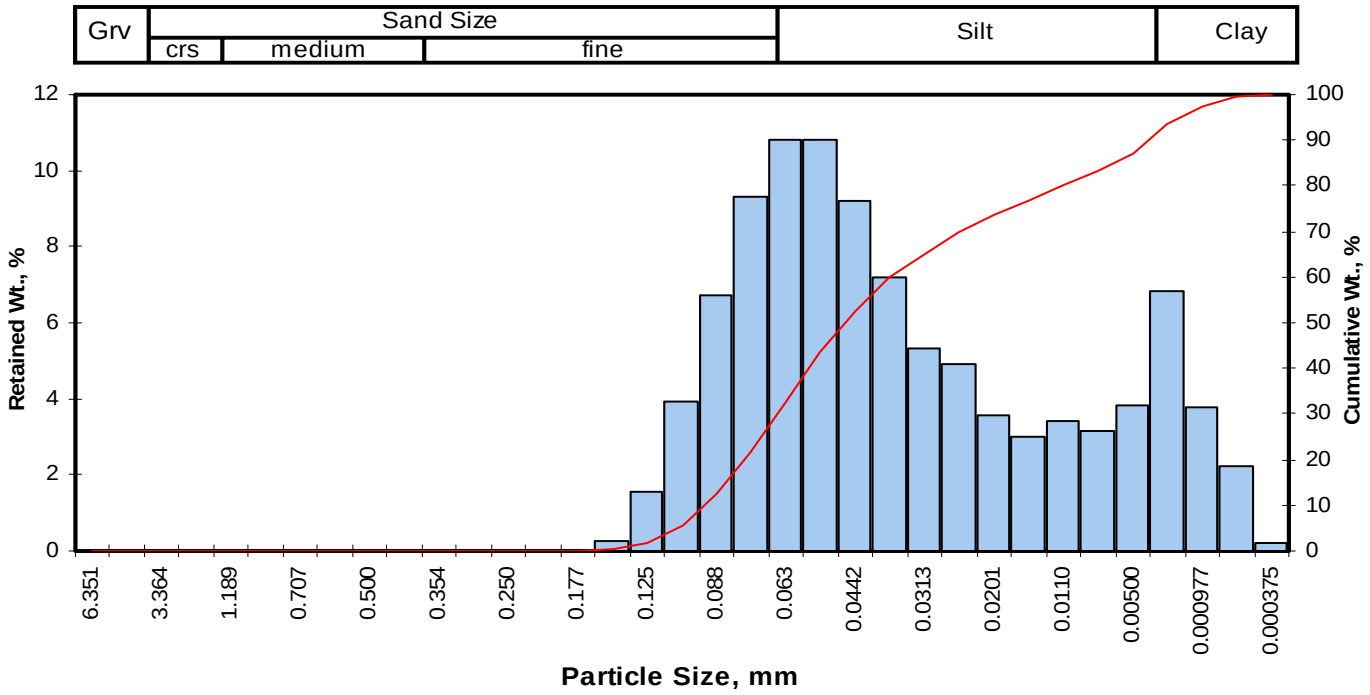
Measure	Trask	Inman	Folk-Ward
Median, phi	1.80	1.80	1.80
Median, in.	0.0113	0.0113	0.0113
Median, mm	0.287	0.287	0.287
Mean, phi	1.80	1.83	1.82
Mean, in.	0.0113	0.0111	0.0111
Mean, mm	0.287	0.281	0.283
Sorting	1.221	0.428	0.452
Skewness	0.981	0.063	0.101
Kurtosis	0.249	0.839	1.122
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	8.59
Fine Sand	200	89.84
Silt	>0.005 mm	1.19
Clay	<0.005 mm	0.38
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/20-22'/050920
Project No:	15-03095.14-006	**Depth, ft:**	20.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.01	0.01	0.01
0.0059	0.149	2.75	100	0.25	0.25	0.26
0.0049	0.125	3.00	120	1.53	1.53	1.79
0.0041	0.105	3.25	140	3.92	3.92	5.71
0.0035	0.088	3.50	170	6.73	6.73	12.44
0.0029	0.074	3.75	200	9.31	9.31	21.75
0.0025	0.063	4.00	230	10.80	10.80	32.55
0.0021	0.053	4.25	270	10.80	10.80	43.35
0.00174	0.0442	4.50	325	9.23	9.23	52.58
0.00146	0.0372	4.75	400	7.17	7.17	59.75
0.00123	0.0313	5.00	450	5.31	5.31	65.06
0.000986	0.0250	5.32	500	4.92	4.92	69.98
0.000790	0.0201	5.64	635	3.55	3.55	73.53
0.000615	0.0156	6.00		3.02	3.02	76.55
0.000435	0.0110	6.50		3.42	3.42	79.97
0.000308	0.00781	7.00		3.13	3.13	83.10
0.000197	0.00500	7.65		3.83	3.83	86.93
0.000077	0.00195	9.00		6.82	6.82	93.75
0.000038	0.000977	10.00		3.78	3.78	97.53
0.000019	0.000488	11.00		2.24	2.24	99.77
0.000015	0.000375	11.38		0.23	0.23	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.21	0.0043	0.108
10	3.41	0.0037	0.094
16	3.60	0.0033	0.083
25	3.83	0.0028	0.071
40	4.17	0.0022	0.055
50	4.43	0.0018	0.046
60	4.76	0.0015	0.037
75	5.82	0.0007	0.018
84	7.15	0.0003	0.007
90	8.26	0.0001	0.003
95	9.33	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.43	4.43	4.43
Median, in.	0.0018	0.0018	0.0018
Median, mm	0.046	0.046	0.046
Mean, phi	4.50	5.37	5.06
Mean, in.	0.0017	0.0009	0.0012
Mean, mm	0.044	0.024	0.030
Sorting	1.993	1.778	1.817
Skewness	0.763	0.531	0.565
Kurtosis	0.291	0.723	1.262

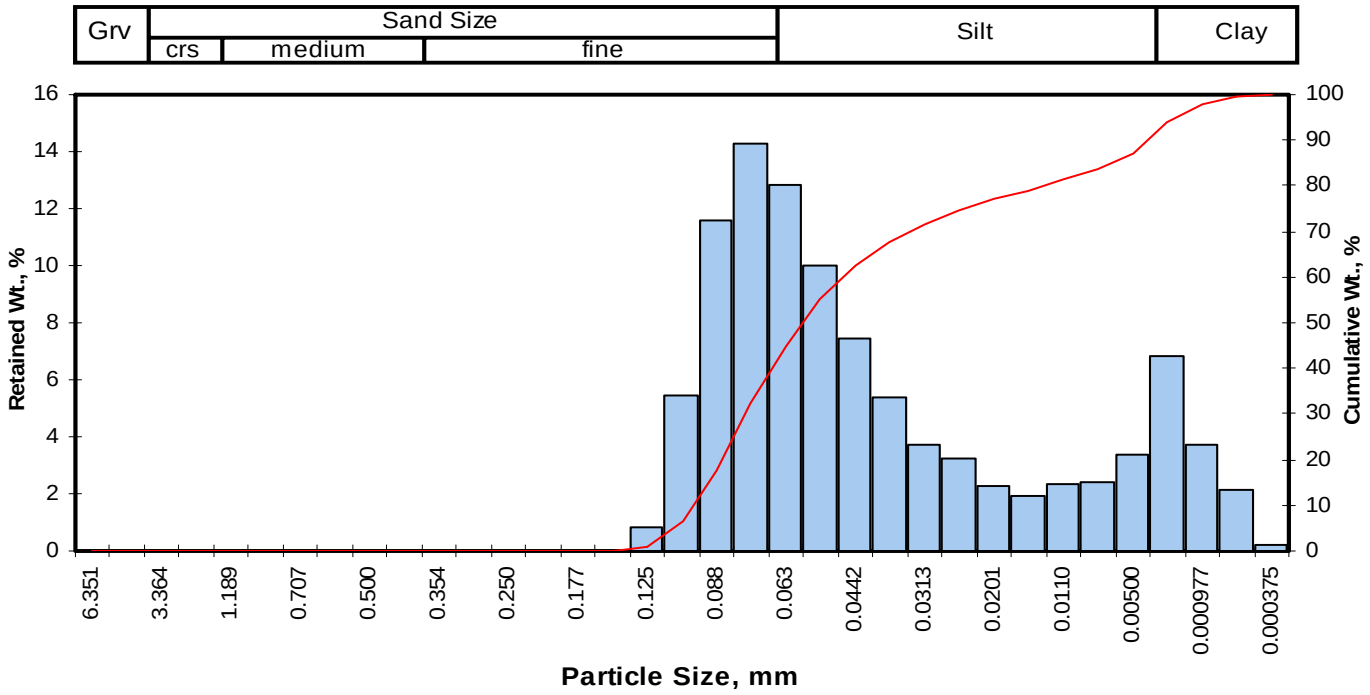
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	21.75
Silt	>0.005 mm	65.18
Clay	<0.005 mm	13.07
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/22-24'/050920
Project No:	15-03095.14-006	**Depth, ft:**	23.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.01	0.01	0.01
0.0049	0.125	3.00	120	0.84	0.84	0.85
0.0041	0.105	3.25	140	5.42	5.42	6.27
0.0035	0.088	3.50	170	11.60	11.60	17.87
0.0029	0.074	3.75	200	14.30	14.30	32.18
0.0025	0.063	4.00	230	12.80	12.80	44.98
0.0021	0.053	4.25	270	9.99	9.99	54.97
0.00174	0.0442	4.50	325	7.43	7.43	62.40
0.00146	0.0372	4.75	400	5.39	5.39	67.79
0.00123	0.0313	5.00	450	3.74	3.74	71.53
0.000986	0.0250	5.32	500	3.24	3.24	74.78
0.000790	0.0201	5.64	635	2.28	2.28	77.06
0.000615	0.0156	6.00		1.96	1.96	79.02
0.000435	0.0110	6.50		2.32	2.32	81.34
0.000308	0.00781	7.00		2.40	2.40	83.74
0.000197	0.00500	7.65		3.37	3.37	87.11
0.000077	0.00195	9.00		6.80	6.80	93.91
0.000038	0.000977	10.00		3.75	3.75	97.66
0.000019	0.000488	11.00		2.12	2.12	99.78
0.000015	0.000375	11.38		0.22	0.22	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.19	0.0043	0.109
10	3.33	0.0039	0.099
16	3.46	0.0036	0.091
25	3.62	0.0032	0.081
40	3.90	0.0026	0.067
50	4.13	0.0023	0.057
60	4.42	0.0018	0.047
75	5.35	0.0010	0.024
84	7.05	0.0003	0.008
90	8.22	0.0001	0.003
95	9.29	0.0001	0.002

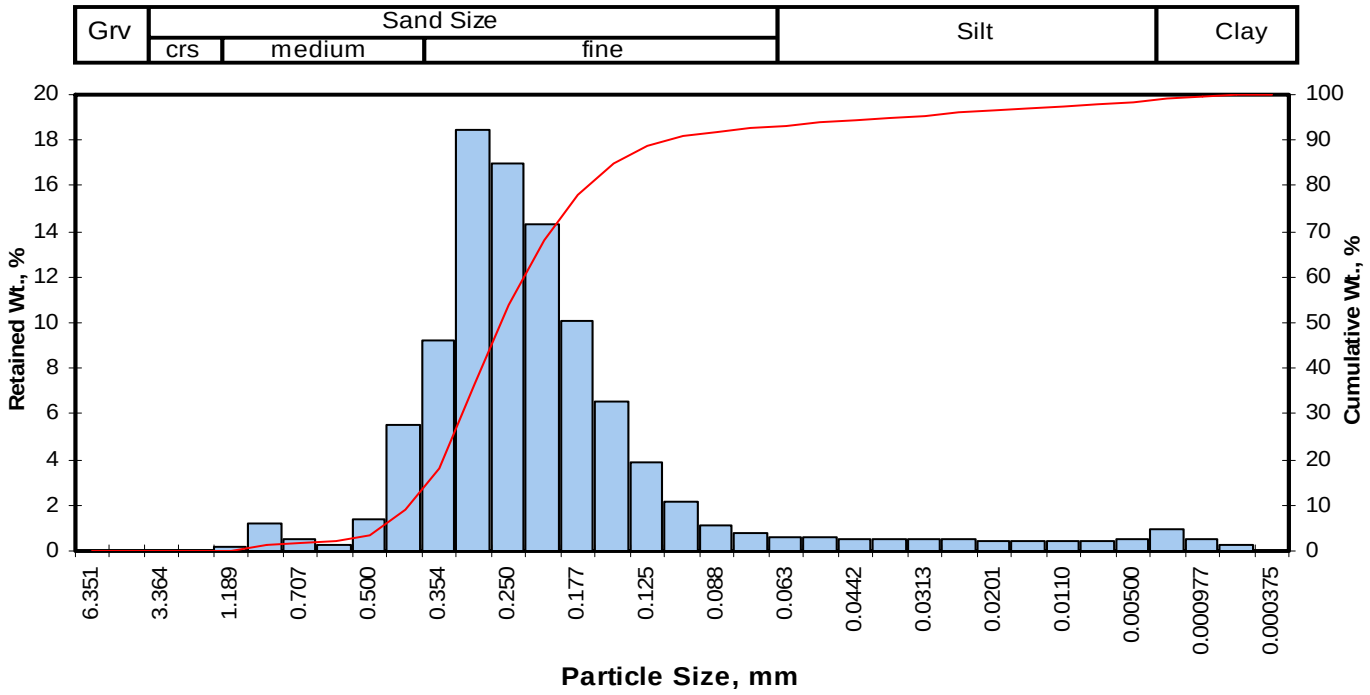
Measure	Trask	Inman	Folk-Ward
Median, phi	4.13	4.13	4.13
Median, in.	0.0023	0.0023	0.0023
Median, mm	0.057	0.057	0.057
Mean, phi	4.24	5.25	4.88
Mean, in.	0.0021	0.0010	0.0013
Mean, mm	0.053	0.026	0.034
Sorting	1.819	1.795	1.822
Skewness	0.778	0.629	0.661
Kurtosis	0.295	0.699	1.448
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	32.18
Silt	>0.005 mm	54.93
Clay	<0.005 mm	12.89
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/31-32.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	31.3



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.15	0.15	0.15
0.0331	0.841	0.25	20	1.24	1.24	1.39
0.0278	0.707	0.50	25	0.55	0.55	1.94
0.0234	0.595	0.75	30	0.28	0.28	2.22
0.0197	0.500	1.00	35	1.39	1.39	3.61
0.0166	0.420	1.25	40	5.51	5.51	9.12
0.0139	0.354	1.50	45	9.20	9.20	18.31
0.0117	0.297	1.75	50	18.50	18.49	36.80
0.0098	0.250	2.00	60	17.00	16.99	53.79
0.0083	0.210	2.25	70	14.30	14.29	68.09
0.0070	0.177	2.50	80	10.10	10.10	78.18
0.0059	0.149	2.75	100	6.53	6.53	84.71
0.0049	0.125	3.00	120	3.92	3.92	88.63
0.0041	0.105	3.25	140	2.15	2.15	90.78
0.0035	0.088	3.50	170	1.15	1.15	91.93
0.0029	0.074	3.75	200	0.74	0.74	92.67
0.0025	0.063	4.00	230	0.62	0.62	93.29
0.0021	0.053	4.25	270	0.57	0.57	93.86
0.00174	0.0442	4.50	325	0.56	0.56	94.42
0.00146	0.0372	4.75	400	0.54	0.54	94.96
0.00123	0.0313	5.00	450	0.49	0.49	95.45
0.000986	0.0250	5.32	500	0.52	0.52	95.96
0.000790	0.0201	5.64	635	0.43	0.43	96.39
0.000615	0.0156	6.00		0.40	0.40	96.79
0.000435	0.0110	6.50		0.46	0.46	97.25
0.000308	0.00781	7.00		0.41	0.41	97.66
0.000197	0.00500	7.65		0.49	0.49	98.15
0.000077	0.00195	9.00		0.96	0.96	99.11
0.000038	0.000977	10.00		0.56	0.56	99.67
0.000019	0.000488	11.00		0.30	0.30	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.06	0.0188	0.479
10	1.27	0.0163	0.414
16	1.44	0.0145	0.369
25	1.59	0.0131	0.332
40	1.80	0.0113	0.288
50	1.94	0.0102	0.260
60	2.11	0.0091	0.232
75	2.42	0.0074	0.187
84	2.72	0.0060	0.151
90	3.16	0.0044	0.112
95	4.77	0.0014	0.037

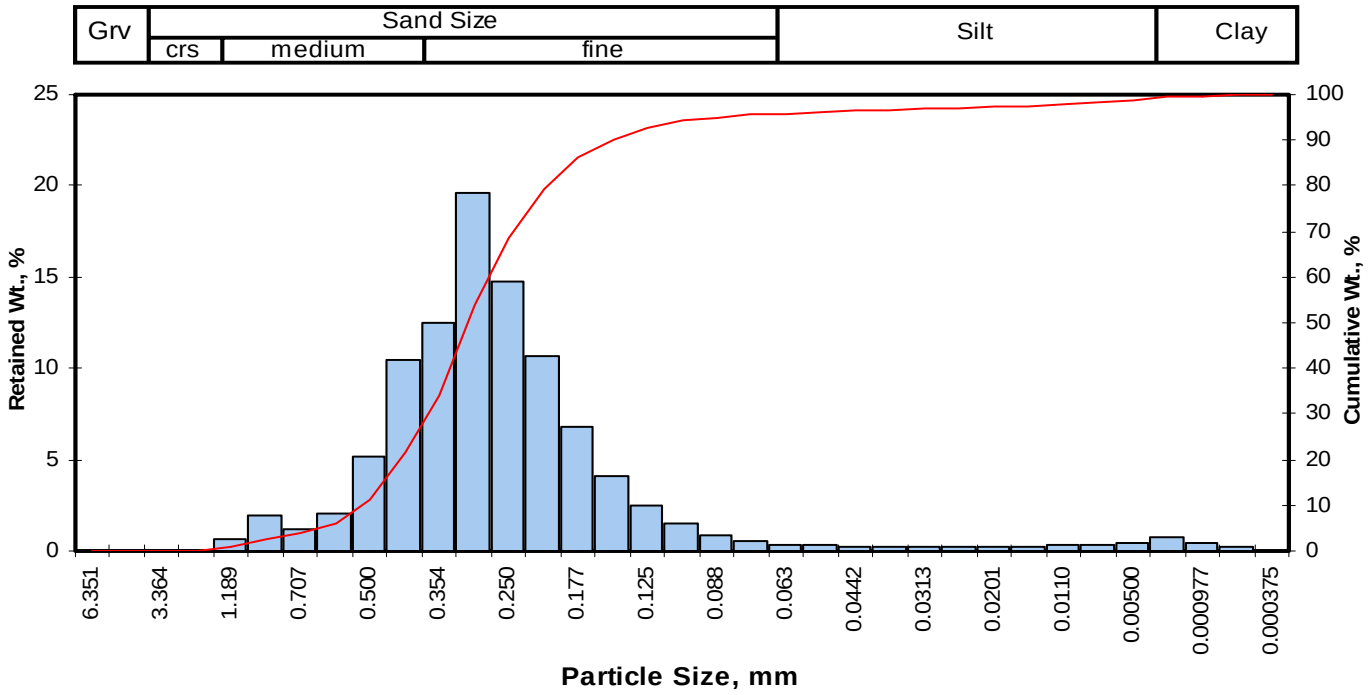
Measure	Trask	Inman	Folk-Ward
Median, phi	1.94	1.94	1.94
Median, in.	0.0102	0.0102	0.0102
Median, mm	0.260	0.260	0.260
Mean, phi	1.95	2.08	2.03
Mean, in.	0.0102	0.0093	0.0096
Mean, mm	0.259	0.237	0.244
Sorting	1.334	0.643	0.883
Skewness	0.958	0.211	0.368
Kurtosis	0.241	1.885	1.830
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	9.12
Fine Sand	200	83.55
Silt	>0.005 mm	5.49
Clay	<0.005 mm	1.85
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/32.5-34.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	33.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.65	0.65	0.65
0.0331	0.841	0.25	20	1.98	1.98	2.63
0.0278	0.707	0.50	25	1.23	1.23	3.86
0.0234	0.595	0.75	30	2.08	2.08	5.94
0.0197	0.500	1.00	35	5.22	5.22	11.16
0.0166	0.420	1.25	40	10.50	10.50	21.66
0.0139	0.354	1.50	45	12.50	12.50	34.17
0.0117	0.297	1.75	50	19.60	19.60	53.77
0.0098	0.250	2.00	60	14.80	14.80	68.57
0.0083	0.210	2.25	70	10.70	10.70	79.28
0.0070	0.177	2.50	80	6.77	6.77	86.05
0.0059	0.149	2.75	100	4.13	4.13	90.18
0.0049	0.125	3.00	120	2.53	2.53	92.71
0.0041	0.105	3.25	140	1.49	1.49	94.20
0.0035	0.088	3.50	170	0.83	0.83	95.03
0.0029	0.074	3.75	200	0.50	0.50	95.53
0.0025	0.063	4.00	230	0.37	0.37	95.90
0.0021	0.053	4.25	270	0.30	0.30	96.20
0.00174	0.0442	4.50	325	0.25	0.25	96.45
0.00146	0.0372	4.75	400	0.22	0.22	96.67
0.00123	0.0313	5.00	450	0.20	0.20	96.87
0.000986	0.0250	5.32	500	0.23	0.23	97.10
0.000790	0.0201	5.64	635	0.22	0.22	97.32
0.000615	0.0156	6.00		0.24	0.24	97.56
0.000435	0.0110	6.50		0.32	0.32	97.88
0.000308	0.00781	7.00		0.31	0.31	98.19
0.000197	0.00500	7.65		0.40	0.40	98.59
0.000077	0.00195	9.00		0.77	0.77	99.36
0.000038	0.000977	10.00		0.41	0.41	99.77
0.000019	0.000488	11.00		0.21	0.21	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.64	0.0253	0.643
10	0.94	0.0205	0.520
16	1.12	0.0182	0.462
25	1.32	0.0158	0.401
40	1.57	0.0132	0.336
50	1.70	0.0121	0.307
60	1.86	0.0109	0.276
75	2.15	0.0089	0.225
84	2.42	0.0073	0.186
90	2.74	0.0059	0.150
95	3.49	0.0035	0.089

Measure	Trask	Inman	Folk-Ward
Median, phi	1.70	1.70	1.70
Median, in.	0.0121	0.0121	0.0121
Median, mm	0.307	0.307	0.307
Mean, phi	1.67	1.77	1.75
Mean, in.	0.0123	0.0115	0.0117
Mean, mm	0.313	0.293	0.298
Sorting	1.335	0.655	0.760
Skewness	0.978	0.104	0.179
Kurtosis	0.238	1.180	1.404

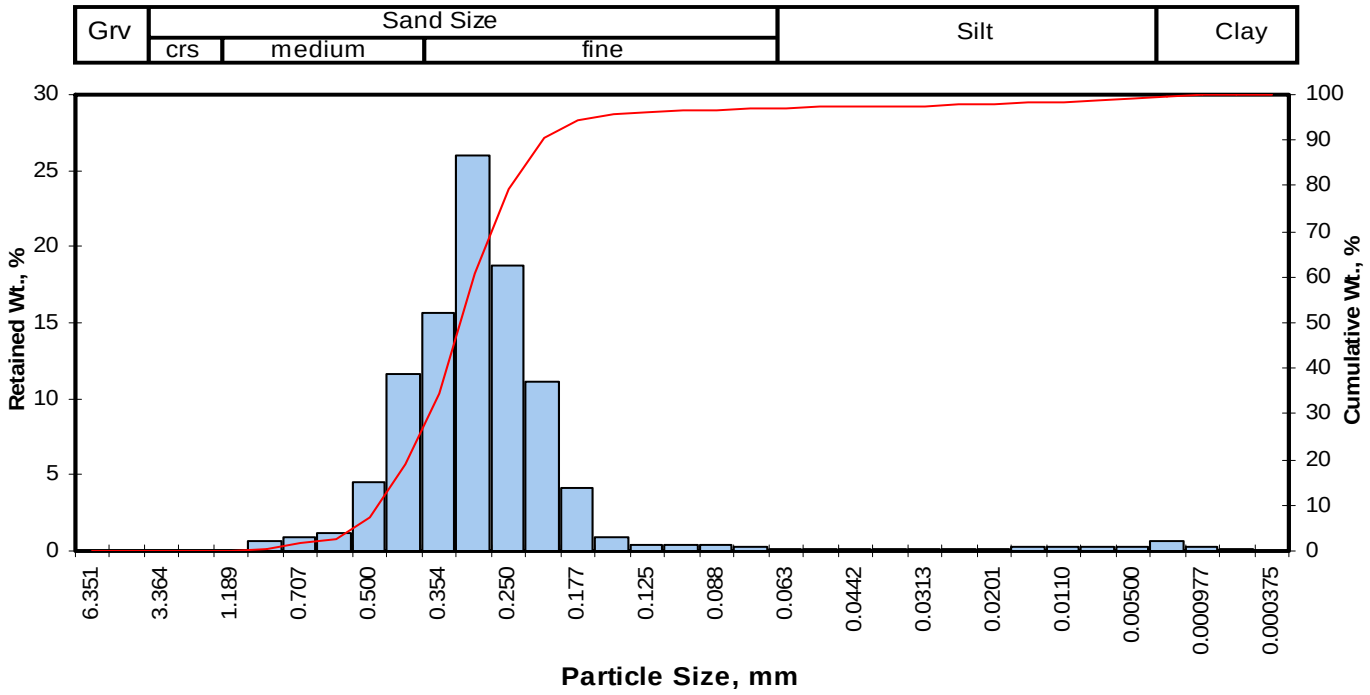
Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	21.66
Fine Sand	200	73.87
Silt	>0.005 mm	3.06
Clay	<0.005 mm	1.41
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/34.5-36.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	35.25



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.61	0.61	0.61
0.0278	0.707	0.50	25	0.92	0.92	1.53
0.0234	0.595	0.75	30	1.20	1.20	2.73
0.0197	0.500	1.00	35	4.48	4.48	7.21
0.0166	0.420	1.25	40	11.70	11.70	18.90
0.0139	0.354	1.50	45	15.70	15.69	34.60
0.0117	0.297	1.75	50	26.00	25.99	60.59
0.0098	0.250	2.00	60	18.70	18.69	79.28
0.0083	0.210	2.25	70	11.10	11.10	90.38
0.0070	0.177	2.50	80	4.20	4.20	94.58
0.0059	0.149	2.75	100	0.96	0.96	95.54
0.0049	0.125	3.00	120	0.41	0.41	95.95
0.0041	0.105	3.25	140	0.45	0.45	96.40
0.0035	0.088	3.50	170	0.35	0.35	96.75
0.0029	0.074	3.75	200	0.20	0.20	96.95
0.0025	0.063	4.00	230	0.14	0.14	97.09
0.0021	0.053	4.25	270	0.13	0.13	97.22
0.00174	0.0442	4.50	325	0.13	0.13	97.34
0.00146	0.0372	4.75	400	0.13	0.13	97.47
0.00123	0.0313	5.00	450	0.13	0.13	97.60
0.000986	0.0250	5.32	500	0.17	0.17	97.77
0.000790	0.0201	5.64	635	0.18	0.18	97.95
0.000615	0.0156	6.00		0.20	0.20	98.15
0.000435	0.0110	6.50		0.27	0.27	98.42
0.000308	0.00781	7.00		0.26	0.26	98.68
0.000197	0.00500	7.65		0.32	0.32	99.00
0.000077	0.00195	9.00		0.61	0.61	99.61
0.000038	0.000977	10.00		0.30	0.30	99.91
0.000019	0.000488	11.00		0.09	0.09	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.88	0.0214	0.545
10	1.06	0.0189	0.480
16	1.19	0.0173	0.439
25	1.35	0.0155	0.393
40	1.55	0.0134	0.341
50	1.65	0.0126	0.319
60	1.74	0.0118	0.298
75	1.94	0.0102	0.260
84	2.11	0.0091	0.232
90	2.24	0.0083	0.211
95	2.61	0.0064	0.164

Measure	Trask	Inman	Folk-Ward
Median, phi	1.65	1.65	1.65
Median, in.	0.0126	0.0126	0.0126
Median, mm	0.319	0.319	0.319
Mean, phi	1.61	1.65	1.65
Mean, in.	0.0129	0.0126	0.0126
Mean, mm	0.327	0.319	0.319
Sorting	1.229	0.459	0.492
Skewness	1.002	-0.002	0.054
Kurtosis	0.248	0.888	1.193
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

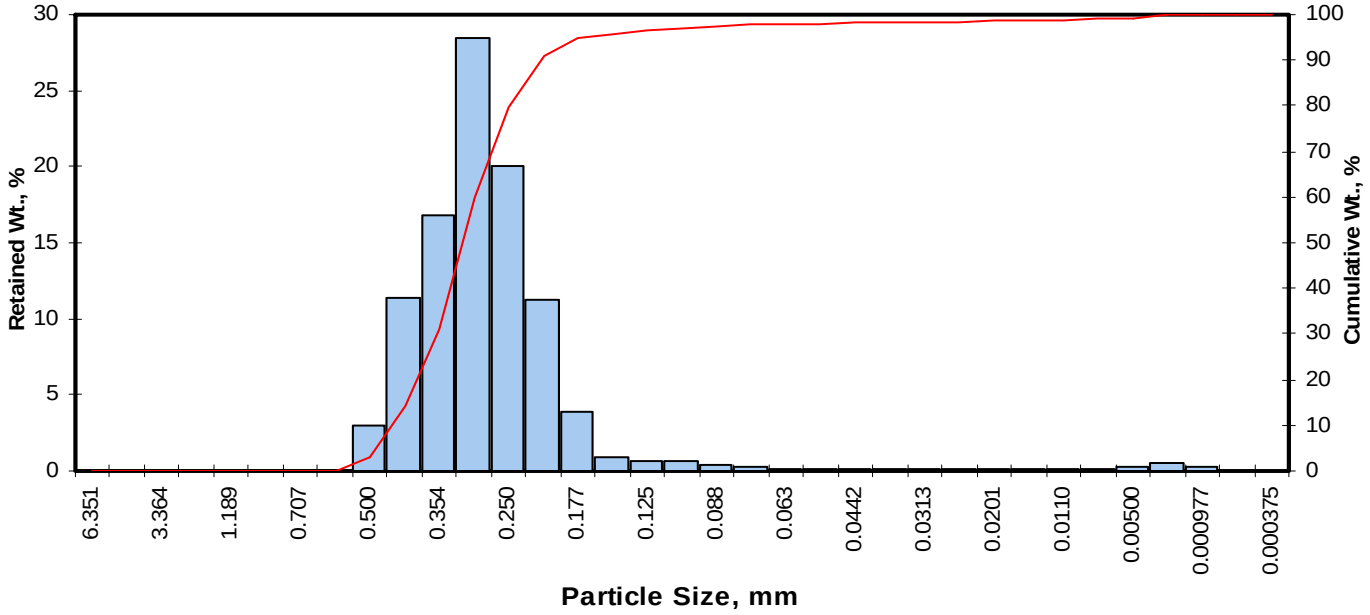
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	18.90
Fine Sand	200	78.04
Silt	>0.005 mm	2.06
Clay	<0.005 mm	1.00
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/36.5-38.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	36.8

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.06	0.06	0.06
0.0197	0.500	1.00	35	2.93	2.93	2.99
0.0166	0.420	1.25	40	11.40	11.40	14.39
0.0139	0.354	1.50	45	16.80	16.81	31.20
0.0117	0.297	1.75	50	28.50	28.51	59.71
0.0098	0.250	2.00	60	20.00	20.01	79.72
0.0083	0.210	2.25	70	11.20	11.20	90.92
0.0070	0.177	2.50	80	3.94	3.94	94.86
0.0059	0.149	2.75	100	0.94	0.94	95.81
0.0049	0.125	3.00	120	0.59	0.59	96.40
0.0041	0.105	3.25	140	0.64	0.64	97.04
0.0035	0.088	3.50	170	0.44	0.44	97.48
0.0029	0.074	3.75	200	0.22	0.22	97.70
0.0025	0.063	4.00	230	0.15	0.15	97.85
0.0021	0.053	4.25	270	0.13	0.13	97.98
0.00174	0.0442	4.50	325	0.12	0.12	98.10
0.00146	0.0372	4.75	400	0.10	0.10	98.20
0.00123	0.0313	5.00	450	0.09	0.09	98.29
0.000986	0.0250	5.32	500	0.12	0.12	98.41
0.000790	0.0201	5.64	635	0.13	0.13	98.54
0.000615	0.0156	6.00		0.14	0.14	98.68
0.000435	0.0110	6.50		0.18	0.18	98.86
0.000308	0.00781	7.00		0.18	0.18	99.04
0.000197	0.00500	7.65		0.25	0.25	99.29
0.000077	0.00195	9.00		0.50	0.50	99.79
0.000038	0.000977	10.00		0.20	0.20	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.04	0.0191	0.485
10	1.15	0.0177	0.449
16	1.27	0.0163	0.414
25	1.41	0.0148	0.377
40	1.58	0.0132	0.335
50	1.66	0.0124	0.315
60	1.75	0.0117	0.297
75	1.94	0.0103	0.260
84	2.10	0.0092	0.234
90	2.23	0.0084	0.213
95	2.54	0.0068	0.172

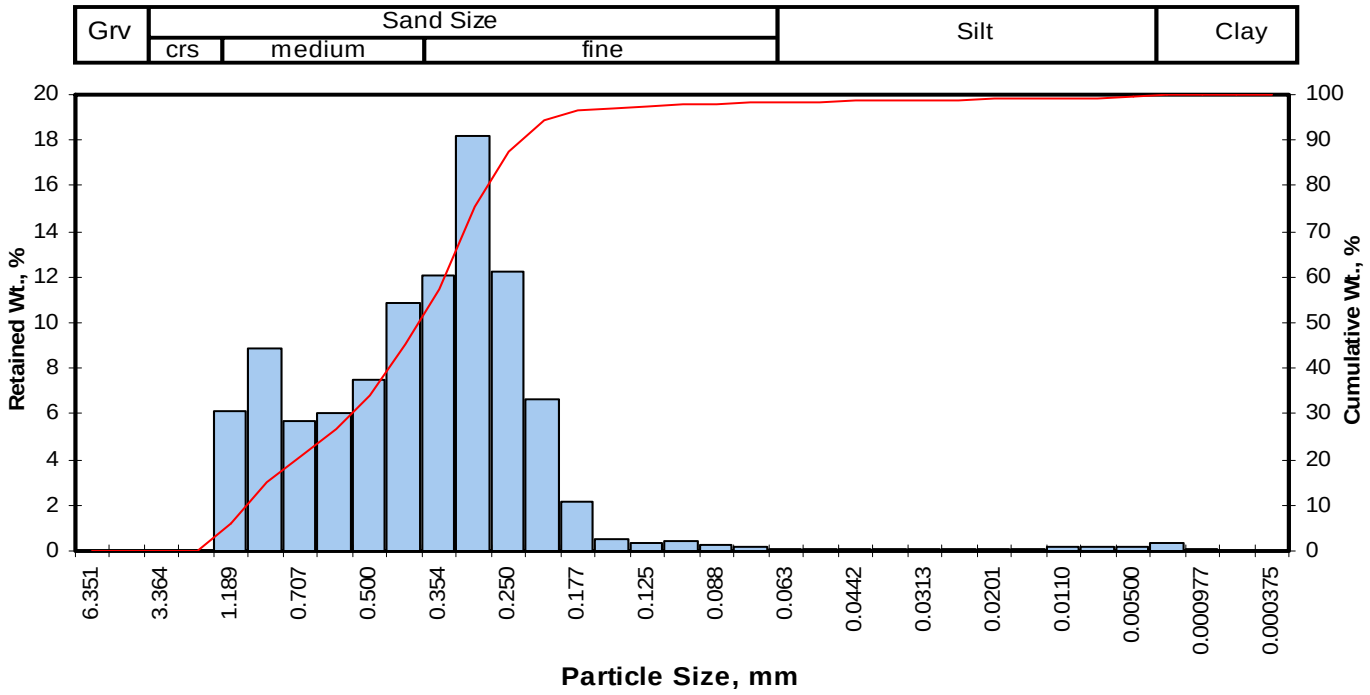
Measure	Trask	Inman	Folk-Ward
Median, phi	1.66	1.66	1.66
Median, in.	0.0124	0.0124	0.0124
Median, mm	0.315	0.315	0.315
Mean, phi	1.65	1.68	1.68
Mean, in.	0.0125	0.0122	0.0123
Mean, mm	0.319	0.311	0.312
Sorting	1.203	0.411	0.431
Skewness	0.993	0.048	0.108
Kurtosis	0.247	0.816	1.147
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	14.39
Fine Sand	200	83.30
Silt	>0.005 mm	1.59
Clay	<0.005 mm	0.71
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/38.5-40.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	38.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	6.10	6.10	6.10
0.0331	0.841	0.25	20	8.92	8.92	15.02
0.0278	0.707	0.50	25	5.69	5.69	20.72
0.0234	0.595	0.75	30	6.07	6.07	26.79
0.0197	0.500	1.00	35	7.47	7.47	34.26
0.0166	0.420	1.25	40	10.90	10.90	45.16
0.0139	0.354	1.50	45	12.10	12.10	57.26
0.0117	0.297	1.75	50	18.20	18.20	75.47
0.0098	0.250	2.00	60	12.20	12.20	87.67
0.0083	0.210	2.25	70	6.63	6.63	94.30
0.0070	0.177	2.50	80	2.19	2.19	96.49
0.0059	0.149	2.75	100	0.49	0.49	96.98
0.0049	0.125	3.00	120	0.35	0.35	97.33
0.0041	0.105	3.25	140	0.39	0.39	97.72
0.0035	0.088	3.50	170	0.27	0.27	97.99
0.0029	0.074	3.75	200	0.16	0.16	98.15
0.0025	0.063	4.00	230	0.12	0.12	98.27
0.0021	0.053	4.25	270	0.12	0.12	98.39
0.00174	0.0442	4.50	325	0.11	0.11	98.50
0.00146	0.0372	4.75	400	0.10	0.10	98.60
0.00123	0.0313	5.00	450	0.10	0.10	98.70
0.000986	0.0250	5.32	500	0.12	0.12	98.82
0.000790	0.0201	5.64	635	0.11	0.11	98.93
0.000615	0.0156	6.00		0.12	0.12	99.05
0.000435	0.0110	6.50		0.15	0.15	99.20
0.000308	0.00781	7.00		0.15	0.15	99.35
0.000197	0.00500	7.65		0.19	0.19	99.54
0.000077	0.00195	9.00		0.33	0.33	99.87
0.000038	0.000977	10.00		0.12	0.12	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.39	0.0514	1.306
10	-0.03	0.0402	1.022
16	0.29	0.0321	0.816
25	0.68	0.0246	0.626
40	1.13	0.0180	0.456
50	1.35	0.0154	0.392
60	1.54	0.0136	0.344
75	1.74	0.0118	0.299
84	1.92	0.0104	0.263
90	2.09	0.0093	0.235
95	2.33	0.0078	0.199

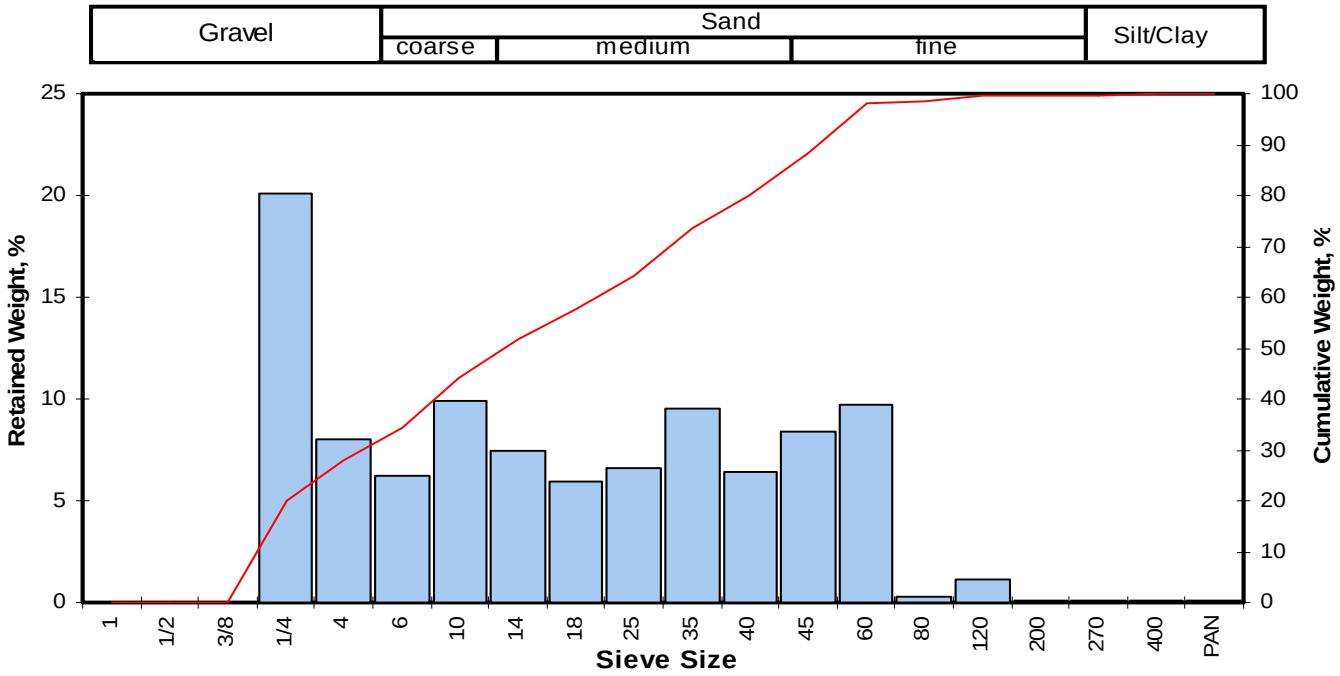
Measure	Trask	Inman	Folk-Ward
Median, phi	1.35	1.35	1.35
Median, in.	0.0154	0.0154	0.0154
Median, mm	0.392	0.392	0.392
Mean, phi	1.11	1.11	1.19
Mean, in.	0.0182	0.0183	0.0173
Mean, mm	0.462	0.464	0.439
Sorting	1.448	0.816	0.819
Skewness	1.102	-0.296	-0.287
Kurtosis	0.208	0.664	1.043
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	45.16
Fine Sand	200	52.99
Silt	>0.005 mm	1.39
Clay	<0.005 mm	0.46
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/40.5-42.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	40.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	5.73	20.13	20.13
0.1873	4.757	-2.25	4	2.27	7.98	28.11
0.1324	3.364	-1.75	6	1.76	6.18	34.29
0.0787	2.000	-1.00	10	2.83	9.94	44.24
0.0557	1.414	-0.50	14	2.11	7.41	51.65
0.0394	1.000	0.00	18	1.68	5.90	57.55
0.0278	0.707	0.50	25	1.87	6.57	64.13
0.0197	0.500	1.00	35	2.71	9.52	73.65
0.0166	0.420	1.25	40	1.83	6.43	80.08
0.0139	0.354	1.50	45	2.38	8.36	88.44
0.0098	0.250	2.00	60	2.76	9.70	98.14
0.0070	0.177	2.50	80	0.08	0.28	98.42
0.0049	0.125	3.00	120	0.31	1.09	99.51
0.0029	0.074	3.75	200	0.04	0.14	99.65
0.0021	0.053	4.25	270	0.04	0.14	99.79
0.0015	0.037	4.75	400	0.02	0.07	99.86
			PAN	0.04	0.14	100.00
TOTALS				28.46	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-3.10	0.3384	8.596
10	-2.96	0.3062	7.778
16	-2.79	0.2716	6.898
25	-2.41	0.2096	5.324
40	-1.32	0.0983	2.496
50	-0.61	0.0601	1.528
60	0.19	0.0346	0.879
75	1.05	0.0190	0.482
84	1.37	0.0153	0.388
90	1.58	0.0132	0.334
95	1.84	0.0110	0.280

Measure	Trask	Inman	Folk-Ward
Median, phi	-0.61	-0.61	-0.61
Median, in.	0.0601	0.0601	0.0601
Median, mm	1.528	1.528	1.528
Mean, phi	-1.54	-0.71	-0.68
Mean, in.	0.1143	0.0644	0.0629
Mean, mm	2.903	1.635	1.599
Sorting	3.323	2.077	1.787
Skewness	1.049	-0.047	-0.028
Kurtosis	0.325	0.190	0.584
Grain Size Description (ASTM-USCS Scale)		Coarse sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	28.11
Coarse Sand	10	16.13
Medium Sand	40	35.84
Fine Sand	200	19.57
Silt/Clay	<200	0.35
	Total	100

APPENDIX D

RETEC REPORT

LNAPL Distribution and Recovery Model Summary

The Hartford Working Group

Prepared by:

The RETEC Group, Inc.
1726 Cole Blvd
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RETEC Project Number: CENV3-19041-303

Prepared for:

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Downers Grove, IL 60515

December 14, 2005

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Attachments

Attachment 1: PTS Laboratory Reports
Attachment 2: Specific LNAPL Thickness (Available electronically upon request)
Attachment 3: API Distribution and Recovery Model Spreadsheets (Available electronically upon request)
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Table 6 Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-2
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Table 8 Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-4
Table 9 Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-5

List Acronyms and Abbreviations

µm	micrometer
amsl	above mean sea level
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
bgs	below ground surface
cm/sec	centimeters per second
CMS	Corrective Measures Study
cp	centipoise
The Site	Hartford Working Group's site in Hartford, IL
gpm	gallons per minute
GC	gas chromatogram
LNAPL	light non-aqueous phase liquid
mm	millimeters
PTS	PTS Laboratories, Inc.
psi	pounds per square inch
psig	pounds per square inch gauge
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation Report
ROC	radius of capture
ROI	radius of influence
USCS	Unified Soil Classification System

1 Introduction

This report summarizes the results of data collection and modeling analyses to complete the light non-aqueous phase liquid (LNAPL) recoverability investigation and modeling for the Hartford Working Group's site in Hartford, Illinois (the Site).

1.1 Modeling Objectives

The objective of the LNAPL modeling work is to provide "point in space" relative LNAPL recovery performance predictions for the specific recovery methods (i.e., skimming, dual-phase pumping, and vacuum-enhanced pumping) for each of the modeling scenarios. "Point in space" recovery performance estimates consider only the conditions present within the assumed radius of influence of the recovery well and do not consider potential areal variations in LNAPL distribution and behavior. The LNAPL modeling calculation will be made using all relevant existing data and site-specific parameters obtained from laboratory-analyzed soil core and fluid samples for each scenario.

For this evaluation, the American Petroleum Institute (API) LNAPL distribution and recovery model (Charbeneau, 2003) was used to evaluate LNAPL recovery. The distribution portion of the model predicts LNAPL saturation and permeability based on measured LNAPL thickness in a monitoring well and several site-specific soil, fluid (i.e., LNAPL and groundwater), and soil-fluid interaction parameters. Using the results of the distribution model, the recovery portion of the API model predicts LNAPL recovery over time. After predicting LNAPL recovery for each recovery well, the model results are validated against one year of actual LNAPL recovery data. The model results are then used to predict long-term LNAPL recovery and evaluate several remedial technologies (e.g., skimming, vacuum-enhanced skimming, dual pump recovery, and dual phase extraction).

1.2 Scope of Work

The following individual tasks were completed as part of the LNAPL modeling for the Site:

1. Core depth interval selection for five locations using existing data and considering the conceptual site model

2. Selection of laboratory core tests (i.e., number and type of tests) based on an evaluation of laboratory core photography results (under both ultraviolet and visible light)

3. Evaluation of laboratory core and fluid sample analyses results, baildown tests and vacuum recovery tests in preparation for API model input

4. API model setup for five locations

5. Running and calibrating the API model for each location

6. Calculating LNAPL recovery performance predictions for the five scenarios for a well equipped with a single pump (i.e., LNAPL skimming), dual pump (LNAPL and water), vacuum-enhanced skimming, and dual phase extraction (i.e., dual pump recovery with vacuum enhancement)

7. Report on modeling results describing steps 1 through 6 and conclusions

1.3 Report Organization

This report describes the input parameters and results of API LNAPL distribution and recovery models for each of the five locations. The following sections summarize data collection and analysis methods; inputs, results, and sensitivity analysis of the API LNAPL distribution and recovery modeling; and study conclusions.

Attachment 1 includes laboratory results, Attachment 2 includes calculations for LNAPL specific thickness, Attachment 3 includes API LNAPL modeling distribution and recovery worksheets, and Attachment 4 includes recovery model validation.

2 Data Collection

Data collection of site-specific soil, groundwater, and LNAPL parameters is required to accurately run the API model. For the Hartford site, the following data were collected:

- Soil lithological data
- ROST data
- Porosity
- Grain size distribution
- Water and LNAPL saturations with depth
- Capillary pressure (moisture retention) curves
- Hydraulic conductivity
- LNAPL density
- LNAPL viscosity
- Air/water surface tension
- Air/LNAPL surface tension
- LNAPL/water surface tension
- LNAPL characterization (i.e., gas chromatography)
- Measured LNAPL thickness in wells over time
- Hydrographs
- LNAPL Baildown Tests
- Historical LNAPL recovery

The methods of data collection are described below.

2.1 Core Sampling and Sample Interval Selection

Soil boring locations were chosen based on monitoring wells with elevated LNAPL thicknesses and historical LNAPL recovery. Soil borings were advanced at five locations across the Site (HCSB-1 through 5) and undisturbed soil cores collected for specialized LNAPL testing. Soil cores were sent to PTS Laboratories Inc. (PTS) of Santa Fe Springs, California, to photograph and to obtain soil and soil-fluid interaction parameters. The specialized soil core analyses used in the LNAPL recovery evaluations are summarized in the PTS laboratory data reports included in Attachment 1.

Initially, the five cores were photographed under natural light to identify changes in soil lithology (color and texture) and again under ultraviolet light which fluoresces if hydrocarbons are present. Then, after review of the photographs, specific sample intervals were identified for the various laboratory tests, as outlined below. The tests were conducted on plug samples

drilled out of the core by PTS. The plugs were drilled in a frozen state. The plugs were approximately 1 inch in diameter and 2 inches long.

2.2 Fluid Sampling

Groundwater and LNAPL samples were collected from corresponding monitoring wells and sent to Torkelson Geochemistry, Inc. (Torkelson), Tulsa, Oklahoma for analysis. Fluid samples were collected using disposable bailers and were transferred to laboratory-prepared sample containers. Laboratory report summaries of fluid properties are provided in Attachment 1.

2.3 Laboratory Testing

PTS Laboratories of Santa Fe Springs, California, performed laboratory testing of the soil core plug. Torkelson performed the laboratory testing of fluid samples.

2.3.1 Soil Analyses

The plugs were analyzed for soil properties including density and porosity by the API Publication Method RP-40. The soil grain size distributions of particle sizes larger than 75 micrometers (μm) (retained by the No. 200 sieve) were evaluated by sieving following the American Society for Testing and Materials (ASTM) Method D422. The grain-size distributions of particle sizes finer than 75 μm (passing the No. 200 sieve) were evaluated using a Laser Method (ASTM method D4464M) for grain size analysis. The PTS laboratory reports are provided in Attachment 1.

Special core analyses consisted of soil-fluid interaction properties. Plugs from each sample were selected for special core analysis and were analyzed for water and LNAPL saturations by API Method RP-40. Air/water drainage capillary pressure curves were measured using the centrifugal technique following ASTM Method D425M. The PTS laboratory reports include capillary pressure plots as presented in Attachment 1.

2.3.2 Fluid Analyses

Fluid properties were measured by Torkelson for both groundwater and LNAPL. The fluid samples were analyzed for density and viscosity by ASTM Method D445 and API Method RP40. They were analyzed for LNAPL-water interfacial tension and LNAPL and groundwater surface tensions by a DuNouy ring tensiometer using ASTM Method D971. Torkelson laboratory reports are provided in Attachment 1.

2.3.3 Dean-Stark Analyses

Soil core analyses were performed using a method for the measurement of fluid saturations in a core sample by centrifuge extraction. This method is known as the Dean-Stark method (ASTM D425M). The Dean-Stark analysis is a distillation extraction method of determining fluid saturations. It depends upon the distillation of the water fraction of a sample and the solvent extraction of LNAPL from a sample. The sample is weighed and the water fraction is vaporized by boiling solvent. The water is condensed and collected in a calibrated receiver. Vaporized solvent also condenses, soaks the sample, and extracts the LNAPL. The sample is oven-dried and weighed. The LNAPL content is then determined by gravimetric difference. The PTS laboratory report for the Dean-Stark analyses including LNAPL and water saturations is included in Attachment 1.

2.4 Measured LNAPL Thickness and Baildown Testing

Groundwater and LNAPL elevations have been gauged within the area and recent LNAPL thickness and recovery data were used for the API model, as discussed in Sections 3 and 4. At locations with appreciable LNAPL thickness, LNAPL baildown tests were performed to provide LNAPL transmissivity estimates. Baildown test results at the five locations are summarized in Attachment 2.

3 LNAPL Distribution Modeling

This section summarizes API LNAPL distribution modeling for the Site. Input parameters required by the model and the model results are discussed below.

The LNAPL distribution model is a formulation by Charbeneau (2003) for the API. LNAPL recoverability is a function of LNAPL saturation. The API distribution model uses the van Genuchten (1980) algorithm for capillary pressure (Charbeneau, 2003) to predict the LNAPL distribution in soil. Two versions of the API model are available for calculating the relative permeability of LNAPL in the subsurface: the Burdine or the Mualem model. The Burdine model is typically more applicable for sandier materials (personal communication with R.J. Charbeneau on May 24, 2004). It was used to model each of the five locations.

The API Model spreadsheet formulations are intended as tools for analyzing site-specific data to evaluate the distribution and recovery of LNAPL from porous media. The model assumes homogeneity of the porous media, vertical equilibrium of the LNAPL/groundwater system, and unconfined/water table groundwater conditions. Output of the model includes the LNAPL saturation profile with depth at a given location and the LNAPL-specific thickness ($feet^3/foot^2$) (D_o) for a given measured LNAPL well thickness. D_o is the integral of the LNAPL saturation over the entire depth of the soil column, also known as the specific thickness of LNAPL (i.e., the true amount of LNAPL in the subsurface) over a given soil column area. This should not be confused with or conceptualized as a continuous layer of LNAPL in the soil formation (i.e., a “pool” or “pancake” of LNAPL does not exist in the porous media in the subsurface). Instead, it represents the total thickness of LNAPL that occurs as disseminated and discontinuous pockets of LNAPL throughout the LNAPL-impacted soil column. Monitoring wells do not accurately represent the true thickness of LNAPL in the subsurface because capillary forces in soil do not exist in a monitoring well, and the thickness measured in a well is exaggerated due to density differences between LNAPL and water.

This section discusses the analytical data and calculation methods that were used to estimate the saturation of LNAPL within the study area. The calculation methods presented herein are based on standard petroleum engineering practice (Charbeneau, 2003). As such, evaluation results are verified and calibrated using observational rather than statistical methods. Using laboratory data obtained from the soil core and fluid analyses, the API LNAPL distribution model was calibrated at five locations (HCSB-1 through HCSB-5). However, three models could have sufficed because locations HCSB-2, -3, and -4 are similar based on grain size distribution and LNAPL characterization.

3.1 Distribution Model Inputs

This subsection describes the various inputs necessary to run the API distribution model. The model input parameters include:

- Measured LNAPL thickness in a well
- Soil input parameters: porosity, the van Genuchten parameters "N" and "α," irreducible water saturation, and residual LNAPL saturation in the vadose and saturated zones
- Fluid input parameters: LNAPL density, air/water surface tension, air/LNAPL surface tension, and LNAPL/water surface tension

These parameters were taken from field measurements and observations, the results of the PTS analysis of the soil plug samples and the fluid samples, or based on professional judgment. Table 1 lists each input parameter for each modeled well location, and Attachment 1 includes soil and fluid input parameters. A description of each parameter follows.

3.1.1 Measured LNAPL Thickness

All measured LNAPL thickness and corrected groundwater elevation at wells were based on previous gauging measurements. Calibration of the distribution model was performed using LNAPL thickness measurements from monitoring and/or recovery wells during a period of inactivity and are indicative of equilibrium conditions. LNAPL thickness measurements used as input parameters for each recovery well distribution model are presented in Table 1.

3.1.2 Soil Input Parameters

Porosity was measured at several locations in the sand lithology at the water table, and the value used for the API model was estimated as the average porosity of the cores tested for air/water capillary pressure analysis. Soil sample collection is described in Section 2 and porosity values for each modeled well locations are presented in Table 1.

3.1.3 Fluid Input Parameters

The fluid parameters were input based on the most representative fluid samples for each well. LNAPL density was measured by Torkelson (Section 2). Viscosity, specific gravity, and density data can be found in Attachment 2. Measured LNAPL density in the five well locations ranged from 0.741 to 0.783 grams per cubic centimeter. The surface tensions were also measured by Torkelson (Section 2). The surface tension data can be

found in Attachment 2. The air/water surface tensions ranged from 58.8 to 68.5 dynes per centimeter. The air/LNAPL surface tensions ranged from 19.4 to 21.9 dynes per centimeter. The LNAPL/water surface tensions ranged from 19.2 to 22.1 dynes per centimeter.

3.1.4 Capillary Pressure Data Analysis

The API model requires van Genuchten parameters "N" and "α" which are curve-fitting parameters which describe the capillarity potential (i.e., moisture retention) of a porous media. These parameters can be estimated by curve-fit of capillary pressure data. Capillary pressure data, taken from a water drainage pressure test, is described in Section 2. The RETC program (USEPA, 1991) was used to average the air/water capillary pressure data sets obtained from soil types representing the fine sand which is predominant at capillary fringe at the site. This soil type contains higher than 90% sand. Based on the RETC output capillary pressure curve, van Genuchten parameters were estimated for use in the distribution model. Curve-fits of the capillary pressure data produce values for "N" and "α." Capillary pressure curves were taken at several depths for each soil core (Attachment 1). The "N" and "α" pair that best matched the measured LNAPL saturation distribution were used in the model with an "N" value of 2.73 and an "α" value of 1.16 feet. Values used in the model are presented in Table 1, and the capillary curve-fit parameter estimation worksheets for each location are provided in Attachment 2.

The irreducible water saturation was also interpreted from the results of the capillary pressure data. The irreducible water saturation is described as the minimum water (wetting) phase saturation at large capillary pressures (Charbeneau et al., 1999). The water saturation values correspond to the same sample from which the van Genuchten "N" and "α" values were taken (Attachment 2). The irreducible water saturation was estimated based on the average air/water capillary pressure curve to be 30.1%.

3.1.5 Residual LNAPL Saturation

Cores retrieved from the site were spun for one hour at a rate that simulates 1000 times the gravitational force. Because the LNAPL types are similar and the soil type at the water table was characterized as fine sand, residual saturation was set as the average residual saturation estimated from all cores that contained mobile LNAPL. The range of residual saturations estimated from the free product mobility testing was 2.8% up to 6.0% of the pore volume. For modeling purposes, the residual LNAPL saturation was set at 4.8% of the pore volume.

3.2 Distribution Model Calibration

To aid in distribution model calibration, actual LNAPL saturation data was collected, and the measured saturation values are plotted for each well in Attachment 2. The API distribution model was run to estimate the LNAPL saturation profile at the five soil boring locations. Attachment 2 includes the results of the modeled LNAPL specific thickness was compared to the specific LNAPL thickness calculated over the same interval using measured saturations from laboratory core analyses.

The vertical location of the maximum LNAPL saturation in each distribution model is strongly dependant on the elevation of the water table. The location of maximum modeled saturation is approximately the same as the maximum measured value, due to the input elevation of the water table. Overall, however, the distribution model results in Attachment 2 show good calibration between the measured values and modeled LNAPL saturations.

3.3 LNAPL Distribution Model Results

The LNAPL distribution model output provides the LNAPL saturation and permeability profiles and the LNAPL specific thickness (feet^3/foot^2) (D_o) corresponding to measured LNAPL thickness in a well. D_o is the specific thickness of LNAPL (feet^3/foot^2) per unit surface area, but is expressed as a length (in units of feet) and is representative of the actual amount of LNAPL in a formation.

Using the measured LNAPL thickness in wells (Table 1), the model estimated a specific LNAPL volume (D_o) in the formation for each of the wells as the following:

- HCSB-1: 0.60 feet^3/foot^2
- HCSB-2: 0.15 feet^3/foot^2
- HCSB-3: 0.21 feet^3/foot^2
- HCSB-4: 0.38 feet^3/foot^2
- HCSB-5: 0.47 feet^3/foot^2

In other words, the soil column at monitoring well HCSB-1 contains a total LNAPL specific thickness of 0.60 feet^3 (i.e., 4.5 gallons) of oil for every square foot of surface area. This specific volume is the equivalent thickness of LNAPL distributed throughout a vertical profile if the soil column could be separated into each phase (i.e., air, water, LNAPL, and soil).

4 LNAPL Recovery Modeling

LNAPL recoverability is defined as the recovery of appreciable volumes of LNAPL using technically practicable remediation systems, such as the dual pump recovery, dual phase extraction, skimming, or vacuum enhanced skimming. LNAPL recoverability, or quantities of LNAPL recovered, is a more reliable endpoint criterion than apparent or measured LNAPL thickness in monitoring or recovery wells, which are not accurate representations of LNAPL in the subsurface. However, based on measured LNAPL thicknesses in wells and its modeled distribution in the subsurface, the API model provides predictions of LNAPL recovery over time for four remedial technologies, including skimming, vacuum-enhanced skimming, dual pump recovery, and dual phase extraction.

The results from each API distribution model for each recovery well were used as the basis for the API recovery model at the five locations. The data required for analysis of recovery-well-system performance includes the radius of capture (ROC) for the well, the LNAPL viscosity (the water viscosity is assumed to be 1 centipoise [cp]), and water production rate for a water-enhanced system or wellhead vacuum pressure for a vacuum-enhanced system. For a water-enhanced system, the effective depth of penetration of the well into the aquifer must be specified, while for a vacuum-enhanced system, the screened interval of the vadose zone must be given along with the effective relative permeability of the vadose zone (due to the presence of soil water, the permeability of the vadose zone may be reduced from its air-saturated value). If zero water production and wellhead pressure are specified, then the well is assumed to function as a skimmer well. The API recovery model gives estimates of the total volume of LNAPL within the ROC of each recovery well, the amount of LNAPL that is recoverable at each well, the rate of recovery, the total time in which that LNAPL can be recovered, the LNAPL thickness over time in the recovery well, and the LNAPL recovery rate in gallons per day.

The performance of each well is characterized in terms of its ROC. For dual pump well systems, the ROC could extend out to the radius of influence (ROI) (water production) of the well. For vacuum-enhanced systems, the ROI of the vacuum extraction well (which is typically on the order of 30 to 50 feet) limits the ROC. For skimmer wells, the ROC is limited to a smaller but unknown extent, which is probably on the order of 20 to 30 feet or less.

To validate the model, model predictions were compared to empirical LNAPL recovery data from July and August 2005 for well RW-4. After validation, model results were then used to estimate the LNAPL recovery and remedial lifespan for each location. To help evaluate potential remedial technologies, LNAPL recovery via dual pump recovery, dual phase extraction, skimming, and vacuum enhanced skimming were modeled for each of the five locations.

The following sections describe the API recovery model inputs, model calibration to actual LNAPL recovery at each well, API model results, and model sensitivity.

4.1 Recovery Model Inputs

Potentially recoverable LNAPL volumes and rates were estimated for each of the five locations (HCSB-1 through 5) by using the API recovery model (Charbeneau, 2003). The recovery model inputs for each well are shown in Table 2. A description of each parameter follows.

- LNAPL recovery was predicted for each well location for periods of one, six and 10 years.

- The ROC is the distance from the pumping well at which LNAPL will be recovered. The estimated ROC for vacuum enhanced skimming, dual pump recovery and dual phase extraction was estimated at 45 feet, based on groundwater drawdown observed at adjacent wells, the proximity of other wells, and previous experience in similar geologic conditions. For the skimming model, the pumping rate was reduced to 0 gpm and the ROC was reduced to 25 feet.

- The LNAPL viscosity was based on fluid data collected at the representative well for each area. (See Section 2 for discussion). The viscosity of LNAPL, classified as a gasoline and diesel, ranged from 0.52 to 0.88 cp.

- Hydraulic conductivity was measured from the soil core samples, as described in Section 2, as well as measured in the field through pump and slug testing. Hydraulic conductivity is used to calculate the drawdown that was used as a calibration parameter for the ROI. The API model also derives the absolute LNAPL conductivity (i.e., LNAPL conductivity at 100% LNAPL saturation), from the hydraulic conductivity using the appropriate corrections based on measured fluid properties.

- The aquifer thickness is the effective thickness of the aquifer, which in the case of a thick formation, is estimated as the submerged screen length (Charbeneau, 2003). This value was calculated by taking the difference in the LNAPL/air interface elevation and the bottom of the well screen elevation. Table 2 provides estimates of the submerged screen length for each model location.

- The ROI is the distance from the well from which water can be produced. ROI was assumed to be 100 feet at all locations. ROI

has no effect on the LNAPL recovery volume or rate, but is used to calculate the drawdown and should be greater than the ROC (personal communication with R.J. Charbeneau on May 24, 2004).

4.2 Recovery Model Validation

One method for model validation uses calculated LNAPL transmissivity based on relative permeabilities in conjunction with the absolute permeability existing in the subsurface. LNAPL transmissivity can be calculated from core analyses and hydraulic conductivities obtained from field testing. The calculated transmissivity values were compared to field observations, and, in general the range of transmissivities correlated to the transmissivities estimated from the field tests, as shown in Attachment 2. Because permeability and conductivity may vary dramatically across the site and in order to provide more accurate model recovery estimates, the absolute permeability was adjusted by a factor equal to the error of observed versus calculated at each location. The Cooper, et al, (1946) results were used for calculating this correction factor to error on the higher side of LNAPL mobility.

4.3 Recovery Model Results

The following sections provide a summary of the API recovery model results for the five locations. Table 4 summarizes the predicted LNAPL recovery for each technology applied at the five well locations. Attachment 3 provides printouts of API distribution and recovery model spreadsheets for each well location.

4.3.1 Model-Predicted LNAPL Recovery

The API model was used to predict recovery at HCSB-1 through 5, over a 10-year time span. For comparison purposes, the five locations were modeled under skimming, vacuum enhanced skimming, dual pump recovery, and dual phase extraction conditions. Table 4 summarized the predictions of LNAPL recovery for each remedial technology over 1, 6, and 10-year timeframes.

Additional model validation and LNAPL recovery predictions can be made as additional data is collected over time to refine the output and increase confidence in recovery predictions.

4.3.2 Technology Comparison

The same time frame was modeled for each location for skimming, vacuum enhanced skimming, dual pump recovery, and dual phase extraction to provide a comparison of LNAPL recovery potential and remedial system

effectiveness. 10-year LNAPL recovery predictions are provided in Table 4, and range from 0.7 to 5,123 gallons for skimming, 13 to 16,994 gallons for vacuum-enhanced skimming, 11 to 16,936 gallons for dual pump recovery and 23 to 17,185 gallons for dual phase extraction. As shown in Table 4, the LNAPL recovery volume for all wells is approximately the same with vacuum enhanced skimming and dual pump recovery, while both technologies are more effective than skimming alone (by a factor of 2 to 20, with a greater effect on lower producing wells). Dual phase extraction produces the largest of all of the technologies primarily because it induces twice the drawdown as vacuum enhanced and dual pump recovery technologies.

4.4 Sensitivity Analysis

A sensitivity analysis was performed on key input parameters of the API model to evaluate their effect on predicted LNAPL recovery for each technology. To determine sensitivity of the API model to key input parameters, sensitivity of the model examined the following parameters: initial LNAPL thickness, hydraulic conductivity, and radius of capture (ROC), applied vacuum, drawdown, and radius of influence (ROI). Other input parameters have been examined in prior sensitivity analyses, and were determined to have little to no effect on model results.

Of all input parameters included in the sensitivity analyses, the initial measured LNAPL thickness has the greatest effect on recoverable volumes. Tables 5 through 9 present the sensitivity analysis results for wells HCSB-1 through 5, respectively. Varying the initial measured LNAPL thickness had the greatest effect on predicted LNAPL recovery on all locations with the exception of HCSB-1. Although there is great sensitivity with initial LNAPL thickness, the input value was based on actual gauging measurements, which are susceptible to seasonal and temporal fluctuations, so confidence in this parameter is considered moderate.

Model predictions are also sensitive to hydraulic conductivity and ROC, albeit to a lesser degree. Hydraulic conductivity is measured both in the laboratory and in the field, and, although this parameter can vary in the field, confidence in this parameter is high. The ROC is based on field observations as well as industry experience at other sites with remedial technologies applied in similar soils, so confidence in the parameter is medium to high.

Overall, the sensitivity analysis shows that the examined parameters are critical for accurate model results. Because the majority of these parameters were based on field and laboratory measurements, and verified by calibration to actual recovery values, the overall confidence in the model is medium to high. In addition, the sensitivity analysis does not affect the comparison of remedial technologies, because model predictions for each technology are affected proportionally.

5 Conclusions

The following conclusions are based on the results of the API LNAPL distribution and recovery modeling:

1. LNAPL distributions were calculated at five locations (HCSB-1 through 5) using the API model. The modeled LNAPL saturations are consistent with measured LNAPL saturation data, indicating successful validation of the distribution model.

2. The distribution model estimates that, although a maximum of 2.5 feet of measurable LNAPL is observed in monitoring wells at the five model locations, only a maximum of 0.60 $feet^3$ (i.e., 4.5 gallons) of oil is present for every square foot of surface area. This specific volume is the equivalent thickness of LNAPL distributed throughout a vertical profile if the soil column could be separated into each phase (i.e., air, water, LNAPL, and soil).

3. The following table summarizes the API-model predicted recovery for the five locations:

Boring Location	Time	Skimming (gallons)	Vacuum Enhanced Skimming (gallons)	Dual Pump Recovery (gallons)	Dual Phase Extraction
HCSB-1	1 year	3,895	14,010	13,462	15,646
	6 year	5,011	16,786	16,717	17,033
	10 year	5,123	16,994	16,936	17,185
HCSB-2	1 year	209	1,262	1,157	1,660
	6 year	527	2,209	2,142	2,439
	10 year	594	2,405	2,352	2,572
HCSB-3	1 year	1.5	27	23	48
	6 year	8.7	129	115	198
	10 year	13.9	185	167	263
HCSB-4	1 year	1,297	5,526	5,339	6,331
	6 year	1,971	6,821	6,794	6,733
	10 year	2,054	6,925	6,892	7,065
HCSB-5	1 year	0.1	1	1	2.4
	6 year	0.4	8	7	17
	10 year	0.7	13.0	11	23

4. The sensitivity analyses performed for the model suggests that confidence in the API model predictions is medium to high, and changes to input assumptions will not appreciably affect the evaluation of remedial technologies.

LNAPL recovery can be tracked over time to further refine the LNAPL recoverability model and measure progress towards reaching an LNAPL endpoint.

6 References

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Tables

Table 1
Distribution Model Inputs

Modeled Well	**HCSB-1**	**HCSB-2**	**HCSB-3**	**HCSB-4**	**HCSB-5**
Observation Well for WLs	HMW-44C	RW-5	MP-50	MP-39C	MP-29D
Measured LNAPL Thickness, b_o (ft)	2.50	0.97	0.40	1.52	0.48
Date of Measured LNAPL Thickness	10/11/05	9/1/05	ROST Log	8/31/05	9/20/05
Porosity, n (ratio pore volume)	0.472	0.472	0.472	0.472	0.472
van Genuchten "N," N (dimensionless)	2.730	2.730	2.730	2.730	2.730
van Genuchten "α," α (feet^{-1})	1.160	1.160	1.160	1.160	1.160
Irreducible Water Saturation, S_{wr} (ratio pore volume)	0.302	0.302	0.302	0.302	0.302
Residual LNAPL Saturation, Vadose Zone, S_{orv} (ratio pore volume)	0.049	0.049	0.049	0.049	0.049
Residual LNAPL Saturation, Saturated Zone, S_{ors} (ratio pore volume)	0.049	0.049	0.049	0.049	0.049
LNAPL Sample Collected at:	**HMW-44C**	**RW-5**	**MP-50**	**MP-39C**	**MP-29D**
Water Sample Collected at:	**HMW-44C**	**RW-5**	**MP-50**	**MP-39C**	**MP-29D**
LNAPL Density, ρ_o (g/cm^3)	0.7641	0.7511	0.741	0.7481	0.783
Air/Water Surface Tension, σ_{aw} (dyne/cm)	60.2	62.3	68.5	58.8	59.6
Air/LNAPL Surface Tension, σ_{ao} (dyne/cm)	20.9	20.2	19.4	19.8	21.9
LNAPL/Water Surface Tension, σ_{ow} (dyne/cm)	22.1	21.4	19.2	21.4	19.3

Table 2
Recovery Model Inputs

Modeled Well	**HCSB-1**	**HCSB-2**	**HCSB-3**	**HCSB-4**	**HCSB-5**
Time of Recovery, trecovery (yr)	1 to 10	1 to 10	1 to 10	1 to 10	1 to 10
Radius of Capture, R_c (ft) {Dual Pump Recovery}	45	45	45	45	45
Radius of Capture, R_c (ft) {intermittant vacuum recovery}	45	NA	NA	NA	NA
Radius of Capture, R_c (ft) {vacuum enhanced skimming}	45	45	45	45	45
Radius of Capture, R_c (ft) {skimming}	25	25	25	25	25
LNAPL dynamic viscosity, μ_o (centipoise)	0.73	0.58	0.53	0.52	0.88
Hydraulic Conductivity, K_w (ft/d)	73.6	73.6	73.6	73.6	15.1
Radius of Well Screen, r_w (ft)	0.2	0.2	0.2	0.2	0.2
Average Vacuum for intermittant vacuum recovery (atm)	0.031	0.031	0.031	0.031	0.031
Vacuum for vacuum recovery (atm)	0.031	0.031	0.031	0.031	0.031
Submerged Screen Length/ Aquifer Thickness, b_w (ft)	50.0	50.0	50.0	50.0	50.0
Radius of Influence, R_I (ft)	100	100	100	100	100
Measured Drawdown, s_w meas (ft)	1.0	1.0	1.0	1.0	1.0
Resultant Discharge Rate for Water (gpm)	20	20	20	20	4

Note:

Measured drawdown was limited to a maximum of 5 feet to prevent further smearing of mobile LNAPL

The discharge rate for water was limited to a maximum of 20 gpm as a preliminary practical limit for water production per recovery well

The aquifer thickness was estimated at 50 feet and partial penetration effects were assumed to be negligible based on the small drawdowns.

Table 3
Field Recovery vs API Model Results at RW-4

Dates of Vacuum Recovery Events	Burdine Modeled Cumulative Recovered LNAPL (gal)	Actual Cumulative Recovered LNAPL (gal)	Burdine Modeled LNAPL Recovery Rate (gpd)	Actual LNAPL Recovery Rate (gpd)
7/25/2005	93	231	31	77
7/26/2005	246	426	51	65
7/27/2005	488	637	81	71
7/28/2005	725	853	79	72
7/29/2005	958	1,058	78	68
8/1/2005	1124	1,228	18	57
8/2/2005	1187	1,400	21	57

Table 4
API Model-Predicted LNAPL Recovery

Boring Locaton	Time	Skimming (gallons)	Vacuum Enhanced Skimming (gallons)	Dual Pump Recovery (gallons)	Dual Phase Extraction (gallons)
HCSB-1	1 year	3,895	14,010	13,462	15,646
	6 year	5,011	16,786	16,717	17,033
	10 year	5,123	16,994	16,936	17,185
HCSB-2	1 year	209	1,262	1,157	1,660
	6 year	527	2,209	2,142	2,439
	10 year	594	2,405	2,352	2,572
HCSB-3	1 year	1.5	27	23	48
	6 year	8.7	129	115	198
	10 year	13.9	185	167	263
HCSB-4	1 year	1,297	5,526	5,339	6,331
	6 year	1,971	6,821	6,794	6,733
	10 year	2,054	6,925	6,892	7,065
HCSB-5	1 year	0.1	1	1	2.4
	6 year	0.4	8	7	17
	10 year	0.7	13.0	11	23

Table 5
Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-1

Parameter	Range	Value	LNAPL Transmissivity (ft^2/day)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Initial LNAPL Thickness (feet)	Low	2.1	10.1	9,419	12,069	14,991
	Actual	2.5	17.2	14,010	16,786	20,237
	High	3.47	39.8	26,421	29,456	33,928
Hydraulic Conductivity (feet/day)	Low	4	0.93	2,695	9,463	20,237
	Actual	73.6	17.2	14,010	16,786	
	High	150	35.2	15,860	17,064	
Applied Vacuum (atm)	Low	0	17.2	3,895	5,011	6,246
	Actual	0.03		14,010	16,786	20,237
	High	0.15		16,688	17,282	20,237
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	17.2	7,165	7,608	8,994
	Actual	45		14,010	16,786	20,237
	High	60		20,707	29,207	35,978

Sensitivity Analysis for Dual Pump Recovery

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	10	10,741	16,184	20,237
	Actual	1.0	20	13,462	16,717	
	High	5	100	16,614	17,253	
Hydraulic Conductivity (feet/day)	Low	4	1.0	2,325	8,587	20,237
	Actual	73.6	20	13,462	16,717	
	High	150	39	15,472	16,997	
Radius of Influence - Water (feet)	Low	50	22	13,885	16,760	20,237
	Actual	100	20	13,462	16,717	
	High	150	18	13,132	16,668	
Radius of Capture - LNAPL (feet)	Low	30	20	6,988	7,576	8,994
	Actual	45		13,462	16,717	20,237
	High	60		20,004	29,025	35,978

Sensitivity Analysis for Dual Phase Extraction

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	10	15,016	16,935	20,237
	Actual	1	20	15,646	17,032	
	High	10	100	16,741	17,298	
Applied Vacuum (atm)	Low	0	20	13,462	16,717	20,237
	Actual	0.03		15,646	17,032	
	High	0.15		16,761	17,310	
Radius of Influence - Water (feet)	Low	50	22	15,723	17,048	20,237
	Actual	100	20	15,646	17,032	
	High	150	18	15,541	17,016	
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	20	7,395	7,672	8,994
	Actual	45		15,646	17,032	20,237
	High	60		25,014	29,854	35,978

Table 6
Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-2

Parameter	Range	Value	LNAPL Transmissivity (ft^2/day)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Initial LNAPL Thickness (feet)	Low	0.32	4.7E-04	0.5	2.9	576
	Actual	0.97	0.7	1,262	2,209	3,885
Hydraulic Conductivity (feet/day)	Low	4	0.04	114	581	3,885
	Actual	73.6	0.7	1,262	2,209	
	High	150	1.4	1,702	2,467	
Applied Vacuum (atm)	Low	0	0.7	209	527	1,199
	Actual	0.03		1,262	2,209	3,885
	High	0.15		2,113	2,646	3,885
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	0.7	795	1,118	1,727
	Actual	45		1,262	2,209	3,885
	High	60		1,493	3,422	6,906

Sensitivity Analysis for Dual Pump Recovery

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Groundwater Drawdown (feet)	Low	0.5	10	725	1,821	3,885
	Actual	1.0	20	1,157	2,145	
	High	5	100	2,060	2,629	
Hydraulic Conductivity (feet/day)	Low	4	1.0	98	498	3,885
	Actual	73.6	20	1,157	2,145	
	High	150	39	1,614	2,414	
Radius of Influence - Water (feet)	Low	50	22	1,228	2,186	3,885
	Actual	100	20	1,157	2,145	
	High	150	18	1,078	2,097	
Radius of Capture - LNAPL (feet)	Low	30	20	744	1,090	1,726
	Actual	45		1,157	2,145	3,885
	High	60		1,389	3,337	6,906

Sensitivity Analysis for Dual Phase Extraction

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Groundwater Drawdown (feet)	Low	0.5	10	1,490	2,351	3,885
	Actual	1	20	1,660	2,440	
	High	10	100	2,161	2,657	
Applied Vacuum (atm)	Low	0	20	1,157	2,145	3,885
	Actual	0.03		1,660	2,440	
	High	0.15		2,183	2,664	
Radius of Influence - Water (feet)	Low	50	22	1,675	2,453	3,885
	Actual	100	20	1,660	2,440	
	High	150	18	1,630	2,425	
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	20	923	1,170	1,726
	Actual	45		1,660	2,440	3,885
	High	60		2,243	3,943	6,906

Table 7
Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-3

Parameter	Range	Value	LNAPL Transmissivity (ft^2/day)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Initial LNAPL Thickness (feet)	Actual	0.4	8.5E-03	27	129	973
	High	1.75	17.3	11,320	12,913	15,326
Hydraulic Conductivity (feet/day)	Low	4	1.2E-03	2	9	973
	Actual	73.6	8.5E-03	27	129	
	High	150	1.7E-02	52	209	
Applied Vacuum (atm)	Low	0	8.5E-03	1.5	8.7	300
	Actual	0.03		27	129	973
	High	0.15		109	319	973
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	8.5E-03	27	103	433
	Actual	45		27	129	973
	High	60		26	138	1,730

Sensitivity Analysis for Dual Pump Recovery

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Groundwater Drawdown (feet)	Low	0.5	10	12	64	973
	Actual	1.0	20	23	115	
	High	5	100	99	305	
Hydraulic Conductivity (feet/day)	Low	4	1.0	1	7	973
	Actual	73.6	20	23	115	
	High	150	39	44	185	
Radius of Influence - Water (feet)	Low	50	22	25	123	973
	Actual	100	20	23	115	
	High	150	18	21	105	
Radius of Capture - LNAPL (feet)	Low	30	20	22	90	433
	Actual	45		23	115	973
	High	60		24	126	1,730

Sensitivity Analysis for Dual Phase Extraction

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Groundwater Drawdown (feet)	Low	0.5	10	38	167	973
	Actual	1	20	48	198	
	High	10	100	117	330	
Applied Vacuum (atm)	Low	0	20	23	115	973
	Actual	0.03		48	198	
	High	0.15		124	338	
Radius of Influence - Water (feet)	Low	50	22	50	203	973
	Actual	100	20	48	198	
	High	150	18	46	192	
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	20	45	136	433
	Actual	45		48	198	973
	High	60		49	232	1,730

Table 8
Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-4

Parameter	Range	Value	LNAPL Transmissivity (ft^2/day)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Initial LNAPL Thickness (feet)	Low	0.5	5.2E-03	17	87	1,070
	Actual	1.52	5.3	5,512	6,821	9,078
	High	1.75	9.1	7,851	9,222	11,799
Hydraulic Conductivity (feet/day)	Low	4	0.29	879	3,391	9,078
	Actual	73.6	5.3	5,512	6,821	
	High	150	10.9	6,411	6,970	
Applied Vacuum (atm)	Low	0	5.3	1,297	1,971	2,802
	Actual	0.03		5,512	6,821	9,078
	High	0.15		6,783	7,160	9,078
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	5.3	2,908	3,115	4,034
	Actual	45		5,512	6,821	9,078
	High	60		7,853	11,876	16,140

Sensitivity Analysis for Dual Pump Recovery

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	10	3,944	6,572	9,078
	Actual	1.0	20	5,339	6,794	
	High	5	100	6,770	7,136	
Hydraulic Conductivity (feet/day)	Low	4	1.0	698	2,936	9,078
	Actual	73.6	20	5,339	6,794	
	High	150	39	6,231	6,926	
Radius of Influence - Water (feet)	Low	50	22	5,421	6,810	9,078
	Actual	100	20	5,339	6,794	
	High	150	18	5,106	6,776	
Radius of Capture - LNAPL (feet)	Low	30	20	2,832	3,092	4,034
	Actual	45		5,339	6,794	9,078
	High	60		7,599	11,797	16,140

Sensitivity Analysis for Dual Phase Extraction

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	10	6,065	6,983	9,078
	Actual	1	20	6,281	7,071	
	High	10	100	6,799	7,303	
Applied Vacuum (atm)	Low	0	20	5,339	6,794	9,078
	Actual	0.03		6,281	7,071	
	High	0.15		6,818	7,313	
Radius of Influence - Water (feet)	Low	50	22	6,318	7,085	9,078
	Actual	100	20	6,281	7,071	
	High	150	18	6,226	7,056	
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	20	2,980	3,233	4,034
	Actual	45		6,281	7,071	9,078
	High	60		9,971	12,180	16,140

Table 9
Sensitivity Analysis Results for Vacuum Enhanced Skimming HCSB-5

Parameter	Range	Value	LNAPL Transmissivity (ft^2/day)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Initial LNAPL Thickness (feet)	Actual	0.48	4.0E-04	1	8	993
	High	1.4	0.4	1,249	4,917	13,530
Hydraulic Conductivity (feet/day)	Low	4	1.1E-04	0.3	2	993
	Actual	15.1	4.0E-04	1	8	
	High	150	4.0E-03	13	69	
Applied Vacuum (atm)	Low	0	4.0E-04	0.1	0.4	306
	Actual	0.03		1	8	993
	High	0.15		6	36	993
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	4.0E-04	1	8	441
	Actual	45		1	8	993
	High	60		1	8	1,765

Sensitivity Analysis for Dual Pump Recovery

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	2	1	3	993
	Actual	1.0	4	1	7	
	High	5	20	6	32	
Hydraulic Conductivity (feet/day)	Low	4	1.0	0.3	2	993
	Actual	15.1	4	1	7	
	High	150	40	11	60	
Radius of Influence - Water (feet)	Low	50	4.5	1	7	993
	Actual	100	4.0	1	7	
	High	150	3.7	1	6	
Radius of Capture - LNAPL (feet)	Low	30	4	1	7	441
	Actual	45		1	7	993
	High	60		1	7	1,765

Sensitivity Analysis for Dual Phase Extraction

Parameter	Range	Value	Resultant Water Discharge (gpm)	Recovery after 1 Year (gallons)	Recovery after 6 Years (gallons)	Total In-Place Volume (gallons)
Drawdown (feet)	Low	0.5	2	2	11	993
	Actual	1	4	2	14	
	High	10	20	7	39	
Applied Vacuum (atm)	Low	0	4	1	7	993
	Actual	0.03		2	14	
	High	0.15		7	42	
Radius of Influence - Water (feet)	Low	50	4.5	3	15	993
	Actual	100	4.0	2	14	
	High	150	3.7	2	14	
Radius of Capture - Vacuum and LNAPL (feet)	Low	30	4	3	23	441
	Actual	45		2	14	993
	High	60		2	14	1,765

Attachment 1

CORE PHOTOGRAPHY AND PHYSICAL PROPERTIES DATA

Hartford Working Group

Project No: 15-03095.14-006

Borings: HCSB-1, HCSB-2, and HCSB-3

PTS File No.: 35565 **September 2005**

PTS Laboratories
ENVIRONMENTAL SERVICES

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Laboratories
ENVIRONMENTAL SERVICES

October 31, 2005

Bradley K. Martin, P.E.
Clayton Group Services, Inc.
3140 Finley Road
Downers Grove, IL 60515

Re: Physical Properties Data and Core Photography
Hartford Working Group; 15-03095.14-006
PTS File No: 35565

Dear Mr. Martin:

Please find enclosed final data for Physical Properties Analyses conducted upon material from your Hartford Working Group; 15-03095.14-006 project. All analyses were performed by applicable ASTM, EPA, or API methodologies. An electronic version of the report has previously been sent to your attention and the electronic data is enclosed on compact disk along with the core image archive (Core PhotoLog). The remaining core is currently in frozen storage and will be retained indefinitely pending additional analyses. We await your instructions. You may contact me regarding long term storage, disposal or return of the core.

PTS Laboratories, Inc. appreciates the opportunity to be of service. If you have any questions or require additional information, please give me a call at (562) 907-3607.

Sincerely,
PTS Laboratories, Inc.

Michael Mark Brady, P.G.
Project Manager

Encl.

8100 Secura Way – Santa Fe Springs, CA 90670
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PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Drng. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4;3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-1/9.5-11.5'/050923	9.5-11.5(A)	1.9	3	10.0, 10.15, 10.6, 11.1	10.45		9.6, 10.3, 10.8	
HCSB-1/11.5-13.5'/050923	11.5-13.5(B)	2.0	2	12.1	12.25			
HCSB-1/16.5-18.5'/050926	16.5-18.5(C)	2.1	3	17.15	17.7		17.0, 17.4	
HCSB-1/18.5-20.5'/050926	18.5-20.5(D)	2.1	3	19.1, 19.4, 20.2	19.8	19.6	20.05	
HCSB-1/20.5-22.5'/050926	20.5-22.5(E)	2.2	3	21.9, 22.4				
HCSB-1/27-29'/050926	27.0-29.0(F)	2.0	2	27.3, 27.8, 28.4	28.2			
HCSB-1/29-31'/050926	29.0-31.0(G)	1.7	2	29.75, 30.15	30.3	29.65	30.0	
HCSB-1/31-33'/050926	31.0-33.0(H)	1.7	2	31.15, 31.6, 32.25	31.3	32.1	32.4	
HCSB-1/33-35'/050926	33.0-35.0(I)	1.7	2	33.3	33.5			
HCSB-1/35-37'/050926	35.0-37.0(J)	0.85	1	37.6				
HCSB-1/37-39'/050926	37.0-39.0(K)	1.0	1					
HCSB-1/39-41'/050926	39.0-41.0(L)	1.4	2	39.2, 39.4, 39.7		40.2	40.3	
HCSB-1/41-43'/050926	41.0-43.0(M)	1.6	2	41.6	41.6			
HCSB-1/43-45'/050926	43.0-45.0(N)	1.45	2					
HCSB-2/9-11'/000923	9.0-11.0(A)	2.0	2					
HCSB-2/11-13'/000923	11.0-13.0(B)	2.0	2					
HCSB-2/17-19'/000923	17.0-19.0©	2.0	2	17.7	17.5			
HCSB-2/19-21'/000923	19.0-21.0(D)	2.0	2					
HCSB-2/27-29'/000923	27.0-29.0(E)	1.7	2	28.5				
HCSB-2/29-31'/000923	29.0-31.0(F)	1.6	2	29.3	29.1			
HCSB-2/31-33'/000923	31.0-33.0(G)	1.6	2	31.2, 31.5, 31.7, 32.1	31.9	31.4		
HCSB-2/33-35'/000923	33.0-35.0(H)	1.8	2	33.2, 33.35, 33.8	33.5	33.7		
HCSB-2/35-37'/000923	35.0-37.0(I)	1.9	2	35.5, 35.65, 36.2	35.8			
HCSB-2/37-39'/000923	37.0-39.0(J)	1.9	2	37.6				

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Dmg. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4:3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-2/39-41'/000923	39.0-41.0(K)	1.8	2					
HCSB-2/41-43'/000923	41.0-43.0(L)	1.9	2					
HCSB-3/17.5-19.5'/050928	17.5-19.5(A)	1.35	2					
HCSB-3/19.5-21.5'/050928	19.5-21.5(B)	1.7	3					
HCSB-3/30.0-32.0'/050928	30.0-32.0(C)	1.9	2	30.2, 30.8, 31.4	30.35, 31.6	31.2		
HCSB-3/32.0-34.0'/050928	32.0-34.0(D)	1.9	2	32.2, 32.6, 32.8	32.4			
HCSB-3/34.0-36.0'/050928	34.0-36.0(E)	1.7	2	34.4	34.4			
HCSB-3/36.0-38.0'/050928	36.0-38.0(F)	1.3	2	35.0				
HCSB-3/38.0-40.0'/050928	38.0-40.0(G)	1.0	1	38.1	38.4			
HCSB-3/40.0-42.0'/050928	40.0-42.0(H)	1.85	2					
HCSB-4/28.5-30.5'/050927	28.5-30.5(A)	2.0	3	29.5, 30.1	29.1			
HCSB-4/30.5-32.5'/052927	30.5-32.5(B)	1.9	1	31.0	30.8			
HCSB-4/32.5-34.5'/052927	32.5-34.5©	1.7	3					
HCSB-4/34.5-36.5'/052927	34.5-36.5(D)	0.7	1	35.0	33.9			
HCSB-4/36.5-38.5'/052927	36.5-38.5(E)	1.9	3	38.5	37.0			
HCSB-4/38.5-40.5'/052927	38.5-40.5(F)	1.7	2					
HCSB-4/40.5-42.5'/052927	40.5-42.5(G)	2.0	2	41.2				
HCSB-4/49-51'/052927	49-51(H)	1.5	2					
HCSB-4/51-53'/052927	51-53(I)	1.6	2					
HCSB-5/16-18'/050920	16-18(A)	2.0	2	17.5				
HCSB-5/18-20'/050920	18-20(B)	1.15	2					
HCSB-5/20-22'/050920	20-22(C)	2.2	3	20.8	20.5			

Project Name: Hartford Working Group
Project Number: 15-03095.14-006

TEST PROGRAM

CORE ID	Depth ft.	Core Recovery ft.	Slab & Core Photo	Pore Fluid Saturation Package	Grain Size Anal.	A/W Drng. Capillarity Pkg.	Free Product Mobility	Notes
		Plugs:	1/4:3/4	Vert. 1.5"	Grab	Vert. 1"	Vert. 1.5"	HOLD CORE FROZEN
HCSB-5/22-24'/050920	22-24(D)	2.2	3	23.5, 23.65, 23.85	23.0	23.75	24.0	
HCSB-5/24-26'/050920	24-26(E)	1.7	2					
HCSB-5/29-31'/050920	29-31(F)	2.0	2					
HCSB-5/31-32.5'/050921	31-32.5(G)	0.5	1	31.1	31.3			
HCSB-5/32.5-34.5'/050921	32.5-34.5(H)	1.7	3	32.8, 33.3, 33.7, 34.0	33.0			
HCSB-5/34.5-36.5'/050921	34.5-36.5(I)	1.4	1	34.8, 35.1, 35.6, 35.8	35.25	35.5	35.35	
HCSB-5/36.5-38.5'/050922	36.5-38.5(J)	0.8	2	37.0	36.8			
HCSB-5/38.5-40.5'/050922	38.5-40.5(K)	1.4	2	38.5, 39.1, 39.5	38.9	39.25	39.25	
HCSB-5/40.5-42.5'/050922	40.5-42.5(L)	1.35	2	41.1	40.9			
HCSB-5/42.5-44.0'/050922	42.5-44.0(M)	1.5	2					
HCSB-5/44.0-45.5'/050922	44.0-45.5(N)	1.95	2					
HCSB-5/45.5-47.5'/050922	45.5-47.5(O)	1.4	3					
HCSB-5/47.5-49.5'/050922	47.5-49.5(P)	1.6	2					
TOTALS:	59 cores	116.0	123	73	31	10	12	

Laboratory Test Program Notes
Sample locations to be selected from core photography by Hartford Working Group.
RUSH - Electronic data to be delivered to Clayton/Hartford Working Group by November 1, 2005

Fluid Properties and IFT on product and water (0 pair).
Pair 1
Water ID:
Product ID:

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

			API RP 40 /						
		METHODS:	ASTM D2216	API RP 40		API RP 40		API RP 40	
		SAMPLE	MOISTURE	DENSITY		POROSITY, %Vb (2)		PORE FLUID	
SAMPLE	DEPTH,	ORIENTATION	CONTENT	BULK	GRAIN		AIR	SATURATIONS, % Pv (3)	
ID.	ft.	(1)	(% wt)	(g/cc)	(g/cc)	TOTAL	FILLED	WATER	NAPL
HCSB-1/9.5-11.5'/050923	10.0	H	30.6	1.31	2.56	49.0	8.3	78.4	4.7
HCSB-1/9.5-11.5'/050923	10.15	H	30.1	1.26	2.58	51.2	12.4	70.9	4.8
HCSB-1/9.5-11.5'/050923	10.6	H	26.9	1.27	2.59	50.9	16.1	65.8	2.5
HCSB-1/9.5-11.5'/050923	11.1	H	26.4	1.32	2.62	49.7	14.7	69.5	0.9
HCSB-1/11.5-13.5'/050923	12.1	H	19.3	1.23	2.63	53.2	28.7	42.1	3.9
HCSB-1/16.5-18.5'/050926	17.15	H	46.0	1.10	2.65	58.4	7.2	85.0	2.6
HCSB-1/18.5-20.5'/050926	19.1	H	25.8	1.27	2.62	51.5	18.3	62.5	2.0
HCSB-1/18.5-20.5'/050926	19.4	H	24.8	1.33	2.62	49.3	15.9	65.6	2.2
HCSB-1/20.5-22.5'/050926	20.2	H	30.4	1.34	2.62	49.0	7.7	81.8	2.4
HCSB-1/20.5-22.5'/050926	21.9	H	36.5	1.24	2.64	53.2	7.8	85.3	ND<0.1
HCSB-1/20.5-22.5'/050926	22.4	H	37.7	1.21	2.65	54.1	7.9	84.5	0.9
HCSB-1/27-29'/050926	27.3	H	36.1	1.29	2.64	51.2	4.2	89.7	2.0
HCSB-1/27-29'/050926	27.8	H	26.9	1.40	2.65	47.1	8.9	79.8	1.3
HCSB-1/27-29'/050926	28.4	H	21.2	1.55	2.65	41.4	8.0	78.9	1.8
HCSB-1/29-31'/050926	29.75	H	13.3	1.53	2.66	42.7	21.9	44.2	4.6
HCSB-1/29-31'/050926	30.15	H	8.9	1.52	2.65	42.5	28.0	27.4	6.7
HCSB-1/31-33'/050926	31.15	H	11.5	1.43	2.65	46.2	26.6	15.2	27.2
HCSB-1/31-33'/050926	31.6	H	14.1	1.51	2.65	43.1	17.4	19.4	40.2
HCSB-1/31-33'/050926	32.25	H	17.7	1.50	2.66	43.7	14.7	44.6	21.8
HCSB-1/33-35'/050926	33.3	H	20.0	1.46	2.65	45.1	15.4	63.0	2.7
HCSB-1/35-37'/050926	37.6	H	20.0	1.46	2.65	44.9	14.9	61.9	4.9
HCSB-1/39-41'/050926	39.2	H	14.5	1.72	2.65	35.2	9.6	66.8	5.8
HCSB-1/39-41'/050926	39.4	H	12.3	1.76	2.65	33.6	11.3	60.6	5.8
HCSB-1/39-41'/050926	39.7	H	10.9	1.78	2.66	33.2	13.0	52.5	8.3
HCSB-1/41-43'/050926	41.6	H	17.0	1.58	2.65	40.4	13.0	64.9	2.8
HCSB-2/17-19'/000923	17.7	H	32.7	1.30	2.65	50.9	7.9	83.3	1.1
HCSB-2/27-29'/000923	28.5	H	36.8	1.25	2.62	52.4	6.2	87.0	1.1
HCSB-2/29-31'/000923	29.3	H	26.5	1.44	2.63	45.3	7.1	84.4	ND<0.1
HCSB-2/31-33'/000923	31.2	H	6.5	1.51	2.64	42.7	32.4	21.6	2.6
HCSB-2/31-33'/000923	31.5	H	7.6	1.44	2.64	45.6	34.6	23.8	0.3
HCSB-2/31-33'/000923	31.75	H	7.2	1.42	2.63	46.2	35.6	20.4	2.5
HCSB-2/31-33'/000923	32.15	H	18.8	1.46	2.64	44.7	16.2	55.1	8.5
HCSB-2/33-35'/000923	32.2	H	16.6	1.48	2.64	44.0	18.7	52.2	5.2
HCSB-2/33-35'/000923	33.35	H	20.2	1.47	2.64	44.3	14.0	63.0	5.3
HCSB-2/33-35'/000923	33.8	H	20.1	1.42	2.64	46.1	17.1	58.4	4.5
HCSB-2/35-37'/000923	35.5	H	20.1	1.54	2.64	41.7	10.2	70.8	4.8
HCSB-2/35-37'/000923	35.65	H	21.1	1.49	2.64	43.5	11.3	68.0	6.0
HCSB-2/35-37'/000923	36.2	H	20.2	1.51	2.64	42.8	11.9	68.2	4.0
HCSB-2/37-39'/000923	37.6	H	22.3	1.46	2.61	43.9	10.6	69.2	6.8

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	MOISTURE CONTENT (% wt)	DENSITY BULK (g/cc)	DENSITY GRAIN (g/cc)	POROSITY, %Vb (2) TOTAL	POROSITY, %Vb (2) AIR FILLED	PORE FLUID SATURATIONS, % Pv (3) WATER	PORE FLUID SATURATIONS, % Pv (3) NAPL
HCSB-3/30.0-32.0'/050928	30.2	H	26.2	1.40	2.65	47.4	9.9	74.6	4.6
HCSB-3/30.0-32.0'/050928	30.8	H	9.6	1.49	2.65	43.7	28.9	31.3	2.5
HCSB-3/30.0-32.0'/050928	31.4	H	15.4	1.59	2.66	40.3	14.3	58.7	5.8
HCSB-3/32.0-34.0'/050928	32.2	H	8.3	1.50	2.65	43.1	30.1	27.1	3.2
HCSB-3/32.0-34.0'/050928	32.6	H	15.4	1.50	2.65	43.2	19.5	50.0	4.9
HCSB-3/32.0-34.0'/050928	32.8	H	16.2	1.50	2.65	43.3	18.2	51.5	6.6
HCSB-3/34.0-36.0'/050928	34.4	H	21.8	1.51	2.65	43.2	9.2	69.5	9.2
HCSB-3/36.0-38.0'/050928	35.0	H	20.5	1.54	2.65	41.9	9.3	69.1	8.6
HCSB-3/38.0-40.0'/050928	38.1	H	16.8	1.63	2.64	38.4	10.3	67.2	6.1
HCSB-4/28.5-30.5'/050927	29.5	H	27.9	1.35	2.61	48.3	10.5	78.0	0.3
HCSB-4/28.5-30.5'/050927	30.1	H	17.3	1.49	2.64	43.5	17.1	58.1	2.6
HCSB-4/30.5-32.5'/052927	31.0	H	26.3	1.31	2.50	47.6	11.8	66.0	9.2
HCSB-4/34.5-36.5'/052927	35.0	H	17.2	1.49	2.65	43.8	17.2	53.7	7.0
HCSB-4/36.5-38.5'/052927	38.55	H	20.9	1.50	2.64	43.3	10.9	68.0	6.9
HCSB-4/40.5-42.5'/052927	41.2	H	32.2	1.31	2.63	50.4	7.1	78.0	8.0
HCSB-5/16-18'/050920	17.5	H	24.2	1.44	2.64	45.6	10.4	76.2	1.0
HCSB-5/20-22'/050920	20.8	H	34.1	1.27	2.64	52.0	7.1	76.1	10.2
HCSB-5/22-24'/050920	23.45	H	30.7	1.32	2.64	50.2	8.2	74.5	9.2
HCSB-5/22-24'/050920	23.6	H	21.1	1.38	2.64	47.6	17.0	55.4	8.8
HCSB-5/22-24'/050920	23.9	H	22.2	1.44	2.65	45.8	12.8	64.7	7.3
HCSB-5/31-32.5'/050921	31.1	H	12.1	1.54	2.65	41.8	21.8	38.1	9.7
HCSB-5/32.5-34.5'/050921	32.8	H	17.3	1.46	2.65	44.9	18.5	51.6	7.2
HCSB-5/32.5-34.5'/050921	33.3	H	20.4	1.45	2.66	45.6	14.7	59.5	8.2
HCSB-5/32.5-34.5'/050921	33.7	H	21.6	1.45	2.64	45.2	13.0	65.2	6.0
HCSB-5/32.5-34.5'/050921	34.0	H	18.0	1.49	2.65	43.6	15.7	57.5	6.5
HCSB-5/34.5-36.5'/050921	34.8	H	20.0	1.44	2.66	45.8	16.0	59.7	5.4
HCSB-5/34.5-36.5'/050921	35.1	H	20.4	1.47	2.65	44.7	13.8	63.8	5.4
HCSB-5/34.5-36.5'/050921	35.6	H	18.9	1.50	2.66	43.7	14.4	61.3	5.8
HCSB-5/34.5-36.5'/050921	35.8	H	19.8	1.45	2.65	45.2	15.6	60.7	4.9
HCSB-5/36.5-38.5'/050922	37.0	H	21.3	1.52	2.65	42.7	9.8	74.3	2.8
HCSB-5/38.5-40.5'/050922	38.5	H	17.6	1.59	2.64	39.6	11.0	70.4	1.8
HCSB-5/38.5-40.5'/050922	39.1	H	19.4	1.48	2.65	44.1	14.6	61.6	5.3
HCSB-5/38.5-40.5'/050922	39.5	H	18.8	1.54	2.66	42.3	13.1	68.0	1.0
HCSB-5/40.5-42.5'/050922	41.1	H	11.4	1.82	2.65	31.5	10.1	59.3	8.5

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detected

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

METHODS:			API RP40	API RP40	API RP40	ASTM D425M, DEAN-STARK			
						PORE FLUID SATURATIONS, % Pv			
						Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	BULK DENSITY, (g/cc)	GRAIN DENSITY, (g/cc)	TOTAL POROSITY, %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HCSB-1/9.5-11.5'/050923	9.6	V	1.41	2.66	46.9	82.6	3.6	60.4	3.6
NOTE: No LNAPL produced. Produced water clear with faint hydrocarbon odor.									
HCSB-1/9.5-11.5'/050923	10.3	V	1.32	2.57	48.7	68.9	3.5	29.7	3.2
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/9.5-11.5'/050923	10.8	V	1.27	2.65	52.3	55.6	1.1	31.7	0.9
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/16.5-18.5'/050926	17.0	V	1.29	2.67	51.5	87.2	1.7	67.7	1.5
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/16.5-18.5'/050926	17.4	V	1.14	2.68	57.6	90.8	0.4	83.7	0.4
NOTE: No LNAPL produced. Produced water clear with no odor.									
HCSB-1/18.5-20.5'/050926	20.05	V	1.36	2.63	48.3	78.4	2.5	43.5	2.1
NOTE: Trace LNAPL produced. Produced water clear with sheen on surface.									
HCSB-1/27-29'/050926	30.0	V	1.62	2.66	39.1	76.2	4.8	44.9	4.8
NOTE: No LNAPL produced. Produced water clear with no odor.									
HCSB-1/29-31'/050926	32.4	V	1.48	2.65	44.2	32.2	30.4	10.7	6.0
NOTE: Produced LNAPL (gasoline) amber in color and floating on top of clear water.									
HCSB-1/39-41'/050926	40.3	V	1.53	2.65	42.4	50.3	9.1	7.8	5.1
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									

N/A = Not Analyzed. Vb = Bulk Volume, Pv = Pore Volume. (1) H = horizontal, V = vertical
Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation as received prior to centrifuging at 1000xG
Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after centrifuging at 1000xG
Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

FREE PRODUCT MOBILITY: INITIAL AND RESIDUAL SATURATIONS

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

METHODS:			API RP40	API RP40	API RP40	ASTM D425M, DEAN-STARK			
						PORE FLUID SATURATIONS, % Pv			
						Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENTATION (1)	BULK DENSITY, (g/cc)	GRAIN DENSITY, (g/cc)	TOTAL POROSITY, %Vb	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HCSB-5/22-24'/050920	24.0	V	1.36	2.66	48.7	76.1	5.9	46.9	4.9
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									
HCSB-5/34.5-36.5'/050921	35.35	V	1.45	2.64	45.2	57.5	6.8	5.7	6.0
NOTE: Produced LNAPL (gasoline) light brown in color and floating on top of clear water.									
HCSB-5/38.5-40.5'/050922	39.35	V	1.47	2.65	44.7	60.1	4.0	7.8	2.8
NOTE: Produced LNAPL (gasoline) light yellow in color and floating on top of clear water.									

N/A = Not Analyzed. Vb = Bulk Volume, Pv = Pore Volume. (1) H = horizontal, V = vertical
Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation as received prior to centrifuging at 1000xG
Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after centrifuging at 1000xG
Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

PTS Laboratories

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PHYSICAL PROPERTIES DATA - AIR/WATER CAPILLARY PRESSURE

(METHODOLOGY: ASTM D2216 / API RP40, API RP40)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

		METHODS:	API RP 40 / ASTM D2216	API RP 40		API RP 40		API RP 40	
SAMPLE ID.	DEPTH, ft.	SAMPLE ORIENT. (1)	MOISTURE CONTENT (% wt)	DENSITY BULK (g/cc)	DENSITY GRAIN (g/cc)	POROSITY, %Vb (2) TOTAL	POROSITY, %Vb (2) AIR FILLED	PORE FLUID SATURATIONS, % Pv (3) WATER	PORE FLUID SATURATIONS, % Pv (3) NAPL
HCSB-1/18.5-20.5'/050926	19.6	V	23.2	1.31	2.64	50.6	19.4	54.9	6.9
HCSB-1/29-31'/050926	29.65	V	17.4	1.48	2.67	44.6	17.7	52.9	7.4
HCSB-1/31-33'/050926	32.1	V	11.6	1.41	2.65	46.9	28.4	23.1	16.3
HCSB-1/39-41'/050926	40.2	V	10.5	1.80	2.68	32.9	13.1	53.6	6.7
HCSB-2/31-33'/000923	31.4	V	15.1	1.57	2.65	40.9	16.5	55.7	3.9
HCSB-2/33-35'/000923	33.7	V	17.9	1.41	2.65	46.6	20.3	50.7	5.8
HCSB-3/30.0-32.0'/050928	31.2	V	7.0	1.37	2.65	48.4	38.3	19.9	1.0
HCSB-5/22-24'/050920	23.75	V	23.3	1.35	2.66	49.3	16.5	57.2	9.4
HCSB-5/34.5-36.5'/050921	35.5	V	19.7	1.39	2.65	47.6	19.3	53.3	6.0
HCSB-5/38.5-40.5'/050922	39.25	V	17.9	1.42	2.65	46.3	19.5	52.8	5.0

(1) Sample Orientation: H = horizontal; V = vertical (2) Total Porosity = no pore fluids in place; all interconnected pore channels; Air Filled = pore channels not occupied by pore fluids (3) Water = 0.9996 g/cc, Hydrocarbon = 0.7500 g/cc; Vb = Bulk Volume, cc; Pv = Pore Volume, cc; ND = Not Detect

CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/18.5-20.5'/050926 at 19.6 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	32.2
0.086	6.02	0.198	100.0	32.2
0.193	13.5	0.446	100.0	32.2
0.343	24.1	0.793	99.8	32.1
0.535	37.6	1.24	98.8	31.8
0.771	54.2	1.78	98.2	31.6
1.05	73.8	2.43	97.4	31.3
1.37	96.3	3.17	96.4	31.0
2.14	151	4.95	94.6	30.5
3.08	217	7.13	90.5	29.1
4.40	310	10.2	82.7	26.6
5.86	412	13.6	73.2	23.5
6.94	488	16.1	68.4	21.9
8.56	602	19.8	61.9	19.8
19.3	1355	44.6	47.0	14.9

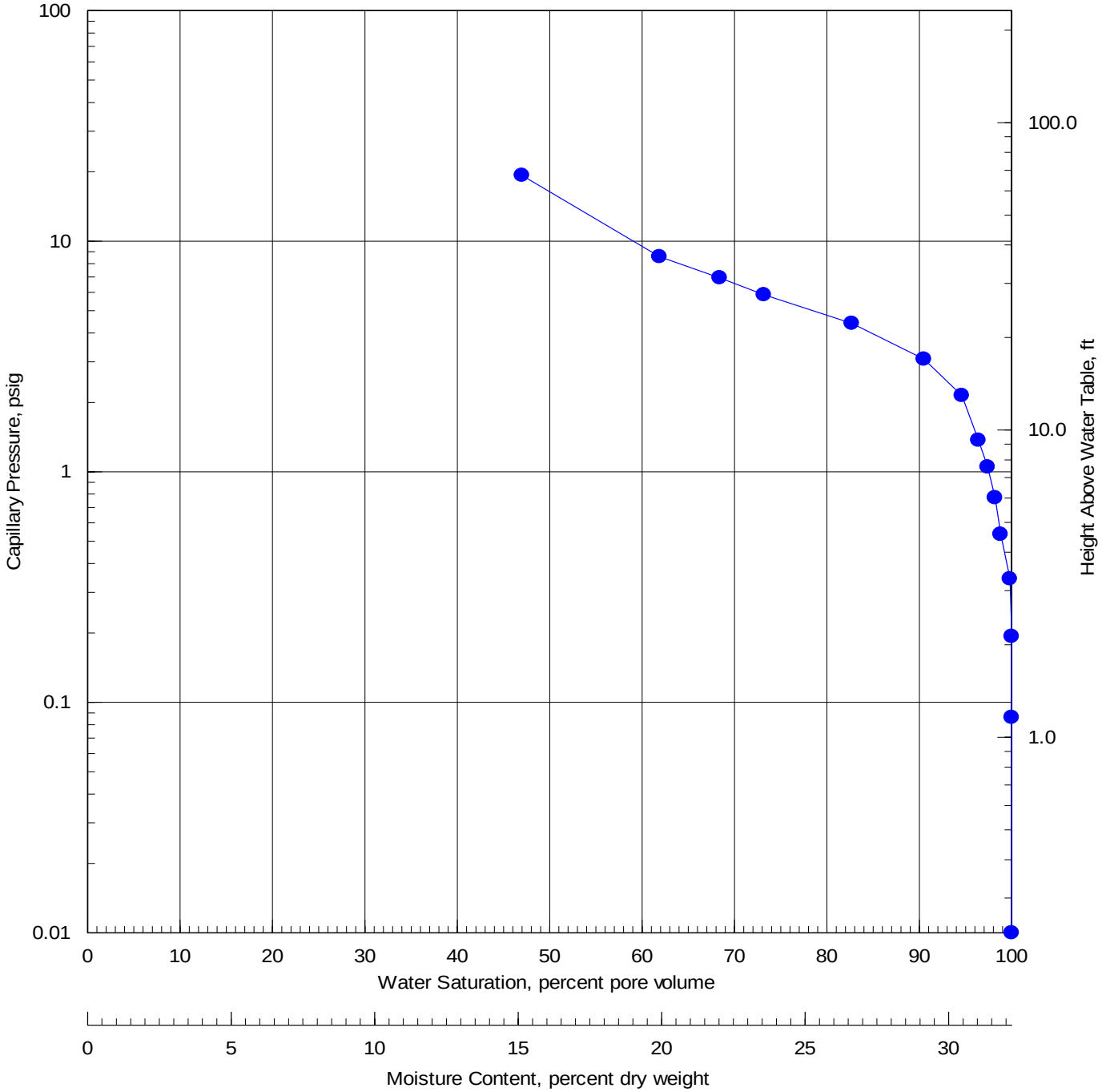
Specific Permeability to Air, md:	292
Permeability to Water, md:	39.8
Saturated Hydraulic Conductivity, cm/sec:	3.89E-05

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/18.5-20.5'/050926
Depth, ft: 19.6



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/29-31'/050926 at 29.65 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	24.0
0.091	6.38	0.210	100.0	24.0
0.204	14.3	0.472	99.8	23.9
0.363	25.5	0.840	99.4	23.8
0.567	39.9	1.31	98.3	23.5
0.816	57.4	1.89	97.2	23.1
1.11	78.1	2.57	95.6	22.6
1.45	102	3.36	92.5	21.7
2.27	159	5.25	82.8	18.8
3.26	230	7.56	75.7	16.6
4.66	328	10.8	68.5	14.4
6.20	436	14.4	62.4	12.6
7.35	516	17.0	59.1	11.6
9.07	638	21.0	55.5	10.5
20.4	1435	47.2	46.9	7.9

Specific Permeability to Air, md:	565
Permeability to Water, md:	227
Saturated Hydraulic Conductivity, cm/sec:	2.23E-04

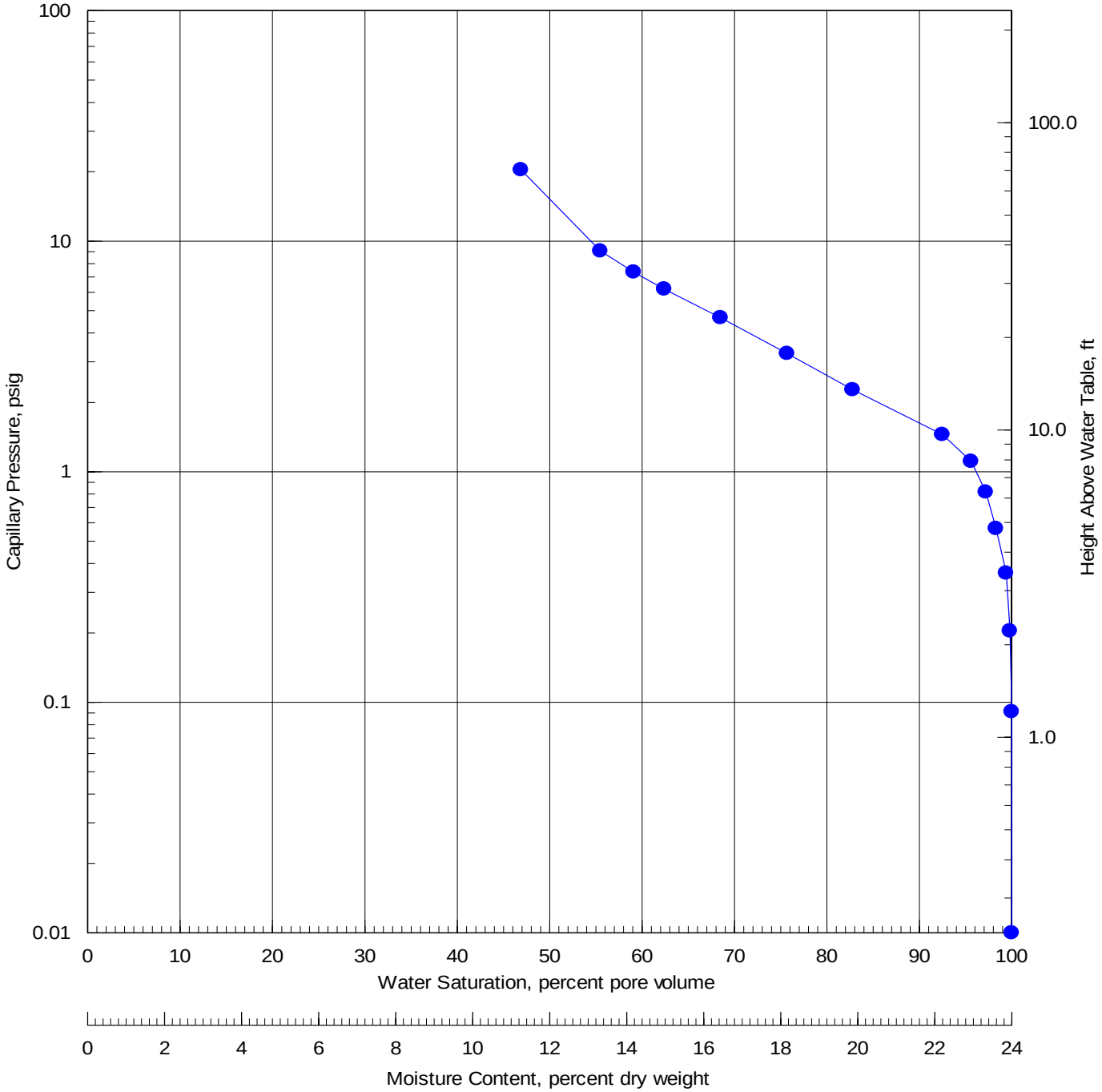
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HHCSB-1/29-31'/050926
Depth, ft: 29.65



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/31-33'/050926 at 32.1 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	21.9
0.094	6.61	0.218	100.0	21.9
0.212	14.9	0.490	100.0	21.9
0.376	26.5	0.871	99.4	21.7
0.588	41.3	1.36	96.4	20.8
0.847	59.5	1.96	82.5	16.8
1.15	81.0	2.67	64.4	11.5
1.51	106	3.48	56.6	9.2
2.35	165	5.44	45.2	5.8
3.39	238	7.84	40.3	4.4
4.84	340	11.2	37.0	3.5
6.43	452	14.9	34.9	2.9
7.62	536	17.6	33.7	2.5
9.41	661	21.8	32.5	2.1
21.2	1488	49.0	30.7	1.6

Specific Permeability to Air, md:	3995
Permeability to Water, md:	1043
Saturated Hydraulic Conductivity, cm/sec:	1.02E-03

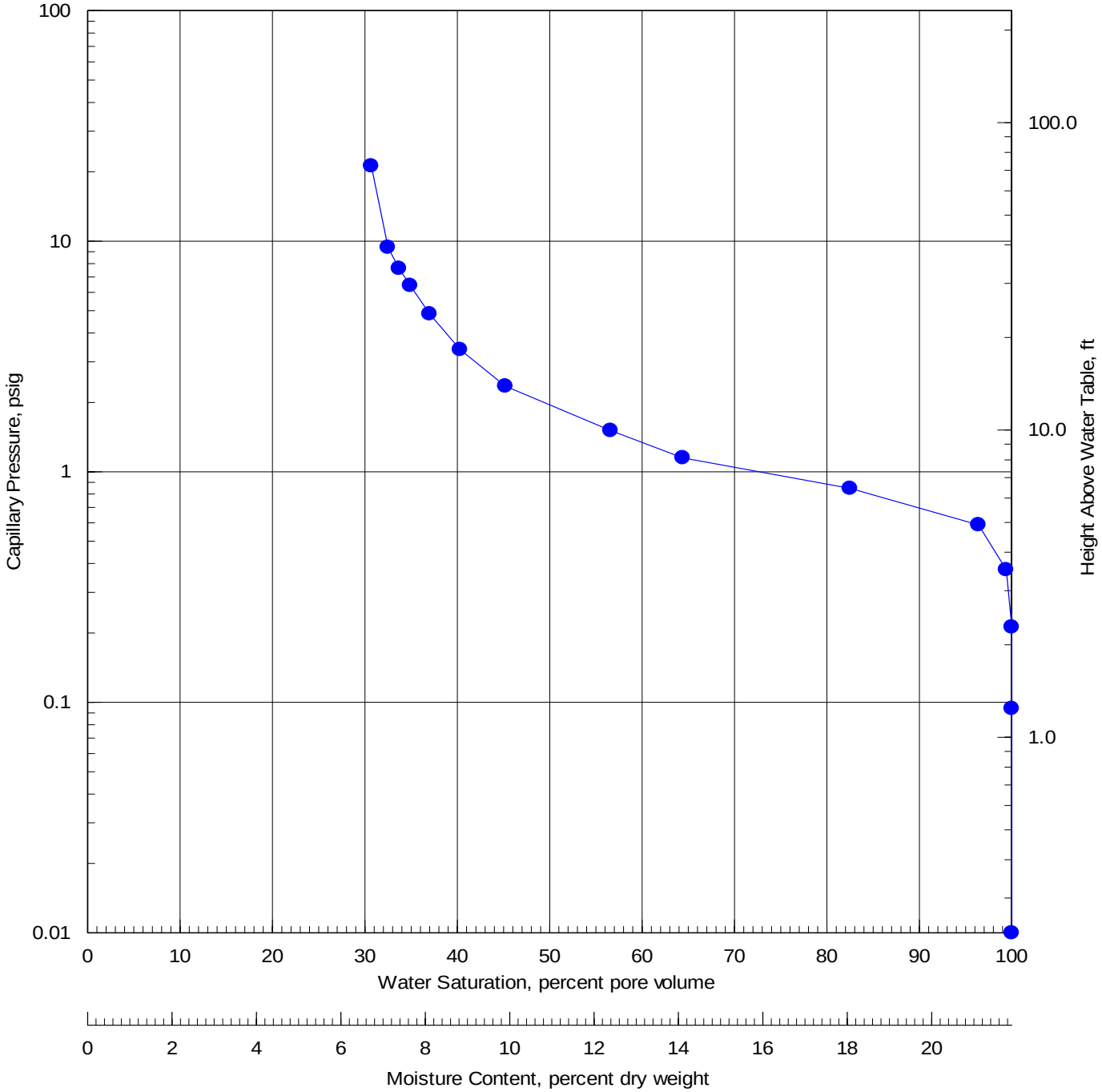
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/31-33'/050926
Depth, ft: 32.1



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-1/39-41'/050926 at 40.2 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	12.1
0.089	6.26	0.206	100.0	12.1
0.200	14.1	0.464	98.9	11.9
0.356	25.1	0.825	93.5	10.9
0.557	39.1	1.29	86.0	9.5
0.802	56.4	1.86	79.1	8.2
1.09	76.7	2.53	73.6	7.2
1.43	100	3.30	69.7	6.5
2.23	157	5.15	62.8	5.2
3.21	225	7.42	59.3	4.6
4.58	322	10.6	57.0	4.2
6.09	428	14.1	55.8	3.9
7.22	507	16.7	55.0	3.8
8.91	626	20.6	54.2	3.7
20.0	1409	46.4	51.9	3.2

Specific Permeability to Air, md:	2500
Permeability to Water, md:	2009
Saturated Hydraulic Conductivity, cm/sec:	1.97E-03

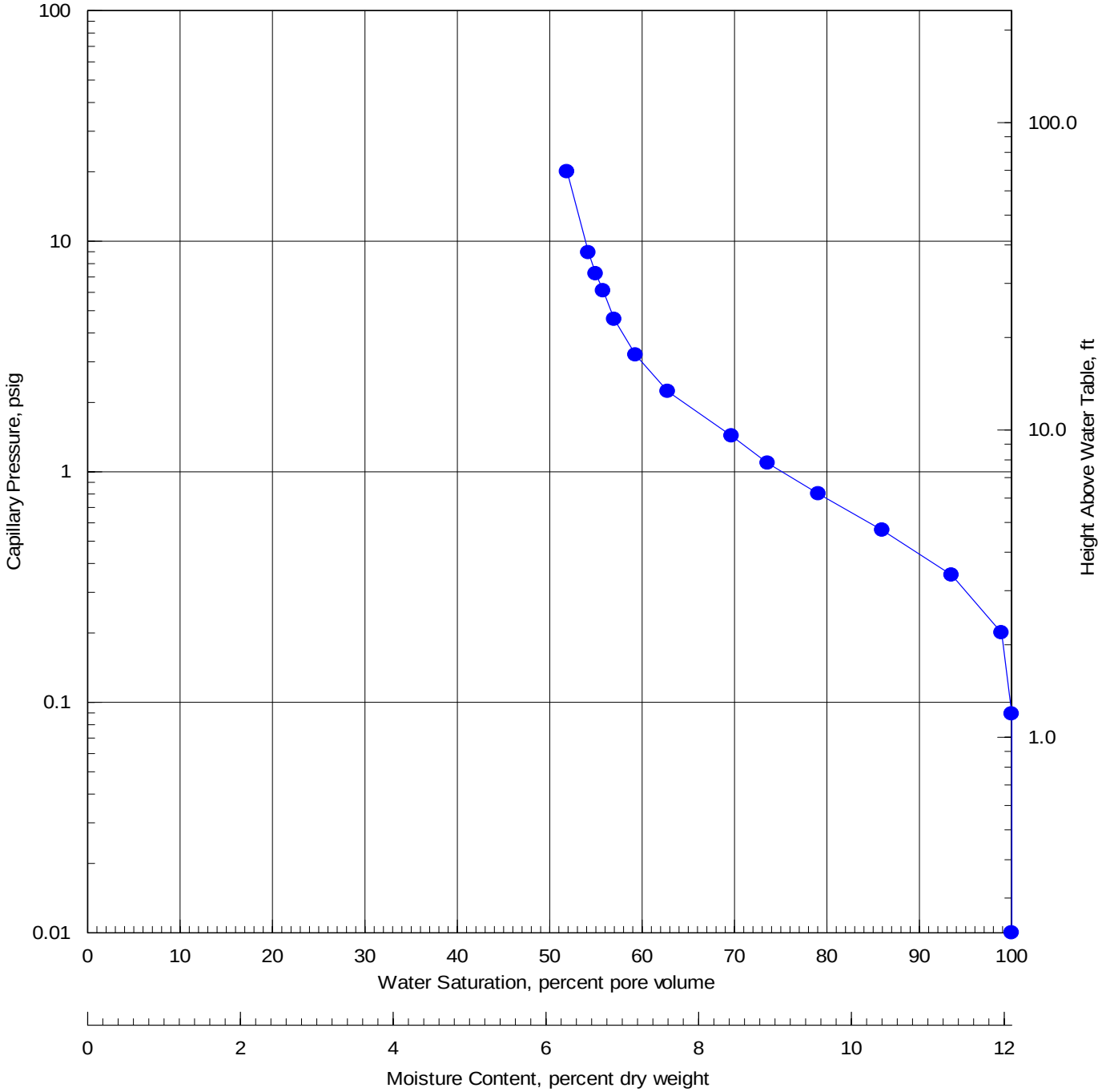
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-1/39-41'/050926
Depth, ft: 40.2



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-2/31-33'/000923 at 31.4 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	20.0
0.088	6.19	0.204	100.0	20.0
0.198	13.9	0.459	100.0	20.0
0.352	24.8	0.815	99.4	19.8
0.550	38.7	1.27	98.1	19.5
0.793	55.7	1.83	95.7	18.8
1.08	75.9	2.50	88.8	17.0
1.41	99.1	3.26	84.9	16.0
2.20	155	5.10	78.3	14.3
3.17	223	7.34	72.7	12.8
4.53	318	10.5	68.3	11.6
6.02	424	13.9	64.6	10.7
7.13	502	16.5	62.1	10.0
8.81	619	20.4	59.7	9.4
19.8	1393	45.9	50.3	6.9

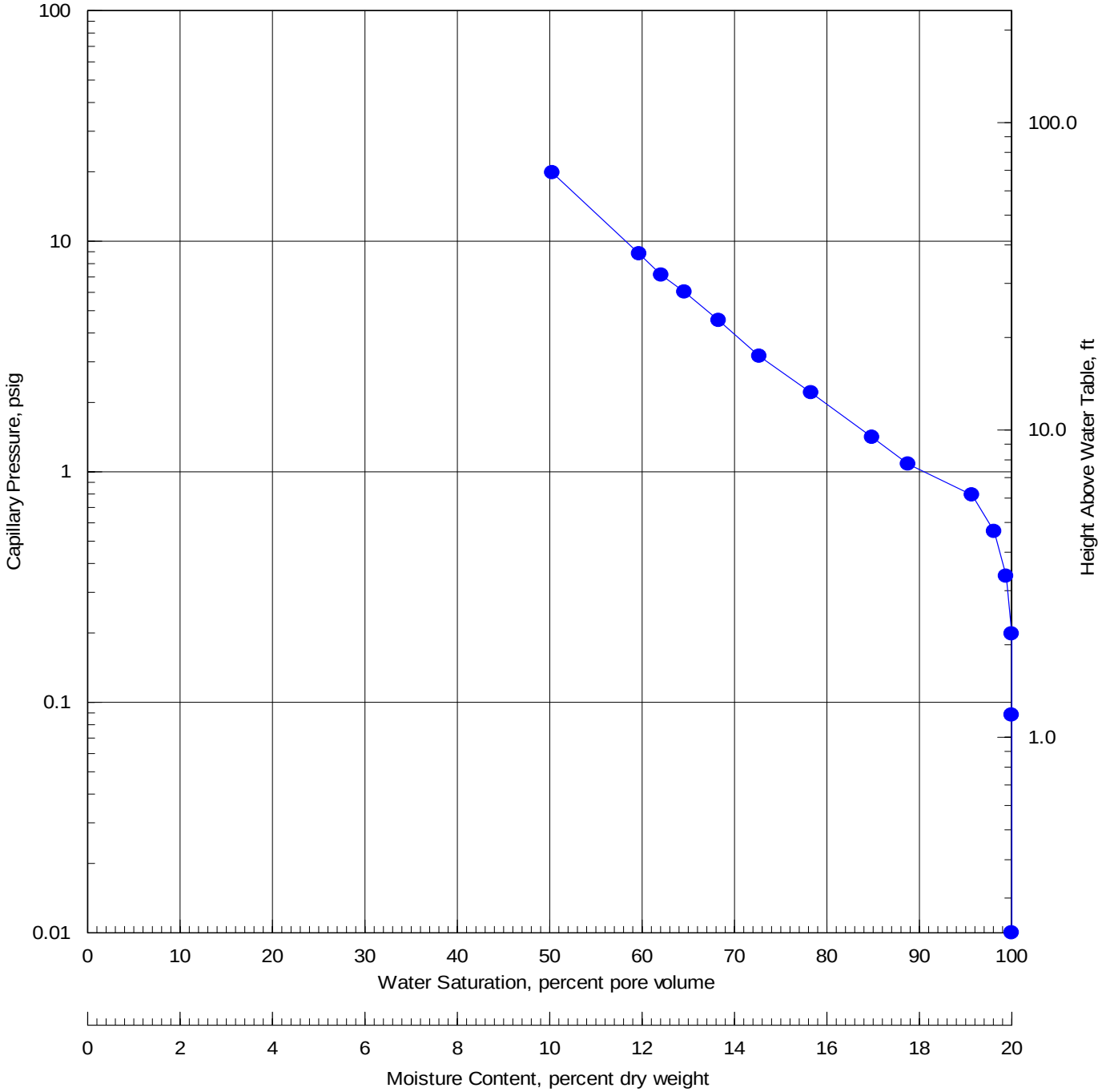
Specific Permeability to Air, md:	545
Permeability to Water, md:	90.8
Saturated Hydraulic Conductivity, cm/sec:	8.88E-05

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-2/31-33'/000923
Depth, ft: 31.4



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-2/33-35'/000923 at 33.7 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	22.0
0.078	5.50	0.181	100.0	22.0
0.176	12.4	0.407	100.0	22.0
0.313	22.0	0.724	97.8	21.3
0.489	34.4	1.13	94.1	20.2
0.704	49.5	1.63	81.6	16.5
0.958	67.3	2.22	67.6	12.3
1.25	88.0	2.89	58.8	9.7
1.95	137	4.52	46.3	5.9
2.81	198	6.51	40.4	4.1
4.02	283	9.30	37.0	3.1
5.35	376	12.4	34.4	2.3
6.33	445	14.7	33.1	1.9
7.82	550	18.1	32.3	1.7
17.6	1237	40.7	31.6	1.5

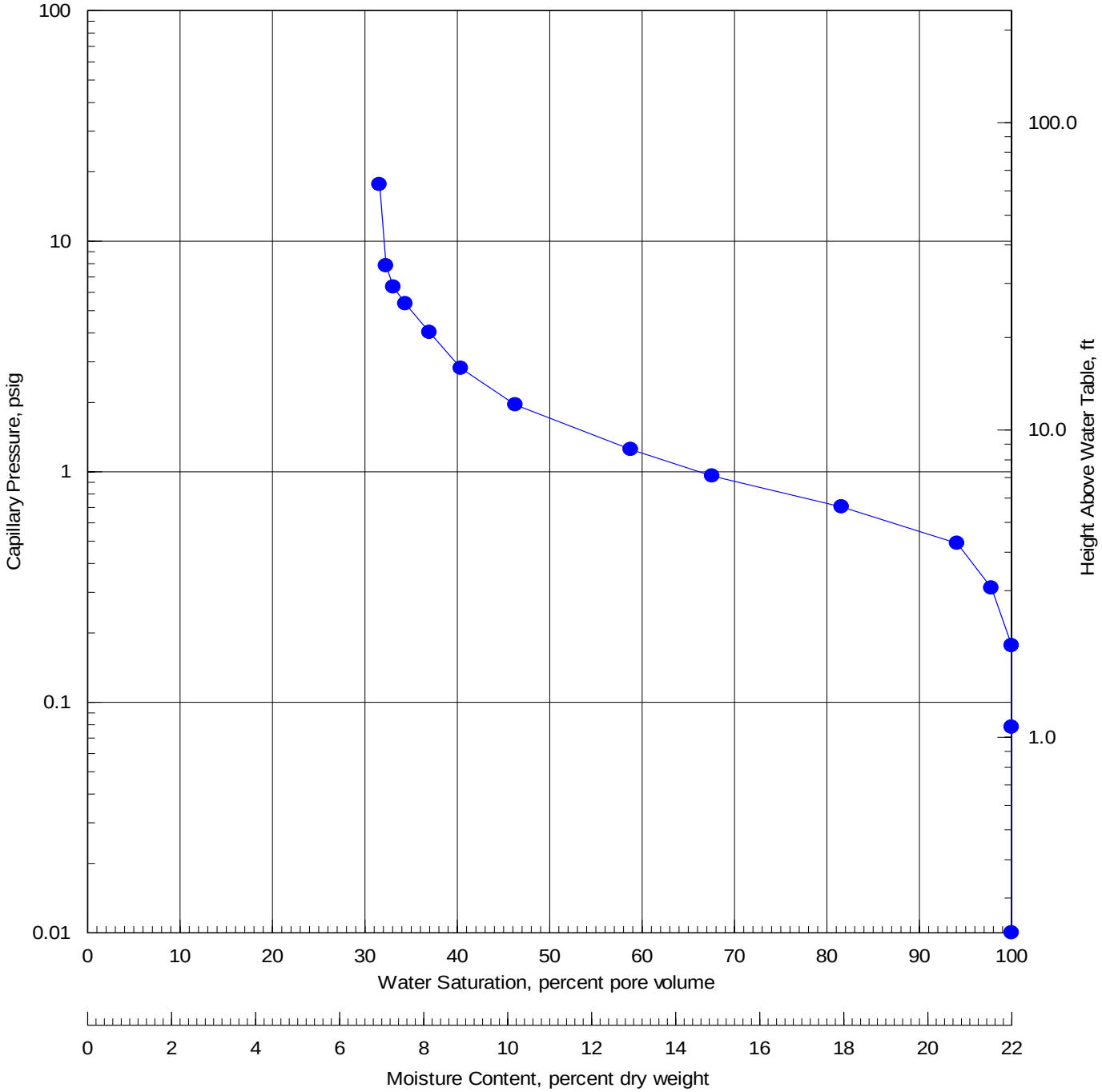
Specific Permeability to Air, md:	3961
Permeability to Water, md:	1370
Saturated Hydraulic Conductivity, cm/sec:	1.32E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-2/33-35'/000923
Depth, ft: 33.7



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-3/30.0-32.0'/050928 at 31.2 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	21.3
0.093	6.56	0.216	100.0	21.3
0.210	14.8	0.486	99.4	21.1
0.373	26.2	0.863	98.1	20.8
0.583	41.0	1.35	93.3	19.4
0.839	59.0	1.94	76.7	14.6
1.14	80.3	2.64	65.4	11.4
1.49	105	3.45	58.5	9.4
2.33	164	5.40	47.8	6.3
3.36	236	7.77	41.9	4.6
4.80	337	11.1	39.6	3.9
6.38	449	14.8	37.7	3.4
7.56	531	17.5	37.1	3.2
9.33	656	21.6	35.8	2.9
21.0	1476	48.6	33.3	2.1

Specific Permeability to Air, md:	3954
Permeability to Water, md:	2110
Saturated Hydraulic Conductivity, cm/sec:	2.05E-03

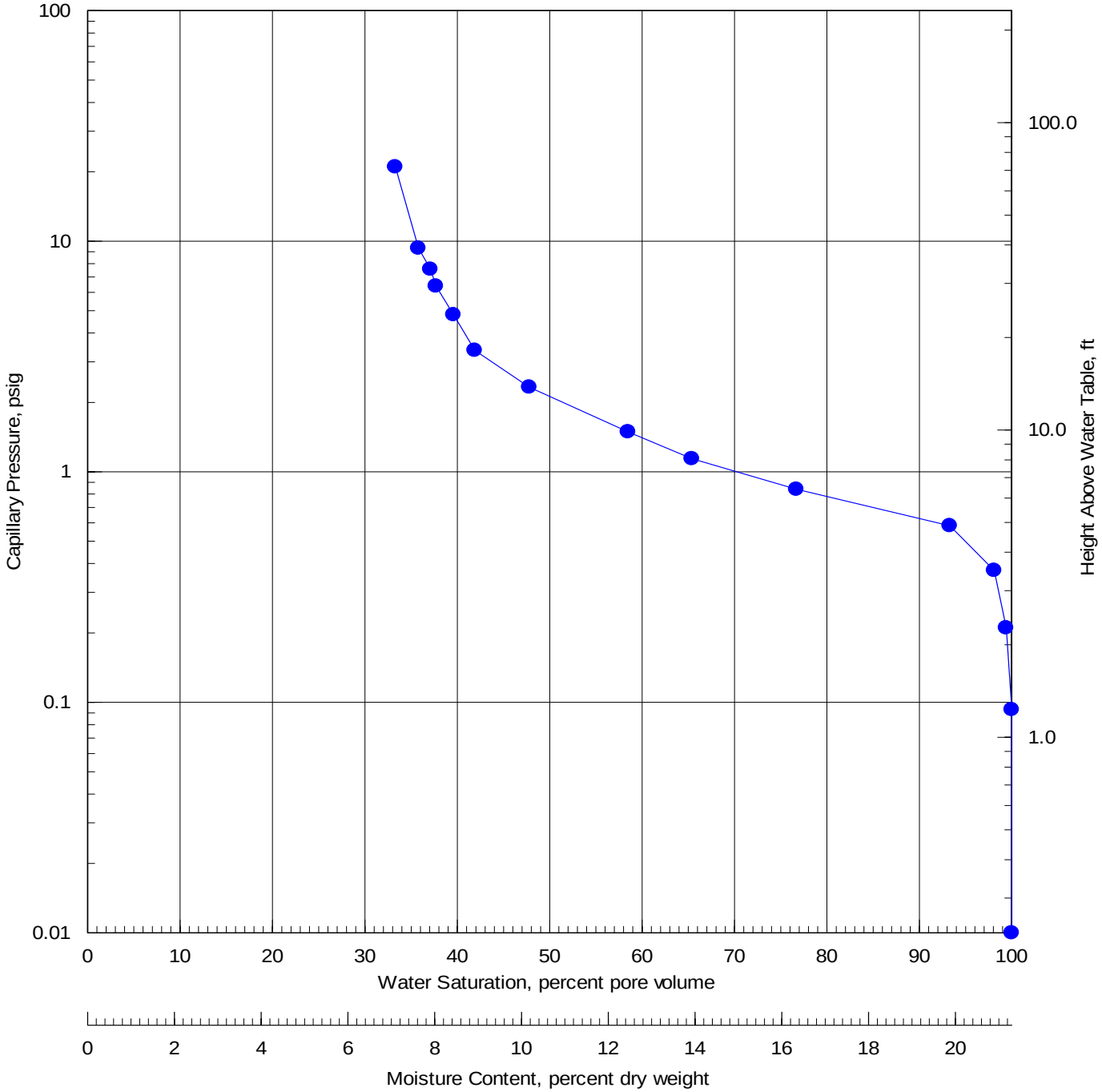
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-3/30.0-32.0'/050928
Depth, ft: 31.2



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/22-24'/050920 at 23.75 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	26.9
0.081	5.72	0.188	100.0	26.9
0.183	12.9	0.423	100.0	26.9
0.325	22.9	0.753	99.0	26.6
0.508	35.7	1.18	96.4	25.7
0.732	51.5	1.69	86.3	22.6
1.00	70.0	2.31	78.9	20.2
1.30	91.5	3.01	73.8	18.6
2.03	143	4.70	66.8	16.4
2.93	206	6.77	61.7	14.8
4.18	294	9.67	58.5	13.7
5.56	391	12.9	56.3	13.1
6.59	463	15.2	55.0	12.7
8.13	572	18.8	53.4	12.1
18.3	1286	42.3	48.3	10.5

Specific Permeability to Air, md:	1896
Permeability to Water, md:	1528
Saturated Hydraulic Conductivity, cm/sec:	1.48E-03

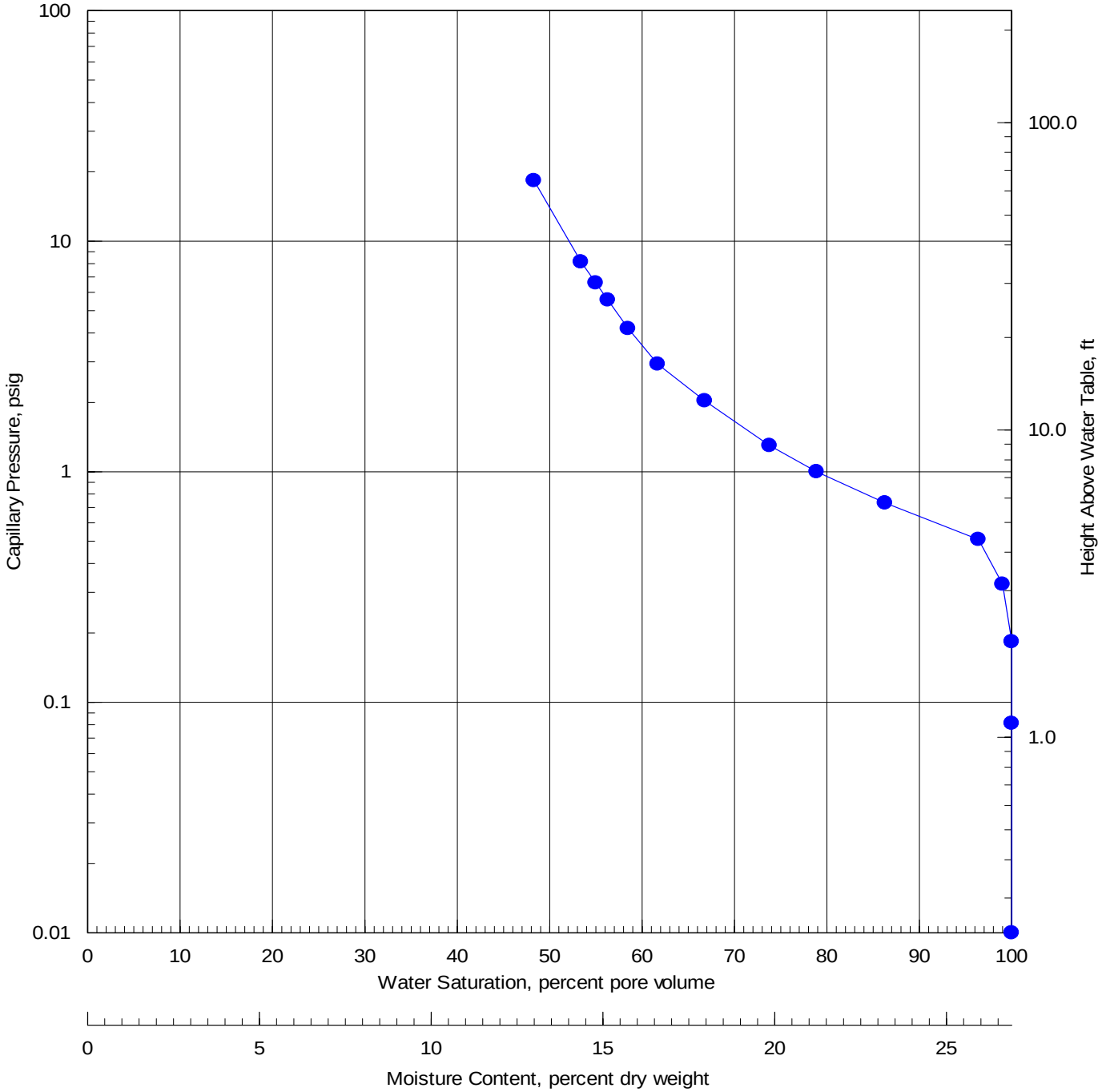
PTS Laboratories
ENVIRONMENTAL SERVICES

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/22-24'/050920
Depth, ft: 23.75



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/34.5-36.5'/050921 at 35.5 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	23.2
0.093	6.53	0.215	100.0	23.2
0.209	14.7	0.484	97.0	22.3
0.372	26.1	0.860	92.8	21.1
0.581	40.8	1.34	86.1	19.2
0.836	58.8	1.93	75.9	16.2
1.14	80.0	2.63	52.4	9.4
1.49	104	3.44	45.1	7.3
2.83	199	6.55	35.5	4.5
3.34	235	7.74	33.1	3.8
4.55	320	10.5	30.0	2.9
6.62	465	15.3	28.2	2.4
7.52	529	17.4	27.6	2.2
9.29	653	21.5	27.0	2.1
20.9	1469	48.4	25.8	1.7

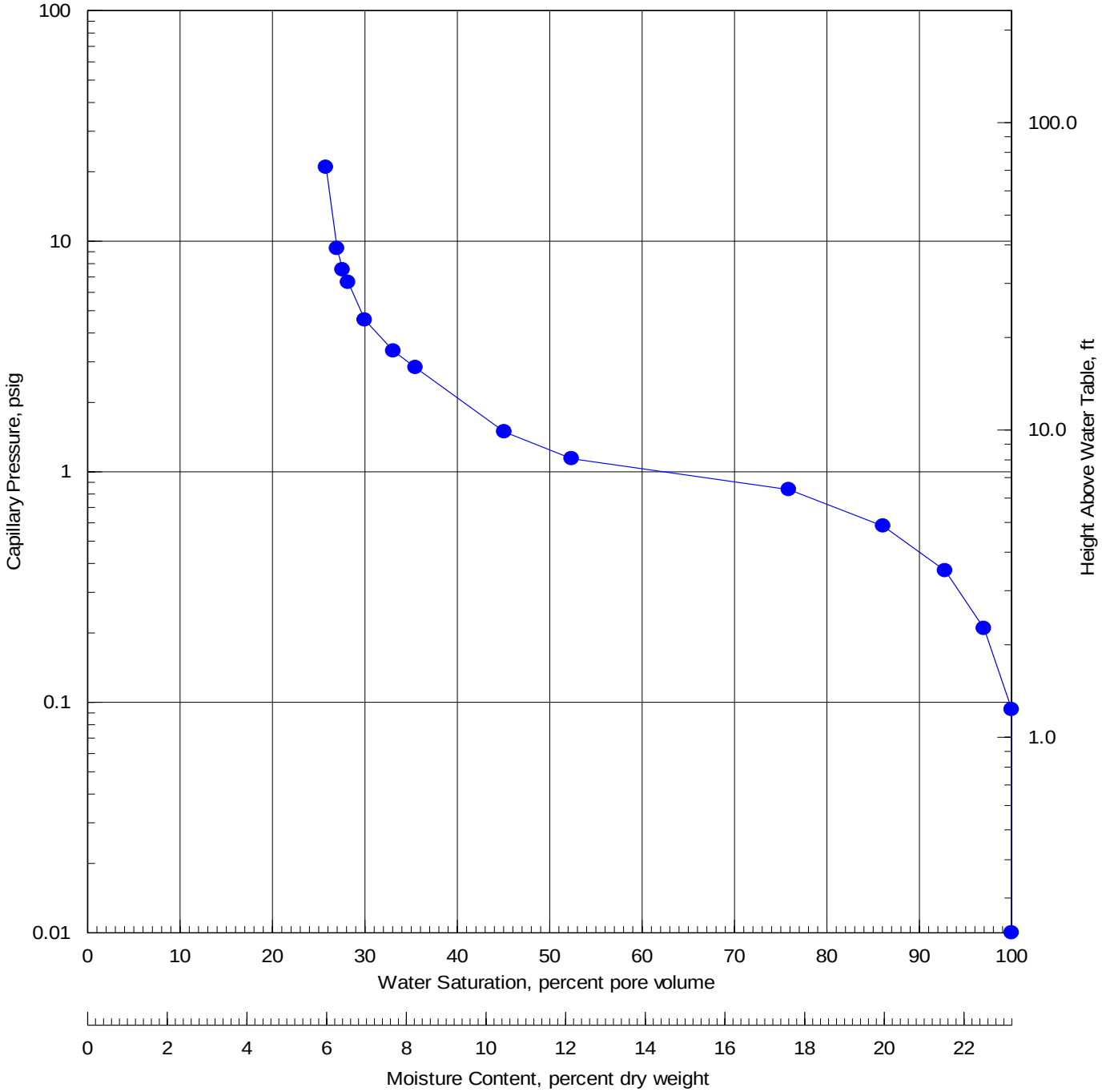
Specific Permeability to Air, md:	3756
Permeability to Water, md:	1407
Saturated Hydraulic Conductivity, cm/sec:	1.37E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/34.5-36.5'/050921
Depth, ft: 35.5



CAPILLARY PRESSURE DATA

(ASTM D425M, Centrifugal Method: air displacing water)

PROJECT NAME: Hartford Working Group
PROJECT NO: 15-03095.14-006

Capillary Pressure		Height Above Water Table,	Sample ID	
			HCSB-5/38.5-40.5'/050922 at 39.25 ft	
psi	cm water	ft	Saturation, % Pore Volume	Moisture, % dry weight
0.000	0.00	0.000	100.0	22.7
0.087	6.14	0.202	100.0	22.7
0.196	13.8	0.454	100.0	22.7
0.349	24.5	0.808	98.5	22.3
0.545	38.3	1.26	94.3	21.0
0.785	55.2	1.82	86.1	18.5
1.07	75.2	2.47	63.3	11.7
1.40	98.2	3.23	54.4	9.1
2.66	187	6.15	41.1	5.1
3.14	221	7.27	38.5	4.4
4.28	301	9.90	34.9	3.3
6.22	437	14.4	32.8	2.6
7.07	497	16.4	32.2	2.5
8.73	614	20.2	31.6	2.3
19.6	1380	45.4	29.7	1.7

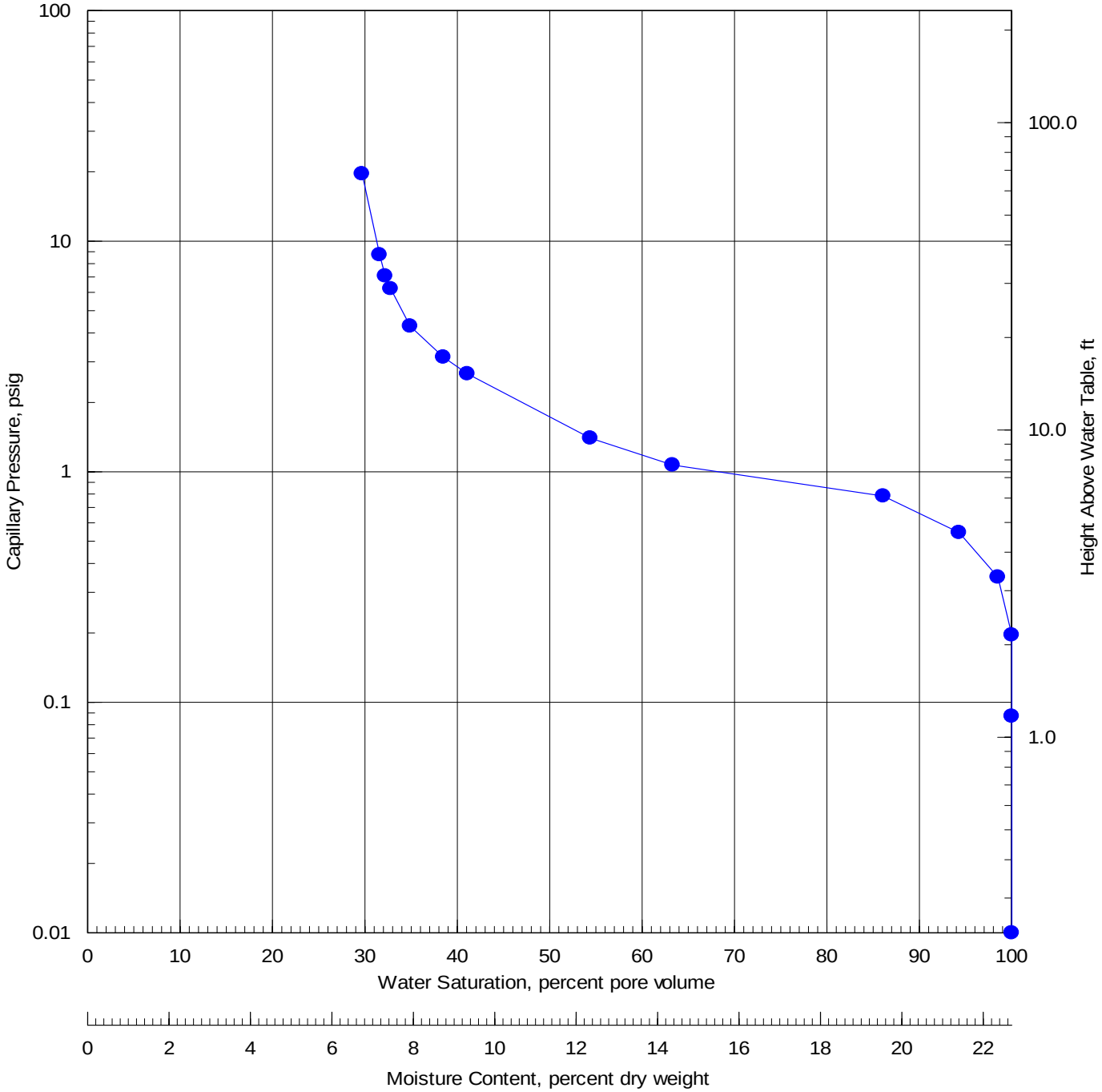
Specific Permeability to Air, md:	3658
Permeability to Water, md:	1191
Saturated Hydraulic Conductivity, cm/sec:	1.15E-03

Hartford Working Group C/O Clayton Group Services
File No.: 35565

CAPILLARY PRESSURE
Centrifugal Method
Air Displacing Water System - ASTM D425M

Project Name: Hartford Working Group
Project No: 15-03095.14-006

Sample ID: HCSB-5/38.5-40.5'/050922
Depth, ft: 39.25



DATE **PTS FILE#** 35565 **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-5/16-18'/050920	9-20-05	11:35	16-18' (A)																		1
HCSB-5/18-20'/050920	9-20-05	11:50	18-20' (B)																		
HCSB-5/20-22'/050920	9-20-05	12:57	20-22' (C)																		
HCSB-5/22-24'/050920	9-20-05	13:21	22-24' (D)																		
HCSB-5/24-26'/050920	9-20-05	14:30	24-26' (E)																		
HCSB-5/29-31'/050920	9-20-05	16:00	29-31' (F)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/20/05 TIME: 16:30	DATE: 9/21/05 TIME: 11:30	DATE TIME	DATE TIME

DATE **PTS FILE#** 35565 **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOHo

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: 24 HOURS / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-5/31-32.5'/050921	9-21-05	9:50	31-32.5' (G)																		1
3 HCSB-5/32.5-34.5'/050921	9-21-05	10:30	32.5-34.5' (H)																		
HCSB-5/34.5-36.5'/050921	9-21-05	12:45	34.5-36.5' (I)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-21-05 TIME: 1403 P.M.	DATE: 9/22/05 TIME: 10:50	DATE TIME	DATE TIME

DATE PTS FILE# 35565 **CHAIN OF CUSTODY RECORD** PAGE 1 OF 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road, Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14.006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

ANALYSIS REQUEST

PO#

SPECIAL HANDLING: 24 HOURS / 5 DAYS / 72 HOURS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
✓ HCSB5/36.5-38.5'/050922	9-22-05	9:15	36.5-38.5 (J)																		1
✓ HCSB-5/38.5-40.5'/050922	9-22-05	9:30	38.5-40.5' (K)																		
✓ HCSB-5/40.5-42.5'/050922	9-22-05	10:30	40.5-42.5' (L)																		
✓ HCSB-5/42.5-44.0/050922	9-22-05	11:00	42.5-44.0 (M)																		
✓ HCSB-5/44.0-45.5/050922	9-22-05	11:45	44.0-45.5' (N)																		
✓ HCSB-5/45.5-47.5/050922	9-22-05	13:45	45.5-47.5' (O)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-22-05 TIME: 1430PM	DATE: 9/23/05 TIME: 10:20	DATE TIME	DATE TIME

DATE 9 PTS FILE# 35565 **CHAIN OF CUSTODY RECORD** PAGE 1 OF 2

3 Coolers

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS, 72 HOURS, 5 DAYS, NORMAL, OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB-5/47.5-49.5'/050922	9-22-05	1415 P.M	47.5-49.5' (P)																						1
HCSB-3/9-11'/050923	9-23-05	7:40AM	9'-11.0' (A)																						
HCSB-2/11-13'/050923	9-23-05	8:00AM	11.0-13.0' (B)																						
HCSB-2/17-19'/050923	9-23-05	8:15AM	17.0-19.0 (C)																						
HCSB-2/19-21'/050923	9-23-05	8:30AM	19.0-21.0 (D)																						
HCSB-2/27-29'/050923	9-23-05	8:45AM	27.0-29.0 (E)																						
HCSB-2/29-31'/050923	9-23-05	9:00AM	29.0-31.0 (F)																						
HCSB-2/31-33'/050923	9-23-05	9:25AM	31.0-33.0 (G)																						
HCSB-2/33-35'/050923	9-23-05	9:40AM	33.0-35.0 (H)																						
HCSB-2/35-37'/050923	9-23-05	10:00AM	35.0-37.0 (I)																						
HCSB-2/37-39'/050923	9-23-05	10:30AM	37.0-39.0 (J)																						

COMMENTS

Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
	Reg Guillen		
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/23/05 TIME: 1600	DATE: 9-26-05 TIME: 11:30	DATE TIME	DATE TIME

3 coolers

DATE PTS FILE# 35565 CHAIN OF CUSTODY RECORD PAGE 2 OF 2

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 745-3200

PROJECT NUMBER: 15-03595.14-006

FAX NUMBER: 630 745-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#

SPECIAL HANDLING: 24 HOURS (circled) 5 DAYS; 72 HOURS NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB2/39-41'/050923	9-23-05	11:00AM	39.0-41.0'(K)																						1
HCSB2/41-43'/050923	9-23-05	11:30AM	41.0-43.0'(L)																						
HCSB1/9.5-11.5'/050923	9-23-05	15:30PM	9.5-11.5'(A)																						
HCSB1/11.5-13.5'/050923	9-23-05	15:50PM	11.5-13.5'(B)																						

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/23/05 TIME: 16:00	DATE: 9-26-09 TIME: 11:30	DATE TIME	DATE TIME

2 coolers.

DATE PTS FILE# CHAIN OF CUSTODY RECORD PAGE 1 OF 2

COMPANY: Northfield Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin 630 795-3200

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-1130

PROJECT NUMBER: 15-03095.14-006

FAX NUMBER:

SITE LOCATION: Village of Northfield, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: (24 HOURS) 5 DAYS; 72 HOURS NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-1/16-18.5/050926	9-26-05	8:45	16.5-18.5' (C)																		1
HCSB-1/18.5-20/050926	9-26-05	9:00	18.5-20.5' (D)																		
HCSB-1/20.5-22.5/050926	9-26-05	9:15	20.5-22.5' (E)																		
HCSB-1/27-29/050926	9-26-05	9:30	27.0-29.0' (F)																		
HCSB-1/29-31/050926	9-26-05	10:15	29.0-31.0 (G)																		
HCSB-1/31-33/050926	9-26-05	10:45	31.0-33.0 (H)																		
HCSB-1/33-35/050926	9-26-05	11:00	33.0-35.0 (I)																		
HCSB-1/35-37/050926	9-26-05	11:30	35.0-37.0 (J)																		
HCSB-1/37-39'/050926	9-26-05	11:45	37.0-39.0 (K)																		
HCSB-1/39-41'/050926	9-26-05	12:45	39.0-41.0 (L)																		
HCSB-1/41-43'/050926	9-26-05	1330	41.0-43.0 (M)																		

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS LABS	COMPANY:	COMPANY:
DATE: 9/26/05 TIME: 1600 p.m.	DATE: 9/27/05 TIME: 17:30	DATE: TIME:	DATE: TIME:

2 coolers

CHAIN OF CUSTODY RECORD

DATE | PTS FILE# | PAGE 2 OF 2

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - Void

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.0304.5.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: 24 HOURS (circled) | 5 DAYS | 72 HOURS | NORMAL | OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO | SEALED YES/NO | OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE					NUMBER OF SAMPLES
HCSB-1/43-45'/050926	9-26-05	1400	43.0-45.0' (N)																						1

COMMENTS: Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS LABS	COMPANY:	COMPANY:
DATE: 9/26/05 TIME: 1600PM	DATE: 9/27/05 TIME: 17:00	DATE: TIME:	DATE: TIME:

CHAIN OF CUSTODY RECORD

DATE PTS FILE# PAGE 1 OF 1 (2 coolers)

COMPANY: Northfield Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15-03095.14-02L

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Northfield, IL.

SAMPLER SIGNATURE:

PO#:

SPECIAL HANDLING: ~~24 HOURS~~ 5 DAYS; 72 HOURS; NORMAL; OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES
HCSB-4/28.5-30.5'/050927	9-27-05	9:30	28.5-30.5 (A)																		1
HCSB-4/30.5-32.5'/050927	9-27-05	10:15	30.5-32.5' (B)																		
HCSB-4/32.5-34.5'/050927	9-27-05	10:30	32.5-34.5' (C)																		
HCSB-4/34.5-36.5'/050927	9-27-05	11:00	34.5-36.5' (D)																		
HCSB-4/36.5-38.5'/050927	9-27-05	11:30	36.5-38.5' (E)																		
HCSB-4/38.5-40.5'/050927	9-27-05	11:45	38.5-40.5' (F)																		
HCSB-4/40.5-42.5'/050927	9-27-05	1300	40.5-42.5' (G)																		
HCSB-4/49-51'/050927	9-27-05	1330	49.0-51.0' (H)																		
HCSB-4/51-53'/050927	9-27-05	1430	51.0-53.0' (I)																		

COMMENTS: Contact Brad Martin at Clayton upon sample receipt for required geotechnical or chemical testing.

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9/27/05 TIME: 1600	DATE: 9/28/05 TIME: 15:00	DATE TIME	DATE TIME

2 coolers.

DATE 35565 **PTS FILE#** **CHAIN OF CUSTODY RECORD** **PAGE** 1 **OF** 1

COMPANY: Hartford Working Group c/o Clayton Group Services

ADDRESS: 3140 Finley Road Downers Grove, IL 60515

PROJECT MANAGER: Brad Martin

PROJECT NAME: Core Sampling - VOH

PHONE NUMBER: 630 795-3200

PROJECT NUMBER: 15.03095.14-006

FAX NUMBER: 630 795-1130

SITE LOCATION: Village of Hartford, IL.

SAMPLER SIGNATURE: [signature]

PO#

SPECIAL HANDLING: 24 HOURS (circled) / 72 HOURS / 5 DAYS / NORMAL / OTHER

SAMPLE CONDITIONS: RECEIVED ON ICE YES/NO; SEALED YES/NO; OTHER YES/NO

ANALYSIS REQUEST

SAMPLE ID NUMBER	DATE	TIME	DEPTH, FT	PHYSICAL PROPERTIES PACKAGE, API RP40	MOISTURE CONTENT, ASTM D2216	POROSITY, API RP40	GRAIN DENSITY, API RP40	BULK DENSITY, API RP40	AIR PERMEABILITY, API RP40	SPECIFIC RETENTION/YIELD ASTM D425	CAPILLARY PRESSURE, ASTM D425M	SOIL pH, EPA 9045	GRAIN SIZE: DRY; 400 MESH	GRAIN SIZE: SIEVE & LASER	GRAIN SIZE: LASER; 1 MICRON	HYDRAULIC CONDUCTIVITY, EPA 9100, API RP40	TOC: WALKLEY-BLACK	HYDRAULIC CONDUCTIVITY PACKAGE	ATTERBERG LIMITS, ASTM D4318	TNRCC PROPERTIES PACKAGE	NUMBER OF SAMPLES	COMMENTS
HCSB-3/17.5-19.5'/050928	9-28-05	9:00	17.5-19.5' (A)																		1	Contact Brad Martin of Clayton upon sample receipt for required geotechnical or chemical testing.
HCSB-3/19.5-21.5'/050928	9-28-05	9:20	19.5-21.5' (B)																			
HCSB-3/30.0-32.0'/050928	9-28-05	9:45	30.0-32.0' (C)																			
HCSB-3/32.0-34.0'/050928	9-28-05	10:15	32.0-34.0' (D)																			
HCSB-3/34.0-36.0'/050928	9-28-05	10:25	34.0-36.0' (E)																			
HCSB-3/36.0-38.0'/050928	9-28-05	10:45	36.0-38.0' (F)																			
HCSB-3/38.0-40.0'/050928	9-28-05	11:15	38.0-40.0' (G)																			
HCSB-3/40.0-42.0'/050928	9-28-05	11:45	40.0-42.0' (H)																			

1. RELINQUISHED BY	2. RECEIVED BY	3. RELINQUISHED BY	4. RECEIVED BY
[signature]	[signature]		
COMPANY: Clayton Group Services	COMPANY: PTS	COMPANY	COMPANY
DATE: 9-28-05 TIME: 1600	DATE: 9-29-05 TIME: 13:00	DATE TIME	DATE TIME

CORE PHOTOGRAPHY AND PHYSICAL PROPERTIES DATA

Hartford Working Group

Project No: 15-03095.14-006

Borings: HCSB-4 and HCSB-5

PTS File No.: 35565 **September 2005**

PTS Laboratories
ENVIRONMENTAL SERVICES

) Secura Way – Santa Fe Springs, CA 90670
Phone 562.907.3607 Fax 562.907.3610
www.ptsgeolabs.com

4342 West 12th Street – Houston, Texas 77055
Phone 713.680.0467 Fax 713.680.0763
www.ptsgeolabs.com

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-1/9.5-11.5'/050923	10.45	Silt	0.034	0.00	0.00	0.08	16.13	72.04	11.75	83.79
HCSB-1/11.5-13.5'/050923	12.25	Silt	0.035	0.00	0.00	0.00	8.57	77.01	14.42	91.43
HCSB-1/16.5-18.5'/050926	17.7	Silt	0.011	0.00	0.00	0.10	19.92	46.46	33.52	79.98
HCSB-1/18.5-20.5'/050926	19.8	Silt	0.047	0.00	0.00	0.00	20.95	66.59	12.46	79.05
HCSB-1/27-29'/050926	28.2	Silt	0.037	0.00	0.00	0.04	33.98	47.69	18.29	65.98
HCSB-1/29-31'/050926	30.3	Fine sand	0.239	0.00	0.00	2.57	87.75	7.41	2.26	9.68
HCSB-1/31-33'/050926	31.3	Fine sand	0.297	0.00	0.00	12.95	83.23	2.71	1.11	3.82
HCSB-1/33-35'/050926	33.5	Fine sand	0.338	0.00	0.00	31.23	60.87	6.04	1.87	7.90
HCSB-1/41-43'/050926	41.6	Medium sand	0.605	1.47	6.72	66.74	24.54	(2)	(2)	0.53
HCSB-2/17-19'/000923	17.5	Silt	0.006	0.00	0.00	0.00	0.00	53.95	46.05	100.00
HCSB-2/29-31'/000923	29.1	Silt	0.005	0.00	0.00	0.00	0.00	50.69	49.31	100.00
HCSB-2/31-33'/000923	31.9	Fine sand	0.245	0.00	0.00	2.35	91.04	4.25	2.36	6.61
HCSB-2/33-35'/000923	33.5	Fine sand	0.284	0.00	0.00	13.20	78.68	5.58	2.54	8.12
HCSB-2/35-37'/000923	35.8	Fine sand	0.311	0.00	0.00	16.47	81.69	1.42	0.43	1.84
HCSB-3/30-32'/050928	30.35	Silt	0.044	0.00	0.00	0.06	34.68	49.03	16.23	65.27

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-3/30-32'/050928	31.6	Medium sand	0.383	0.00	0.00	44.54	50.47	3.42	1.57	4.99
HCSB-3/32-34'/050928	32.4	Fine sand	0.282	0.00	0.00	13.65	77.78	5.45	3.12	8.57
HCSB-3/34-36'/050928	34.4	Fine sand	0.358	0.00	0.00	39.86	55.30	3.51	1.33	4.84
HCSB-3/38-40'/050928	38.4	Medium sand	0.408	0.69	3.89	43.64	50.82	(2)	(2)	0.97
HCSB-4/28.5-30.5'/050927	29.1	Silt	0.042	0.00	0.00	0.00	18.71	66.79	14.50	81.28
HCSB-4/30.5-32.5'/052927	30.8	Fine sand	0.084	0.00	0.00	3.36	51.15	37.23	8.26	45.49
HCSB-4/34.5-36.5'/052927	33.9	Fine sand	0.278	0.00	0.00	4.74	95.26	0.00	0.00	0.00
HCSB-4/36.5-38.5'/052927	37.0	Fine sand	0.287	0.00	0.00	8.59	89.84	1.19	0.38	1.57
HCSB-5/20-22'/050920	20.5	Silt	0.046	0.00	0.00	0.00	21.75	65.18	13.07	78.25
HCSB-5/22-24'/050920	23.0	Silt	0.057	0.00	0.00	0.00	32.18	54.93	12.89	67.82
HCSB-5/31-32.5'/050921	31.3	Fine sand	0.260	0.00	0.00	9.12	83.55	5.49	1.85	7.33
HCSB-5/32.5-34.5'050921	33.0	Fine sand	0.307	0.00	0.00	21.66	73.87	3.06	1.41	4.47
HCSB-5/34.5-36.5'/050921	35.25	Fine sand	0.319	0.00	0.00	18.90	78.04	2.06	1.00	3.05
HCSB-5/36.5-38.5'/050922	36.8	Fine sand	0.315	0.00	0.00	14.39	83.30	1.59	0.71	2.30

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Hartford Working Group C/O Clayton Group Services
PTS File No: 35565

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Harford Working Group
PROJECT NO: 15-03095.14-006

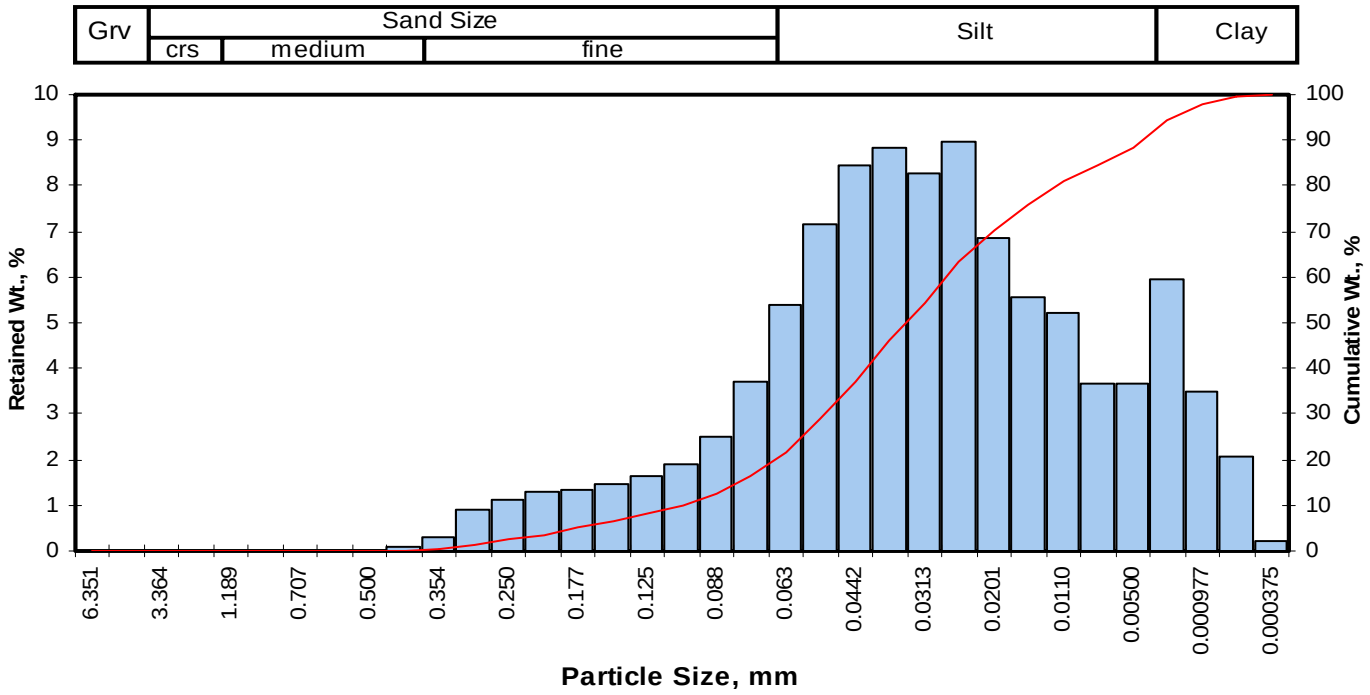
Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
HCSB-5/38.5-40.5'/050922	38.9	Medium sand	0.392	0.00	0.00	45.16	52.99	1.39	0.46	1.85
HCSB-5/40.5-42.5'/050922	40.9	Coarse sand	1.528	28.11	16.13	35.84	19.57	(2)	(2)	0.35

(1) Based on Mean from Trask
(2) Mechanical sieve does not differentiate silt/clay fractions

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/9.5-11.5'/050923
Project No:	15-03095.14-006	**Depth, ft:**	10.45



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.08	0.08	0.08
0.0139	0.354	1.50	45	0.29	0.29	0.37
0.0117	0.297	1.75	50	0.89	0.89	1.26
0.0098	0.250	2.00	60	1.12	1.12	2.38
0.0083	0.210	2.25	70	1.28	1.28	3.66
0.0070	0.177	2.50	80	1.35	1.35	5.01
0.0059	0.149	2.75	100	1.48	1.48	6.49
0.0049	0.125	3.00	120	1.62	1.62	8.11
0.0041	0.105	3.25	140	1.88	1.88	9.99
0.0035	0.088	3.50	170	2.50	2.50	12.49
0.0029	0.074	3.75	200	3.72	3.72	16.21
0.0025	0.063	4.00	230	5.40	5.40	21.61
0.0021	0.053	4.25	270	7.14	7.14	28.75
0.00174	0.0442	4.50	325	8.46	8.46	37.21
0.00146	0.0372	4.75	400	8.82	8.82	46.03
0.00123	0.0313	5.00	450	8.28	8.28	54.31
0.000986	0.0250	5.32	500	8.98	8.98	63.29
0.000790	0.0201	5.64	635	6.84	6.84	70.13
0.000615	0.0156	6.00		5.55	5.55	75.68
0.000435	0.0110	6.50		5.21	5.21	80.89
0.000308	0.00781	7.00		3.68	3.68	84.57
0.000197	0.00500	7.65		3.68	3.68	88.25
0.000077	0.00195	9.00		5.95	5.95	94.20
0.000038	0.000977	10.00		3.49	3.49	97.69
0.000019	0.000488	11.00		2.09	2.09	99.78
0.000015	0.000375	11.38		0.22	0.22	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.50	0.0070	0.177
10	3.25	0.0041	0.105
16	3.74	0.0030	0.075
25	4.12	0.0023	0.058
40	4.58	0.0016	0.042
50	4.87	0.0013	0.034
60	5.20	0.0011	0.027
75	5.96	0.0006	0.016
84	6.92	0.0003	0.008
90	8.04	0.0001	0.004
95	9.23	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.87	4.87	4.87
Median, in.	0.0013	0.0013	0.0013
Median, mm	0.034	0.034	0.034
Mean, phi	4.76	5.33	5.18
Mean, in.	0.0015	0.0010	0.0011
Mean, mm	0.037	0.025	0.028
Sorting	1.890	1.593	1.817
Skewness	0.890	0.288	0.292
Kurtosis	0.205	1.112	1.502

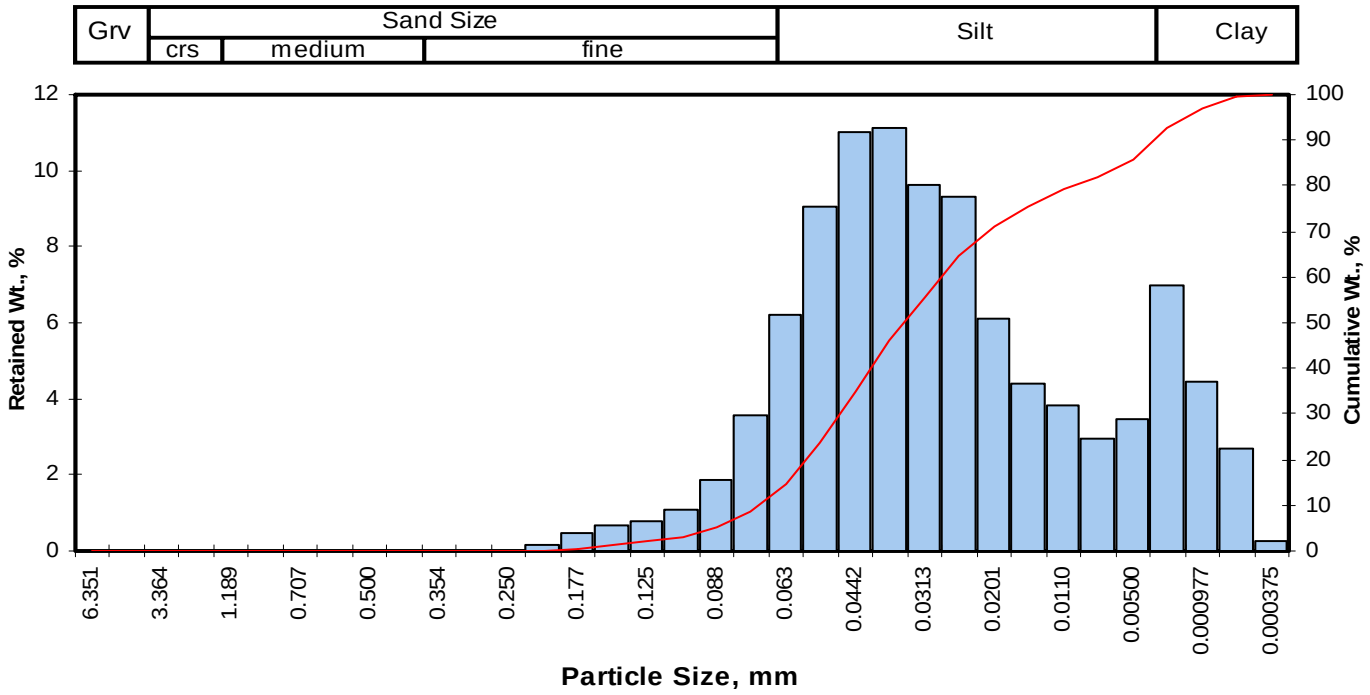
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.08
Fine Sand	200	16.13
Silt	>0.005 mm	72.04
Clay	<0.005 mm	11.75
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/11.5-13.5'/050923
Project No:	15-03095.14-006	**Depth, ft:**	12.25



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.02	0.02	0.02
0.0083	0.210	2.25	70	0.18	0.18	0.20
0.0070	0.177	2.50	80	0.44	0.44	0.64
0.0059	0.149	2.75	100	0.66	0.66	1.30
0.0049	0.125	3.00	120	0.80	0.80	2.10
0.0041	0.105	3.25	140	1.07	1.07	3.17
0.0035	0.088	3.50	170	1.84	1.84	5.01
0.0029	0.074	3.75	200	3.56	3.56	8.57
0.0025	0.063	4.00	230	6.22	6.22	14.79
0.0021	0.053	4.25	270	9.06	9.06	23.84
0.00174	0.0442	4.50	325	11.00	11.00	34.84
0.00146	0.0372	4.75	400	11.10	11.10	45.93
0.00123	0.0313	5.00	450	9.62	9.62	55.55
0.000986	0.0250	5.32	500	9.29	9.29	64.84
0.000790	0.0201	5.64	635	6.10	6.10	70.93
0.000615	0.0156	6.00		4.38	4.38	75.31
0.000435	0.0110	6.50		3.84	3.84	79.15
0.000308	0.00781	7.00		2.94	2.94	82.09
0.000197	0.00500	7.65		3.49	3.49	85.58
0.000077	0.00195	9.00		6.99	6.99	92.56
0.000038	0.000977	10.00		4.47	4.47	97.03
0.000019	0.000488	11.00		2.69	2.69	99.72
0.000015	0.000375	11.38		0.28	0.28	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.50	0.0035	0.088
10	3.81	0.0028	0.071
16	4.03	0.0024	0.061
25	4.28	0.0020	0.052
40	4.62	0.0016	0.041
50	4.86	0.0014	0.035
60	5.15	0.0011	0.028
75	5.97	0.0006	0.016
84	7.35	0.0002	0.006
90	8.50	0.0001	0.003
95	9.55	0.0001	0.001

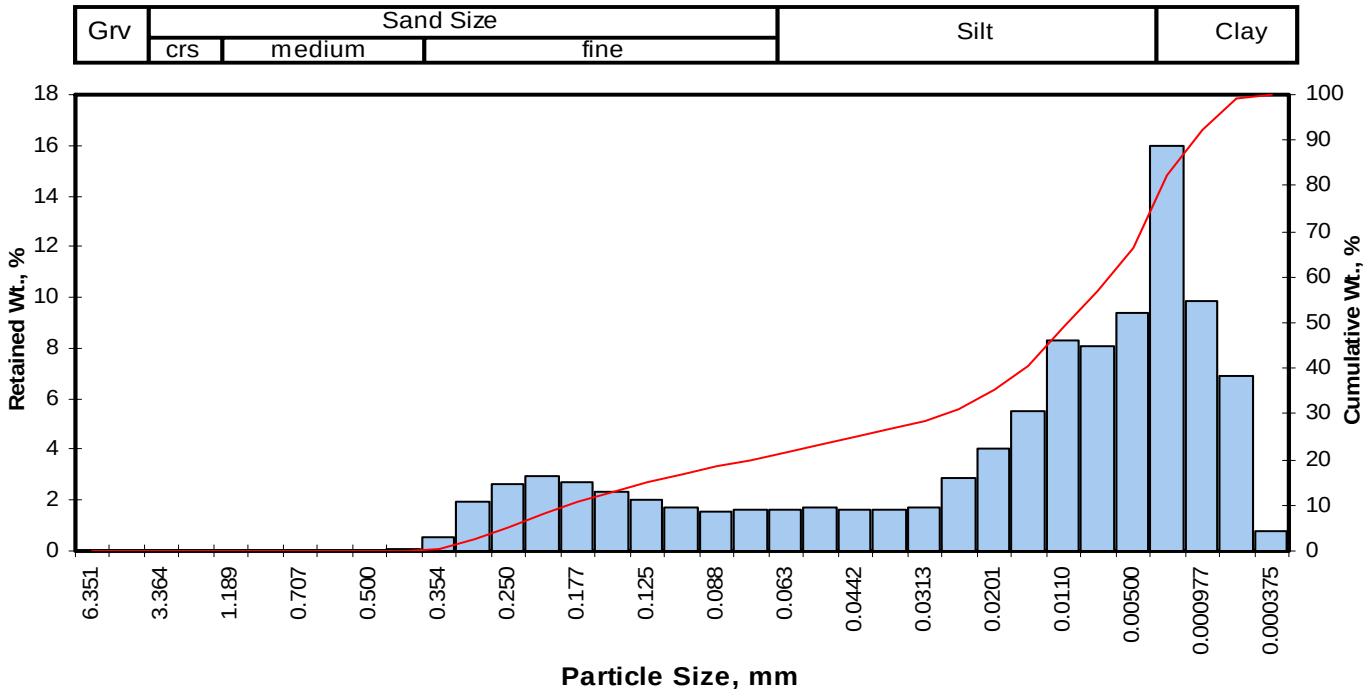
Measure	Trask	Inman	Folk-Ward
Median, phi	4.86	4.86	4.86
Median, in.	0.0014	0.0014	0.0014
Median, mm	0.035	0.035	0.035
Mean, phi	4.89	5.69	5.41
Mean, in.	0.0013	0.0008	0.0009
Mean, mm	0.034	0.019	0.023
Sorting	1.801	1.660	1.746
Skewness	0.830	0.505	0.528
Kurtosis	0.260	0.821	1.459
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	8.57
Silt	>0.005 mm	77.01
Clay	<0.005 mm	14.42
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/16.5-18.5'/050926
Project No:	15-03095.14-006	**Depth, ft:**	17.7



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.10	0.10	0.10
0.0139	0.354	1.50	45	0.51	0.51	0.61
0.0117	0.297	1.75	50	1.93	1.93	2.54
0.0098	0.250	2.00	60	2.62	2.62	5.16
0.0083	0.210	2.25	70	2.93	2.93	8.09
0.0070	0.177	2.50	80	2.70	2.70	10.78
0.0059	0.149	2.75	100	2.34	2.34	13.12
0.0049	0.125	3.00	120	1.98	1.98	15.10
0.0041	0.105	3.25	140	1.72	1.72	16.82
0.0035	0.088	3.50	170	1.59	1.59	18.41
0.0029	0.074	3.75	200	1.61	1.61	20.02
0.0025	0.063	4.00	230	1.66	1.66	21.68
0.0021	0.053	4.25	270	1.67	1.67	23.35
0.00174	0.0442	4.50	325	1.62	1.62	24.97
0.00146	0.0372	4.75	400	1.60	1.60	26.57
0.00123	0.0313	5.00	450	1.73	1.73	28.30
0.000986	0.0250	5.32	500	2.84	2.84	31.14
0.000790	0.0201	5.64	635	4.03	4.03	35.17
0.000615	0.0156	6.00		5.53	5.53	40.69
0.000435	0.0110	6.50		8.34	8.34	49.03
0.000308	0.00781	7.00		8.07	8.07	57.10
0.000197	0.00500	7.65		9.39	9.39	66.48
0.000077	0.00195	9.00		16.00	15.99	82.48
0.000038	0.000977	10.00		9.88	9.88	92.35
0.000019	0.000488	11.00		6.88	6.88	99.23
0.000015	0.000375	11.38		0.77	0.77	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.98	0.0099	0.253
10	2.43	0.0073	0.186
16	3.13	0.0045	0.114
25	4.50	0.0017	0.044
40	5.95	0.0006	0.016
50	6.56	0.0004	0.011
60	7.20	0.0003	0.007
75	8.37	0.0001	0.003
84	9.15	0.0001	0.002
90	9.76	0.0000	0.001
95	10.38	0.0000	0.001

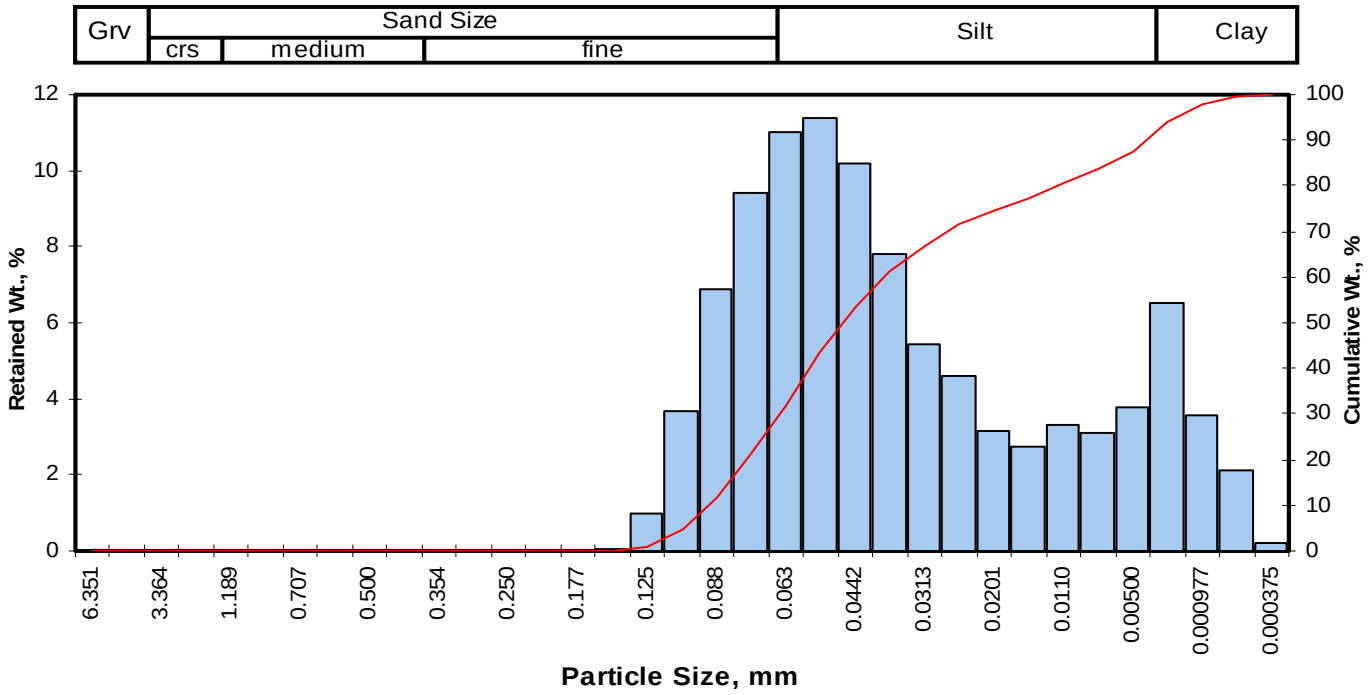
Measure	Trask	Inman	Folk-Ward
Median, phi	6.56	6.56	6.56
Median, in.	0.0004	0.0004	0.0004
Median, mm	0.011	0.011	0.011
Mean, phi	5.41	6.14	6.28
Mean, in.	0.0009	0.0006	0.0005
Mean, mm	0.024	0.014	0.013
Sorting	3.813	3.012	2.779
Skewness	1.090	-0.139	-0.114
Kurtosis	0.111	0.394	0.891
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.10
Fine Sand	200	19.92
Silt	>0.005 mm	46.46
Clay	<0.005 mm	33.52
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/18.5-20.5'/050926
Project No:	15-03095.14-006	**Depth, ft:**	19.8



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.05	0.05	0.05
0.0049	0.125	3.00	120	0.97	0.97	1.02
0.0041	0.105	3.25	140	3.67	3.67	4.69
0.0035	0.088	3.50	170	6.86	6.86	11.55
0.0029	0.074	3.75	200	9.41	9.41	20.95
0.0025	0.063	4.00	230	11.00	10.99	31.94
0.0021	0.053	4.25	270	11.40	11.39	43.34
0.00174	0.0442	4.50	325	10.20	10.19	53.53
0.00146	0.0372	4.75	400	7.84	7.84	61.37
0.00123	0.0313	5.00	450	5.45	5.45	66.82
0.000986	0.0250	5.32	500	4.61	4.61	71.42
0.000790	0.0201	5.64	635	3.17	3.17	74.59
0.000615	0.0156	6.00		2.76	2.76	77.35
0.000435	0.0110	6.50		3.31	3.31	80.66
0.000308	0.00781	7.00		3.11	3.11	83.77
0.000197	0.00500	7.65		3.77	3.77	87.54
0.000077	0.00195	9.00		6.51	6.51	94.04
0.000038	0.000977	10.00		3.59	3.59	97.63
0.000019	0.000488	11.00		2.14	2.14	99.77
0.000015	0.000375	11.38		0.23	0.23	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.26	0.0041	0.104
10	3.44	0.0036	0.092
16	3.62	0.0032	0.081
25	3.84	0.0027	0.070
40	4.18	0.0022	0.055
50	4.41	0.0018	0.047
60	4.71	0.0015	0.038
75	5.69	0.0008	0.019
84	7.04	0.0003	0.008
90	8.16	0.0001	0.004
95	9.27	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.41	4.41	4.41
Median, in.	0.0018	0.0018	0.0018
Median, mm	0.047	0.047	0.047
Mean, phi	4.49	5.33	5.02
Mean, in.	0.0018	0.0010	0.0012
Mean, mm	0.045	0.025	0.031
Sorting	1.899	1.711	1.765
Skewness	0.782	0.535	0.576
Kurtosis	0.285	0.755	1.330

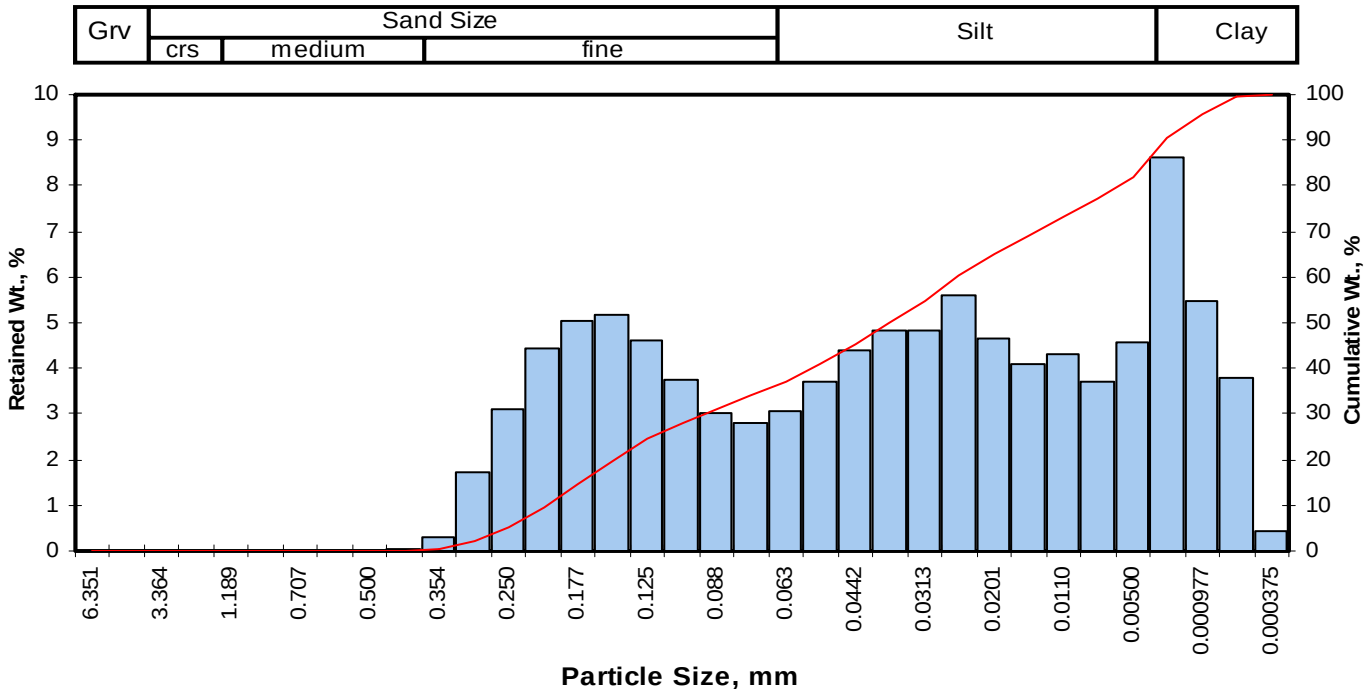
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	20.95
Silt	>0.005 mm	66.59
Clay	<0.005 mm	12.46
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/27-29'/050926
Project No:	15-03095.14-006	**Depth, ft:**	28.2



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.04	0.04	0.04
0.0139	0.354	1.50	45	0.32	0.32	0.36
0.0117	0.297	1.75	50	1.74	1.74	2.10
0.0098	0.250	2.00	60	3.11	3.11	5.21
0.0083	0.210	2.25	70	4.42	4.42	9.63
0.0070	0.177	2.50	80	5.06	5.06	14.69
0.0059	0.149	2.75	100	5.16	5.16	19.85
0.0049	0.125	3.00	120	4.60	4.60	24.45
0.0041	0.105	3.25	140	3.75	3.75	28.20
0.0035	0.088	3.50	170	3.03	3.03	31.23
0.0029	0.074	3.75	200	2.79	2.79	34.02
0.0025	0.063	4.00	230	3.07	3.07	37.09
0.0021	0.053	4.25	270	3.69	3.69	40.78
0.00174	0.0442	4.50	325	4.40	4.40	45.18
0.00146	0.0372	4.75	400	4.82	4.82	50.00
0.00123	0.0313	5.00	450	4.81	4.81	54.81
0.000986	0.0250	5.32	500	5.62	5.62	60.43
0.000790	0.0201	5.64	635	4.66	4.66	65.09
0.000615	0.0156	6.00		4.08	4.08	69.17
0.000435	0.0110	6.50		4.30	4.30	73.47
0.000308	0.00781	7.00		3.69	3.69	77.16
0.000197	0.00500	7.65		4.55	4.55	81.71
0.000077	0.00195	9.00		8.61	8.61	90.32
0.000038	0.000977	10.00		5.47	5.47	95.79
0.000019	0.000488	11.00		3.79	3.79	99.58
0.000015	0.000375	11.38		0.42	0.42	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.98	0.0100	0.253
10	2.27	0.0082	0.208
16	2.56	0.0067	0.169
25	3.04	0.0048	0.122
40	4.20	0.0021	0.055
50	4.75	0.0015	0.037
60	5.30	0.0010	0.025
75	6.71	0.0004	0.010
84	8.01	0.0002	0.004
90	8.95	0.0001	0.002
95	9.86	0.0000	0.001

Measure	Trask	Inman	Folk-Ward
Median, phi	4.75	4.75	4.75
Median, in.	0.0015	0.0015	0.0015
Median, mm	0.037	0.037	0.037
Mean, phi	3.93	5.28	5.11
Mean, in.	0.0026	0.0010	0.0011
Mean, mm	0.066	0.026	0.029
Sorting	3.569	2.721	2.553
Skewness	0.919	0.196	0.247
Kurtosis	0.273	0.447	0.879
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

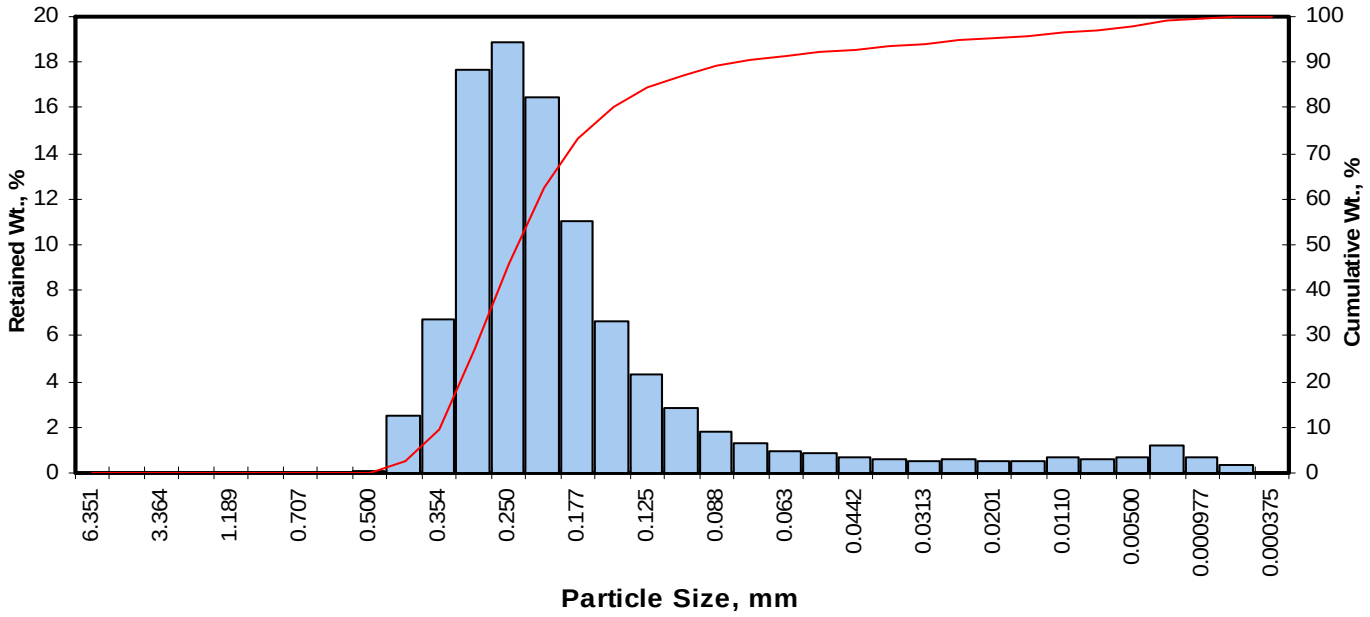
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.04
Fine Sand	200	33.98
Silt	>0.005 mm	47.69
Clay	<0.005 mm	18.29
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/29-31'/050926
Project No:	15-03095.14-006	**Depth, ft:**	30.3

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.10	0.09	0.09
0.0166	0.420	1.25	40	2.48	2.48	2.57
0.0139	0.354	1.50	45	6.73	6.73	9.30
0.0117	0.297	1.75	50	17.70	17.69	26.99
0.0098	0.250	2.00	60	18.90	18.89	45.87
0.0083	0.210	2.25	70	16.50	16.49	62.36
0.0070	0.177	2.50	80	11.00	10.99	73.36
0.0059	0.149	2.75	100	6.68	6.68	80.03
0.0049	0.125	3.00	120	4.33	4.33	84.36
0.0041	0.105	3.25	140	2.87	2.87	87.23
0.0035	0.088	3.50	170	1.84	1.84	89.06
0.0029	0.074	3.75	200	1.26	1.26	90.32
0.0025	0.063	4.00	230	0.98	0.98	91.30
0.0021	0.053	4.25	270	0.82	0.82	92.12
0.00174	0.0442	4.50	325	0.71	0.71	92.83
0.00146	0.0372	4.75	400	0.63	0.63	93.46
0.00123	0.0313	5.00	450	0.55	0.55	94.01
0.000986	0.0250	5.32	500	0.61	0.61	94.62
0.000790	0.0201	5.64	635	0.55	0.55	95.17
0.000615	0.0156	6.00		0.56	0.56	95.73
0.000435	0.0110	6.50		0.68	0.68	96.41
0.000308	0.00781	7.00		0.62	0.62	97.03
0.000197	0.00500	7.65		0.71	0.71	97.74
0.000077	0.00195	9.00		1.21	1.21	98.95
0.000038	0.000977	10.00		0.66	0.66	99.61
0.000019	0.000488	11.00		0.36	0.36	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.34	0.0155	0.395
10	1.51	0.0138	0.351
16	1.59	0.0130	0.331
25	1.72	0.0119	0.303
40	1.92	0.0104	0.264
50	2.06	0.0094	0.239
60	2.21	0.0085	0.216
75	2.56	0.0067	0.169
84	2.98	0.0050	0.127
90	3.69	0.0031	0.078
95	5.54	0.0008	0.021

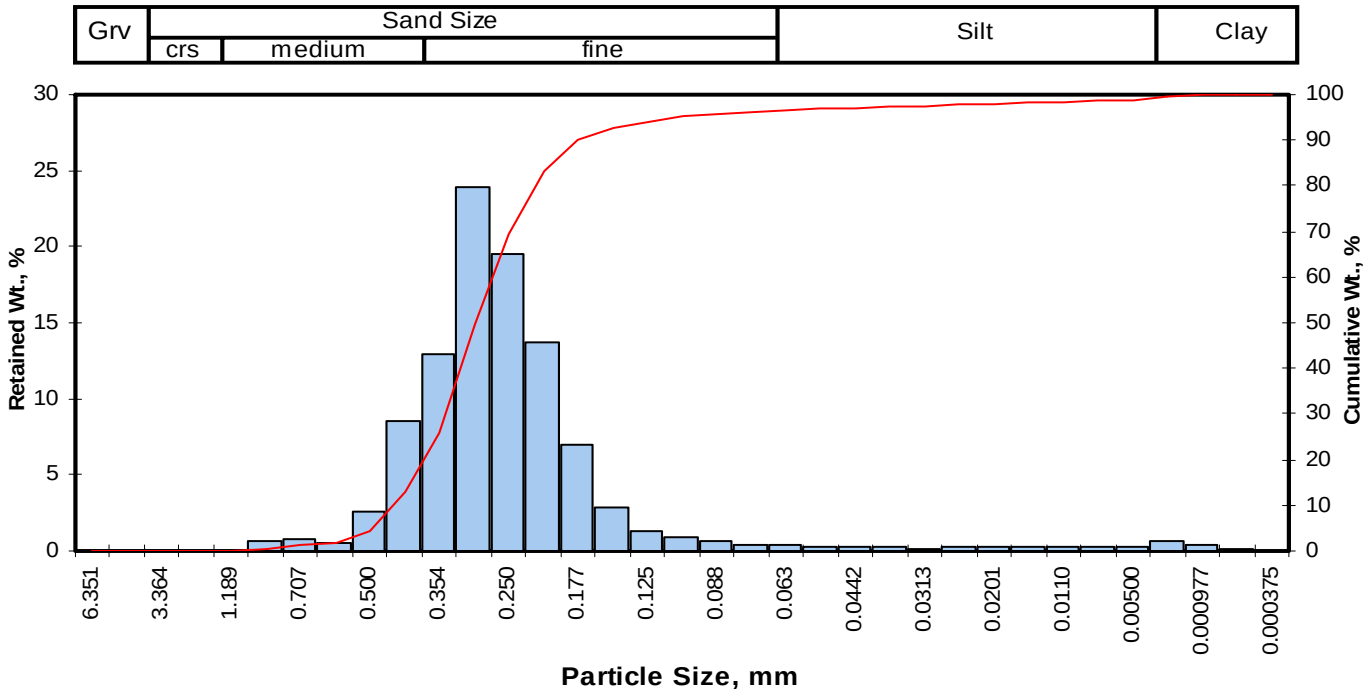
Measure	Trask	Inman	Folk-Ward
Median, phi	2.06	2.06	2.06
Median, in.	0.0094	0.0094	0.0094
Median, mm	0.239	0.239	0.239
Mean, phi	2.08	2.29	2.21
Mean, in.	0.0093	0.0081	0.0085
Mean, mm	0.236	0.205	0.216
Sorting	1.338	0.692	0.983
Skewness	0.947	0.324	0.490
Kurtosis	0.245	2.034	2.050
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.57
Fine Sand	200	87.75
Silt	>0.005 mm	7.41
Clay	<0.005 mm	2.26
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/31-33'/050926
Project No:	15-03095.14-006	**Depth, ft:**	31.3



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.61	0.61	0.61
0.0278	0.707	0.50	25	0.73	0.73	1.34
0.0234	0.595	0.75	30	0.47	0.47	1.81
0.0197	0.500	1.00	35	2.58	2.58	4.39
0.0166	0.420	1.25	40	8.57	8.57	12.95
0.0139	0.354	1.50	45	12.90	12.89	25.85
0.0117	0.297	1.75	50	23.90	23.89	49.74
0.0098	0.250	2.00	60	19.60	19.59	69.33
0.0083	0.210	2.25	70	13.70	13.69	83.02
0.0070	0.177	2.50	80	7.00	7.00	90.01
0.0059	0.149	2.75	100	2.82	2.82	92.83
0.0049	0.125	3.00	120	1.34	1.34	94.17
0.0041	0.105	3.25	140	0.91	0.91	95.08
0.0035	0.088	3.50	170	0.65	0.65	95.73
0.0029	0.074	3.75	200	0.45	0.45	96.18
0.0025	0.063	4.00	230	0.34	0.34	96.52
0.0021	0.053	4.25	270	0.28	0.28	96.80
0.00174	0.0442	4.50	325	0.24	0.24	97.04
0.00146	0.0372	4.75	400	0.21	0.21	97.25
0.00123	0.0313	5.00	450	0.19	0.19	97.44
0.000986	0.0250	5.32	500	0.21	0.21	97.65
0.000790	0.0201	5.64	635	0.20	0.20	97.85
0.000615	0.0156	6.00		0.21	0.21	98.06
0.000435	0.0110	6.50		0.26	0.26	98.32
0.000308	0.00781	7.00		0.25	0.25	98.57
0.000197	0.00500	7.65		0.32	0.32	98.89
0.000077	0.00195	9.00		0.66	0.66	99.55
0.000038	0.000977	10.00		0.35	0.35	99.90
0.000019	0.000488	11.00		0.10	0.10	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.02	0.0194	0.494
10	1.16	0.0176	0.446
16	1.31	0.0159	0.404
25	1.48	0.0141	0.358
40	1.65	0.0126	0.319
50	1.75	0.0117	0.297
60	1.88	0.0107	0.271
75	2.10	0.0092	0.233
84	2.29	0.0081	0.205
90	2.50	0.0070	0.177
95	3.23	0.0042	0.107

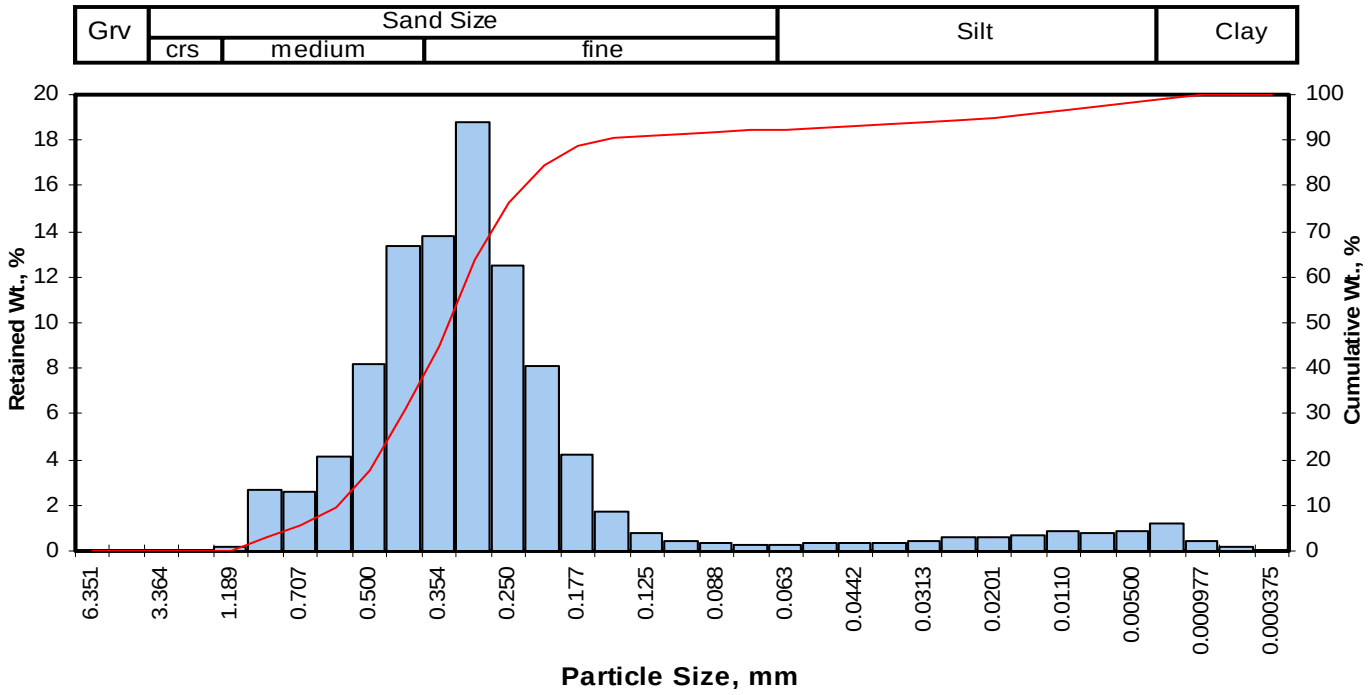
Measure	Trask	Inman	Folk-Ward
Median, phi	1.75	1.75	1.75
Median, in.	0.0117	0.0117	0.0117
Median, mm	0.297	0.297	0.297
Mean, phi	1.76	1.80	1.78
Mean, in.	0.0116	0.0113	0.0114
Mean, mm	0.295	0.288	0.291
Sorting	1.240	0.488	0.579
Skewness	0.973	0.090	0.212
Kurtosis	0.232	1.264	1.460
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	12.95
Fine Sand	200	83.23
Silt	>0.005 mm	2.71
Clay	<0.005 mm	1.11
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/33-35'/050926
Project No:	15-03095.14-006	**Depth, ft:**	33.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.21	0.21	0.21
0.0331	0.841	0.25	20	2.71	2.71	2.92
0.0278	0.707	0.50	25	2.56	2.56	5.48
0.0234	0.595	0.75	30	4.17	4.17	9.65
0.0197	0.500	1.00	35	8.18	8.18	17.83
0.0166	0.420	1.25	40	13.40	13.40	31.23
0.0139	0.354	1.50	45	13.80	13.80	45.02
0.0117	0.297	1.75	50	18.80	18.80	63.82
0.0098	0.250	2.00	60	12.50	12.50	76.32
0.0083	0.210	2.25	70	8.09	8.09	84.41
0.0070	0.177	2.50	80	4.20	4.20	88.61
0.0059	0.149	2.75	100	1.75	1.75	90.36
0.0049	0.125	3.00	120	0.74	0.74	91.10
0.0041	0.105	3.25	140	0.42	0.42	91.52
0.0035	0.088	3.50	170	0.31	0.31	91.83
0.0029	0.074	3.75	200	0.27	0.27	92.10
0.0025	0.063	4.00	230	0.30	0.30	92.40
0.0021	0.053	4.25	270	0.31	0.31	92.71
0.00174	0.0442	4.50	325	0.33	0.33	93.04
0.00146	0.0372	4.75	400	0.38	0.38	93.42
0.00123	0.0313	5.00	450	0.41	0.41	93.82
0.000986	0.0250	5.32	500	0.57	0.57	94.39
0.000790	0.0201	5.64	635	0.61	0.61	95.00
0.000615	0.0156	6.00		0.67	0.67	95.67
0.000435	0.0110	6.50		0.86	0.86	96.53
0.000308	0.00781	7.00		0.76	0.76	97.29
0.000197	0.00500	7.65		0.84	0.84	98.13
0.000077	0.00195	9.00		1.20	1.20	99.33
0.000038	0.000977	10.00		0.46	0.46	99.79
0.000019	0.000488	11.00		0.19	0.19	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.45	0.0288	0.730
10	0.76	0.0232	0.590
16	0.94	0.0205	0.520
25	1.13	0.0179	0.456
40	1.41	0.0148	0.377
50	1.57	0.0133	0.338
60	1.70	0.0121	0.308
75	1.97	0.0100	0.255
84	2.24	0.0083	0.212
90	2.70	0.0061	0.154
95	5.64	0.0008	0.020

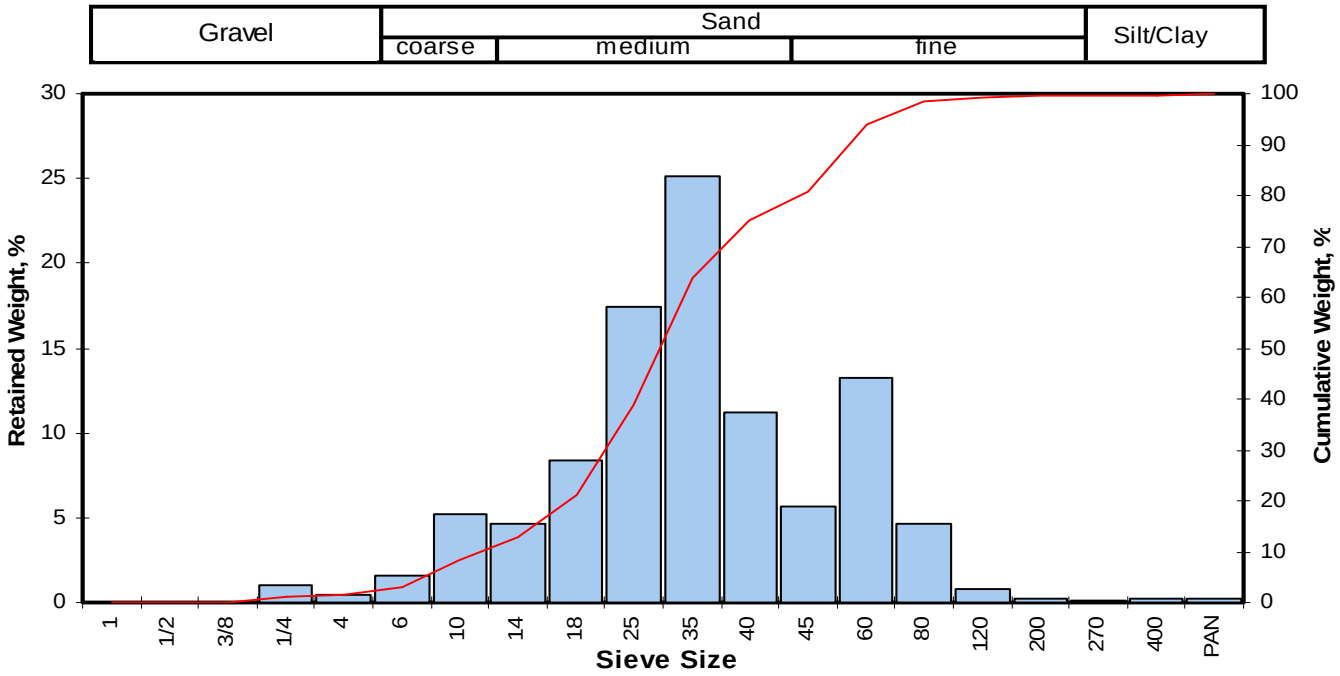
Measure	Trask	Inman	Folk-Ward
Median, phi	1.57	1.57	1.57
Median, in.	0.0133	0.0133	0.0133
Median, mm	0.338	0.338	0.338
Mean, phi	1.49	1.59	1.58
Mean, in.	0.0140	0.0131	0.0131
Mean, mm	0.355	0.332	0.334
Sorting	1.338	0.647	1.109
Skewness	1.009	0.038	0.304
Kurtosis	0.230	3.009	2.530
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	31.23
Fine Sand	200	60.87
Silt	>0.005 mm	6.04
Clay	<0.005 mm	1.87
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-1/41-43'/050926
Project No:	15-03095.14-006	**Depth, ft:**	41.6



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	0.54	1.06	1.06
0.1873	4.757	-2.25	4	0.21	0.41	1.47
0.1324	3.364	-1.75	6	0.79	1.54	3.01
0.0787	2.000	-1.00	10	2.65	5.18	8.19
0.0557	1.414	-0.50	14	2.36	4.61	12.80
0.0394	1.000	0.00	18	4.30	8.40	21.20
0.0278	0.707	0.50	25	8.95	17.49	38.69
0.0197	0.500	1.00	35	12.84	25.09	63.77
0.0166	0.420	1.25	40	5.71	11.16	74.93
0.0139	0.354	1.50	45	2.90	5.67	80.60
0.0098	0.250	2.00	60	6.76	13.21	93.81
0.0070	0.177	2.50	80	2.36	4.61	98.42
0.0049	0.125	3.00	120	0.41	0.80	99.22
0.0029	0.074	3.75	200	0.13	0.25	99.47
0.0021	0.053	4.25	270	0.06	0.12	99.59
0.0015	0.037	4.75	400	0.09	0.18	99.77
			PAN	0.12	0.23	100.00
TOTALS				51.18	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-1.46	0.1084	2.754
10	-0.80	0.0687	1.745
16	-0.31	0.0488	1.239
25	0.11	0.0365	0.927
40	0.53	0.0273	0.694
50	0.73	0.0238	0.605
60	0.92	0.0207	0.527
75	1.25	0.0165	0.420
84	1.63	0.0127	0.323
90	1.86	0.0109	0.276
95	2.13	0.0090	0.229

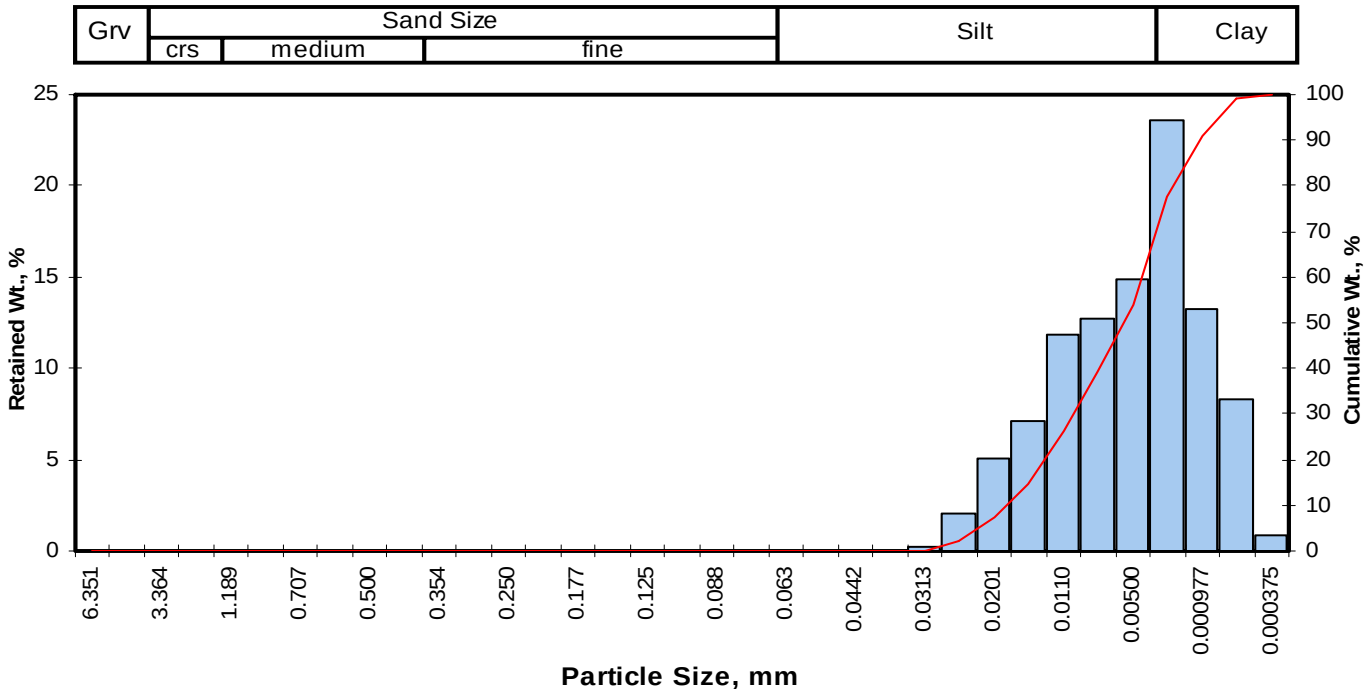
Measure	Trask	Inman	Folk-Ward
Median, phi	0.73	0.73	0.73
Median, in.	0.0238	0.0238	0.0238
Median, mm	0.605	0.605	0.605
Mean, phi	0.57	0.66	0.68
Mean, in.	0.0265	0.0249	0.0245
Mean, mm	0.674	0.633	0.623
Sorting	1.487	0.969	1.029
Skewness	1.031	-0.068	-0.143
Kurtosis	0.173	0.853	1.286
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	1.47
Coarse Sand	10	6.72
Medium Sand	40	66.74
Fine Sand	200	24.54
Silt/Clay	<200	0.53
	Total	100

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/17-19'/000923
Project No:	15-03095.14-006	**Depth, ft:**	17.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.00	0.00	0.00
0.0049	0.125	3.00	120	0.00	0.00	0.00
0.0041	0.105	3.25	140	0.00	0.00	0.00
0.0035	0.088	3.50	170	0.00	0.00	0.00
0.0029	0.074	3.75	200	0.00	0.00	0.00
0.0025	0.063	4.00	230	0.00	0.00	0.00
0.0021	0.053	4.25	270	0.00	0.00	0.00
0.00174	0.0442	4.50	325	0.00	0.00	0.00
0.00146	0.0372	4.75	400	0.00	0.00	0.00
0.00123	0.0313	5.00	450	0.21	0.21	0.21
0.000986	0.0250	5.32	500	2.07	2.07	2.28
0.000790	0.0201	5.64	635	5.02	5.02	7.30
0.000615	0.0156	6.00		7.14	7.14	14.44
0.000435	0.0110	6.50		11.90	11.90	26.34
0.000308	0.00781	7.00		12.70	12.70	39.05
0.000197	0.00500	7.65		14.90	14.90	53.95
0.000077	0.00195	9.00		23.60	23.60	77.55
0.000038	0.000977	10.00		13.20	13.20	90.75
0.000019	0.000488	11.00		8.35	8.35	99.10
0.000015	0.000375	11.38		0.90	0.90	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	5.49	0.0009	0.022
10	5.78	0.0007	0.018
16	6.07	0.0006	0.015
25	6.44	0.0005	0.011
40	7.04	0.0003	0.008
50	7.47	0.0002	0.006
60	7.99	0.0002	0.004
75	8.85	0.0001	0.002
84	9.49	0.0001	0.001
90	9.94	0.0000	0.001
95	10.51	0.0000	0.001

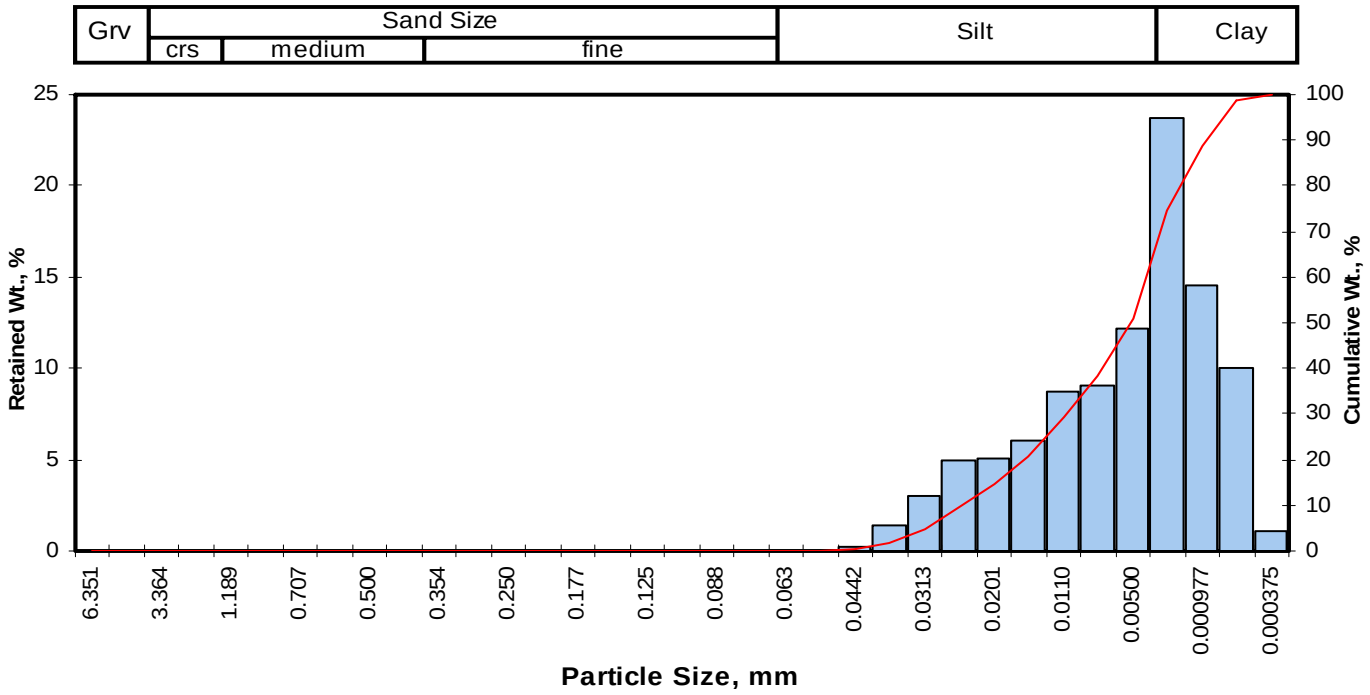
Measure	Trask	Inman	Folk-Ward
Median, phi	7.47	7.47	7.47
Median, in.	0.0002	0.0002	0.0002
Median, mm	0.006	0.006	0.006
Mean, phi	7.19	7.78	7.68
Mean, in.	0.0003	0.0002	0.0002
Mean, mm	0.007	0.005	0.005
Sorting	2.306	1.712	1.616
Skewness	0.886	0.177	0.194
Kurtosis	0.271	0.465	0.853
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	0.00
Silt	>0.005 mm	53.95
Clay	<0.005 mm	46.05
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/29-31'/000923
Project No:	15-03095.14-006	**Depth, ft:**	29.1



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.00	0.00	0.00
0.0049	0.125	3.00	120	0.00	0.00	0.00
0.0041	0.105	3.25	140	0.00	0.00	0.00
0.0035	0.088	3.50	170	0.00	0.00	0.00
0.0029	0.074	3.75	200	0.00	0.00	0.00
0.0025	0.063	4.00	230	0.00	0.00	0.00
0.0021	0.053	4.25	270	0.00	0.00	0.00
0.00174	0.0442	4.50	325	0.22	0.22	0.22
0.00146	0.0372	4.75	400	1.39	1.39	1.61
0.00123	0.0313	5.00	450	2.99	2.99	4.60
0.000986	0.0250	5.32	500	4.96	4.96	9.56
0.000790	0.0201	5.64	635	5.10	5.10	14.66
0.000615	0.0156	6.00		6.01	6.01	20.67
0.000435	0.0110	6.50		8.75	8.75	29.42
0.000308	0.00781	7.00		9.07	9.07	38.49
0.000197	0.00500	7.65		12.20	12.20	50.69
0.000077	0.00195	9.00		23.70	23.70	74.39
0.000038	0.000977	10.00		14.50	14.50	88.89
0.000019	0.000488	11.00		9.99	9.99	98.88
0.000015	0.000375	11.38		1.12	1.12	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	5.03	0.0012	0.031
10	5.35	0.0010	0.025
16	5.72	0.0007	0.019
25	6.25	0.0005	0.013
40	7.08	0.0003	0.007
50	7.61	0.0002	0.005
60	8.18	0.0001	0.003
75	9.04	0.0001	0.002
84	9.66	0.0000	0.001
90	10.11	0.0000	0.001
95	10.61	0.0000	0.001

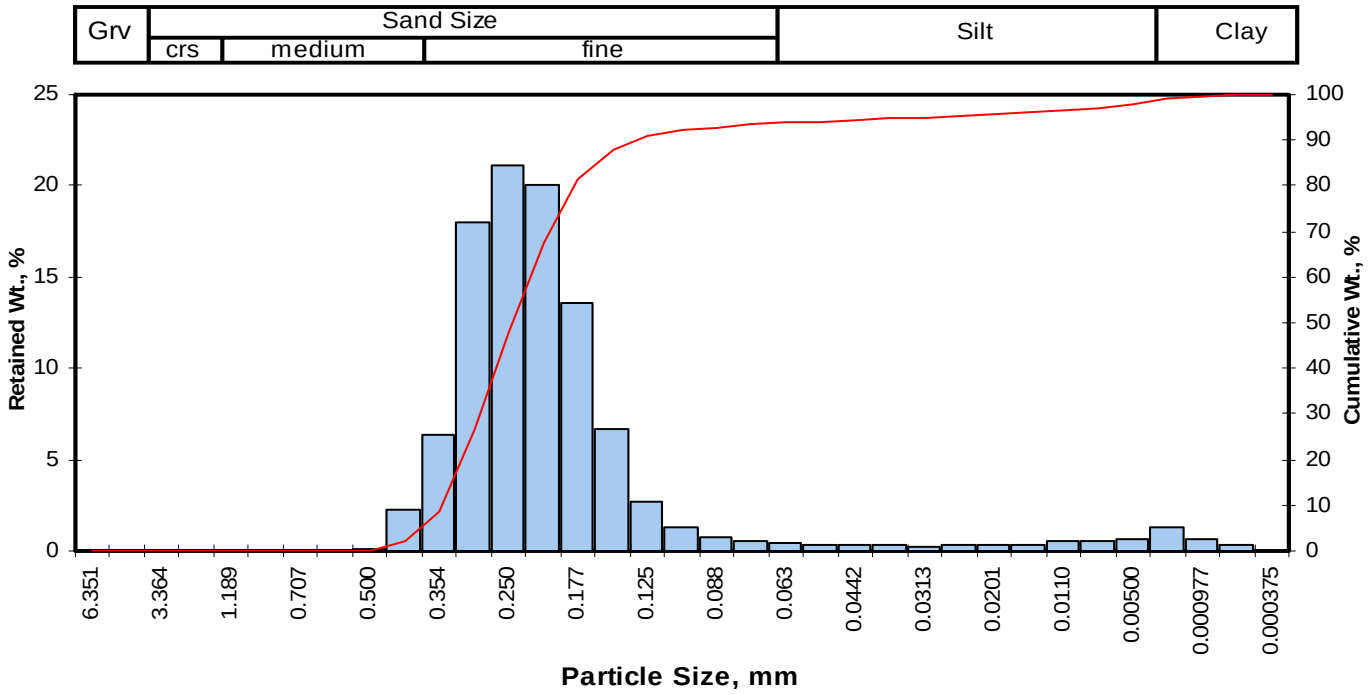
Measure	Trask	Inman	Folk-Ward
Median, phi	7.61	7.61	7.61
Median, in.	0.0002	0.0002	0.0002
Median, mm	0.005	0.005	0.005
Mean, phi	7.05	7.69	7.66
Mean, in.	0.0003	0.0002	0.0002
Mean, mm	0.008	0.005	0.005
Sorting	2.634	1.971	1.832
Skewness	0.975	0.042	0.059
Kurtosis	0.238	0.417	0.819
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	0.00
Silt	>0.005 mm	50.69
Clay	<0.005 mm	49.31
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/31-33'/000923
Project No:	15-03095.14-006	**Depth, ft:**	31.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.10	0.10	0.10
0.0166	0.420	1.25	40	2.25	2.25	2.35
0.0139	0.354	1.50	45	6.34	6.34	8.69
0.0117	0.297	1.75	50	18.00	18.00	26.69
0.0098	0.250	2.00	60	21.10	21.10	47.80
0.0083	0.210	2.25	70	20.00	20.00	67.80
0.0070	0.177	2.50	80	13.60	13.60	81.40
0.0059	0.149	2.75	100	6.69	6.69	88.10
0.0049	0.125	3.00	120	2.71	2.71	90.81
0.0041	0.105	3.25	140	1.24	1.24	92.05
0.0035	0.088	3.50	170	0.78	0.78	92.83
0.0029	0.074	3.75	200	0.56	0.56	93.39
0.0025	0.063	4.00	230	0.42	0.42	93.81
0.0021	0.053	4.25	270	0.34	0.34	94.15
0.00174	0.0442	4.50	325	0.30	0.30	94.45
0.00146	0.0372	4.75	400	0.28	0.28	94.73
0.00123	0.0313	5.00	450	0.25	0.25	94.98
0.000986	0.0250	5.32	500	0.30	0.30	95.28
0.000790	0.0201	5.64	635	0.31	0.31	95.59
0.000615	0.0156	6.00		0.35	0.35	95.94
0.000435	0.0110	6.50		0.49	0.49	96.43
0.000308	0.00781	7.00		0.52	0.52	96.95
0.000197	0.00500	7.65		0.69	0.69	97.64
0.000077	0.00195	9.00		1.29	1.29	98.93
0.000038	0.000977	10.00		0.69	0.69	99.62
0.000019	0.000488	11.00		0.35	0.35	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.35	0.0154	0.391
10	1.52	0.0137	0.349
16	1.60	0.0130	0.330
25	1.73	0.0119	0.302
40	1.91	0.0105	0.267
50	2.03	0.0097	0.245
60	2.15	0.0089	0.225
75	2.38	0.0076	0.192
84	2.60	0.0065	0.165
90	2.93	0.0052	0.132
95	5.02	0.0012	0.031

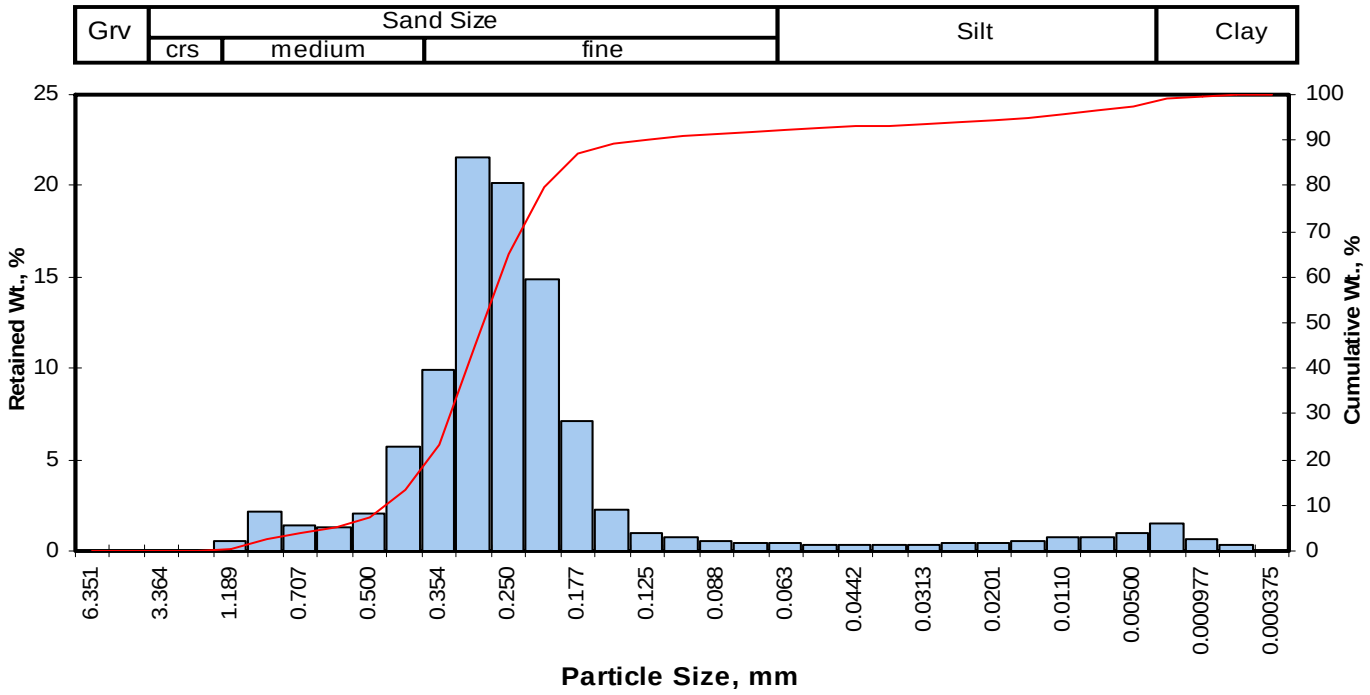
Measure	Trask	Inman	Folk-Ward
Median, phi	2.03	2.03	2.03
Median, in.	0.0097	0.0097	0.0097
Median, mm	0.245	0.245	0.245
Mean, phi	2.02	2.10	2.08
Mean, in.	0.0097	0.0092	0.0093
Mean, mm	0.247	0.233	0.237
Sorting	1.255	0.498	0.805
Skewness	0.982	0.144	0.389
Kurtosis	0.254	2.687	2.293
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	2.35
Fine Sand	200	91.04
Silt	>0.005 mm	4.25
Clay	<0.005 mm	2.36
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/33-35'/000923
Project No:	15-03095.14-006	**Depth, ft:**	33.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.53	0.53	0.53
0.0331	0.841	0.25	20	2.14	2.14	2.67
0.0278	0.707	0.50	25	1.40	1.40	4.07
0.0234	0.595	0.75	30	1.31	1.31	5.38
0.0197	0.500	1.00	35	2.09	2.09	7.47
0.0166	0.420	1.25	40	5.73	5.73	13.20
0.0139	0.354	1.50	45	9.90	9.90	23.10
0.0117	0.297	1.75	50	21.60	21.60	44.70
0.0098	0.250	2.00	60	20.20	20.20	64.90
0.0083	0.210	2.25	70	14.90	14.90	79.79
0.0070	0.177	2.50	80	7.12	7.12	86.91
0.0059	0.149	2.75	100	2.25	2.25	89.16
0.0049	0.125	3.00	120	0.94	0.94	90.10
0.0041	0.105	3.25	140	0.75	0.75	90.85
0.0035	0.088	3.50	170	0.58	0.58	91.43
0.0029	0.074	3.75	200	0.45	0.45	91.88
0.0025	0.063	4.00	230	0.40	0.40	92.28
0.0021	0.053	4.25	270	0.36	0.36	92.64
0.00174	0.0442	4.50	325	0.33	0.33	92.97
0.00146	0.0372	4.75	400	0.33	0.33	93.30
0.00123	0.0313	5.00	450	0.32	0.32	93.62
0.000986	0.0250	5.32	500	0.42	0.42	94.04
0.000790	0.0201	5.64	635	0.45	0.45	94.49
0.000615	0.0156	6.00		0.52	0.52	95.01
0.000435	0.0110	6.50		0.74	0.74	95.75
0.000308	0.00781	7.00		0.77	0.77	96.52
0.000197	0.00500	7.65		0.94	0.94	97.46
0.000077	0.00195	9.00		1.53	1.53	98.99
0.000038	0.000977	10.00		0.67	0.67	99.66
0.000019	0.000488	11.00		0.31	0.31	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.68	0.0246	0.625
10	1.11	0.0182	0.463
16	1.32	0.0158	0.400
25	1.52	0.0137	0.348
40	1.70	0.0122	0.309
50	1.82	0.0112	0.284
60	1.94	0.0103	0.261
75	2.17	0.0088	0.222
84	2.40	0.0075	0.190
90	2.97	0.0050	0.127
95	5.99	0.0006	0.016

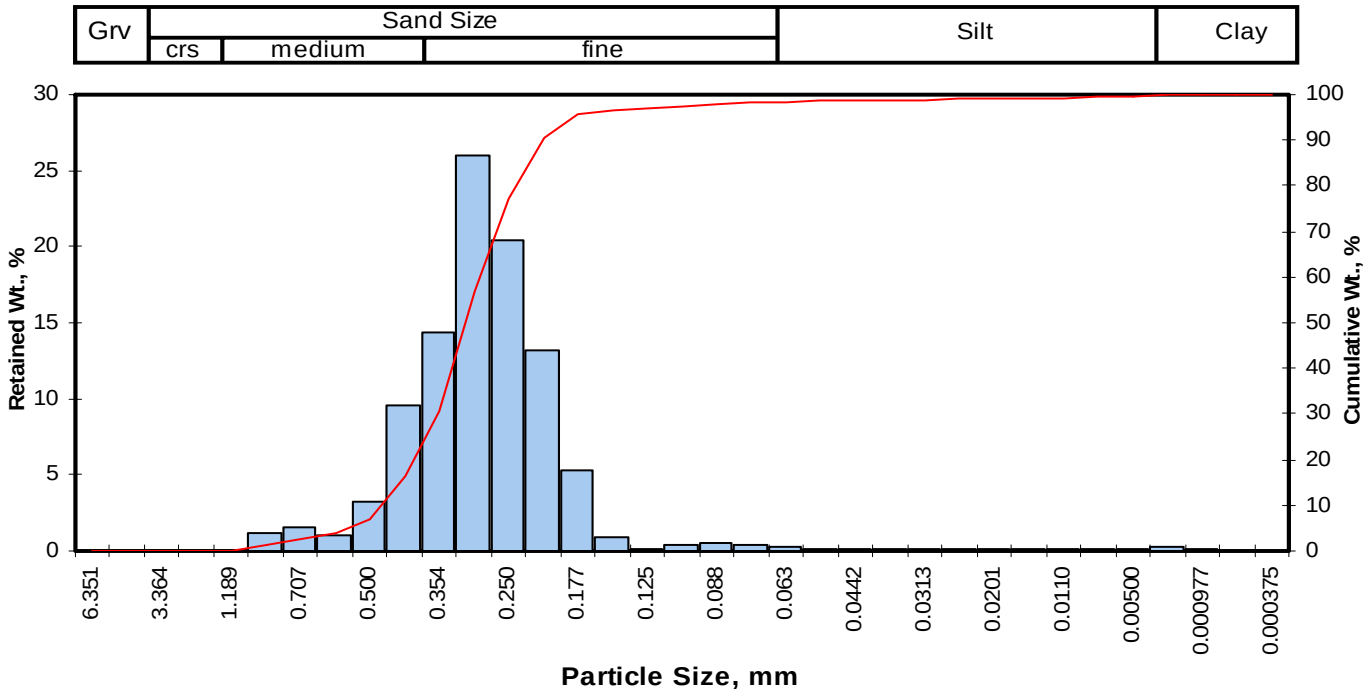
Measure	Trask	Inman	Folk-Ward
Median, phi	1.82	1.82	1.82
Median, in.	0.0112	0.0112	0.0112
Median, mm	0.284	0.284	0.284
Mean, phi	1.81	1.86	1.84
Mean, in.	0.0112	0.0109	0.0110
Mean, mm	0.285	0.276	0.278
Sorting	1.252	0.538	1.074
Skewness	0.979	0.081	0.326
Kurtosis	0.188	3.934	3.363
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	13.20
Fine Sand	200	78.68
Silt	>0.005 mm	5.58
Clay	<0.005 mm	2.54
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-2/35-37'/000923
Project No:	15-03095.14-006	**Depth, ft:**	35.8



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	1.12	1.12	1.12
0.0278	0.707	0.50	25	1.57	1.57	2.69
0.0234	0.595	0.75	30	1.05	1.05	3.74
0.0197	0.500	1.00	35	3.18	3.18	6.91
0.0166	0.420	1.25	40	9.56	9.55	16.47
0.0139	0.354	1.50	45	14.30	14.29	30.76
0.0117	0.297	1.75	50	26.00	25.98	56.74
0.0098	0.250	2.00	60	20.50	20.48	77.22
0.0083	0.210	2.25	70	13.20	13.19	90.41
0.0070	0.177	2.50	80	5.31	5.31	95.72
0.0059	0.149	2.75	100	0.97	0.97	96.69
0.0049	0.125	3.00	120	0.19	0.19	96.88
0.0041	0.105	3.25	140	0.43	0.43	97.31
0.0035	0.088	3.50	170	0.51	0.51	97.82
0.0029	0.074	3.75	200	0.34	0.34	98.16
0.0025	0.063	4.00	230	0.20	0.20	98.36
0.0021	0.053	4.25	270	0.15	0.15	98.51
0.00174	0.0442	4.50	325	0.14	0.14	98.65
0.00146	0.0372	4.75	400	0.12	0.12	98.77
0.00123	0.0313	5.00	450	0.10	0.10	98.86
0.000986	0.0250	5.32	500	0.10	0.10	98.96
0.000790	0.0201	5.64	635	0.09	0.09	99.05
0.000615	0.0156	6.00		0.09	0.09	99.14
0.000435	0.0110	6.50		0.13	0.13	99.27
0.000308	0.00781	7.00		0.13	0.13	99.40
0.000197	0.00500	7.65		0.17	0.17	99.57
0.000077	0.00195	9.00		0.31	0.31	99.88
0.000038	0.000977	10.00		0.11	0.11	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.85	0.0219	0.555
10	1.08	0.0186	0.473
16	1.24	0.0167	0.424
25	1.40	0.0149	0.379
40	1.59	0.0131	0.332
50	1.69	0.0122	0.311
60	1.79	0.0114	0.289
75	1.97	0.0100	0.255
84	2.13	0.0090	0.229
90	2.24	0.0083	0.211
95	2.47	0.0071	0.181

Measure	Trask	Inman	Folk-Ward
Median, phi	1.69	1.69	1.69
Median, in.	0.0122	0.0122	0.0122
Median, mm	0.311	0.311	0.311
Mean, phi	1.66	1.68	1.68
Mean, in.	0.0125	0.0123	0.0123
Mean, mm	0.317	0.311	0.311
Sorting	1.220	0.445	0.468
Skewness	0.999	-0.005	-0.019
Kurtosis	0.238	0.815	1.155
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

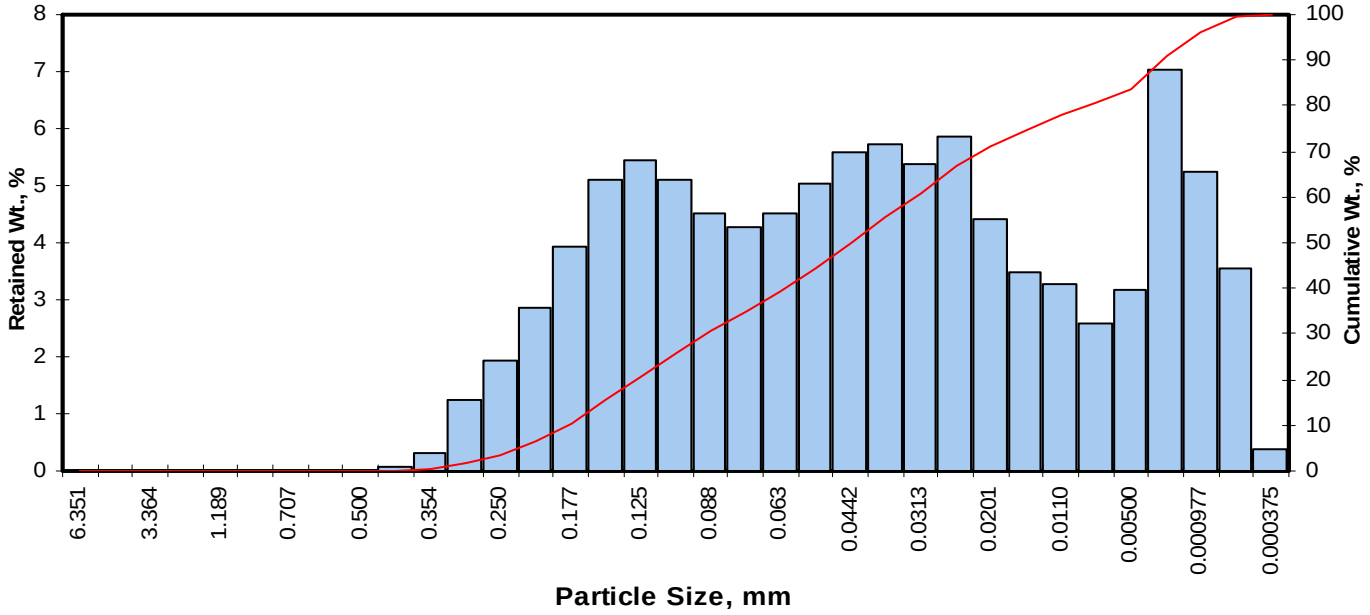
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	16.47
Fine Sand	200	81.69
Silt	>0.005 mm	1.42
Clay	<0.005 mm	0.43
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/30-32'/050928
Project No:	15-03095.14-006	**Depth, ft:**	30.35

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.06	0.06	0.06
0.0139	0.354	1.50	45	0.30	0.30	0.36
0.0117	0.297	1.75	50	1.23	1.23	1.59
0.0098	0.250	2.00	60	1.92	1.92	3.51
0.0083	0.210	2.25	70	2.86	2.86	6.37
0.0070	0.177	2.50	80	3.94	3.94	10.31
0.0059	0.149	2.75	100	5.09	5.09	15.40
0.0049	0.125	3.00	120	5.45	5.45	20.85
0.0041	0.105	3.25	140	5.10	5.10	25.95
0.0035	0.088	3.50	170	4.51	4.51	30.46
0.0029	0.074	3.75	200	4.27	4.27	34.73
0.0025	0.063	4.00	230	4.50	4.50	39.24
0.0021	0.053	4.25	270	5.04	5.04	44.28
0.00174	0.0442	4.50	325	5.58	5.58	49.86
0.00146	0.0372	4.75	400	5.74	5.74	55.60
0.00123	0.0313	5.00	450	5.39	5.39	60.99
0.000986	0.0250	5.32	500	5.85	5.85	66.84
0.000790	0.0201	5.64	635	4.40	4.40	71.24
0.000615	0.0156	6.00		3.49	3.49	74.73
0.000435	0.0110	6.50		3.27	3.27	78.00
0.000308	0.00781	7.00		2.58	2.58	80.59
0.000197	0.00500	7.65		3.18	3.18	83.77
0.000077	0.00195	9.00		7.05	7.05	90.82
0.000038	0.000977	10.00		5.25	5.25	96.07
0.000019	0.000488	11.00		3.54	3.54	99.61
0.000015	0.000375	11.38		0.39	0.39	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.13	0.0090	0.228
10	2.48	0.0071	0.179
16	2.78	0.0057	0.146
25	3.20	0.0043	0.109
40	4.04	0.0024	0.061
50	4.51	0.0017	0.044
60	4.95	0.0013	0.032
75	6.04	0.0006	0.015
84	7.69	0.0002	0.005
90	8.84	0.0001	0.002
95	9.80	0.0000	0.001

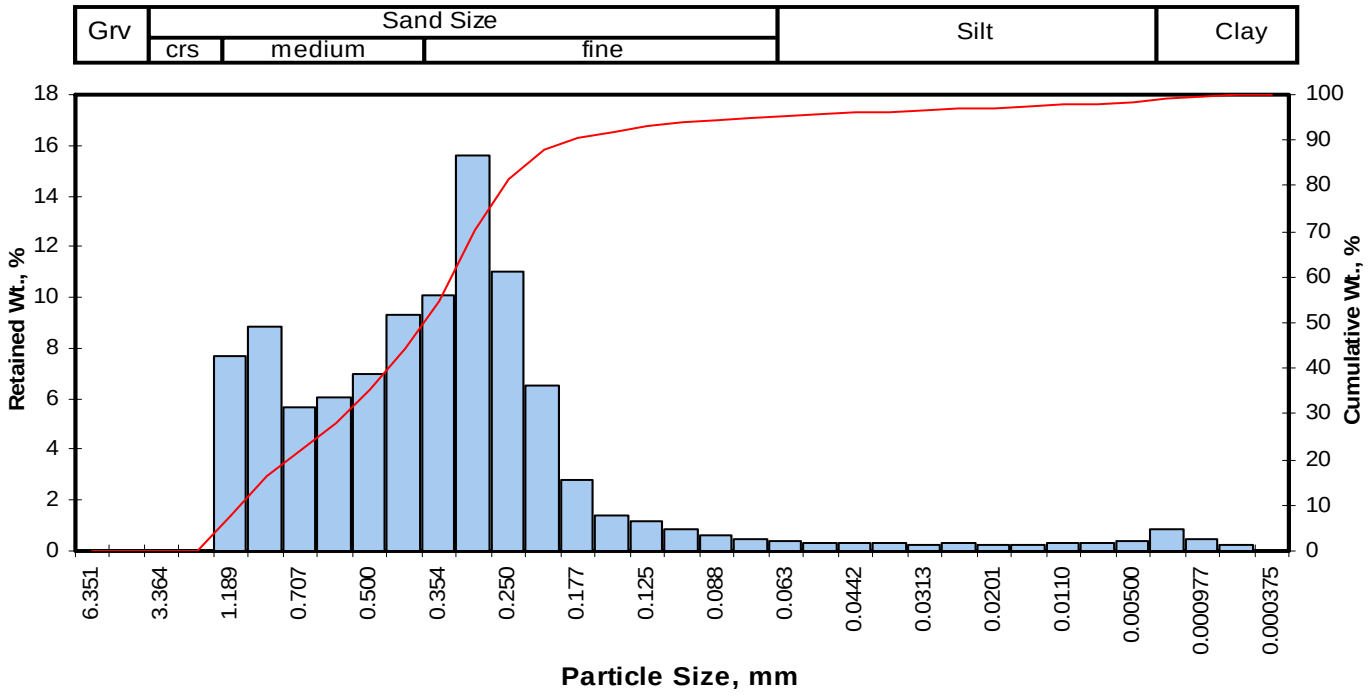
Measure	Trask	Inman	Folk-Ward
Median, phi	4.51	4.51	4.51
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.044	0.044	0.044
Mean, phi	4.01	5.23	4.99
Mean, in.	0.0024	0.0010	0.0012
Mean, mm	0.062	0.027	0.031
Sorting	2.673	2.456	2.390
Skewness	0.923	0.296	0.338
Kurtosis	0.264	0.561	1.107
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.06
Fine Sand	200	34.68
Silt	>0.005 mm	49.03
Clay	<0.005 mm	16.23
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/30-32'/050928
Project No:	15-03095.14-006	**Depth, ft:**	31.6



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	7.66	7.66	7.66
0.0331	0.841	0.25	20	8.82	8.82	16.49
0.0278	0.707	0.50	25	5.66	5.66	22.15
0.0234	0.595	0.75	30	6.07	6.07	28.22
0.0197	0.500	1.00	35	7.01	7.01	35.23
0.0166	0.420	1.25	40	9.30	9.30	44.54
0.0139	0.354	1.50	45	10.10	10.10	54.64
0.0117	0.297	1.75	50	15.60	15.61	70.25
0.0098	0.250	2.00	60	11.00	11.00	81.25
0.0083	0.210	2.25	70	6.48	6.48	87.73
0.0070	0.177	2.50	80	2.81	2.81	90.55
0.0059	0.149	2.75	100	1.43	1.43	91.98
0.0049	0.125	3.00	120	1.13	1.13	93.11
0.0041	0.105	3.25	140	0.87	0.87	93.98
0.0035	0.088	3.50	170	0.59	0.59	94.57
0.0029	0.074	3.75	200	0.44	0.44	95.01
0.0025	0.063	4.00	230	0.39	0.39	95.40
0.0021	0.053	4.25	270	0.34	0.34	95.74
0.00174	0.0442	4.50	325	0.30	0.30	96.04
0.00146	0.0372	4.75	400	0.28	0.28	96.32
0.00123	0.0313	5.00	450	0.25	0.25	96.57
0.000986	0.0250	5.32	500	0.28	0.28	96.85
0.000790	0.0201	5.64	635	0.26	0.26	97.11
0.000615	0.0156	6.00		0.26	0.26	97.37
0.000435	0.0110	6.50		0.32	0.32	97.69
0.000308	0.00781	7.00		0.32	0.32	98.01
0.000197	0.00500	7.65		0.42	0.42	98.43
0.000077	0.00195	9.00		0.85	0.85	99.28
0.000038	0.000977	10.00		0.47	0.47	99.75
0.000019	0.000488	11.00		0.23	0.23	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.51	0.0561	1.425
10	-0.12	0.0427	1.085
16	0.22	0.0337	0.857
25	0.62	0.0257	0.652
40	1.13	0.0180	0.458
50	1.39	0.0151	0.383
60	1.59	0.0131	0.333
75	1.86	0.0109	0.276
84	2.11	0.0091	0.232
90	2.45	0.0072	0.183
95	3.75	0.0029	0.075

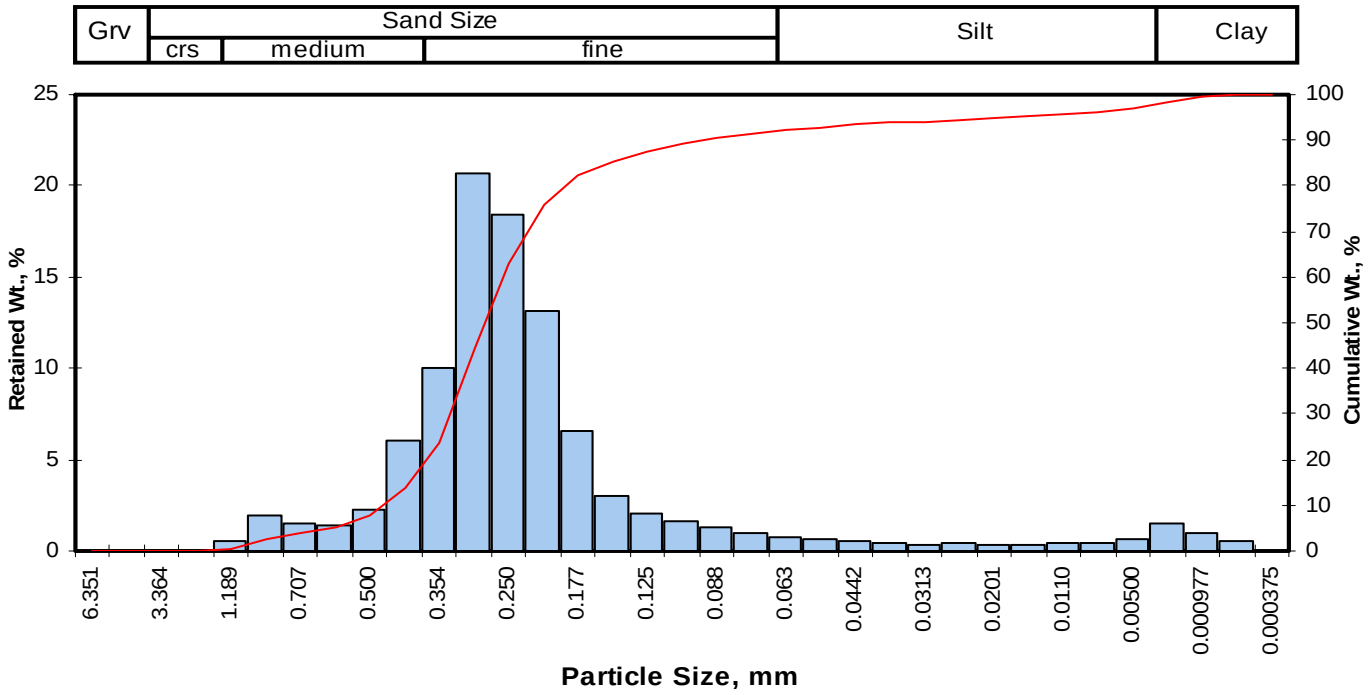
Measure	Trask	Inman	Folk-Ward
Median, phi	1.39	1.39	1.39
Median, in.	0.0151	0.0151	0.0151
Median, mm	0.383	0.383	0.383
Mean, phi	1.11	1.16	1.24
Mean, in.	0.0183	0.0176	0.0167
Mean, mm	0.464	0.446	0.424
Sorting	1.537	0.942	1.116
Skewness	1.108	-0.235	-0.063
Kurtosis	0.208	1.260	1.406
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	44.54
Fine Sand	200	50.47
Silt	>0.005 mm	3.42
Clay	<0.005 mm	1.57
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/32-34'/050928
Project No:	15-03095.14-006	**Depth, ft:**	32.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.51	0.51	0.51
0.0331	0.841	0.25	20	1.96	1.96	2.47
0.0278	0.707	0.50	25	1.46	1.46	3.93
0.0234	0.595	0.75	30	1.40	1.40	5.33
0.0197	0.500	1.00	35	2.27	2.27	7.60
0.0166	0.420	1.25	40	6.05	6.05	13.65
0.0139	0.354	1.50	45	9.99	9.99	23.64
0.0117	0.297	1.75	50	20.70	20.70	44.34
0.0098	0.250	2.00	60	18.40	18.40	62.74
0.0083	0.210	2.25	70	13.10	13.10	75.84
0.0070	0.177	2.50	80	6.60	6.60	82.44
0.0059	0.149	2.75	100	3.05	3.05	85.49
0.0049	0.125	3.00	120	2.04	2.04	87.53
0.0041	0.105	3.25	140	1.66	1.66	89.19
0.0035	0.088	3.50	170	1.27	1.27	90.46
0.0029	0.074	3.75	200	0.97	0.97	91.43
0.0025	0.063	4.00	230	0.79	0.79	92.22
0.0021	0.053	4.25	270	0.63	0.63	92.85
0.00174	0.0442	4.50	325	0.52	0.52	93.37
0.00146	0.0372	4.75	400	0.44	0.44	93.81
0.00123	0.0313	5.00	450	0.36	0.36	94.17
0.000986	0.0250	5.32	500	0.38	0.38	94.55
0.000790	0.0201	5.64	635	0.35	0.35	94.90
0.000615	0.0156	6.00		0.36	0.36	95.26
0.000435	0.0110	6.50		0.46	0.46	95.72
0.000308	0.00781	7.00		0.48	0.48	96.20
0.000197	0.00500	7.65		0.68	0.68	96.88
0.000077	0.00195	9.00		1.51	1.51	98.39
0.000038	0.000977	10.00		1.00	1.00	99.39
0.000019	0.000488	11.00		0.56	0.56	99.95
0.000015	0.000375	11.38		0.05	0.05	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.69	0.0244	0.619
10	1.10	0.0184	0.467
16	1.31	0.0159	0.404
25	1.52	0.0138	0.350
40	1.70	0.0121	0.308
50	1.83	0.0111	0.282
60	1.96	0.0101	0.257
75	2.23	0.0084	0.213
84	2.63	0.0064	0.162
90	3.41	0.0037	0.094
95	5.74	0.0007	0.019

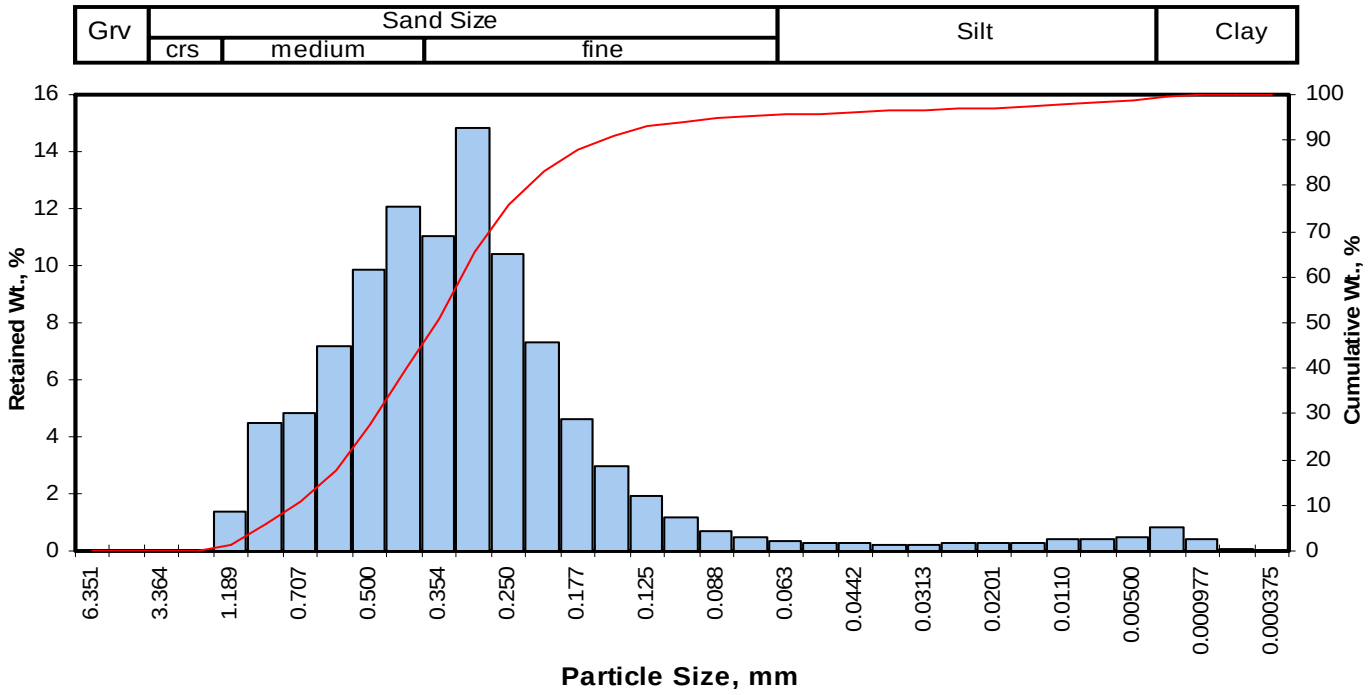
Measure	Trask	Inman	Folk-Ward
Median, phi	1.83	1.83	1.83
Median, in.	0.0111	0.0111	0.0111
Median, mm	0.282	0.282	0.282
Mean, phi	1.83	1.97	1.92
Mean, in.	0.0111	0.0101	0.0104
Mean, mm	0.281	0.256	0.264
Sorting	1.282	0.660	1.095
Skewness	0.967	0.215	0.382
Kurtosis	0.184	2.829	2.885
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	13.65
Fine Sand	200	77.78
Silt	>0.005 mm	5.45
Clay	<0.005 mm	3.12
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/34-36'/050928
Project No:	15-03095.14-006	**Depth, ft:**	34.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	1.37	1.37	1.37
0.0331	0.841	0.25	20	4.46	4.46	5.83
0.0278	0.707	0.50	25	4.84	4.84	10.67
0.0234	0.595	0.75	30	7.19	7.19	17.86
0.0197	0.500	1.00	35	9.89	9.89	27.76
0.0166	0.420	1.25	40	12.10	12.10	39.86
0.0139	0.354	1.50	45	11.00	11.00	50.86
0.0117	0.297	1.75	50	14.80	14.80	65.66
0.0098	0.250	2.00	60	10.40	10.40	76.07
0.0083	0.210	2.25	70	7.33	7.33	83.40
0.0070	0.177	2.50	80	4.62	4.62	88.02
0.0059	0.149	2.75	100	2.96	2.96	90.98
0.0049	0.125	3.00	120	1.92	1.92	92.90
0.0041	0.105	3.25	140	1.15	1.15	94.05
0.0035	0.088	3.50	170	0.66	0.66	94.71
0.0029	0.074	3.75	200	0.45	0.45	95.16
0.0025	0.063	4.00	230	0.37	0.37	95.53
0.0021	0.053	4.25	270	0.31	0.31	95.84
0.00174	0.0442	4.50	325	0.26	0.26	96.10
0.00146	0.0372	4.75	400	0.24	0.24	96.34
0.00123	0.0313	5.00	450	0.23	0.23	96.57
0.000986	0.0250	5.32	500	0.27	0.27	96.84
0.000790	0.0201	5.64	635	0.27	0.27	97.11
0.000615	0.0156	6.00		0.30	0.30	97.41
0.000435	0.0110	6.50		0.40	0.40	97.81
0.000308	0.00781	7.00		0.38	0.38	98.19
0.000197	0.00500	7.65		0.48	0.48	98.67
0.000077	0.00195	9.00		0.85	0.85	99.52
0.000038	0.000977	10.00		0.38	0.38	99.90
0.000019	0.000488	11.00		0.10	0.10	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.16	0.0353	0.897
10	0.47	0.0285	0.724
16	0.69	0.0245	0.622
25	0.93	0.0207	0.525
40	1.25	0.0165	0.420
50	1.48	0.0141	0.358
60	1.65	0.0125	0.318
75	1.97	0.0100	0.254
84	2.28	0.0081	0.206
90	2.67	0.0062	0.157
95	3.66	0.0031	0.079

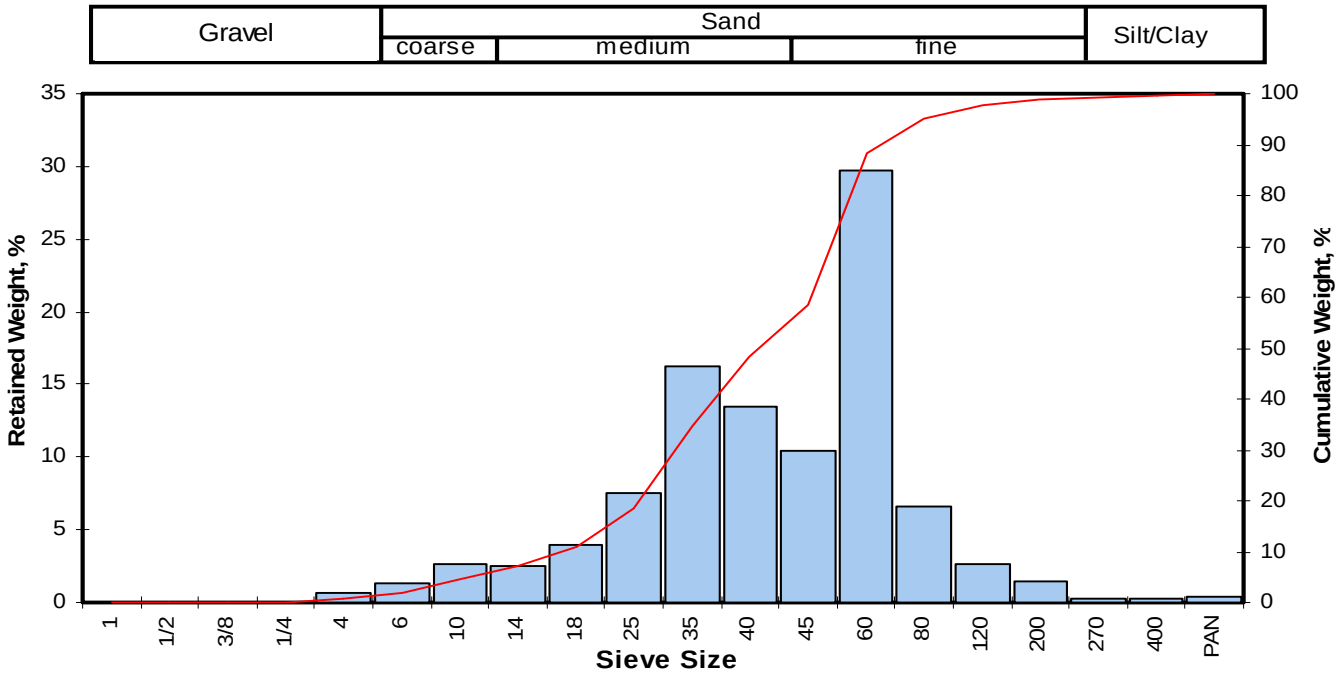
Measure	Trask	Inman	Folk-Ward
Median, phi	1.48	1.48	1.48
Median, in.	0.0141	0.0141	0.0141
Median, mm	0.358	0.358	0.358
Mean, phi	1.36	1.48	1.48
Mean, in.	0.0153	0.0141	0.0141
Mean, mm	0.390	0.358	0.358
Sorting	1.436	0.799	0.930
Skewness	1.020	0.004	0.125
Kurtosis	0.238	1.194	1.376
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	39.86
Fine Sand	200	55.30
Silt	>0.005 mm	3.51
Clay	<0.005 mm	1.33
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-3/38-40'/050928
Project No:	15-03095.14-006	**Depth, ft:**	38.4



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.34	0.69	0.69
0.1324	3.364	-1.75	6	0.64	1.29	1.97
0.0787	2.000	-1.00	10	1.29	2.60	4.57
0.0557	1.414	-0.50	14	1.23	2.48	7.05
0.0394	1.000	0.00	18	1.95	3.93	10.98
0.0278	0.707	0.50	25	3.71	7.48	18.46
0.0197	0.500	1.00	35	8.09	16.30	34.76
0.0166	0.420	1.25	40	6.68	13.46	48.22
0.0139	0.354	1.50	45	5.19	10.46	58.67
0.0098	0.250	2.00	60	14.78	29.78	88.45
0.0070	0.177	2.50	80	3.25	6.55	95.00
0.0049	0.125	3.00	120	1.28	2.58	97.58
0.0029	0.074	3.75	200	0.72	1.45	99.03
0.0021	0.053	4.25	270	0.14	0.28	99.31
0.0015	0.037	4.75	400	0.16	0.32	99.64
			PAN	0.18	0.36	100.00
TOTALS				49.63	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.91	0.0742	1.884
10	-0.12	0.0429	1.090
16	0.34	0.0312	0.792
25	0.70	0.0242	0.615
40	1.10	0.0184	0.467
50	1.29	0.0161	0.408
60	1.52	0.0137	0.348
75	1.77	0.0115	0.292
84	1.93	0.0104	0.263
90	2.12	0.0091	0.230
95	2.50	0.0070	0.177

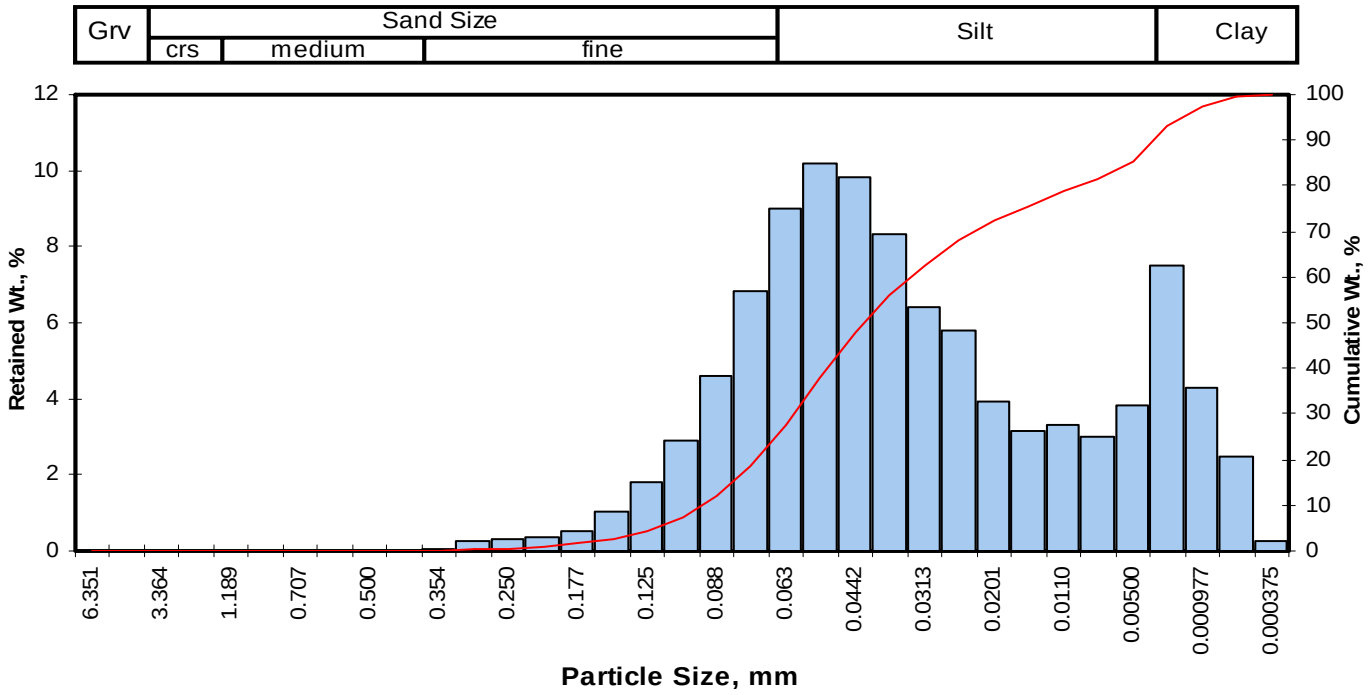
Measure	Trask	Inman	Folk-Ward
Median, phi	1.29	1.29	1.29
Median, in.	0.0161	0.0161	0.0161
Median, mm	0.408	0.408	0.408
Mean, phi	1.14	1.13	1.18
Mean, in.	0.0179	0.0180	0.0173
Mean, mm	0.454	0.457	0.440
Sorting	1.451	0.795	0.915
Skewness	1.039	-0.204	-0.248
Kurtosis	0.188	1.148	1.303
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.69
Coarse Sand	10	3.89
Medium Sand	40	43.64
Fine Sand	200	50.82
Silt/Clay	<200	0.97
	Total	100

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/28.5-30.5'/050927
Project No:	15-03095.14-006	**Depth, ft:**	29.1



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.06	0.05	0.06
0.0117	0.297	1.75	50	0.26	0.26	0.32
0.0098	0.250	2.00	60	0.32	0.32	0.64
0.0083	0.210	2.25	70	0.36	0.36	1.00
0.0070	0.177	2.50	80	0.54	0.54	1.54
0.0059	0.149	2.75	100	1.06	1.06	2.60
0.0049	0.125	3.00	120	1.80	1.80	4.40
0.0041	0.105	3.25	140	2.90	2.90	7.30
0.0035	0.088	3.50	170	4.58	4.58	11.88
0.0029	0.074	3.75	200	6.84	6.84	18.72
0.0025	0.063	4.00	230	8.98	8.98	27.69
0.0021	0.053	4.25	270	10.20	10.20	37.89
0.00174	0.0442	4.50	325	9.84	9.84	47.73
0.00146	0.0372	4.75	400	8.32	8.32	56.05
0.00123	0.0313	5.00	450	6.40	6.40	62.45
0.000986	0.0250	5.32	500	5.82	5.82	68.27
0.000790	0.0201	5.64	635	3.95	3.95	72.22
0.000615	0.0156	6.00		3.15	3.15	75.36
0.000435	0.0110	6.50		3.31	3.31	78.67
0.000308	0.00781	7.00		2.99	2.99	81.66
0.000197	0.00500	7.65		3.84	3.84	85.50
0.000077	0.00195	9.00		7.49	7.49	92.99
0.000038	0.000977	10.00		4.28	4.28	97.27
0.000019	0.000488	11.00		2.47	2.47	99.74
0.000015	0.000375	11.38		0.26	0.26	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.05	0.0047	0.121
10	3.40	0.0037	0.095
16	3.65	0.0031	0.080
25	3.92	0.0026	0.066
40	4.30	0.0020	0.051
50	4.57	0.0017	0.042
60	4.90	0.0013	0.033
75	5.96	0.0006	0.016
84	7.39	0.0002	0.006
90	8.46	0.0001	0.003
95	9.47	0.0001	0.001

Measure	Trask	Inman	Folk-Ward
Median, phi	4.57	4.57	4.57
Median, in.	0.0017	0.0017	0.0017
Median, mm	0.042	0.042	0.042
Mean, phi	4.61	5.52	5.20
Mean, in.	0.0016	0.0009	0.0011
Mean, mm	0.041	0.022	0.027
Sorting	2.023	1.871	1.908
Skewness	0.772	0.510	0.519
Kurtosis	0.270	0.715	1.294
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

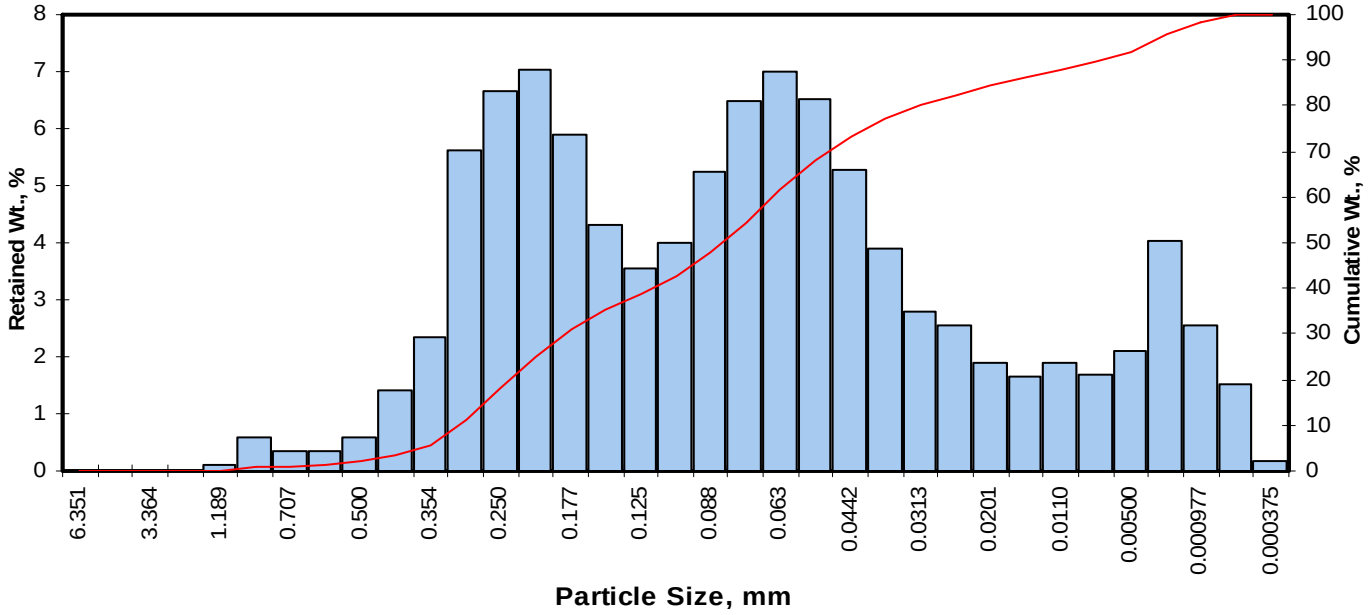
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	18.71
Silt	>0.005 mm	66.79
Clay	<0.005 mm	14.50
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/30.5-32.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	30.8

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.11	0.11	0.11
0.0331	0.841	0.25	20	0.57	0.57	0.68
0.0278	0.707	0.50	25	0.33	0.33	1.01
0.0234	0.595	0.75	30	0.35	0.35	1.36
0.0197	0.500	1.00	35	0.60	0.60	1.96
0.0166	0.420	1.25	40	1.40	1.40	3.36
0.0139	0.354	1.50	45	2.33	2.33	5.69
0.0117	0.297	1.75	50	5.63	5.63	11.32
0.0098	0.250	2.00	60	6.65	6.65	17.97
0.0083	0.210	2.25	70	7.04	7.04	25.01
0.0070	0.177	2.50	80	5.89	5.89	30.90
0.0059	0.149	2.75	100	4.31	4.31	35.21
0.0049	0.125	3.00	120	3.54	3.54	38.75
0.0041	0.105	3.25	140	4.01	4.01	42.76
0.0035	0.088	3.50	170	5.25	5.25	48.01
0.0029	0.074	3.75	200	6.50	6.50	54.51
0.0025	0.063	4.00	230	7.00	7.00	61.51
0.0021	0.053	4.25	270	6.52	6.52	68.03
0.00174	0.0442	4.50	325	5.27	5.27	73.30
0.00146	0.0372	4.75	400	3.89	3.89	77.19
0.00123	0.0313	5.00	450	2.78	2.78	79.97
0.000986	0.0250	5.32	500	2.55	2.55	82.52
0.000790	0.0201	5.64	635	1.90	1.90	84.42
0.000615	0.0156	6.00		1.66	1.66	86.08
0.000435	0.0110	6.50		1.88	1.88	87.96
0.000308	0.00781	7.00		1.69	1.69	89.65
0.000197	0.00500	7.65		2.09	2.09	91.74
0.000077	0.00195	9.00		4.04	4.04	95.78
0.000038	0.000977	10.00		2.54	2.54	98.32
0.000019	0.000488	11.00		1.52	1.52	99.84
0.000015	0.000375	11.38		0.16	0.16	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.43	0.0147	0.372
10	1.69	0.0122	0.310
16	1.93	0.0104	0.263
25	2.25	0.0083	0.210
40	3.08	0.0047	0.118
50	3.58	0.0033	0.084
60	3.95	0.0026	0.065
75	4.61	0.0016	0.041
84	5.57	0.0008	0.021
90	7.11	0.0003	0.007
95	8.74	0.0001	0.002

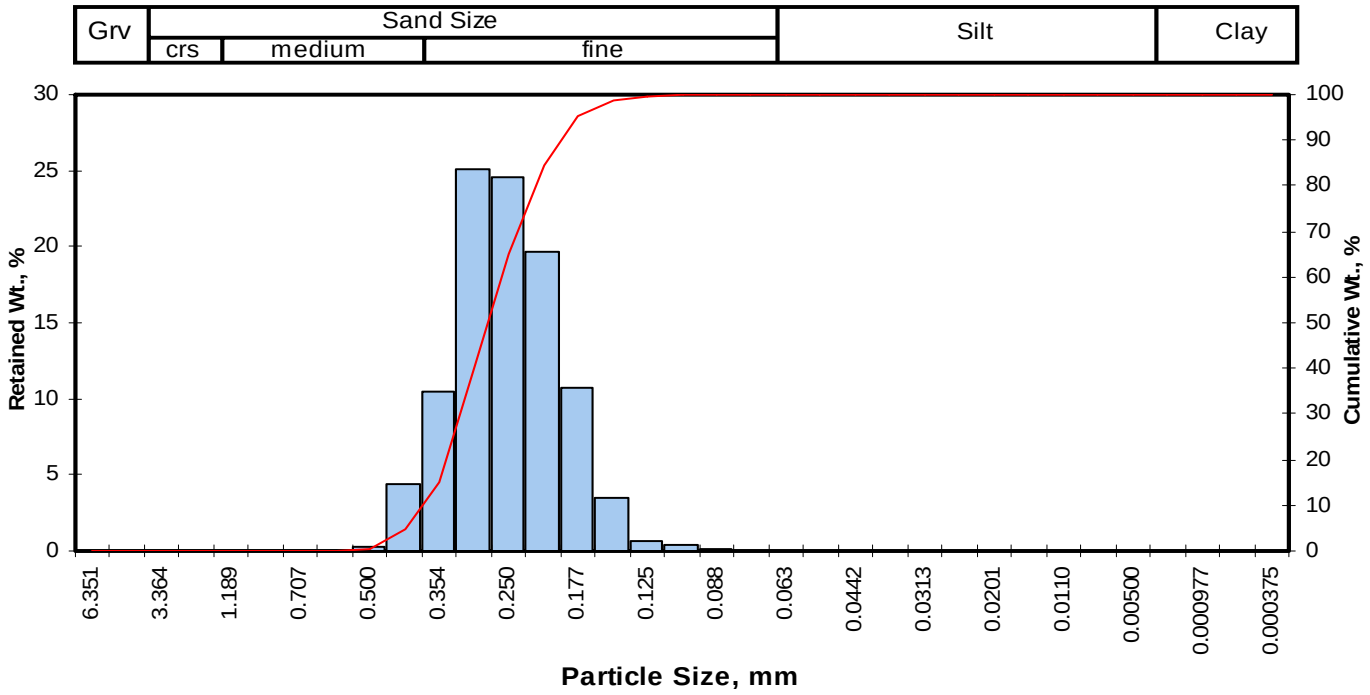
Measure	Trask	Inman	Folk-Ward
Median, phi	3.58	3.58	3.58
Median, in.	0.0033	0.0033	0.0033
Median, mm	0.084	0.084	0.084
Mean, phi	2.99	3.75	3.69
Mean, in.	0.0049	0.0029	0.0030
Mean, mm	0.126	0.074	0.077
Sorting	2.265	1.822	2.019
Skewness	1.107	0.094	0.253
Kurtosis	0.280	1.007	1.270
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	3.36
Fine Sand	200	51.15
Silt	>0.005 mm	37.23
Clay	<0.005 mm	8.26
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/34.5-36.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	33.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.28	0.28	0.28
0.0166	0.420	1.25	40	4.46	4.46	4.74
0.0139	0.354	1.50	45	10.50	10.49	15.23
0.0117	0.297	1.75	50	25.10	25.08	40.32
0.0098	0.250	2.00	60	24.60	24.59	64.90
0.0083	0.210	2.25	70	19.70	19.69	84.59
0.0070	0.177	2.50	80	10.80	10.79	95.38
0.0059	0.149	2.75	100	3.45	3.45	98.83
0.0049	0.125	3.00	120	0.67	0.67	99.50
0.0041	0.105	3.25	140	0.40	0.40	99.90
0.0035	0.088	3.50	170	0.10	0.10	100.00
0.0029	0.074	3.75	200	0.00	0.00	100.00
0.0025	0.063	4.00	230	0.00	0.00	100.00
0.0021	0.053	4.25	270	0.00	0.00	100.00
0.00174	0.0442	4.50	325	0.00	0.00	100.00
0.00146	0.0372	4.75	400	0.00	0.00	100.00
0.00123	0.0313	5.00	450	0.00	0.00	100.00
0.000986	0.0250	5.32	500	0.00	0.00	100.00
0.000790	0.0201	5.64	635	0.00	0.00	100.00
0.000615	0.0156	6.00		0.00	0.00	100.00
0.000435	0.0110	6.50		0.00	0.00	100.00
0.000308	0.00781	7.00		0.00	0.00	100.00
0.000197	0.00500	7.65		0.00	0.00	100.00
0.000077	0.00195	9.00		0.00	0.00	100.00
0.000038	0.000977	10.00		0.00	0.00	100.00
0.000019	0.000488	11.00		0.00	0.00	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.26	0.0165	0.419
10	1.38	0.0152	0.385
16	1.51	0.0138	0.352
25	1.60	0.0130	0.330
40	1.75	0.0117	0.298
50	1.85	0.0109	0.278
60	1.95	0.0102	0.259
75	2.13	0.0090	0.229
84	2.24	0.0083	0.211
90	2.38	0.0076	0.193
95	2.49	0.0070	0.178

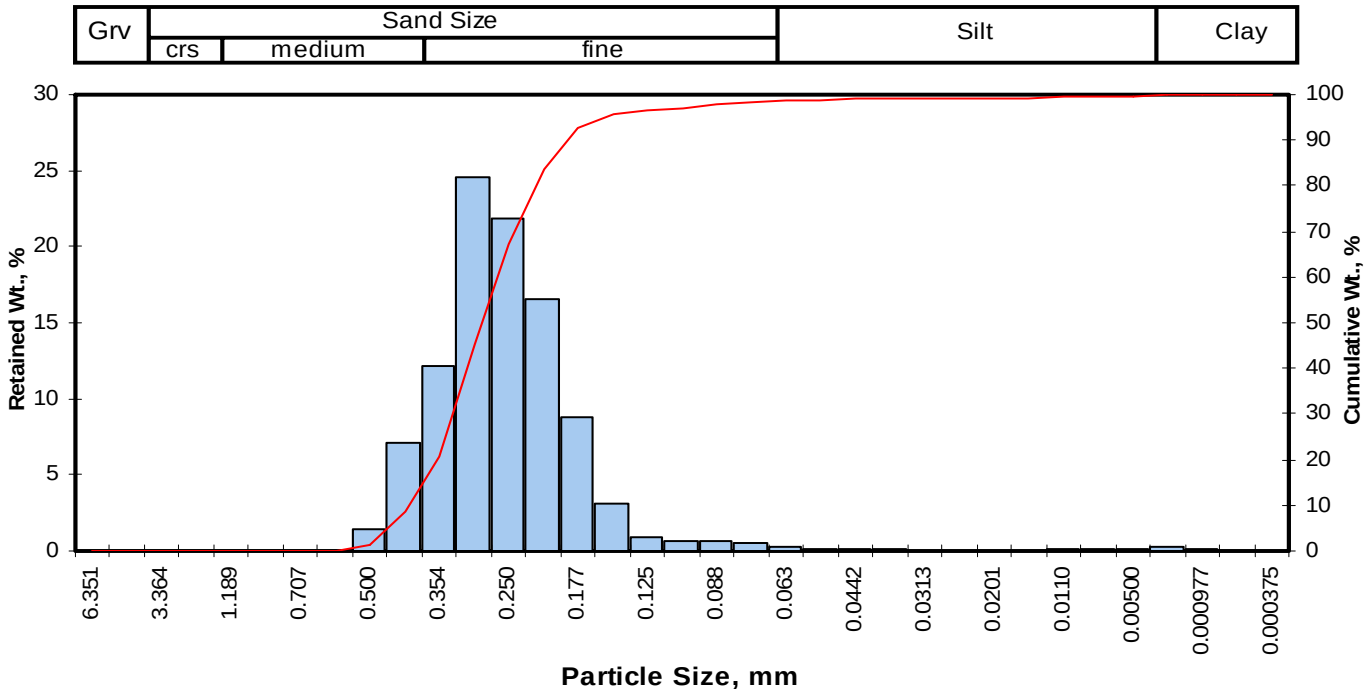
Measure	Trask	Inman	Folk-Ward
Median, phi	1.85	1.85	1.85
Median, in.	0.0109	0.0109	0.0109
Median, mm	0.278	0.278	0.278
Mean, phi	1.84	1.88	1.87
Mean, in.	0.0110	0.0107	0.0108
Mean, mm	0.280	0.273	0.274
Sorting	1.202	0.367	0.371
Skewness	0.990	0.072	0.057
Kurtosis	0.264	0.680	0.953
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	4.74
Fine Sand	200	95.26
Silt	>0.005 mm	0.00
Clay	<0.005 mm	0.00
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-4/36.5-38.5'/052927
Project No:	15-03095.14-006	**Depth, ft:**	37.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.02	0.02	0.02
0.0197	0.500	1.00	35	1.43	1.43	1.45
0.0166	0.420	1.25	40	7.14	7.14	8.59
0.0139	0.354	1.50	45	12.20	12.21	20.80
0.0117	0.297	1.75	50	24.60	24.62	45.42
0.0098	0.250	2.00	60	21.80	21.81	67.23
0.0083	0.210	2.25	70	16.50	16.51	83.74
0.0070	0.177	2.50	80	8.81	8.82	92.56
0.0059	0.149	2.75	100	3.08	3.08	95.64
0.0049	0.125	3.00	120	0.91	0.91	96.55
0.0041	0.105	3.25	140	0.62	0.62	97.17
0.0035	0.088	3.50	170	0.70	0.70	97.87
0.0029	0.074	3.75	200	0.56	0.56	98.43
0.0025	0.063	4.00	230	0.32	0.32	98.75
0.0021	0.053	4.25	270	0.16	0.16	98.91
0.00174	0.0442	4.50	325	0.09	0.09	99.00
0.00146	0.0372	4.75	400	0.08	0.08	99.08
0.00123	0.0313	5.00	450	0.06	0.06	99.14
0.000986	0.0250	5.32	500	0.06	0.06	99.20
0.000790	0.0201	5.64	635	0.05	0.05	99.25
0.000615	0.0156	6.00		0.05	0.05	99.30
0.000435	0.0110	6.50		0.09	0.09	99.38
0.000308	0.00781	7.00		0.10	0.10	99.48
0.000197	0.00500	7.65		0.14	0.14	99.62
0.000077	0.00195	9.00		0.27	0.27	99.89
0.000038	0.000977	10.00		0.10	0.10	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**99.90**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.12	0.0181	0.459
10	1.28	0.0162	0.412
16	1.40	0.0149	0.378
25	1.54	0.0135	0.343
40	1.69	0.0122	0.309
50	1.80	0.0113	0.287
60	1.92	0.0104	0.265
75	2.12	0.0091	0.230
84	2.26	0.0082	0.209
90	2.43	0.0073	0.186
95	2.70	0.0061	0.154

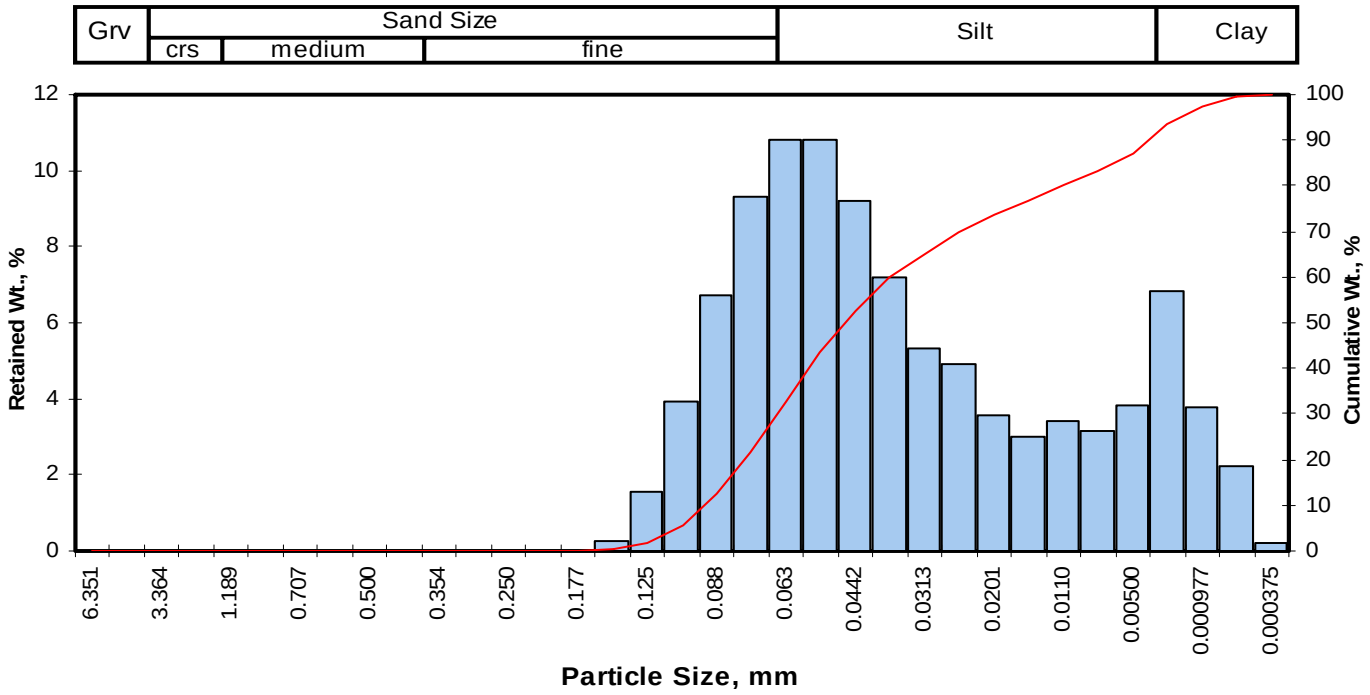
Measure	Trask	Inman	Folk-Ward
Median, phi	1.80	1.80	1.80
Median, in.	0.0113	0.0113	0.0113
Median, mm	0.287	0.287	0.287
Mean, phi	1.80	1.83	1.82
Mean, in.	0.0113	0.0111	0.0111
Mean, mm	0.287	0.281	0.283
Sorting	1.221	0.428	0.452
Skewness	0.981	0.063	0.101
Kurtosis	0.249	0.839	1.122
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	8.59
Fine Sand	200	89.84
Silt	>0.005 mm	1.19
Clay	<0.005 mm	0.38
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/20-22'/050920
Project No:	15-03095.14-006	**Depth, ft:**	20.5



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.01	0.01	0.01
0.0059	0.149	2.75	100	0.25	0.25	0.26
0.0049	0.125	3.00	120	1.53	1.53	1.79
0.0041	0.105	3.25	140	3.92	3.92	5.71
0.0035	0.088	3.50	170	6.73	6.73	12.44
0.0029	0.074	3.75	200	9.31	9.31	21.75
0.0025	0.063	4.00	230	10.80	10.80	32.55
0.0021	0.053	4.25	270	10.80	10.80	43.35
0.00174	0.0442	4.50	325	9.23	9.23	52.58
0.00146	0.0372	4.75	400	7.17	7.17	59.75
0.00123	0.0313	5.00	450	5.31	5.31	65.06
0.000986	0.0250	5.32	500	4.92	4.92	69.98
0.000790	0.0201	5.64	635	3.55	3.55	73.53
0.000615	0.0156	6.00		3.02	3.02	76.55
0.000435	0.0110	6.50		3.42	3.42	79.97
0.000308	0.00781	7.00		3.13	3.13	83.10
0.000197	0.00500	7.65		3.83	3.83	86.93
0.000077	0.00195	9.00		6.82	6.82	93.75
0.000038	0.000977	10.00		3.78	3.78	97.53
0.000019	0.000488	11.00		2.24	2.24	99.77
0.000015	0.000375	11.38		0.23	0.23	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.21	0.0043	0.108
10	3.41	0.0037	0.094
16	3.60	0.0033	0.083
25	3.83	0.0028	0.071
40	4.17	0.0022	0.055
50	4.43	0.0018	0.046
60	4.76	0.0015	0.037
75	5.82	0.0007	0.018
84	7.15	0.0003	0.007
90	8.26	0.0001	0.003
95	9.33	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	4.43	4.43	4.43
Median, in.	0.0018	0.0018	0.0018
Median, mm	0.046	0.046	0.046
Mean, phi	4.50	5.37	5.06
Mean, in.	0.0017	0.0009	0.0012
Mean, mm	0.044	0.024	0.030
Sorting	1.993	1.778	1.817
Skewness	0.763	0.531	0.565
Kurtosis	0.291	0.723	1.262

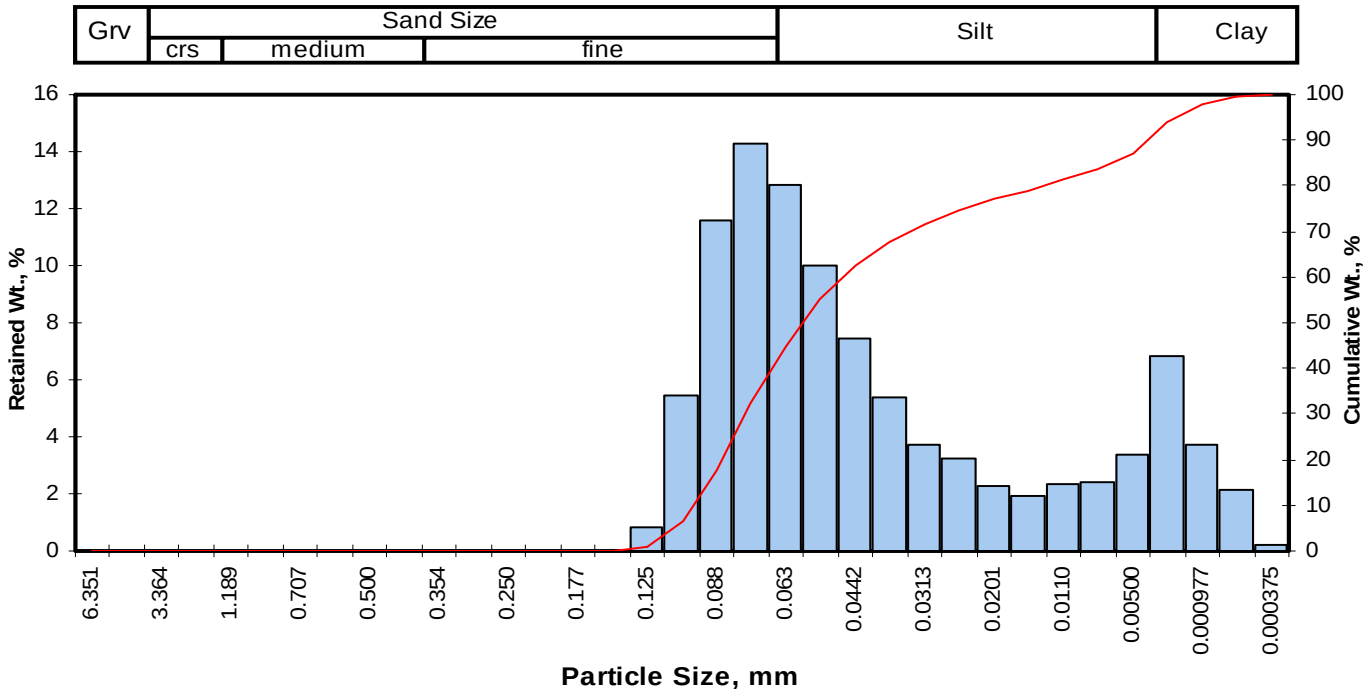
Grain Size Description (ASTM-USCS Scale)	Silt (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	21.75
Silt	>0.005 mm	65.18
Clay	<0.005 mm	13.07
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/22-24'/050920
Project No:	15-03095.14-006	**Depth, ft:**	23.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.00	0.00	0.00
0.0117	0.297	1.75	50	0.00	0.00	0.00
0.0098	0.250	2.00	60	0.00	0.00	0.00
0.0083	0.210	2.25	70	0.00	0.00	0.00
0.0070	0.177	2.50	80	0.00	0.00	0.00
0.0059	0.149	2.75	100	0.01	0.01	0.01
0.0049	0.125	3.00	120	0.84	0.84	0.85
0.0041	0.105	3.25	140	5.42	5.42	6.27
0.0035	0.088	3.50	170	11.60	11.60	17.87
0.0029	0.074	3.75	200	14.30	14.30	32.18
0.0025	0.063	4.00	230	12.80	12.80	44.98
0.0021	0.053	4.25	270	9.99	9.99	54.97
0.00174	0.0442	4.50	325	7.43	7.43	62.40
0.00146	0.0372	4.75	400	5.39	5.39	67.79
0.00123	0.0313	5.00	450	3.74	3.74	71.53
0.000986	0.0250	5.32	500	3.24	3.24	74.78
0.000790	0.0201	5.64	635	2.28	2.28	77.06
0.000615	0.0156	6.00		1.96	1.96	79.02
0.000435	0.0110	6.50		2.32	2.32	81.34
0.000308	0.00781	7.00		2.40	2.40	83.74
0.000197	0.00500	7.65		3.37	3.37	87.11
0.000077	0.00195	9.00		6.80	6.80	93.91
0.000038	0.000977	10.00		3.75	3.75	97.66
0.000019	0.000488	11.00		2.12	2.12	99.78
0.000015	0.000375	11.38		0.22	0.22	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	3.19	0.0043	0.109
10	3.33	0.0039	0.099
16	3.46	0.0036	0.091
25	3.62	0.0032	0.081
40	3.90	0.0026	0.067
50	4.13	0.0023	0.057
60	4.42	0.0018	0.047
75	5.35	0.0010	0.024
84	7.05	0.0003	0.008
90	8.22	0.0001	0.003
95	9.29	0.0001	0.002

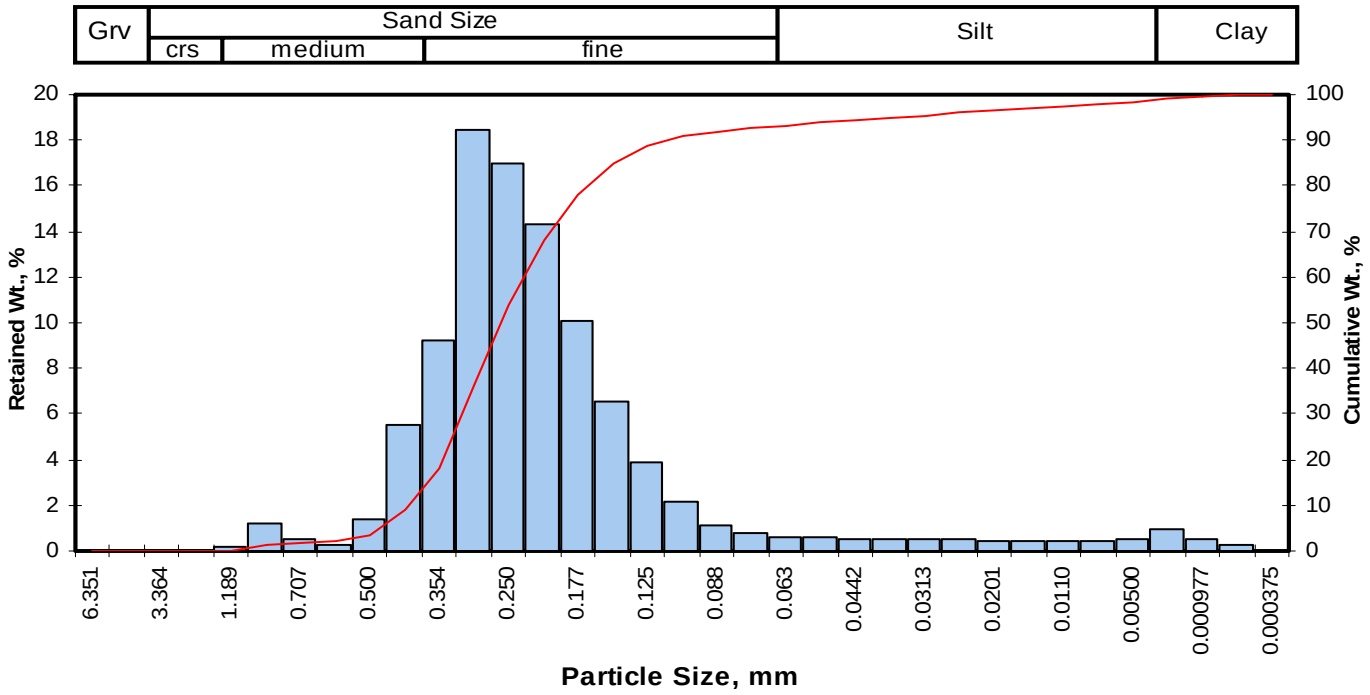
Measure	Trask	Inman	Folk-Ward
Median, phi	4.13	4.13	4.13
Median, in.	0.0023	0.0023	0.0023
Median, mm	0.057	0.057	0.057
Mean, phi	4.24	5.25	4.88
Mean, in.	0.0021	0.0010	0.0013
Mean, mm	0.053	0.026	0.034
Sorting	1.819	1.795	1.822
Skewness	0.778	0.629	0.661
Kurtosis	0.295	0.699	1.448
Grain Size Description (ASTM-USCS Scale)		Silt (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	32.18
Silt	>0.005 mm	54.93
Clay	<0.005 mm	12.89
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/31-32.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	31.3



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.15	0.15	0.15
0.0331	0.841	0.25	20	1.24	1.24	1.39
0.0278	0.707	0.50	25	0.55	0.55	1.94
0.0234	0.595	0.75	30	0.28	0.28	2.22
0.0197	0.500	1.00	35	1.39	1.39	3.61
0.0166	0.420	1.25	40	5.51	5.51	9.12
0.0139	0.354	1.50	45	9.20	9.20	18.31
0.0117	0.297	1.75	50	18.50	18.49	36.80
0.0098	0.250	2.00	60	17.00	16.99	53.79
0.0083	0.210	2.25	70	14.30	14.29	68.09
0.0070	0.177	2.50	80	10.10	10.10	78.18
0.0059	0.149	2.75	100	6.53	6.53	84.71
0.0049	0.125	3.00	120	3.92	3.92	88.63
0.0041	0.105	3.25	140	2.15	2.15	90.78
0.0035	0.088	3.50	170	1.15	1.15	91.93
0.0029	0.074	3.75	200	0.74	0.74	92.67
0.0025	0.063	4.00	230	0.62	0.62	93.29
0.0021	0.053	4.25	270	0.57	0.57	93.86
0.00174	0.0442	4.50	325	0.56	0.56	94.42
0.00146	0.0372	4.75	400	0.54	0.54	94.96
0.00123	0.0313	5.00	450	0.49	0.49	95.45
0.000986	0.0250	5.32	500	0.52	0.52	95.96
0.000790	0.0201	5.64	635	0.43	0.43	96.39
0.000615	0.0156	6.00		0.40	0.40	96.79
0.000435	0.0110	6.50		0.46	0.46	97.25
0.000308	0.00781	7.00		0.41	0.41	97.66
0.000197	0.00500	7.65		0.49	0.49	98.15
0.000077	0.00195	9.00		0.96	0.96	99.11
0.000038	0.000977	10.00		0.56	0.56	99.67
0.000019	0.000488	11.00		0.30	0.30	99.97
0.000015	0.000375	11.38		0.03	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.06	0.0188	0.479
10	1.27	0.0163	0.414
16	1.44	0.0145	0.369
25	1.59	0.0131	0.332
40	1.80	0.0113	0.288
50	1.94	0.0102	0.260
60	2.11	0.0091	0.232
75	2.42	0.0074	0.187
84	2.72	0.0060	0.151
90	3.16	0.0044	0.112
95	4.77	0.0014	0.037

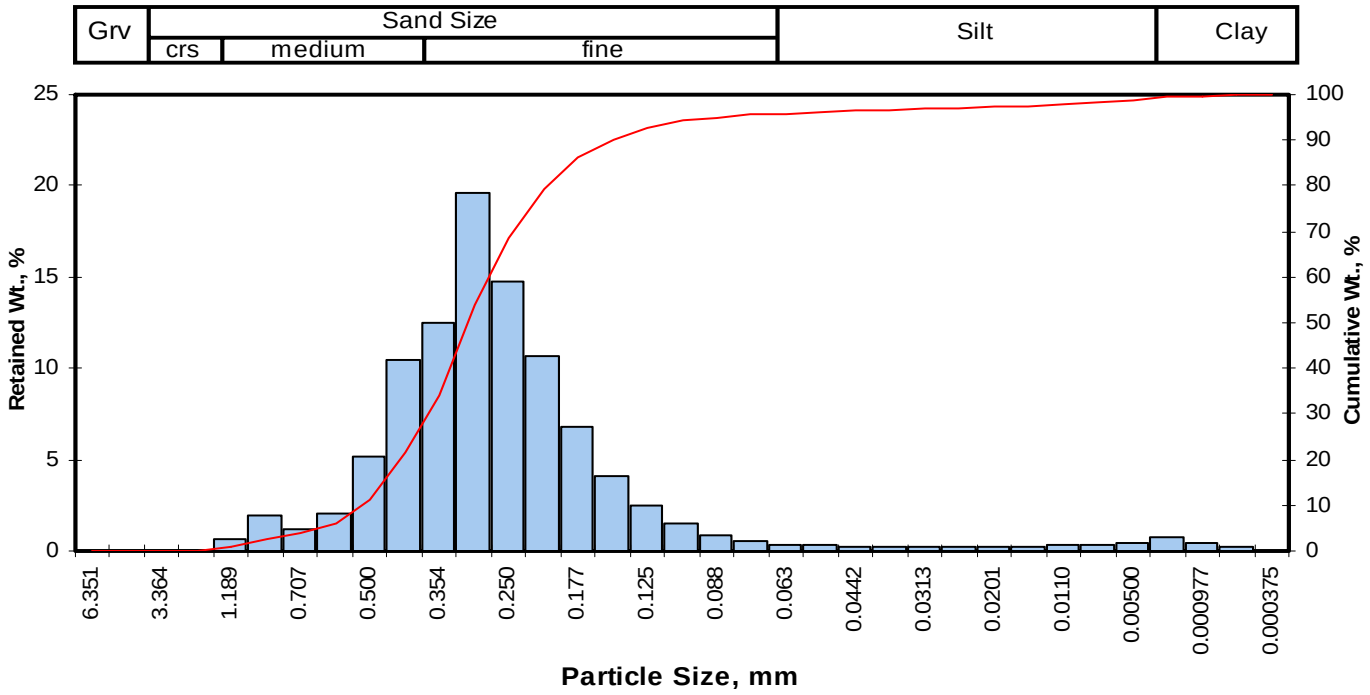
Measure	Trask	Inman	Folk-Ward
Median, phi	1.94	1.94	1.94
Median, in.	0.0102	0.0102	0.0102
Median, mm	0.260	0.260	0.260
Mean, phi	1.95	2.08	2.03
Mean, in.	0.0102	0.0093	0.0096
Mean, mm	0.259	0.237	0.244
Sorting	1.334	0.643	0.883
Skewness	0.958	0.211	0.368
Kurtosis	0.241	1.885	1.830
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	9.12
Fine Sand	200	83.55
Silt	>0.005 mm	5.49
Clay	<0.005 mm	1.85
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/32.5-34.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	33.0



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.65	0.65	0.65
0.0331	0.841	0.25	20	1.98	1.98	2.63
0.0278	0.707	0.50	25	1.23	1.23	3.86
0.0234	0.595	0.75	30	2.08	2.08	5.94
0.0197	0.500	1.00	35	5.22	5.22	11.16
0.0166	0.420	1.25	40	10.50	10.50	21.66
0.0139	0.354	1.50	45	12.50	12.50	34.17
0.0117	0.297	1.75	50	19.60	19.60	53.77
0.0098	0.250	2.00	60	14.80	14.80	68.57
0.0083	0.210	2.25	70	10.70	10.70	79.28
0.0070	0.177	2.50	80	6.77	6.77	86.05
0.0059	0.149	2.75	100	4.13	4.13	90.18
0.0049	0.125	3.00	120	2.53	2.53	92.71
0.0041	0.105	3.25	140	1.49	1.49	94.20
0.0035	0.088	3.50	170	0.83	0.83	95.03
0.0029	0.074	3.75	200	0.50	0.50	95.53
0.0025	0.063	4.00	230	0.37	0.37	95.90
0.0021	0.053	4.25	270	0.30	0.30	96.20
0.00174	0.0442	4.50	325	0.25	0.25	96.45
0.00146	0.0372	4.75	400	0.22	0.22	96.67
0.00123	0.0313	5.00	450	0.20	0.20	96.87
0.000986	0.0250	5.32	500	0.23	0.23	97.10
0.000790	0.0201	5.64	635	0.22	0.22	97.32
0.000615	0.0156	6.00		0.24	0.24	97.56
0.000435	0.0110	6.50		0.32	0.32	97.88
0.000308	0.00781	7.00		0.31	0.31	98.19
0.000197	0.00500	7.65		0.40	0.40	98.59
0.000077	0.00195	9.00		0.77	0.77	99.36
0.000038	0.000977	10.00		0.41	0.41	99.77
0.000019	0.000488	11.00		0.21	0.21	99.98
0.000015	0.000375	11.38		0.02	0.02	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.64	0.0253	0.643
10	0.94	0.0205	0.520
16	1.12	0.0182	0.462
25	1.32	0.0158	0.401
40	1.57	0.0132	0.336
50	1.70	0.0121	0.307
60	1.86	0.0109	0.276
75	2.15	0.0089	0.225
84	2.42	0.0073	0.186
90	2.74	0.0059	0.150
95	3.49	0.0035	0.089

Measure	Trask	Inman	Folk-Ward
Median, phi	1.70	1.70	1.70
Median, in.	0.0121	0.0121	0.0121
Median, mm	0.307	0.307	0.307
Mean, phi	1.67	1.77	1.75
Mean, in.	0.0123	0.0115	0.0117
Mean, mm	0.313	0.293	0.298
Sorting	1.335	0.655	0.760
Skewness	0.978	0.104	0.179
Kurtosis	0.238	1.180	1.404

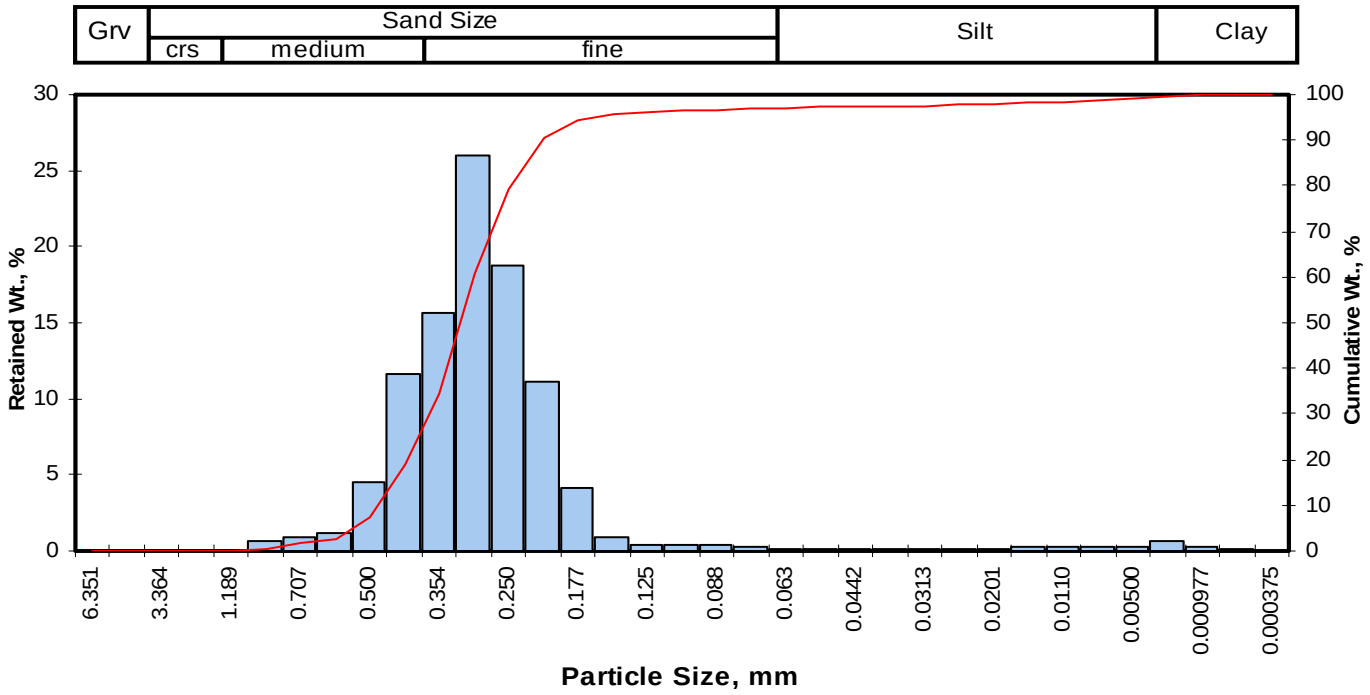
Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	21.66
Fine Sand	200	73.87
Silt	>0.005 mm	3.06
Clay	<0.005 mm	1.41
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/34.5-36.5'/050921
Project No:	15-03095.14-006	**Depth, ft:**	35.25



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.61	0.61	0.61
0.0278	0.707	0.50	25	0.92	0.92	1.53
0.0234	0.595	0.75	30	1.20	1.20	2.73
0.0197	0.500	1.00	35	4.48	4.48	7.21
0.0166	0.420	1.25	40	11.70	11.70	18.90
0.0139	0.354	1.50	45	15.70	15.69	34.60
0.0117	0.297	1.75	50	26.00	25.99	60.59
0.0098	0.250	2.00	60	18.70	18.69	79.28
0.0083	0.210	2.25	70	11.10	11.10	90.38
0.0070	0.177	2.50	80	4.20	4.20	94.58
0.0059	0.149	2.75	100	0.96	0.96	95.54
0.0049	0.125	3.00	120	0.41	0.41	95.95
0.0041	0.105	3.25	140	0.45	0.45	96.40
0.0035	0.088	3.50	170	0.35	0.35	96.75
0.0029	0.074	3.75	200	0.20	0.20	96.95
0.0025	0.063	4.00	230	0.14	0.14	97.09
0.0021	0.053	4.25	270	0.13	0.13	97.22
0.00174	0.0442	4.50	325	0.13	0.13	97.34
0.00146	0.0372	4.75	400	0.13	0.13	97.47
0.00123	0.0313	5.00	450	0.13	0.13	97.60
0.000986	0.0250	5.32	500	0.17	0.17	97.77
0.000790	0.0201	5.64	635	0.18	0.18	97.95
0.000615	0.0156	6.00		0.20	0.20	98.15
0.000435	0.0110	6.50		0.27	0.27	98.42
0.000308	0.00781	7.00		0.26	0.26	98.68
0.000197	0.00500	7.65		0.32	0.32	99.00
0.000077	0.00195	9.00		0.61	0.61	99.61
0.000038	0.000977	10.00		0.30	0.30	99.91
0.000019	0.000488	11.00		0.09	0.09	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.88	0.0214	0.545
10	1.06	0.0189	0.480
16	1.19	0.0173	0.439
25	1.35	0.0155	0.393
40	1.55	0.0134	0.341
50	1.65	0.0126	0.319
60	1.74	0.0118	0.298
75	1.94	0.0102	0.260
84	2.11	0.0091	0.232
90	2.24	0.0083	0.211
95	2.61	0.0064	0.164

Measure	Trask	Inman	Folk-Ward
Median, phi	1.65	1.65	1.65
Median, in.	0.0126	0.0126	0.0126
Median, mm	0.319	0.319	0.319
Mean, phi	1.61	1.65	1.65
Mean, in.	0.0129	0.0126	0.0126
Mean, mm	0.327	0.319	0.319
Sorting	1.229	0.459	0.492
Skewness	1.002	-0.002	0.054
Kurtosis	0.248	0.888	1.193
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

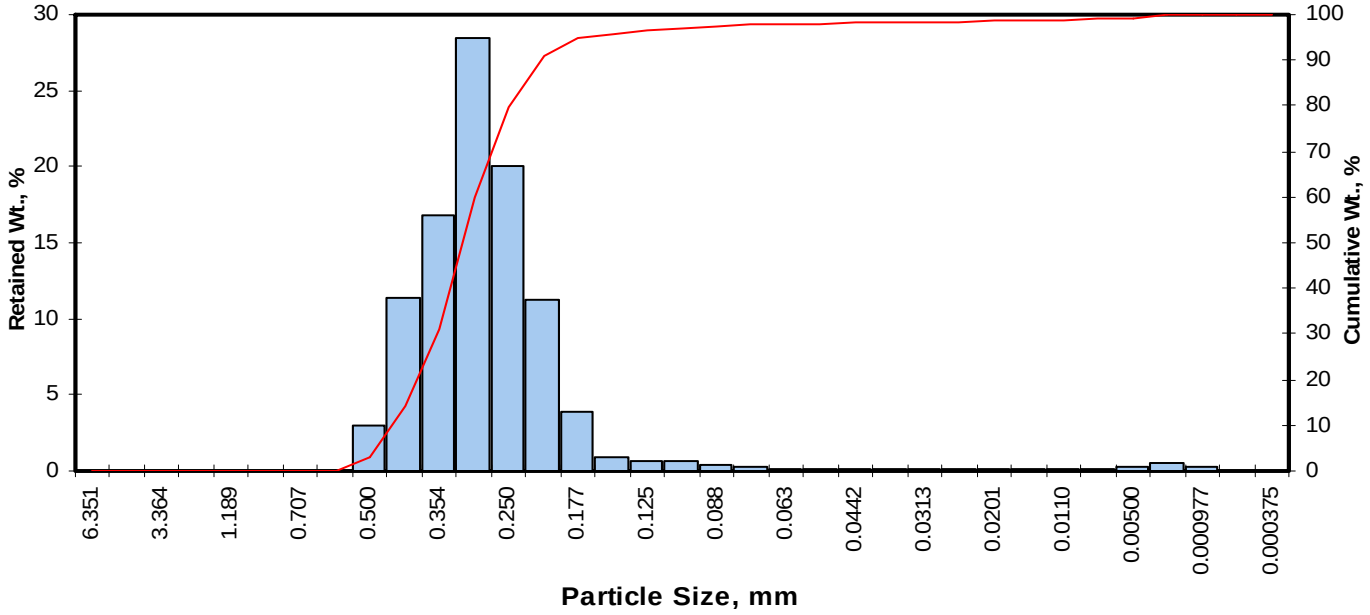
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	18.90
Fine Sand	200	78.04
Silt	>0.005 mm	2.06
Clay	<0.005 mm	1.00
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/36.5-38.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	36.8

Grv	Sand Size			Silt	Clay
	crs	medium	fine		



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.06	0.06	0.06
0.0197	0.500	1.00	35	2.93	2.93	2.99
0.0166	0.420	1.25	40	11.40	11.40	14.39
0.0139	0.354	1.50	45	16.80	16.81	31.20
0.0117	0.297	1.75	50	28.50	28.51	59.71
0.0098	0.250	2.00	60	20.00	20.01	79.72
0.0083	0.210	2.25	70	11.20	11.20	90.92
0.0070	0.177	2.50	80	3.94	3.94	94.86
0.0059	0.149	2.75	100	0.94	0.94	95.81
0.0049	0.125	3.00	120	0.59	0.59	96.40
0.0041	0.105	3.25	140	0.64	0.64	97.04
0.0035	0.088	3.50	170	0.44	0.44	97.48
0.0029	0.074	3.75	200	0.22	0.22	97.70
0.0025	0.063	4.00	230	0.15	0.15	97.85
0.0021	0.053	4.25	270	0.13	0.13	97.98
0.00174	0.0442	4.50	325	0.12	0.12	98.10
0.00146	0.0372	4.75	400	0.10	0.10	98.20
0.00123	0.0313	5.00	450	0.09	0.09	98.29
0.000986	0.0250	5.32	500	0.12	0.12	98.41
0.000790	0.0201	5.64	635	0.13	0.13	98.54
0.000615	0.0156	6.00		0.14	0.14	98.68
0.000435	0.0110	6.50		0.18	0.18	98.86
0.000308	0.00781	7.00		0.18	0.18	99.04
0.000197	0.00500	7.65		0.25	0.25	99.29
0.000077	0.00195	9.00		0.50	0.50	99.79
0.000038	0.000977	10.00		0.20	0.20	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	1.04	0.0191	0.485
10	1.15	0.0177	0.449
16	1.27	0.0163	0.414
25	1.41	0.0148	0.377
40	1.58	0.0132	0.335
50	1.66	0.0124	0.315
60	1.75	0.0117	0.297
75	1.94	0.0103	0.260
84	2.10	0.0092	0.234
90	2.23	0.0084	0.213
95	2.54	0.0068	0.172

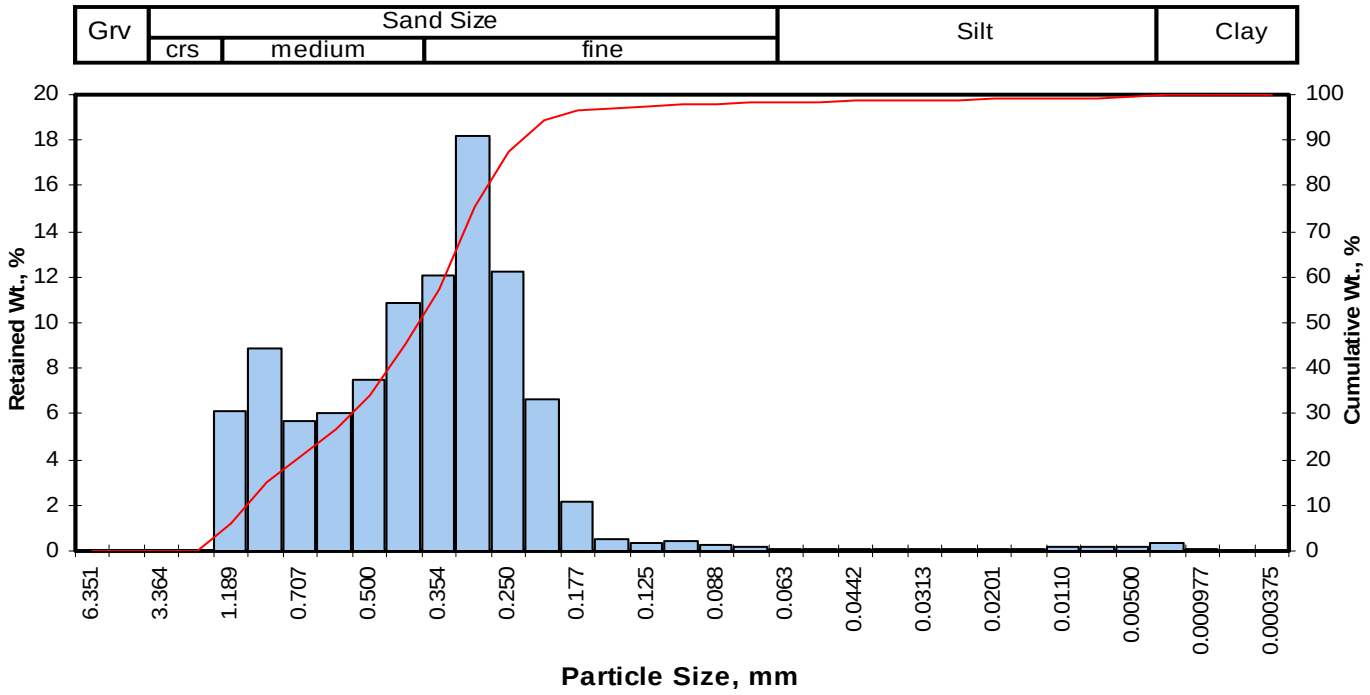
Measure	Trask	Inman	Folk-Ward
Median, phi	1.66	1.66	1.66
Median, in.	0.0124	0.0124	0.0124
Median, mm	0.315	0.315	0.315
Mean, phi	1.65	1.68	1.68
Mean, in.	0.0125	0.0122	0.0123
Mean, mm	0.319	0.311	0.312
Sorting	1.203	0.411	0.431
Skewness	0.993	0.048	0.108
Kurtosis	0.247	0.816	1.147
Grain Size Description (ASTM-USCS Scale)		Fine sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	14.39
Fine Sand	200	83.30
Silt	>0.005 mm	1.59
Clay	<0.005 mm	0.71
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/38.5-40.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	38.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	6.10	6.10	6.10
0.0331	0.841	0.25	20	8.92	8.92	15.02
0.0278	0.707	0.50	25	5.69	5.69	20.72
0.0234	0.595	0.75	30	6.07	6.07	26.79
0.0197	0.500	1.00	35	7.47	7.47	34.26
0.0166	0.420	1.25	40	10.90	10.90	45.16
0.0139	0.354	1.50	45	12.10	12.10	57.26
0.0117	0.297	1.75	50	18.20	18.20	75.47
0.0098	0.250	2.00	60	12.20	12.20	87.67
0.0083	0.210	2.25	70	6.63	6.63	94.30
0.0070	0.177	2.50	80	2.19	2.19	96.49
0.0059	0.149	2.75	100	0.49	0.49	96.98
0.0049	0.125	3.00	120	0.35	0.35	97.33
0.0041	0.105	3.25	140	0.39	0.39	97.72
0.0035	0.088	3.50	170	0.27	0.27	97.99
0.0029	0.074	3.75	200	0.16	0.16	98.15
0.0025	0.063	4.00	230	0.12	0.12	98.27
0.0021	0.053	4.25	270	0.12	0.12	98.39
0.00174	0.0442	4.50	325	0.11	0.11	98.50
0.00146	0.0372	4.75	400	0.10	0.10	98.60
0.00123	0.0313	5.00	450	0.10	0.10	98.70
0.000986	0.0250	5.32	500	0.12	0.12	98.82
0.000790	0.0201	5.64	635	0.11	0.11	98.93
0.000615	0.0156	6.00		0.12	0.12	99.05
0.000435	0.0110	6.50		0.15	0.15	99.20
0.000308	0.00781	7.00		0.15	0.15	99.35
0.000197	0.00500	7.65		0.19	0.19	99.54
0.000077	0.00195	9.00		0.33	0.33	99.87
0.000038	0.000977	10.00		0.12	0.12	99.99
0.000019	0.000488	11.00		0.01	0.01	100.00
0.000015	0.000375	11.38		0.00	0.00	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.39	0.0514	1.306
10	-0.03	0.0402	1.022
16	0.29	0.0321	0.816
25	0.68	0.0246	0.626
40	1.13	0.0180	0.456
50	1.35	0.0154	0.392
60	1.54	0.0136	0.344
75	1.74	0.0118	0.299
84	1.92	0.0104	0.263
90	2.09	0.0093	0.235
95	2.33	0.0078	0.199

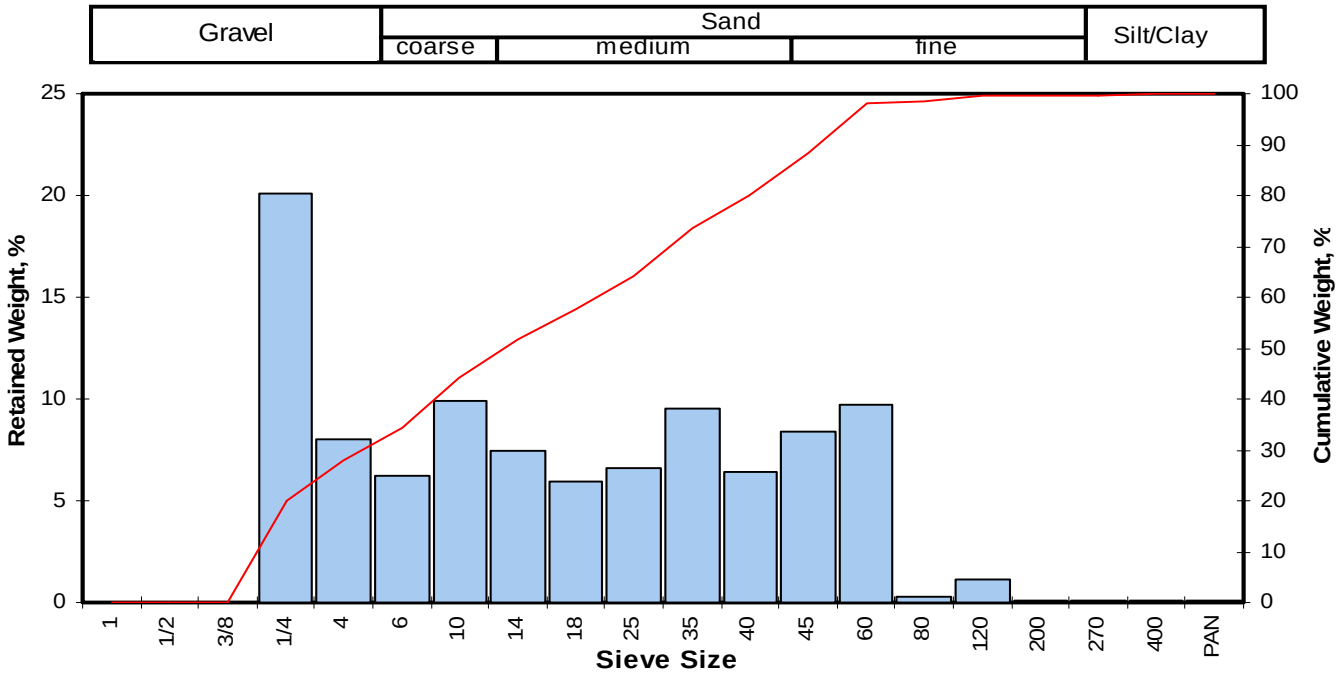
Measure	Trask	Inman	Folk-Ward
Median, phi	1.35	1.35	1.35
Median, in.	0.0154	0.0154	0.0154
Median, mm	0.392	0.392	0.392
Mean, phi	1.11	1.11	1.19
Mean, in.	0.0182	0.0183	0.0173
Mean, mm	0.462	0.464	0.439
Sorting	1.448	0.816	0.819
Skewness	1.102	-0.296	-0.287
Kurtosis	0.208	0.664	1.043
Grain Size Description (ASTM-USCS Scale)		Medium sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	45.16
Fine Sand	200	52.99
Silt	>0.005 mm	1.39
Clay	<0.005 mm	0.46
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D422M

Client:	Hartford Working Group C/O Clayton Group Services	**PTS File No:**	35565
Project:	Harford Working Group	**Sample ID:**	HCSB-5/40.5-42.5'/050922
Project No:	15-03095.14-006	**Depth, ft:**	40.9



Opening Inches	Opening Millimeters	Phi of Screen	U.S. Sieve No.	Sample Weight grams	Incremental Weight, percent	Cumulative Weight, percent
0.9844	25.002	-4.64	1	0.00	0.00	0.00
0.4922	12.501	-3.64	1/2	0.00	0.00	0.00
0.3740	9.500	-3.25	3/8	0.00	0.00	0.00
0.2500	6.351	-2.67	1/4	5.73	20.13	20.13
0.1873	4.757	-2.25	4	2.27	7.98	28.11
0.1324	3.364	-1.75	6	1.76	6.18	34.29
0.0787	2.000	-1.00	10	2.83	9.94	44.24
0.0557	1.414	-0.50	14	2.11	7.41	51.65
0.0394	1.000	0.00	18	1.68	5.90	57.55
0.0278	0.707	0.50	25	1.87	6.57	64.13
0.0197	0.500	1.00	35	2.71	9.52	73.65
0.0166	0.420	1.25	40	1.83	6.43	80.08
0.0139	0.354	1.50	45	2.38	8.36	88.44
0.0098	0.250	2.00	60	2.76	9.70	98.14
0.0070	0.177	2.50	80	0.08	0.28	98.42
0.0049	0.125	3.00	120	0.31	1.09	99.51
0.0029	0.074	3.75	200	0.04	0.14	99.65
0.0021	0.053	4.25	270	0.04	0.14	99.79
0.0015	0.037	4.75	400	0.02	0.07	99.86
			PAN	0.04	0.14	100.00
TOTALS				28.46	100.00	100.00

Cumulative Weight Percent greater than			
Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-3.10	0.3384	8.596
10	-2.96	0.3062	7.778
16	-2.79	0.2716	6.898
25	-2.41	0.2096	5.324
40	-1.32	0.0983	2.496
50	-0.61	0.0601	1.528
60	0.19	0.0346	0.879
75	1.05	0.0190	0.482
84	1.37	0.0153	0.388
90	1.58	0.0132	0.334
95	1.84	0.0110	0.280

Measure	Trask	Inman	Folk-Ward
Median, phi	-0.61	-0.61	-0.61
Median, in.	0.0601	0.0601	0.0601
Median, mm	1.528	1.528	1.528
Mean, phi	-1.54	-0.71	-0.68
Mean, in.	0.1143	0.0644	0.0629
Mean, mm	2.903	1.635	1.599
Sorting	3.323	2.077	1.787
Skewness	1.049	-0.047	-0.028
Kurtosis	0.325	0.190	0.584
Grain Size Description (ASTM-USCS Scale)		Coarse sand (based on Mean from Trask)	

Description	Retained on Sieve #	Weight Percent
Gravel	4	28.11
Coarse Sand	10	16.13
Medium Sand	40	35.84
Fine Sand	200	19.57
Silt/Clay	<200	0.35
	Total	100