Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Conceptual Corrective Action Design Report (CCAD)

Petroleum Remediation Program
Guidance Document 7-02

Doc Type: Corrective Action Design

Instructions: Complete this report to recommend a final corrective action. See Guidance Document 7-01 *Corrective Action Design and Implementation* for more information and requirements. Complete Section 1 if this report is not included as an appendix to Guidance Documents 4-06 *Investigation Report Form* or 4-08 *Monitoring Report*. Complete Section 2 for every corrective action. Complete Section 3 for a simple corrective action or Section 4 for a complex corrective action. Complete Section 5 if a remediation system or other in situ remediation technology is proposed. Do not revise or delete any text or questions from this report form. Items may be added if they are needed to support the corrective action design. If an item is not applicable, provide a brief explanation.

MPCA Leak ID: **8001** Report date: March 26, 2014

Responsible Party Information

Name: **Mille Lacs Oil Company** Phone: 763-689-2220

Mailing address: **102 Main Street**

City: **Cambridge** State: MN Zip code: 55088

Alternate contact (if any) for responsible party: **Ms. Maria Olson** Phone: 763-689-2220

Leak Site Information

Leak Site name: **Former Union 76** Phone: NA

Leak Site address: **329 East First Avenue**

City: **Cambridge** MN Zip code: **55088** County: **Isanti**

Consultant (or other) Information

By signing this document, I/we acknowledge that we are submitting this document on behalf of and as agents of the responsible person or volunteer for this leak Site. I/we acknowledge that if information in this document is inaccurate or incomplete, it will delay the completion of remediation and may harm the environment and may result in a reduction in Petrofund reimbursement. In addition, I/we acknowledge on behalf of the responsible person or volunteer for this leak Site that if this document is determined to contain a false material statement, representation, or certification, or if it omits material information, the responsible person or volunteer may be found to be in violation of Minn. Stat. § 115.075 (2007) or Minn. R. 7000.0300 (Duty of Candor), and that the responsible person or volunteer may be liable for civil penalties.

Company name: **Wenck Associates, Inc.**

Mailing address: **1800 Pioneer Creek Center, P.O. Box 249**

City: **Maple Plain** State: **MN** Zip code: **55359**

Project manager name: **Adam Zobel** Phone: 763-479-5145

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Report Author(s)

Print name: **Adam Zobel** Title: **Environmental Project Manager**

Signature:  Date: March 26, 2014

Print name: Title:

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Signature: _____ Date: _____

Report Reviewer(s)

Print name: **Aaron Benker** Title: **Principal**

Signature:  Date: March 26, 2014

Print name: _____ Title: _____

Signature: _____ Date: _____

Name of field technician(s): Katie Miller, Adam Zobel

Section 1: Site Conceptual Model Update

Include updated cumulative tables and figures from Guidance Document 4-06 *Investigation Report Form* in Appendix A. Include documentation of additional Site investigation, Site monitoring, and interim corrective actions in Appendix B.

1. Describe any additional Site investigation, Site monitoring, and/or interim corrective actions completed since the last submitted report.

As requested by the MPCA, quarterly monitoring well sampling for MWs 1, 3, 6, 7, 9, and 10 was completed on February 3, 2014. Wenck also completed light non-aqueous phase liquid (LNAPL) measurements on MWs 3, 7, and 9 in February and March. MPCA had also requested MW-8 be sampled and that the LNAPL be measured; however, MW-8 was buried under a snow collection pile and not accessible. Monitoring wells and historical sampling locations are shown on the attached Figures.

2. Discuss the results of the additional Site investigation, Site monitoring, and/or interim corrective actions.

LNAPL was measured at a thickness of 0.52 feet in MW-3 and at a thickness of 0.02 feet in MW-7 during the February 3, 2014 sampling event. LNAPL was not observed in the other wells sampled. MW-3 and MW-7 were not sampled for groundwater analysis because product was present in the wells. LNAPL was measured at 0.053 feet in MW-3 and at 0.03 feet in MW-7 for the March 6, 2014 sampling event.

Groundwater from MW-1, MW-6, MW-9, and MW-10 were sampled for analysis of diesel range organics (DRO), gasoline range organics (GRO), and benzene, toluene, ethylbenzene and xylenes (BTEX) on February 3, 2014.

DRO was detected at 1,300 ug/L in MW-1, 7,200 ug/L in MW-6, 6,200 ug/L in MW-9 and 7,500 ug/L in MW-10.

GRO was detected at 1,430 ug/L in MW-1, 20,700 ug/L in MW-6, 35,600 ug/L in MW-9, and 12,000 ug/L in MW-10.

Benzene was detected at 2.2 ug/L in MW-1, 2,480 ug/L in MW-6, 3,950 ug/L in MW-9, and 249 ug/L in MW-10.

Toluene was detected at 1,710 ug/L in MW-6, 6,030 ug/L in MW-9, and 313 ug/L in MW-10. Toluene was not detected above laboratory reporting limits in MW-1.

Ethylbenzene was detected at 20.8 ug/L in MW-1, 1,260 ug/L in MW-6, 1,460 ug/L in MW-9, and 364 ug/L in MW-10.

Total xylene was detected at 434 ug/L in MW-1, 4,170 ug/L in MW-6, 6,860 ug/L in MW-9, and 1,730 ug/L in MW-10.

The cumulative data collected from this sampling event is recorded on the updated **Tables** attached in **Appendix A**. The laboratory analytical report is attached in **Appendix B**.

3. Provide an updated and comprehensive Site conceptual model.

LNAPL
The laser induced fluorescence (LIF) boring data from the Focused Investigation Report shows that LNAPL from the release is defined. Data collected from the first quarterly event in February 2014 showed 0.52 feet of LNAPL in MW-3 and 0.02 feet of LNAPL in MW-7. The results of product level checks on March 6, 2014 revealed 0.53 feet in MW-3 and 0.03 feet in MW-7. The LIF investigation data shows a defined source area of LNAPL that is present at and above the groundwater extending down-gradient of the release area. The LNAPL at the Site appears relatively stable, however, it is contributing to down-gradient impacts to the dissolved phase. This CCAD outlines conceptual remediation options to address the LNAPL with the goal to reduce LNAPL to residual.

Groundwater
Groundwater monitoring/investigation has been ongoing at the Site since June 1995. Concentrations of DRO, GRO, and BTEX are relatively stable compared to historical data. Groundwater analytical data is shown on **Table 11**. Sites within the

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Vapor Intrusion
As noted in the Focused Investigation Report, in 2011, Liesch collected three soil vapor samples to assess off-Site vapor intrusion potential. Vapor Pt #1 was collected west of the Midwest Environmental Consulting building located at 145 Second Avenue SE, Vapor Pt #2 was collected on the east side of the American Legion Building located at 200 Second Avenue SE, and Vapor Pt #3 was collected to the east of the Cambridge Bible Bookstore located at 220 Main Street South. All vapor samples were collected at depths between 6-8 feet below grade. No detectable concentrations of VOCs were identified in Vapor Pt #1 and Vapor Pt #3. Vapor Pt #2 (American Legion) defected several VOCs. Benzene was detected at 84.6 ug/m³ and 1,3-butadine was detected at 64.5 ug/m³. MPCA guidance document 4-01a provides guidelines for comparing soil gas sample results to 10x the ISV and 100 times the ISV. Benzene detected at 86.6 ug/m³ in Vapor Pt #2 exceeds 10 times the Residential ISV of 45 ug/m³, but does not exceed the 10 times the Industrial ISV of 130 ug/m³ or 100 times the Residential ISV 450 ug/m³. While 1,3 Butadiene exceeds 100 times the Residential ISV of 30 ug/m³, 1,3-Butadine is not anticipated to be a compound associated with the identified release. The results are shown on **Table 20**.

In 2011, Liesch collected a subslab vapor sample beneath the basement of the American Legion building to assess the potential for vapor migration into the building. Petroleum VOCs were not detected above 10x the MPCA Residential or Industrial ISVs in sample Subslab-1 (**Table 20**) . Based on results of the Subslab-1 sample beneath the American Legion building, there does not appear to be a vapor pathway between the deeper (18-20') dissolved phase petroleum impacts and the American Legions subslab.

In addition, an updated utility vapor survey was conducted in 2011 and no petroleum vapors were identified. Elevated concentrations of VOC exist in the groundwater. However, the low concentrations of VOCs detected in the soil vapor data and the age of the release suggest that much of the volatilization associated with the release has occurred. Thus, the vapor intrusion risk is low and no vapor mitigation is recommended at this time.

Surface Water Receptors
Figure 1 shows the Rum River located west of the Site. The Rum River is located approximately 4,000 feet down-gradient of the release and 3,500 feet from the leading edge of the contamination plume. Based on the distance to the Rum River, the risk to this receptor is considered low.

4. **Provide recommendations for additional Site investigation, Site monitoring, and/or interim corrective actions to be completed prior to corrective action design (CAD) approval, including their purpose and schedule for completion.**

The MPCA Petroleum Remediation Program has requested the following monitoring schedule for the Site for 2014:

- Sample monitoring wells according to the following schedule:
  - Quarterly: MWs 1, 3, 6, 7, 8, 9, and 10
  - Semi-annually: MW-11
  - Annually: MW-6A
- Monitoring wells will be sampled for diesel range organics (DRO), gasoline range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX). A duplicate sample will also be collected for DRO, GRO, and BTEX once per sampling round.
- Measure water levels in all wells on a quarterly basis.
- Measure LNAPL in wells 3, 7, 8, and 9 on a monthly basis.
- Prepare an Annual Monitoring Report (MPCA Guidance Document 4-08) upon completion of four quarterly sampling events.

Section 2: Final Corrective Action Approach

1. **If the CCAD is different than requested by the Minnesota Pollution Control Agency, identify the differences and explain why.**

Wenck has not identified any differences in this CCAD compared to what was requested by the MPCA.

2. **Discuss the reason for the proposed corrective action.**
This CCAD report has been prepared based on a request by the MCPA to reduce the amount of residual LNAPL at the Site.

3. **Discuss the corrective action goal relative to the corrective action reason.**
The goal of the corrective action is to target the LNAPL zone and reduce the residual LNAPL. The reduction/cleanup of the LNAPL would reduce residual contributions to the dissolved phase and thereby stabilize/reduce the DRO, GRO, and VOC concentrations in groundwater at the Site.

4. **List the two or three most feasible corrective action alternatives. Discuss each alternative's capabilities and limitations relative to achieving the corrective action goal, including major design assumptions, relative life-cycle costs, and implementation time frames. Provide life-cycle cost estimates for each alternative in Appendix C.**

Chemical Injection
Wenck contacted multiple chemical injection contractors to determine if chemical injection would be applicable for the site. Based on the size of the plume and the target zone area, the cost of the injection product alone was determined to be cost prohibitive as a remediation technique.

Excavation
One potential corrective action approach would be to excavate contaminated soil down to the groundwater table at the source area. Based on the LIF data collected in the Focused Investigation Report, a significant amount of impacts exists at the Site in the source area from 0-15 feet below grade. This impacted area is likely contributing to the LNAPL and the dissolved phase. The source area impacts detected in the LIF investigation are shown on the attached **Figure 4**. The total estimated soil volume to complete a source area excavation within a 40 foot radius of MW-3 to a depth of 20 feet would be approximately 4,750 cubic yards or 6,650 tons. MW-3 would need to be sealed prior to the excavation. The extent of the excavation would be limited by the existing former Union 76 structure to the north, Buchannan Street to the West, and the railroad right-of-way to the east. The excavation would also need to be sloped at a 1½ to 1 ratio due to the sandy soil type. The soil would need to be disposed of at an MPCA approved facility. In addition, the hole would need to be backfilled and compacted with clean soils. Upon backfilling the excavation, a new well would need to be installed in place of MW-3. Post excavation monitoring of the wells would need to be completed for several years to determine the effectiveness of the cleanup. Additional corrective action would likely still be necessary since residual impacts would likely still exist in unexcavated areas, which would be accomplished through a venting/air sparge system. An access agreement would need to be obtained for the excavation work since Mille Lacs Oil does not own the site. A life cycle cost estimate is shown in **Appendix C**.

Dual Phase Soil Vapor Extraction (SVE)
This system would consist of SVE wells within and around the LNAPL plume area. The wells would be constructed with 2-inch diameter PVC. Wells would be installed with 5 foot screens intersecting within the top 2 feet of the water table. A smaller stinger drop-tube consisting of 1-inch diameter tubing would be placed at the LNAPL interface within the soil venting well. Vacuum would be applied to the well and the stinger. The applied vacuum creates a vapor and liquid-phase pressure gradient toward the vacuum wells. Both vapor and liquid would be recovered from the wells. This system would need to be pilot tested prior to a final design. One disadvantage to this system would be the potential need for water-treatment and discharge, which would add expense. Another disadvantage to this system is there is not a significant volume of LNAPL to recover with the stinger drop-tube. Monthly monitoring of the groundwater levels in the wells would be required to adjust the depth of the stinger tube. The shallow 0-15' soils at the source area would also be targeted with four shallow SVE wells. A life cycle cost estimate is shown in **Appendix C**.

Air Sparge (AS) and SVE
This system would consist of several deep and shallow SVE wells within and around the perimeter of the target zone. The shallow 0-15' soils at the source area would also be targeted with three (3) shallow SVE wells installed from 5-15'. Through the middle of the plume Wenck proposes twelve (12) deep SVE wells screened from 17-22 feet below grade. Five (5) medium vent wells screened from 12-17' would be installed around the perimeter of the target zone. Three air sparge wells would be installed through the target zone in the groundwater at a depth of 25-27 feet below grade. The system would begin operation as SVE only, and when initial vapor concentrations reach asymptotic levels, the air sparge wells would be engaged to volatilize additional VOCs for recovery. The wells would be incorporated into a manifold so that wells could be run in different configurations. The sandy soil conditions at the site are optimal for this type of system. The system will need to be pilot tested for design considerations and to determine the radius of influence of the SVE wells and sparge wells. A life cycle cost estimate is shown in **Appendix C**.

5. **Identify the selected corrective action alternative and discuss the rationale for selecting it, including discussion of the cost-effectiveness evaluation, if completed.**

Wenck has determined the most practical and efficient way to reduce the LNAPL to residual levels at the site is with an AS/SVE system. The system has the ability to be run solely as an SVE system for an extended period of time at the beginning of start-up. Additional recovery could then be completed by introducing the AS component.

6. **Discuss the measurable corrective action objectives that will be used to demonstrate progress towards achieving the corrective action goal and completing the corrective action.**

A combination of product level checks and monitoring/sampling of the existing monitoring well network and LIF drilling technology is proposed to demonstrate progress towards achieving the corrective action goal. The goal is to reduce the LNAPL detections to residual levels. A 30 foot grid of LIF borings would be drilled in and around the target zone to show progress towards the cleanup goal and/or obtain Site closure. A response of 10% by the LIF is proposed as an indicator of residual levels of LNAPL. Another goal will be to show no LNAPL in wells within the existing monitoring well network.

Section 3: Simple Corrective Action

1. Summarize and reference previously submitted data, analyses, and conclusions that support and form the basis for the proposed corrective action.

2. Discuss implementation of the proposed corrective action to the extent adequate to support CAD approval, including activities, methods and procedures, permits, and implementation reporting. Propose a schedule for completing the corrective action.

3. Identify any contaminated waste types (e.g., gases, liquids, solids) and respective volumes that may be generated by corrective action implementation. Discuss how these wastes will be measured, handled, treated, discharged, and/or disposed of. Contaminated soil removed for treatment should be estimated as in-place cubic yards and supported by providing scaled maps and calculations.

Section 4: Complex Corrective Action

1. **Identify the technical lead responsible for overseeing the design, implementation, and reporting of the corrective action.**
   Aaron Benker is the technical lead and principal for the project. Adam Zobel is the project manager and will be responsible for coordination, reporting and MPCA/client correspondence. Shane Waterman, P.G. and Matt Bowers, P.E. will also provide direct review of the pilot testing and system design.

2. **Identify and briefly discuss any focused investigation work that is recommended before a pilot test work plan or detailed corrective action design report can be completed. Propose a schedule for submitting Guidance Document 7-03 *Focused Investigation Work Plan*.**
   A Focused Investigation has already been completed for the Site. No additional Focused Investigation work is proposed at this time.

3. **If no focused investigation is recommended, propose a schedule for submitting Guidance Document 7-05 *Pilot Test Work Plan*, Guidance Document 7-07a *Remediation System Detailed Corrective Action Design Report (SDCAD)*, or Guidance Document 7-07b *Excavation Detailed Corrective Action Design Report (EDCAD)*.**

   With CCAD approval by April 15, 2014, Wenck proposes the following schedule:

   - Submit Pilot Test Work Plan – May 15, 2014
   - Complete Pilot Test – August 1, 2014
   - Submit Remediation System Detailed Corrective Action Design Report (SDCAD) – October 1, 2014
   - Install Remedial System – April 2015

Section 5: Remediation System Conceptual Design

Provide a Site map and, if necessary, cross sections showing the estimated horizontal and vertical extents of the target zone and the locations and screened intervals of proposed remediation and monitoring points in Section 6.

1. **Describe the targeted contaminant phase(s), chemicals of concern and their behavior, and target-zone geometry and geology.**
   The target zone is the LNAPL in soil above and on top of the groundwater table. **Figures 4, 5,** and **6** detail the target zone. The chemical of concern is gasoline including DRO, GRO, and BTEX compounds. The site geology consists of poorly graded sand and silty sand. The soil profile at the groundwater table consists of poorly graded sand. Groundwater is approximately 20 to 22 feet below grade. A confining clay layer is present at approximately 30 feet below grade across the Site.

   The mobility of the LNAPL is considered low based on monitoring well observations, LIF data, and the age of the release. However, the existing LNAPL is contributing to the dissolved phase down-gradient.

2. **Discuss the remediation strategy, including the relative timing and magnitude of subsurface physical, chemical, and biological processes that the proposed system will be designed to induce and control.**
   The system will likely run off of two blower/enclosures since the LNAPL plume extends across Buchanan Street. One manifold and enclosure is not likely possible because it would require trenching across South Buchanan Street and street utilities. Initially, the system will run as an SVE system with both shallow and deep wells connected to the manifolds, where vacuum and airflows will be monitored and regulated for each well individually to optimize cleanup performance. Once the concentrations of organic vapor recovery reach asymptotic levels, air sparge wells will be introduced to release additional VOCs for capture by the SVE system. The process of venting the target zone will reduce the LNAPL in soil and groundwater.

3. **Describe the location, construction, and screened interval of each proposed remediation and monitoring point in terms of the estimated capture zone or radius of influence.**
   The SVE and AS well locations, as well as the target zone are shown on the attached **Figure 6**. Wenck estimates an effective

   radius of influence of 20 feet from each SVE and AS well. This will be confirmed through pilot testing. Twelve (12) deep SVE wells will be screened from 17-22 feet so the screened interval intersects with the groundwater table and the LNAPL target zone. Five (5) medium depth SVE wells will be installed above the water table, screened from 12-17 feet. Three (3) shallow

wells will be installed at the source area and screened from 5-15'. The purpose of the shallow wells will be to control potential vapor migration, especially during the air sparge remediation stage. Three sparge wells will be constructed with one-inch PVC with a screen from 25-27 feet below grade within the groundwater table.

4. **Discuss the major below- and above-ground equipment (e.g., wells, pumps, compressors, treatment equipment) for the proposed system.**
   The SVE wells will be constructed with 2-inch schedule 40 PVC. The wells will run back to one of two enclosures. Since Buchannan Street is present within the target zone, it may not be possible to run piping under the road to a single enclosure unit. To estimate the highest cost scenario, Wenck is assuming there will be two enclosures needed. The wells will run back to manifolds. The manifold will be in-line with a condensation knock-out tank, blower and vapor discharge to possible treatment such as carbon. The need for and type of effluent treatment will be determined based on the pilot test and startup testing. Air sparge lines will be connected to an air compressor.

5. **Discuss the proposed system's process flow.**
   Once operational, the SVE will pull a vacuum on the SVE wells, creating a vapor pressure gradient to the wells. The soil vapor will be drawn back through the enclosure manifold to a water vapor knock-out tank. From the knock-out tank, the air will cycle through the blower and discharge. Discharge treatment by carbon may be added to the process if necessary.

   When air sparging is incorporated, pulses of compressed air will be introduced to the groundwater table, volatilizing additional hydrocarbons for recovery by the SVE system.

6. **Identify the waste streams that will be generated during system operation. Discuss how the wastes will be handled and disposed of. Discuss any waste disposal limitations and conditions such as permits, approvals, or compliance monitoring that the wastes may be subject to.**
   Operation and start up testing of the vapor effluent will be completed in accordance with MPCA guidance document Air Emission Controls Guidance Document 7-09a. No significant water discharge is anticipated with AS/SVE. The knock-out tank waste will need to be collected and disposed of periodically.

7. **Summarize the proposed system's operation strategy from startup to shutdown and any recommended post-shutdown monitoring. Integrate the corrective action objectives from Section 2, Item 6, including remediation endpoints and proposed time frames to achieve them.**
   The system will start operation as an SVE system. The air sparging will be introduced as necessary. The system will be optimized and pulsed at various intervals to maximize the removal of VOCs. Effluent samples will be collected from the system in accordance with MPCA Guidance document Air Emission Controls Guidance Document 7-09a. Operation monitoring will include testing the discharge effluent for VOCs, as well as individual SVE wells as necessary for optimizing the system. The reduction in VOCs from the target zone will reduce the LNAPL to residual levels over time. Existing monitoring wells will be checked for product monthly. When product is no longer detectable in the monitoring wells, a shut-down protocol will be implemented. Monitoring of the wells will continue for several months. For site closure, a LIF investigation will be completed to confirm the reduction of LNAPL. The system will remain in place until evaluation of the LIF data and existing monitoring wells shows cleanup levels to residual. The benchmark for residual impacts as determined by the LIF investigation will be a response of 10% throughout the existing impacted area. If residual criteria is not met, the system will start-up again, targeting areas in excess of residual.

8. **Briefly describe the operation monitoring plan, including the type of and frequency that data will be collected and how they will be evaluated to determine progress in achieving the corrective action objectives.**

   Operation monitoring will include testing the discharge effluent for VOCs, as well as individual SVE wells as necessary for optimizing the system. Product levels will be measured from existing monitoring wells on a monthly basis during system operation. When product is no longer detectable in the monitoring wells, a shut-down protocol will be implemented. Soil vapor sampling will also be completed outside the SVE well network pre and post startup to the west and south of the LNAPL plume.

9. **Describe the pilot test. Describe the types of data to be collected and the results needed to demonstrate technical and economic feasibility of the proposed technology relative to the remediation and operation strategies.**

   The pilot test will be completed using a series of one sparge well and four SVE wells. The pilot test will be completed in two stages. First stage will be testing the effectiveness of the SVE system. The pilot test data collection will collect data for vacuum, air flow, and radius of influence, which will be needed for sizing the blower(s). Pressure readings will be obtained from pilot holes to test for the radius of influence. A monometer will be used to measure the pressure gradient, vacuum and air flow. A series of pilot holes will be installed at varying distances from the wells will be used to measure pressure and influence. Summa canisters will be used to collect effluent samples for TO-15 VOC analysis to demonstrate that VOCs are being vented from the soil and groundwater and at what concentrations.

Section 6: Figures

Attach new figures specific to this report in order of discussion in the text and list below. All figures must include a north arrow, scale, and legend as applicable. Approximate scales are not acceptable. Figures required in Appendix A should not be included in this section.

☒ One or more Site maps showing (as applicable):

- Structures
- Boring and well locations (including any drinking water wells on Site)
- Suspected source(s) of light non-aqueous phase liquid (LNAPL)
- Locations and depths of on-Site buried utilities
- All past and present petroleum storage tanks, piping, dispensers, and transfer areas
- Horizontal extent of LNAPL
- Horizontal extent of the target zone
- Proposed remediation and monitoring points

Distinguish sequential elements of investigations by dates, symbols, etc. in the legend.

☒ Cross sections depicting target-zone geometry, geology, and hydrogeology and preferential flow routes and barriers to flow

Section 7: Tables

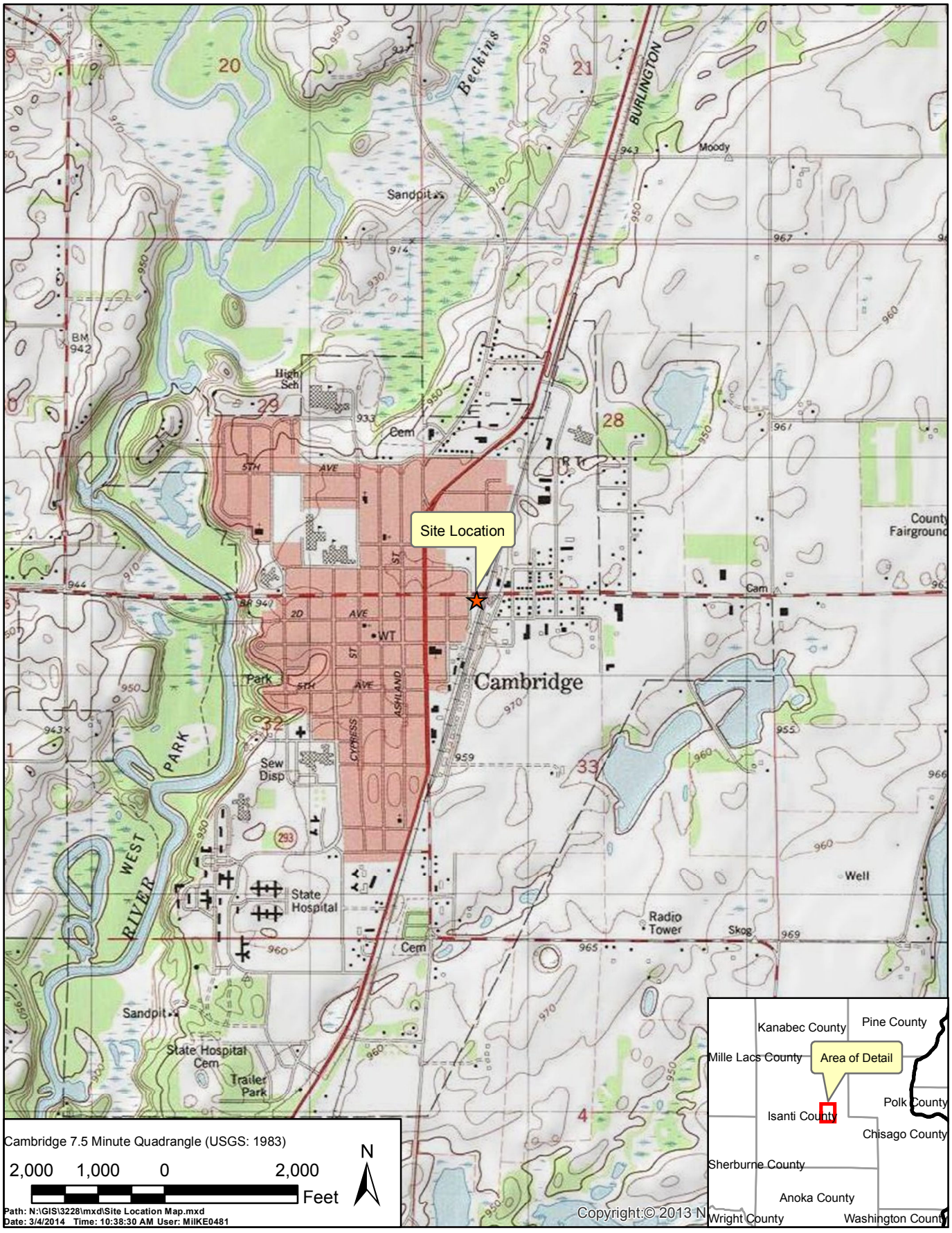
Attach new tables specific to this report in order of discussion in the text and list below. Tables required in Appendix A should not be included in this section.

Section 8: Appendices

Attach all required or applicable appendices in the following order. Indicate those appendices that are included in this report by marking the check box. All reproduced data must be legible. Attach additional appendices as needed and list below.

☒	*Appendix A*	Cumulative and updated tables and figures from Guidance Document 4-06 *Investigation Report Form.*
☒	*Appendix B*	Additional Site investigation, Site monitoring, and interim corrective action methods and procedures and associated documentation (boring logs, sampling information forms, laboratory analytical reports, etc.).
☒	*Appendix C*	Life-cycle cost estimates for each corrective action alternative.

Figures



MILLE LACS OIL COMPANY

Site Location Map

Engineers - Scientists
Business Professionals
www.wenck.com

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1800 Pioneer Creek Center
Maple Plain, MN 55359-0429
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FEB 2014

Figure 1

MILLE LACS OIL COMPANY

Site Detail Map

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Figure 2

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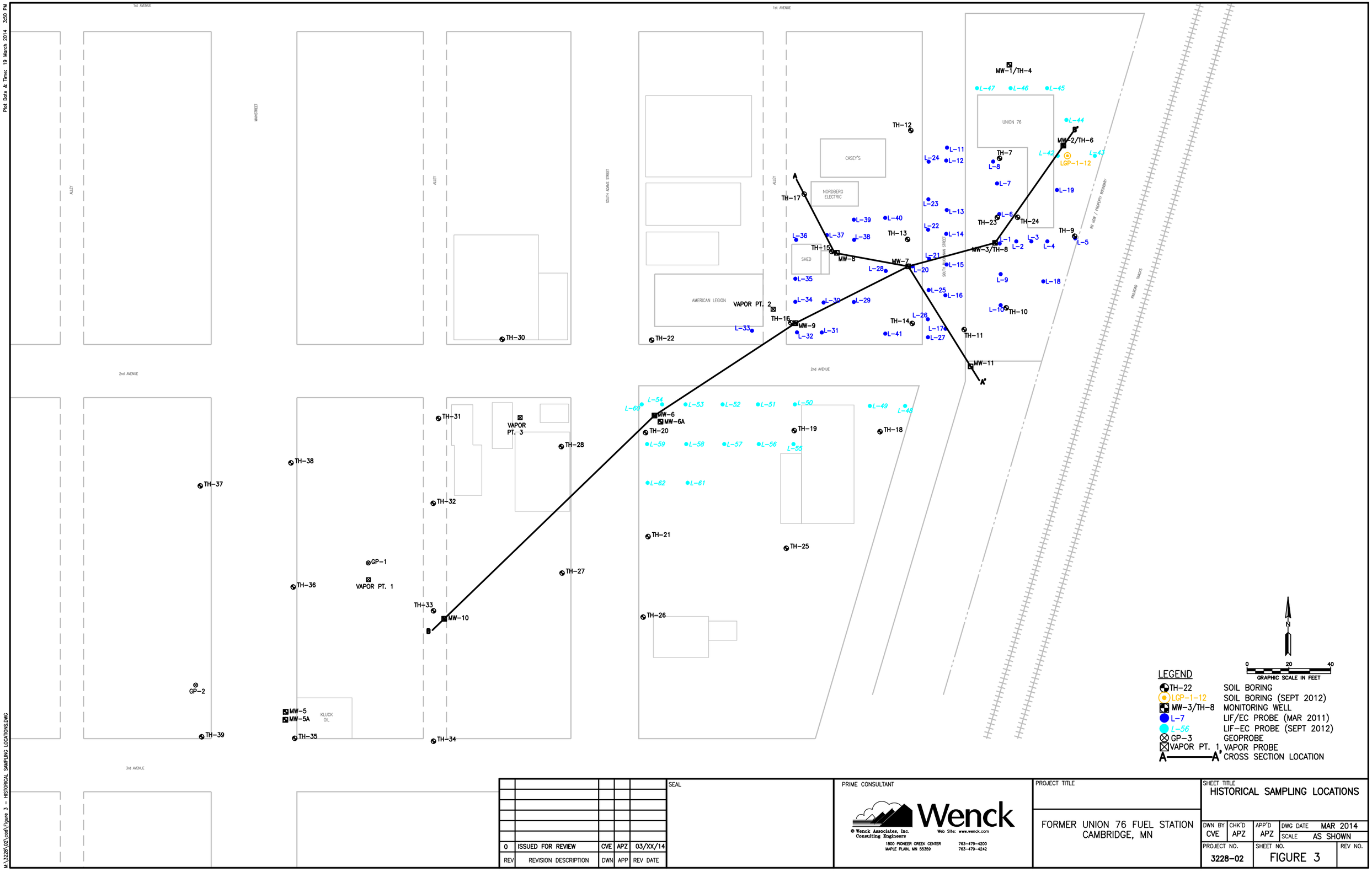

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR REVIEW	CVE	APZ	03/XX/14

SEAL

PRIME CONSULTANT

Wenck

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Web Site: www.wenck.com

PROJECT TITLE

FORMER UNION 76 FUEL STATION
CAMBRIDGE, MN

SHEET TITLE
HISTORICAL SAMPLING LOCATIONS

DWN BY	CHK'D	APP'D	DWG DATE
CVE	APZ	APZ	MAR 2014

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
3228-02	FIGURE 3	

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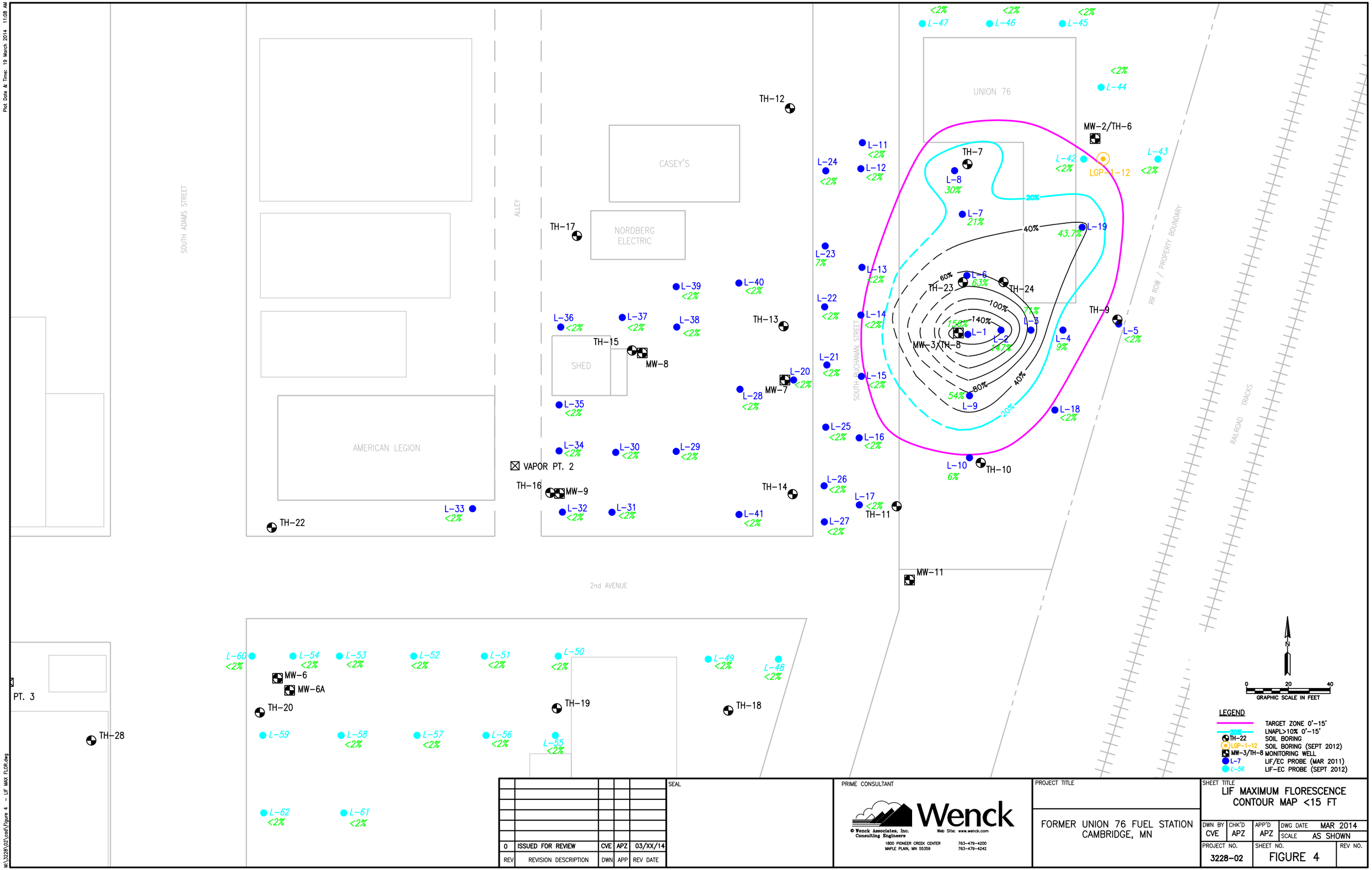

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PROJECT TITLE

FORMER UNION 76 FUEL STATION
CAMBRIDGE, MN

SHEET TITLE

LIF MAXIMUM FLORESCENCE CONTOUR MAP <15 FT

DWN BY	CHK'D	APP'D	DWG DATE	MAR 2014
CVE	APZ	APZ	SCALE	AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
3228-02	FIGURE 4	

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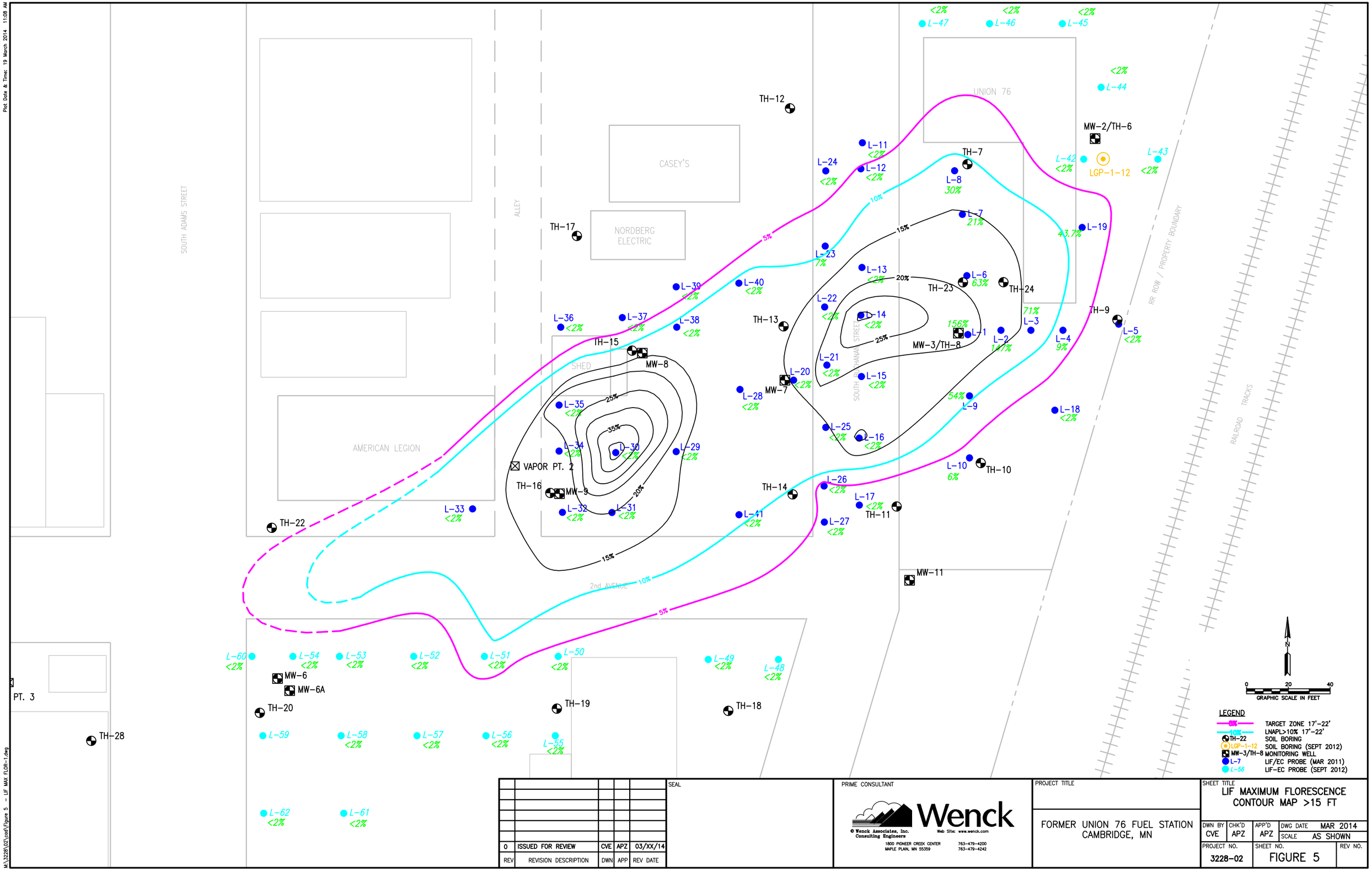

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PROJECT TITLE

FORMER UNION 76 FUEL STATION
CAMBRIDGE, MN

SHEET TITLE

LIF MAXIMUM FLORESCENCE CONTOUR MAP >15 FT

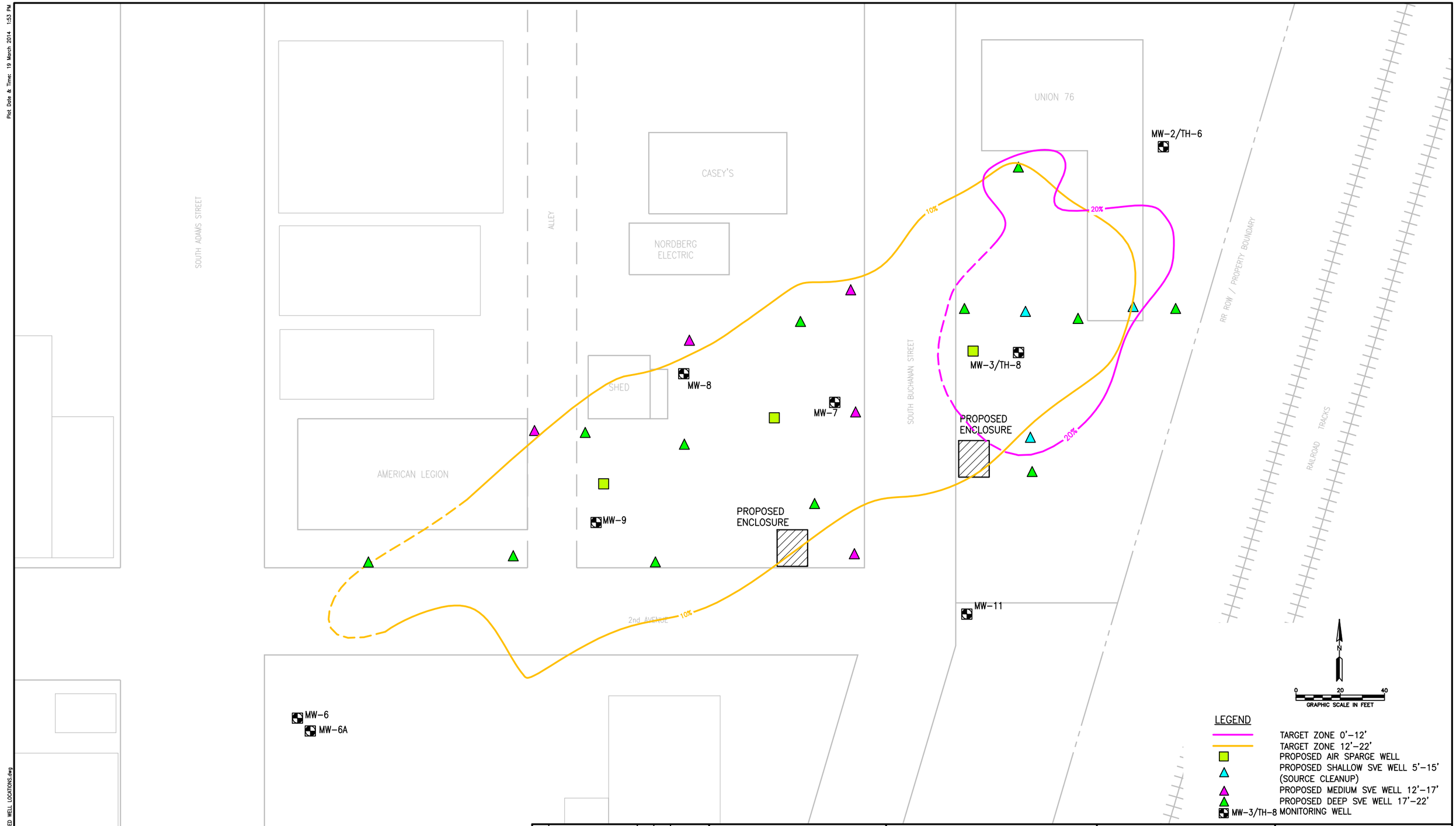
DWN BY	CHK'D	APP'D	DWG DATE
CVE	APZ	APZ	MAR 2014

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
3228-02	FIGURE 5	

M:\3228\02\cad\Figure 5 - LIF MAX FLOR-1.dwg

Plot Date & Time: 19 March 2014 1:53 PM



REV	REVISION DESCRIPTION	DWN	APP	REV DATE
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PROJECT TITLE

FORMER UNION 76 FUEL STATION
CAMBRIDGE, MN

SHEET TITLE

PROPOSED SVE AND AS WELL LOCATIONS

DWN BY	CHK'D	APP'D	DWG DATE
CVE	APZ	APZ	MAR 2014

SCALE AS SHOWN

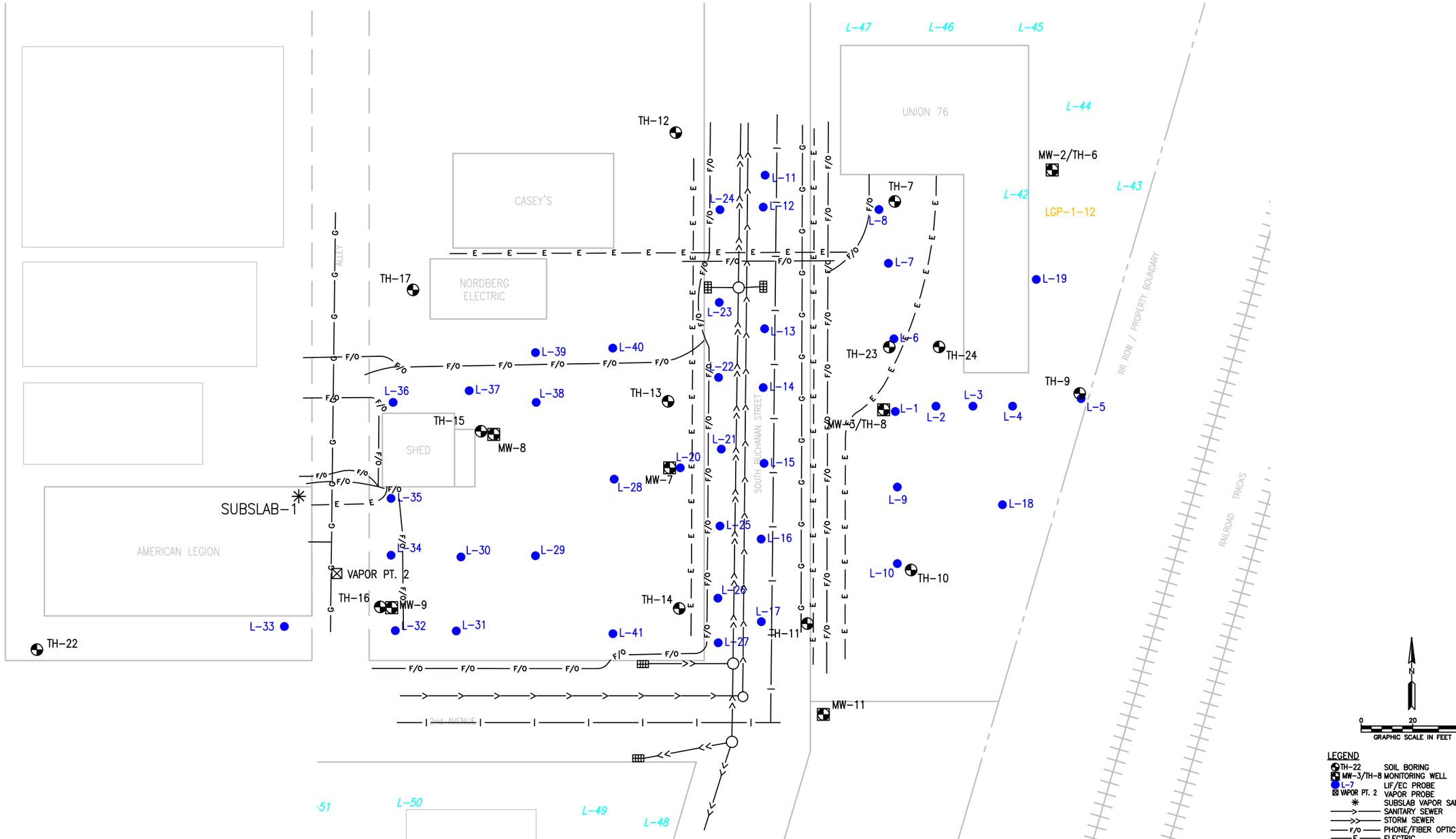
PROJECT NO. 3228-02

SHEET NO. FIGURE 6

REV NO.

M:\3228\02\cad\Figure 6 - PROPOSED WELL LOCATIONS.dwg

Plot Date & Time: 19 March 2014 11:08 AM



REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR REVIEW	CVE	APZ	03/XX/14

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PROJECT TITLE

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CAMBRIDGE, MN

SHEET TITLE

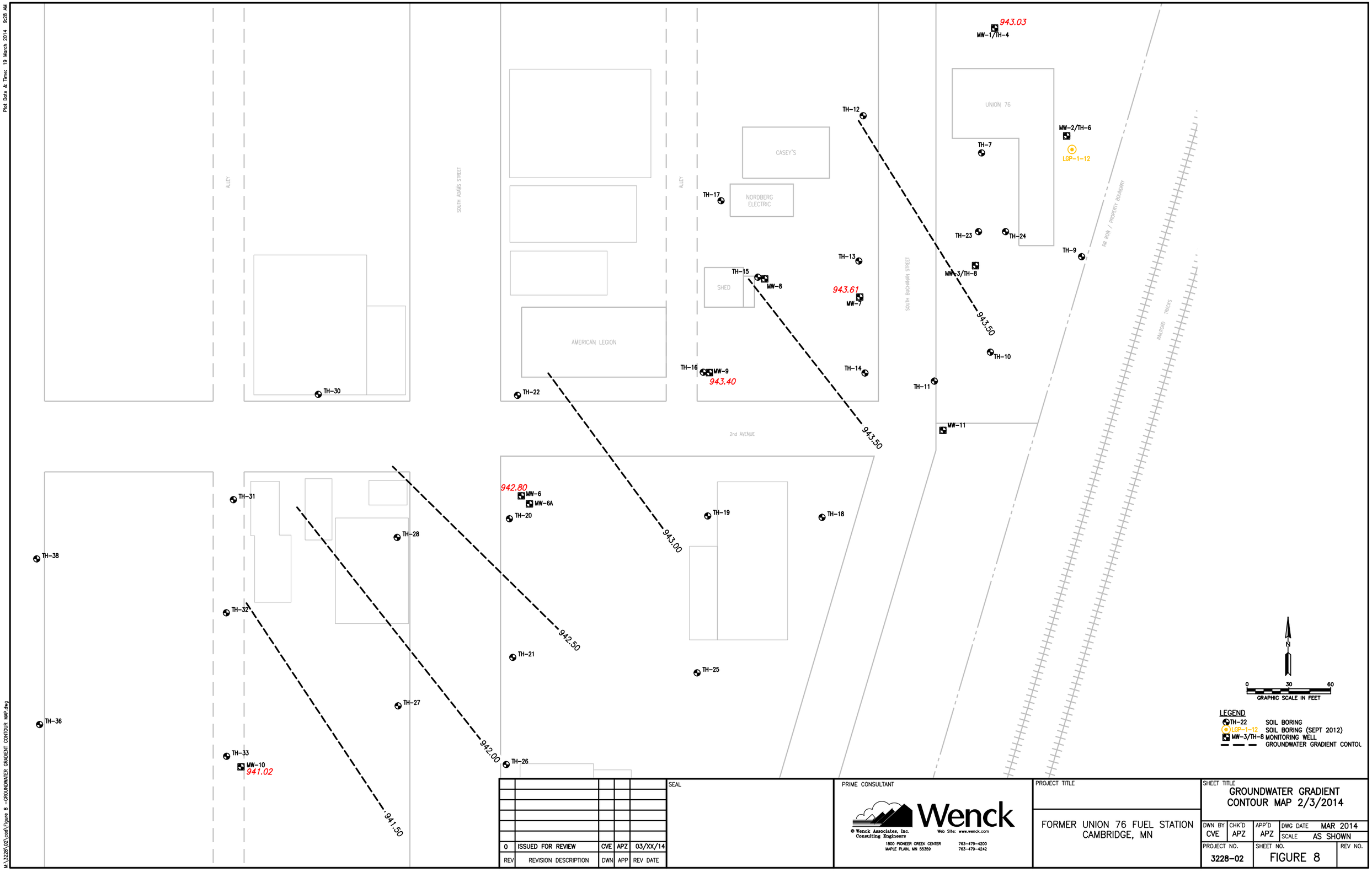
UTILITY LOCATIONS

DWN BY	CHK'D	APP'D	DWG DATE	MAR 2014
CVE	APZ	APZ	SCALE	AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
3228-02	FIGURE 7	

M:\3228\02\cad\Figure 7 - UTILITY LOCATIONS.dwg

Plot Date & Time: 19 March 2014 9:28 AM



LEGEND

TH-22	SOIL BORING
LGP-1-12	SOIL BORING (SEPT 2012)
MW-3/TH-8	MONITORING WELL
	GROUNDWATER GRADIENT CONTOL

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR REVIEW	CVE	APZ	03/XX/14

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PROJECT TITLE

FORMER UNION 76 FUEL STATION
CAMBRIDGE, MN

SHEET TITLE

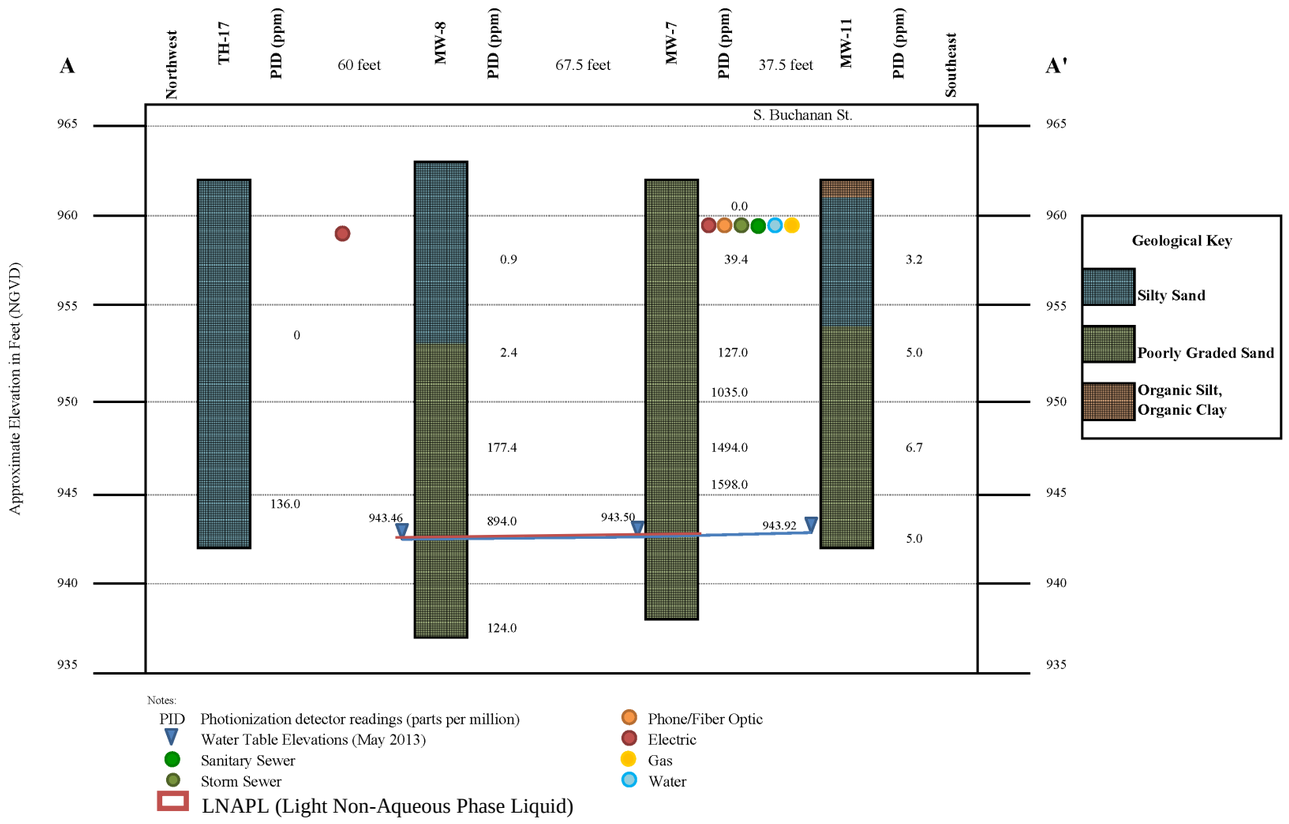
GROUNDWATER GRADIENT CONTOUR MAP 2/3/2014

DWN BY	CHK'D	APP'D	DWG DATE
CVE	APZ	APZ	MAR 2014

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
3228-02	FIGURE 8	

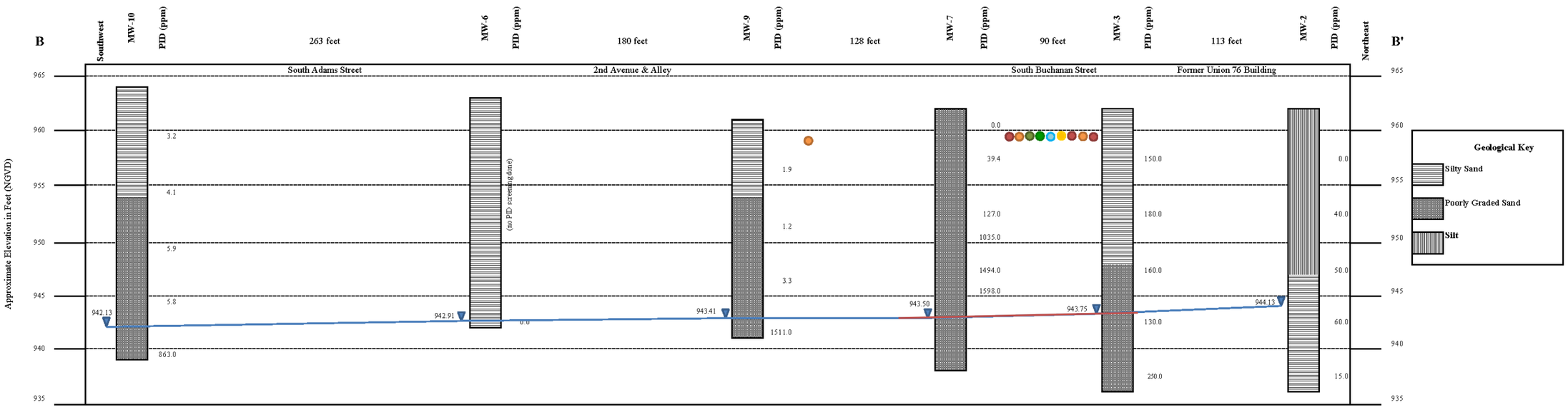
M:\3228\02\cad\Figure 8 --GROUNDWATER GRADIENT CONTOUR MAP.dwg



Source: Liesch Associates, Inc., 6/13

Former Union 76 Fuel Station-Cambridge, MN **Mar 14**

A – A' Cross Section **Figure 9**



Source: Liesch Associates, Inc., 6/13

Former Union 76 Fuel Station Cambridge, MN **Mar 14**

B-B' Cross Section **Figure 10**

Appendix A

Tables

Attach all tables from the *Investigation Report Form* and indicate those that have been updated during this reporting period by marking the check box below. **Tables must include all cumulative data.**

Updated	Table Number and Name
☒	Table 1. Tank Information
☒	Table 2. Results of Soil Headspace Screening
☒	Table 3. Analytical Results of Soil Samples
☐	~~Table 4. Other Contaminants Detected in Soils (Petroleum or Non-petroleum Derived)~~
☐	~~Table 5. Contaminated Surface Soil Results~~
☐	~~Table 6. Water Level Measurements and Depths of Water Samples Collected from Borings~~
☒	Table 7. Analytical Results of Water Samples Collected from Borings
☒	Table 8. Other Contaminants Detected in Water Samples Collected from Borings (Petroleum or Non-petroleum Derived)
☒	Table 9. Monitoring Well Completion Information
☒	Table 10. Water Level Measurements in Wells
☒	Table 11. Analytical Results of Water Samples Collected from Wells
☒	Table 12. Other Contaminants Detected in Water Samples Collected from Wells (Petroleum or Non-petroleum Derived)
☐	~~Table 13. Natural Attenuation Parameters~~
☒	Table 14. Free Product Recovery
☐	~~Table 15. Properties Located within 500 feet of the Release Source~~
☐	~~Table 16. Water Supply Wells Located within 500 feet of the Release Source and Municipal or Industrial Wells within ½ mile~~
☐	~~Table 17. Surface Water Receptor Information~~
☒	Table 18. Utility Receptor Information
☒	Table 19. Vapor Survey Results
☒	Table 20. Results of Soil Gas Sampling for Vapor Intrusion Screening
☐	Table 21. LNAPL Recovery Test

Table 1
Tank Information

Tank #	Tank Material[1]	UST or AST	Capacity (gallons)	Contents (product type)	Year Installed	Tank Status[2]	Tank Condition
001		UST	1,000	Diesel Fuel	Unknown	Removed	Good
002		UST	5,000	Gasoline	Unknown	Removed	Good
003		UST	5,000	Gasoline	Unknown	Removed	Good

[1] "F" for fiberglass or "S" for Steel
[2] Indicate: removed (date), abandoned in place (date), or currently in use.
Add additional rows as needed.
Notes:

Table 2
Results of Soil Headspace Screening

Depth (ft)	Soil Boring ID									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4										
5	80	6.0			210		170			
6						0.0		150		
8										
9										
11	1000+	5.0	5.0	0.0	310	4.0	160	180		
12									66	450
15							135			
16					400	50		160	32	12
17			5.0	0.0						
18	1000+	68								
20	1000+		7.5	0.0					1000+	1000+
21					200	30	140	130		
26					240	0.5	5.0	250		
29	5.0									

Depth (ft)	Soil Boring ID									
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4	0.5	1.0	5.0	9.5						
5										
6										
8	0.0	0.5	1000+	36						
9			1000+			0.0	0.0	0.0	0.0	
11					390					
12	0.0	0.0	580	240						
15	0.5									
16		0.0	1000+	550	1000+					
17										
18										360
20		9.0	1000+	1000+	1000+	105	136	0.0	480	
21										
26										
29										

Table 2
Results of Soil Headspace Screening

Depth (ft)	Soil Boring ID									
	21	**22**	**23**	**24**	**25**					
4										
5			1999	1999	5.0					
6										
8										
9			1999	1999	5.0					
11										
12										
15			1999	1999	5.4					
16										
17										
18	360									
20		698								

Depth (ft)	Soil Boring ID									
	MW-7	**LGP-1-12**	**MW-8**	**MW-9**	**MW-10**	**MW-11**				
0-2	0									
0-2.5		0.5								
0-5			0.9	1.9	3.2	3.2				
2.5-5		0.5								
5-7	39.4									
5-7.5		1.0								
5-10			2.4	1.2	4.1	5.0				
7.5-10		1.2								
10-12	127									
10-12.5		10.2								
10-15			177.4	3.3	5.9	6.7				
12.5-15		6.4								
12.5-14.5	1035									
15-17.5		9.6								
15-20			894	1511	5.8	5.0				
15-17	1494									
15-17.5										
17-19	1598									
17.5-20		3.6								
20-22.5		1.5								
20-25			124		863					
22.5-25		26.7								
25-27.5		2.1								
27.5-30		1.7								

List instruments used and discuss field methods and procedures in Section 6. Add additional rows as needed, and copy the entire table if more columns are needed. Notes:

Table 3
Analytical Results of Soil Samples[1]

Boring ID	Sampled Depth (ft)	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
TH-1	17.5-19.5	4/19/95	<0.05	0.078	<0.05	<0.15		<10*	334	Fix
TH-1	28-30	4/19/95	4.97	52	45.9	322		2140	<10	Fix
TH-2	17.5-19.5	4/19/95	<0.05	0.101	<0.05	0.159		<10	<10	Fix
TH-3	17.5-19.5	4/19/95	<0.05	<0.05	<0.05	<0.15		<10	<10	Fix
TH-4	18.5-20.5	4/19/95	<0.05	0.069	<0.05	<0.15		<10	<10	Fix
TH-6	15-16.5	6/27/95	<0.05	<0.05	<0.05	<0.15		<10	<10	Fix
TH-7	5-6.5	6/27/95	<0.05	<0.145	0.109	<0.15		86.6	155	Fix
TH-7	25-26.5	6/27/95	<0.05	0.089	<0.05	<0.15		<10	<10	Fix
TH-8	5-6.5	6/27/95	326	794	183	955		14700	3470	Fix

[1] Report results in mg/kg. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
Add additional rows as needed.
Notes:

~~Table 4~~
~~Other Contaminants Detected in Soils (Petroleum or Non-petroleum Derived)~~[1]

Boring ID	Sampled Depth (ft)	Date Sampled								Lab Type[2]

[1] Report results in mg/kg. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
Indicate other contaminants (either petroleum or non-petroleum derived) detected in soil collected from borings. Add additional rows as needed, and copy the entire table if more columns are needed.
Notes:

~~**Table 5**~~
~~**Contaminated Surface Soil Results**~~

Sample ID	Headspace 10 ppm or Greater[1] (Y/N)	Petroleum Saturated (Y/N)

[1] As measured with a photoionization detector (PID).
Add additional rows as needed.
Notes:

Table 6
Water Level Measurements and Depths of Water Samples Collected from Borings

	Soil Boring									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Static Water Level Depth[1] (ft)										
Sampled Depth (ft)										
Sampling Method[2]										

[1] Describe the methods used to measure water levels in borings in Section 6.
[2] Refer to Guidance Document 4-05 for acceptable ground water sampling methods.
Notes:

Table 7
Analytical Results of Water Samples Collected from Borings[1]

Boring ID	Date Sampled	Sampled Depth (ft)	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
TH-1	4/19/95		1,080	1,520	943	9,000		5,840		Fixed
TH-9	8/01/95	20	129	133	38.5	68.7		3,200	1,500	Fixed
TH-10	8/01/95	20	318	314	49.9	295		15,100		Fixed
TH-11	8/01/95	20	<1.0	<1.0	<1.0	<3.0		<100		Fixed
TH-12	8/01/95	20	1.1	1.9	1.1	3.1		<100		Fixed
TH-13	8/01/95	20	130,000	349,000	162,000	244,000		9,100,000		Fixed
TH-14	8/01/95	20	19,600	37,200	11,200	66,200		1,660,000		Fixed
TH-15	8/01/95	20	10,100	20,500	5,160	23,100		597,000		Fixed
TH-16	8/01/95	20	2,130	5,210	1,230	5,910		135,000		Fixed
TH-17	11/28/95	20	3.6	<0.4	<0.4	<0.5		<100	300	Fixed
TH-18	11/28/95	20	<0.5	<0.4	<0.4	<0.5		<100	<100	Fixed
TH-19	11/28/95	20	1,900	5,470	3,350	25,730		57,900	7,300	Fixed
TH-20	11/28/95	20	1,450	85.6	75.1	494.7		10,900	1,500	Fixed
TH-21	11/28/95	22	328	55.5	377	910		12,900		Fixed
TH-22	11/28/95	22	122	69.9	17.1	99.6		1,100	100	Fixed
TH-23	6/23/97	20-24	1,346	11,900	990	6,590		49,880		Fixed
TH-24	6/23/97	20-24	1,310	2,650	674	4,200		26,930		Fixed
TH-25	6/23/97	20-24	<1.0	2.1	<1.0	<3.0		<100		Fixed
TH-26	6/23/97	20-24	1.0	3.4	<1.0	<3.0		<100		Fixed
TH-27	6/23/97	22-26	2,260	899	774	1,540		13,100		Fixed
TH-28	6/23/97	22-26	4,160	2,520	538	2,880		22,800		Fixed
TH-29	6/23/97	22	11.3	3.3	<1.0	<3.0		180		Fixed
TH-30	6/23/97	22	<1.0	<1.0	<1.0	<3.0		<100		Fixed
TH-31	6/24/97	22-26	88.2	3.1	<1.0	7.1		730		Fixed
TH-32	6/24/97	22-26	2,550	9,080	1,350	7,190		33,000		Fixed
TH-33	6/24/97	22-26	3,340	5,230	1,980	9,320		50,200		Fixed
TH-34	6/24/97	22-26	28.5	39.5	43.2	209		1,380		Fixed
TH-35	6/24/97	20-22	3,540	9,690	1,370	8,380		37,600		Fixed
TH-36	6/24/97	22-26	1,720	298	294	754		8,360		Fixed
TH-37	7/21/97	24-25	313	3.5	2.2	10.8		1,800		Fixed
TH-38	7/21/97	22-26	209	<1.0	1.2	8.8		700		Fixed
TH-39	7/21/97	28-32	147	<1.0	<1.0	<3.0		500		Fixed
TH-40	7/21/97	24-28	42	<1.0	<1.0	1.8		100		Fixed
TH-41	7/21/97	24-28	<1.0	<1.0	<1.0	<3.0		<100		Fixed
TH-42	8/02/97	24-26	<1.0	<1.0	<1.0	<3.0		<100		Fixed
TH-43	7/23/97	21-26	291	<1.0	1.1	5.3		670		Fixed
TH-44	7/23/97	24-26	36	<1.0	<1.0	<3.0		<100		Fixed
TH-45	7/23/97	26-28	4.9	<1.0	<1.0	<3.0		<100		Fixed
GP-1	1/21/2010	24-29	895	613	508	2,200	<25	10,200	3.6	Fixed
GP-2	1/21/2010	25-30	10.4	3.5	<1.0	8.6	5.7	1,240	0.42	Fixed
Trip Blank	1/21/2010		<1.0	<1.0	<1.0	<1.0	<5.0	<100		Fixed
Equip. Blank										
Lab Blank										
HRL[3]			10	200	50	300		200		

[1] Report results in µg/L. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
[3] See http://www.health.state.mn.us/divs/eh/groundwater/hrltable.html for list of current HRLs.
Add additional rows as needed.
Notes:

Table 8
Other Contaminants Detected in Water Samples
Collected from Borings (Petroleum or Non-petroleum Derived)[1]

Boring ID	Date Sampled	Sampled Depth (ft)	Acetone	Methylethyl ketone	1,2-di-chloroethane	Methyl isobutylethane	1,2-Dibromoethane	Chlorobenzene	Isopropylbenzene	N-propylbenzene	1,3,5-TMB	Tert-Butylbenzene	1,2,4-TMB	Sec-Butylbenzene	p-Isopropyltoluene	n-butylbenzene	Napthalene	Lab Type[2]
TH-17	20	11/20/1995	4.5	<2.8	<0.3	<0.7	<0.8	<0.4	<0.7	<0.8	<0.2	<0.6	<0.7	<0.5	<0.4	<0.3	<0.7	
TH-18	20	11/20/1995	<0.3	<2.8	<0.3	<0.7	<0.8	<0.4	<0.7	<0.8	<0.2	<0.6	<0.7	<0.5	<0.4	<0.3	<0.7	
TH-19	20	11/20/1995	820	52,200	<0.3	<0.7	<0.8	<0.4	7,780	3,010	3,680	1,430	10,200	2,110	968	5,330	2,200	
TH-20	20	11/21/1995	52.3	529	41.9	12	15.9	<0.4	19.4	2.2	70.1	<0.6	375	<0.5	<0.4	28.7	172	
TH-21	22	11/21/1995	56.8	1630	24	<0.7	<0.8	112	302	384	491	120	1500	224	77.5	505	361	
TH-22	22	11/21/1995	29	63	<0.3	<0.7	<0.8	<0.4	4.1	0.9	4.6	<0.6	20.7	<0.5	<0.4	4.8	5.8	
GP-1											113		413					
GP-2	25-30	1/21/2010											1.1					
Trip Blank																		
Equip. Blank																		
Lab Blank																		
HRL[3]																		

[1] Report results in µg/L. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
[3] See http://www.health.state.mn.us/divs/eh/groundwater/hrltable.html for list of current HRLs.
Indicate other contaminants (either petroleum or non-petroleum derived) detected in water samples collected from soil borings and temporary wells. Add additional rows as needed, and copy the entire table if more columns are needed.
Notes:

Table 9 (Previous Data)
Monitoring Well Completion Information[1]

Well Number	MDH Unique Well Number	Date Installed	Surface Elevation	Top of Casing Elevation	Bottom of Well Elevation	Screen Interval (Elev. - Elev.)	Total Well Depth from Surface (ft)
MW-1	554377	6/15/1995	963.07	963.10	939.07	939.07–949.07	24
MW-2	554378	6/15/1995	963.67	963.37	939.67	939.67–949.67	24
MW-3	554379	6/15/1995	961.97	963.72	934.97	934.97–944.97	27
MW-4	617207	9/01/1998	964.87	964.62	935.87	935.87–945.87	29
MW-5	617205	9/02/1998	963.84	963.68	934.84	934.84–944.84	29
MW-5A	617206	9/02/1998	963.81	963.62	919.81	919.81–929.81	44
MW-6	617203	9/02/1998	963.94	963.93	934.94	934.94–944.94	29
MW-6A	617204	9/02/1998	963.76	963.73	922.76	922.76–932.76	41
MW-7	731591	9/19/2005	963.27	963.29	939.29	939.29–949.29	24

[1] Include well construction diagrams and MDH well logs in Section 6.
Add additional rows as needed.
Notes: (location and elevation of benchmark)

Table 9 (January 2013 Resurveyed Data)
Monitoring Well Completion Information[1]

Well Number	MDH Unique Well Number	Date Installed	Surface Elevation	Top of Casing Elevation	Bottom of Well Elevation	Screen Interval (Elev. - Elev.)	Total Well Depth from Surface (ft)
MW-1	554377	6/15/1995	962.92	963.00	938.92	938.92–948.92	24
MW-2	554378	6/15/1995	Unknown	Unknown	Unknown	Unknown	24
MW-3	554379	6/15/1995	962.18	961.59	935.18	935.18–945.18	27
MW-4	617207	9/01/1998	Unknown	Unknown	Unknown	Unknown	29
MW-5	617205	9/02/1998	Unknown	Unknown	Unknown	Unknown	29
MW-5A	617206	9/02/1998	Unknown	Unknown	Unknown	Unknown	44
MW-6	617203	9/02/1998	962.61	962.41	933.61	933.61-943.61	29
MW-6A	617204	9/02/1998	962.65	962.46	921.65	921.65-931.65	41
MW-7	731591	9/19/2005	962.01	961.91	938.01	938.01-948.01	24
MW-8	792988	12/11/2012	962.54	962.60	936.54	936.54-951.54	26
MW-9	792989	12/12/2012	961.89	961.85	935.89	935.89-950.89	26
MW-10	792990	12/13/2012	963.94	963.94	935.94	935.94-945.94	28
MW-11	792991	12/11/2012	962.13	964.46	937.13	937.13-947.13	25

[1] Include well construction diagrams and MDH well logs in Section 6.
Add additional rows as needed.
Notes: (location and elevation of benchmark)

Table 10
Water Level Measurements in Wells[1]

Well Number	Date Sampled	Depth to Water from Top of Riser	Product Thickness	Depth to Water Below Grade	Relative Groundwater Elevation	Water Level Above Screen (Y/N)
MW-1	1/11/2002	NR	NR	NR	NR	NR
	6/24/2002	NR	ND	NR	NR	N
	9/13/2002	18.21	ND	18.18	944.89	N
	12/26/2002	17.73	ND	17.70	945.37	N
	4/14/2003	18.18	ND	18.15	944.92	N
	7/7/2003	17.74	ND	17.71	945.36	N
	10/10/2003	17.42	ND	17.39	945.68	N
	2/6/2004	18.20	ND	18.17	944.9	N
	3/18/2004	18.48	ND	18.45	944.62	N
	6/18/2004	NR	ND	NR	NR	NR
	9/7/2004	18.17	ND	18.14	944.93	N
	9/14/2004	NR	ND	NR	NR	NR
	12/20/2004	18.32	ND	18.29	944.78	N
	2/23/2005	NR	ND	NR	NR	NR
	3/10/2005	18.51	ND	18.48	944.59	N
	4/11/2005	18.79	ND	18.76	944.31	N
	6/9/2005	18.93	ND	18.90	944.17	N
	8/4/2005	18.77	ND	18.74	944.33	N
	11/1/2005	17.16	ND	17.13	945.94	N
	3/1/2006	18.13	ND	18.1	944.97	N
	7/13/2006	Dry	ND	NR	NR	N
	10/4/2006	18.67	ND	18.64	944.43	N
	3/9/2007	NS Covered w snow pile	NA	NR	NR	NA
	7/24/2007	19.28	ND	19.25	943.82	N
	1/20/2010	19.95	ND	19.92	943.15	N
	1/12/2011	18.96	0.15	18.93	944.14	N
	3/21/2011	19.16	ND	19.13	943.94	N
	6/7/2011	18.59	ND	18.56	944.51	N
	10/4/2011	17.03	ND	17.00	946.07	N
	01/10/2013	18.21	ND	18.13	944.79	N
	05/3/2013	18.87	ND	18.79	944.13	N
	2/3/14	**19.97**	**ND**	**19.89**	**943.03**	**N**
MW-3	10/10/2003	18.11	ND	16.36	945.61	Y
	2/6/2004	20.19	1.3’	18.44	943.53	N
	3/18/2004	20.21	1.3	18.46	943.51	N
	6/18/2004	19.65	0.56	17.90	944.07	N
	9/7/2004	18.97	ND	17.22	944.75	N

Table 10
Water Level Measurements in Wells[1]

Well Number	Date Sampled	Depth to Water from Top of Riser	Product Thickness	Depth to Water Below Grade	Relative Groundwater Elevation	Water Level Above Screen (Y/N)
	9/14/2004	18.82	NR	17.07	944.90	N
	12/20/2004	19.13	0.05	17.38	944.59	N
	2/23/2005	10.94	0.77	9.19	952.78	N
	3/10/2005	19.61	0.47	17.86	944.11	Y
	4/11/2005	20.13	0.86	18.38	943.59	N
	6/9/2005	20.46	1.03	18.71	943.26	N
	7/12/2005	20.22	0.82	18.47	943.50	N
	8/4/2005	20.15	0.79	18.4	943.57	N
	9/28/2005	N/R	N/R	NR	NR	
	10/5/2005	16.76	0.3	15.01	946.96	Y
	11/1/2005	17.44	0	15.69	946.28	Y
	3/1/2006	17.65	ND	15.9	946.07	Y
	7/13/2006	18.34	.52’	16.59	945.38	Y
	10/4/2006	18.92	ND	17.17	944.8	N
	3/9/2007	19.98	5.5”	18.23	943.74	N
	7/24/2007	NA	0.8”	NR	NR	N
	1/20/2010	TOC Broken	4”	NR	NR	N
	3/21/2011	17.89	ND	16.14	945.83	Y
	6/7/2011	17.29	ND	15.54	946.43	Y
	10/4/2011	15.77	ND	14.02	947.95	Y
	01/10/2013	NA	7”	NA	NA	NA
	05/3/2013	NA	5”	NA	NA	NA
	2/3/2014	18.04	0.52’ (6.24 “)	17.45	943.55	**N**
	3/6/2014	**18.12**	**0.53’**	**17.53**	**943.63**	
MW-6	1/11/2002	20.21	ND	20.22	943.72	N
	6/24/2002	NR	ND	NR	NR	N
	9/13/2002	19.57	ND	19.58	944.36	N
	12/26/2002	18.58	ND	18.59	945.35	Y
	4/14/2003	18.85	ND	18.86	945.08	Y
	7/7/2003	18.65	ND	18.66	945.28	Y
	10/10/2003	18.21	ND	18.22	945.72	Y
	2/6/2004	19.41	ND	19.42	944.52	N
	3/18/2004	19.14	ND	19.15	944.79	N
	6/18/2004	NR	ND	NR	NR	NR
	9/7/2004	19.02	ND	19.03	944.91	N
	9/14/2004	NR	ND	NR	NR	N
	12/20/2004	19.1	ND	19.11	944.83	N
	2/23/2005	NR	ND	NR	NR	NR

Table 10
Water Level Measurements in Wells[1]

Well Number	Date Sampled	Depth to Water from Top of Riser	Product Thickness	Depth to Water Below Grade	Relative Groundwater Elevation	Water Level Above Screen (Y/N)
	3/10/2005	19.13	ND	19.14	944.80	N
	4/11/2005	20.59	ND	20.60	943.34	N
	6/9/2005	19.65	ND	19.66	944.28	N
	8/4/2005	19.71	ND	19.72	944.22	N
	11/1/2005	19.22	ND	19.23	944.71	N
	3/1/2006	19.74	ND	19.75	944.19	N
	7/13/2006	19.51	ND	19.52	944.42	N
	10/4/2006	19.59	ND	19.60	944.34	N
	3/9/2007	19.87	ND	19.88	944.06	N
	7/24/2007	20.12	ND	20.13	943.81	N
	1/20/2010	20.67	ND	20.68	943.26	N
	1/12/2011	19.73	ND	19.74	944.2	N
	3/21/2011	19.83	ND	19.84	944.1	N
	6/7/2011	19.52	ND	19.53	944.41	N
	10/4/2011	17.98	ND	17.99	945.95	Y
	01/10/2013	18.86	ND	19.06	943.55	N
	05/3/2013	19.50	ND	19.70	942.91	N
	2/3/14	**19.61**	**ND**	**19.81**	**942.8**	**N**
MW-6A	1/11/2002	20.13	ND	20.16	943.6	Y
	6/24/2002	NR	ND	NR	NR	Y
	6/24/2002	NR	ND	NR	NR	Y
	9/13/2002	19.48	ND	19.51	944.25	Y
	12/26/2002	18.61	ND	18.64	945.12	Y
	4/14/2003	18.96	ND	18.99	944.77	Y
	7/7/2003	18.79	ND	18.82	944.94	Y
	10/10/2003	20.19	ND	20.22	943.54	Y
	2/6/2004	19.46	ND	19.49	944.27	Y
	3/18/2004	19.19	ND	19.22	944.54	Y
	6/18/2004	NR	ND	NR	NR	NR
	9/7/2004	19.83	ND	19.86	943.9	Y
	9/14/2004	NR	ND	NR	NR	NR
	12/20/2004	19.18	ND	19.21	944.55	Y
	2/23/2005	NR	ND	NR	NR	NR
	3/10/2005	19.21	ND	19.24	944.52	Y
	4/11/2005	19.44	ND	19.47	944.29	Y
	6/9/2005	20.06	ND	20.09	943.67	Y
	8/4/2005	21.11	ND	21.14	942.62	Y
	11/1/2005	21.51	ND	21.54	942.22	Y
	3/1/2006	19.13	ND	19.16	944.6	Y

Table 10
Water Level Measurements in Wells[1]

Well Number	Date Sampled	Depth to Water from Top of Riser	Product Thickness	Depth to Water Below Grade	Relative Groundwater Elevation	Water Level Above Screen (Y/N)
	7/13/2006	21.19	ND	21.22	942.54	Y
	10/4/2006	20.05	ND	20.08	943.68	Y
	3/9/2007	20.31	ND	20.34	943.42	Y
	7/24/2007	20.16	ND	20.19	943.57	Y
	1/20/2010	20.70	ND	20.73	943.03	Y
	1/12/2011	19.78	ND	19.81	943.95	Y
	3/21/2011	19.87	ND	19.9	943.86	Y
	6/7/2011	19.56	ND	19.59	944.17	Y
	10/4/2011	18.03	ND	18.06	945.7	Y
	01/10/2013	18.53	ND	18.72	943.93	Y
	05/3/2013	19.55	ND	19.74	942.91	Y
MW-7	9/16/2005	17.00	ND	16.98	946.29	N
	11/1/2005	17.72	ND	17.70	945.57	N
	3/1/2006	17.81	ND	17.79	945.48	N
	7/13/2006	18.14	ND	18.12	945.15	N
	10/4/2006	18.20	ND	18.18	945.09	N
	3/9/2007	18.60	ND	18.58	944.69	N
	7/24/2007	18.83	ND	18.81	944.46	N
	1/20/2010	20.45	16”	20.43	942.84	N
	1/21/2011	18.50	0.15	18.48	944.79	N
	3/21/2011	18.8	0.15	18.78	944.49	N
	6/7/2011	18.13	ND	18.11	945.16	N
	10/4/2011	16.53	ND	16.51	946.76	N
	01/10/2013	17.63	0.06’	17.73	944.28	N
	05/3/2013	18.31	0.06’	18.41	943.50	N
	2/3/14	18.30	0.02’	18.40	943.61	**N**
	3/6/2014	**18.35**	**0.03’**	**18.45**	**943.66**	**N**
MW-8	01/10/2013	18.44	ND	18.38	944.16	N
	05/3/2013	19.14	1/16”	19.08	943.46	N
	2/3/2014	**Buried by snow bank, soil pile and construction equipment**				
	3/6/2014	**Buried by snow bank, soil pile and construction equipment**				
MW-9	01/10/2013	17.79	ND	17.83	944.06	N
	05/3/2013	18.44	ND	18.48	943.41	N
	2/3/2014	18.45	ND	18.49	943.40	**N**
	3/6/2014	**18.46**	**ND**	**18.46**	**943.41**	**N**
MW-10	01/10/2013	21.18	ND	21.18	942.76	N
	05/3/2013	21.81	ND	21.81	942.13	N
	2/3/2014	**22.92**	**ND**	**22.92**	**941.02**	**N**
MW-11	01/10/2013	19.87	ND	17.54	944.59	N

Table 10
Water Level Measurements in Wells[1]

Well Number	Date Sampled	Depth to Water from Top of Riser	Product Thickness	Depth to Water Below Grade	Relative Groundwater Elevation	Water Level Above Screen (Y/N)
	05/3/2013	20.54	ND	18.21	943.92	N

[1] Describe the methods used to measure water levels in Section 6.
Add additional rows as needed.
Notes:

Table 11
Analytical Results of Water Samples Collected from Wells[1]

Well Number	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
MW-1	1/11/2002	NS	NS	NS	NS	NS	NS	NS	Fixed
	6/24/2002	<1.0	<1.0	2.6	26/15	<1.0	200	NA	Fixed
	9/13/2002	<1.0	5.6	14	240	NA	610 H	NA	Fixed
	12/26/2002	<1.0	<1.0	<1.0	67	NA	110	NA	Fixed
	4/14/2003	<1.0	2.1	4.1	131	<1.0	1,900	NA	Fixed
	7/7/2003	<1.0	17	8	2,100	<1.0	4,300	NA	Fixed
	10/10/2003	<1.0	10	19	580	<1.0	2,500	NA	Fixed
	2/6/2004	ND	2.1	9.1	192	ND	240	NS	Fixed
	3/18/2004	ND	14	63	1120	ND	2,300	NA	Fixed
	9/7/2004	ND	32	220	2400	ND	6,800	NA	Fixed
	12/20/2004	ND	51.9	300	4660	ND	8,940	NA	Fixed
	3/10/2005	ND	ND	72.8	2940	ND	11,500	NA	Fixed
	6/9/2005	ND	ND	16.4	905	ND	2,220	NA	Fixed
	8/4/2005	3.8	ND	94	2100	ND	4,300	NA	Fixed
	11/9/2005	<0.50	ND	ND	100	ND	9,400	NA	Fixed
	3/1/2006	<1.0	<5.0	110	3,900	NS	10,000	NA	Fixed
	7/13/2006	Well dry	NS	NS	NS	NS	NS	NS	Fixed
	10/4/2006	<0.05	<5.0	2.7	100	<1.0	190	680	Fixed
	3/9/2007	NS	NS	NS	NS	NS	NS	NS	Fixed
	7/24/2007	<0.5	<0.5	0.55	1.93	<1.0	<100	NS	Fixed
	1/20/2010	<1.0	<1.0	<1.0	<3.0	<5.0	<100	180	Fixed
	1/12/2011	<1.0	<1.0	<1.0	23.4	<5.0	<100	2600	Fixed
	3/23/2011	<1.0	<1.0	<1.0	4.7	<5.0	<100	1610	Fixed
	6/8/2011	<1.0	<1.0	1.5	59.2	<5.0	218	2230	Fixed
	10/4/2011	<1.0	<1.0	8.6	272	<5.0	838	1960	Fixed
	01/10/2013	<1.0	<1.0	55.2	1,270	<5.0	3,390	1,450	Fixed
	05/3/2013	<1.0	<1.0	28.9	573	<5.0	2,050	831	Fixed
	2/3/2014	**2.2**	**<1.0**	**20.8**	**434**	**NS**	**1,430**	**1,300**	**Fixed**
MW-3	3/1/2006	1,600	<5,000	<1,000	5,100	NS	260,000	NA	Fixed
	3/23/2011	159	209	46.9	777	ND	8,320	8270	Fixed
	6/8/2011	493	521	71.8	2,900	<50	15,600	12800	Fixed
	10/5/2011	2,420	1780	156	6,800	<50	22,600	7630	Fixed
	01/10/2013	NS	NS	NS	NS	NS	NS	NS	Fixed
	05/3/2013	NS	NS	NS	NS	NS	NS	NS	Fixed

Table 11
Analytical Results of Water Samples Collected from Wells[1]

Well Number	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
MW-3	**2/3/2014**	**NS**	**Product**						
MW-6	1/11/2002	3,600	3,100	680	1,200/490	<1.0	19,000	NA	Fixed
	6/24/2002	5,800	5,800	1,200	3,100/1,100	<50	27,000	NA	Fixed
	9/13/2002	1,600	1,100	360	1,100	NA	8,400 H	NA	Fixed
	12/26/2002	2,800	750	3,200	2,800	NA	16,000	NA	Fixed
	4/14/2003	3,500	2,600	830	2,750	<20	18,000	NA	Fixed
	7/7/2003	2,300	2,200	660	1,940	<50	16,000	NA	Fixed
	10/10/2003	1,500	1,600	450	1,400	<50	10,000	NA	Fixed
	2/6/2004	2700	2,200	1,000	2,540	ND	17,000	NA	Fixed
	3/18/2004	3,200	2,600	830	2,180	ND	17,000	NA	Fixed
	9/7/2004	3,600	2,800	1,200	4,130	ND	21,000	NA	Fixed
	12/20/2004	3,110	6,110	1,470	5,040	ND	25,200	NA	Fixed
	3/10/2005	4,030	7,650	1,610	6,340	ND	28,200	NA	Fixed
	6/9/2005	4,500	5,800	1,570	5,310	ND	25,800	NA	Fixed
	8/4/2005	4,900	2,400	950	2,870	420	18,000	NA	Fixed
	11/9/2005	3,700	4,400	970	100	ND	27,000	NA	Fixed
	3/1/2006	2,500	1,300	<100	3,500	NS	22,000	NA	Fixed
	7/13/2006	2,500	<500	<50	1,100	<100	<10,000	5,100	Fixed
	10/4/2006	3,500	2,100	1,100	2,260	350	18,000	4,300	Fixed
	3/9/2007	4,000	2,700	350	3,540	780	19,000	5,100	Fixed
	7/24/2007	740	480	72	730	<10	5,200	NS	Fixed
	1/20/2010	3,010	1,430	578	1,510	<50	13,700	4,600	Fixed
	1/12/2011	2,200	2,280	725	2,690	<50	14,300	2,670	Fixed
	3/23/2011	2,410	1,670	490	1,320	13.6	13,600	3,850	Fixed
	6/8/2011	1,890	484	272	748	<50	7,060	3,230	Fixed
	10/4/2011	2,810	3,500	913	4,110	<50	18,100	4,250	Fixed
	01/10/2013	2280	3370	1090	4290	<50	16,000	3,750	Fixed
	05/3/2013	2660	3620	1200	4890	<50	26,000	4,350	Fixed
	2/3/2014	**2,480**	**1,710**	**1,260**	**4,170**	**NS**	**20,700**	**7,200**	**Fixed**
MW-6A	1/11/2002	<1.0	<1.0	<1.0	<2.0/<1.0	3.4	<100	NA	Fixed
	6/24/2002	<1.0	<1.0	<1.0	<2.0/<1.0	<1.0	<100	NA	Fixed
	9/13/2002	<1.0	<1.0	<1.0	<1.0 total	<1.0	<100	NA	Fixed
	12/26/2002	<1.0	<1.0	<1.0	<1.0 total	<1.0	<100	NA	Fixed
	4/14/2003	<1.0	<1.0	<1.0	<2.0/<1.0	<1.0	<60	NA	Fixed
	7/7/2003	<1.0	<1.0	<1.0	<2.0/<1.0	<1.0	<60	NA	Fixed
	10/10/2003	<1.0	<1.0	<1.0	<2.0/<1.0	<1.0	<60	NA	Fixed
	2/6/2004	ND	ND	ND	ND	ND	ND	NA	Fixed

Table 11
Analytical Results of Water Samples Collected from Wells[1]

Well Number	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
	3/18/2004	<0.5	<1.0	<1.0	<0.50/<0.50	<1.0	ND	NA	Fixed
	9/7/2004	ND	ND	ND	ND	ND	ND	NA	Fixed
	12/20/2004	ND	ND	ND	ND	ND	ND	NA	Fixed
	3/10/2005	ND	ND	ND	ND	ND	ND	NA	Fixed
	6/9/2005	ND	ND	ND	ND	ND	ND	NA	Fixed
	8/4/2005	ND	ND	ND	ND	ND	ND	NA	Fixed
	11/9/2005	ND	ND	ND	ND	ND	ND	NA	Fixed
	3/1/2006	<1.0	<5.0	<1.0	<3.0	NS	<100	NA	Fixed
	7/13/2006	<0.5	<5.0	<0.5	<1.0	<10.0	<100	140	Fixed
	10/4/2006	<0.5	<5.0	<0.5	<1.0	<10.0	<100	190	Fixed
	3/9/2007	<0.5	<5.0	<0.5	<1.0	<10.0	<100	170	Fixed
	7/24/2007	<0.5	<5.0	<0.5	<1.0	<10.0	<100	NS	Fixed
	1/20/2010	<1.0	<1.0	<1.0	<3.0	<5.0	<100	170	Fixed
	1/12/2011	<1.0	<1.0	<1.0	<3.0	<5.0	<100	126	Fixed
	3/23/2011	<1.0	<1.0	<1.0	<3.0	<5.0	<100	125	Fixed
	6/8/2011	<1.0	<1.0	<1.0	<3.0	<5.0	<100	312	Fixed
	10/4/2011	<1.0	<1.0	<1.0	<3.0	<5.0	<100	146	Fixed
	01/10/2013	<1.0	<1.0	<1.0	<3.0	<1.0	<100	124	Fixed
	05/3/2013	<1.0	<1.0	<1.0	<3.0	<1.0	<100	123	Fixed
MW-7	11/9/2005	3900	8600	1200	7800	ND	37000	NA	Fixed
	3/1/2006	5,200	<12,000	<2,500	8,200	<2,500	42,000	NA	Fixed
	7/13/2006	2,200	6,000	1,400	7,700	<1.0	NA	6,900	Fixed
	10/4/2006	3,300	6,000	1,900	8,300	<50	NA	9,100	Fixed
	3/9/2007	3,900	7,300	1,500	7,000	<10	43,000	10,000	Fixed
	7/24/2007	3,700	7,600	1,700	8,600	1,300	<100,000	8,600	Fixed
	10/4/2011	4,540	8,050	1,910	10,200	572	10200	14,200	Fixed
	01/10/2013	NS	NS	NS	NS	NS	NS	NS	Fixed
	05/3/2013	NS	NS	NS	NS	NS	NS	NS	Fixed
	2/3/2014	**NS**	**Product**						
MW-8	01/10/2013	*2,590*	4,670	1,490	6,840	<20	*26,200*	*27,800*	Fixed
	05/3/2013	NS	NS	NS	NS	NS	NS	NS	Fixed
	2/3/14	**NS**	**Buried under snow bank, construction equipment**						
MW-9	01/10/2013	*6,690*	7,210	1,840	8,950	<20	*30,500*	*16,000*	Fixed
	05/3/2013	*7,110*	7,330	1,950	9,140	<25	*47,000*	*787*	Fixed
	2/3/2014	**3,950**	**6,030**	**1,460**	**6,860**	**NS**	**35,600**	**6,200**	**Fixed**
MW-10	01/10/2013	*375*	207	551	2,750	<10	*12,500*	*14,700*	Fixed
	05/3/2013	*327*	431	427	2,080	<100	*17,700*	*8,960*	Fixed

Table 11
Analytical Results of Water Samples Collected from Wells[1]

Well Number	Date Sampled	Benzene	Toluene	Ethyl-benzene	Xylenes	MTBE	GRO	DRO	Lab Type[2]
MW-10	**2/3/2014**	**249**	**313**	**364**	**1,730**	**NS**	**12,000**	**7,500**	**Fixed**
MW-11	01/10/2013	<1.0	<1.0	<1.0	<3.0	<1.0	<100	<105	Fixed
	05/3/2013	<1.0	<1.0	<1.0	<3.0	<1.0	<100	<104	Fixed
Lab Blank	1/11/2002	ND	ND	ND	ND	NA	ND	NA	Fixed
	6/24/2002	ND	ND	ND	ND	NA	ND	NA	Fixed
	9/13/2002	ND	ND	ND	ND	NA	ND	NA	Fixed
	12/26/2002	ND	ND	ND	ND	NA	ND	NA	Fixed
	4/14/2003	ND	ND	ND	ND	NA	ND	NA	Fixed
	7/7/2003	ND	ND	ND	ND	NA	ND	NA	Fixed
	10/10/2003	ND	ND	ND	ND	NA	ND	NA	Fixed
	2/6/2004	ND	ND	ND	ND	NA	ND	NA	Fixed
	3/18/2004	ND	ND	ND	ND	NA	ND	NA	Fixed
	9/7/2004	ND	ND	ND	ND	NA	ND	NA	Fixed
	12/20/2004	ND	ND	ND	ND	NA	ND	NA	Fixed
	3/10/2005	ND	ND	ND	ND	NA	ND	NA	Fixed
	6/9/2005	ND	ND	ND	ND	NA	ND	NA	Fixed
	8/4/2005	ND	ND	ND	ND	NA	ND	NA	Fixed
	11/9/2005	ND	ND	ND	ND	NA	ND	NA	Fixed
	3/1/2006	ND	ND	ND	ND	NA	ND	NA	Fixed
	7/13/2006	ND	ND	ND	ND	ND	ND	NA	Fixed
	10/4/2006	ND	ND	ND	ND	ND	ND	NA	Fixed
	1/12/2011	ND	ND	ND	ND	ND	ND	NA	Fixed
	3/23/2011	ND	ND	ND	ND	ND	ND	NA	Fixed
	6/8/2011	ND	ND	ND	ND	ND	ND	NA	Fixed
	10/4/2011	ND	ND	ND	ND	ND	ND	NA	Fixed
	01/10/2013	ND	ND	ND	ND	ND	ND	NA	Fixed
	05/3/2013	ND	ND	ND	ND	ND	ND	NA	Fixed
	2/3/2014	Lab blank froze							
HRL(ug/L)		10	1000	700	10000				

[1] Report results in µg/L. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
[3] See http://www.health.state.mn.us/divs/eh/groundwater/hrltable.html for list of current HRLs.
Add additional rows as needed.
Notes:
NS = not sampled

Table 12
Other VOCs

Well Number	MW-8	MW-9	MW-9	MW-10	HRL	**Lab Type[2]**
Date Sampled	1/10/13	1/10/13	5/3/13	1/10/13		
Acetone	523	<500	<500	<250	4,000	Fixed
n-Butylbenzene	43.7	60.9	<25	40.3	NE	Fixed
Sec-Butylbenzene	22.8	31.7	<25	24.3	NE	Fixed
Cyclohexane	881	600	NA	1,030	NE	Fixed
1,2-Dichloroethane	<20	53.7	74.6	<10	4	Fixed
Cumene	115	122	81.1	119	300	Fixed
p-Isopropyltoluene	28.6	37.9	<25	40.5	NE	Fixed
Naphthalene	438	550	428	274	300	Fixed
n-Propylbenzene	234	315	193	225	NE	Fixed
1,2,4-Trimethylbenzene	1,540	2,080	1,270	1,890	100	Fixed
1,3,5-Trimethylbenzene	401	523	320	557	100	Fixed
Trip Blank						
Equip. Blank						
Lab Blank						

[1] Report results in µg/L. Use less than symbols to show detection limit.
[2] Indicate "mobile" or "fixed" in the lab type column.
[3] See http://www.health.state.mn.us/divs/eh/groundwater/hrltable.html for list of current HRLs.
Indicate other contaminants (either petroleum or non-petroleum derived) detected in water samples collected from wells.
Add additional rows as needed, and copy the entire table if more columns are needed.
Notes: NA = Not Analyzed; NE = Not Established

~~Table 13~~
~~Natural Attenuation Parameters~~

Well Number	Sample Date	Temp. °C	pH	Dissolved Oxygen (mg/L)	Nitrate (mg/L)	(Fe II) (mg/L)	(H_2S, HS^-) (mg/L)
MW-1							
MW-2							
MW-3							
MW-4							

Describe the methods and procedures used in Section 6. Add additional rows as needed
Notes:

Table 14
Free Product Recovery

Recovery Location ID	Recovery Date	Pre-Recovery Measurements				Recovery Method	Event Recovery[3]		Cumulative Recovery[4]		Comments
		Depth to FP[1] (ft)	Depth to GW[2] (ft)	FP Thickness (ft)	FP Volume (gal)		FP (gal)	GW (gal)	FP (gal)	GW (gal)	
MW-3	2/3/14	**17.52**	**18.04**	**.52'**	.08	No recovery required at this time	0	0	0	0	
	3/6/14	**17.59**	**18.12**	**.53'**	.08		0	0	0	0	
MW-7	2/3/14	**18.28**	**18.30**	**0.02'**	.004		0	0	0	0	
	3/6/14	**18.32**	**18.35**	**0.03'**	.004		0	0	0	0	
MW-9	2/3/14	**NA**	**18.46**	**NA**	0		0	0	0	0	
	3/6/14	**NA**	**18.46**	**NA**	0		0	0	0	0	
MW-8	2/3/14	NS					0	0	0	0	Not accessible, covered by snow/soil pile
	3/6/14	NS					0	0	0	0	Not accessible, covered by snow/soil pile

[1] FP = Free Product
[2] GW = Ground Water
[3] Volume recovered during individual recovery event for that location.
[4] Cumulative volume recovered at each recovery location (i.e., keep a running total for each recovery point).
Describe the methods and procedures used in Section 6. Add additional rows as needed.
Notes:
NA – Not applicable – no product
NS – not sampled

~~Table 15~~
~~Properties Located within 500 feet of the Release Source~~

Prop ID[1]	Property Address	Distance From Site (ft)	Water Supply Well			Public Water Supply		Base-ment (Y/N)	Sump (Y/N)	Possible Petroleum Sources (Y/N)	Comments (including property use)
			Well Present (Y/N)	How Determined[2]	Well Use[3]	Utilized (Y/N)	Confirmed by City (Y/N)				
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

[1] Property IDs should correspond to labeled properties in the Potential Receptor Map.
[2] For example, visual observation, personal contact, telephone, returned postcard, assumed (i.e., no postcard returned).
[3] For example, domestic, industrial, municipal, livestock, lawn/gardening, irrigation.
Add additional rows as needed.
Notes:

~~Table 16~~
~~Water Supply Wells Located within 500 feet of the~~
~~Release Source and Municipal or Industrial Wells within ½ mile~~

Property ID[1]	MDH Unique Well Number	Ground Elevation	Total Depth (ft)	Base of Casing (ft)	Static Elevation	Aquifer	Use	Owner	Distance and Direction from Source (ft)

[1] Property IDs should correspond to properties listed in Table 15 and labeled properties in the Potential Receptor Map if known or applicable.

Add additional rows as needed.

Notes:

~~Table 17~~
~~Surface Water Receptor Information~~

Map ID[1]	Name and Type[2]	Distance and Direction from Plume Edge (ft)	Clean Boring/Well Between?[3] (Y or N)

[1] Map ID should correspond to a surface water feature ID on the Potential Receptor Map.
[2] Type includes, but is not limited to, lake, retention pond, infiltration pond, ditch, intermittent stream, river, creek, rain garden, etc.
[3] If the surface water feature is upgradient or cross-gradient from the site, indicate so with "NA" for not applicable.
Add additional rows as needed.
Notes:

Table 18
Utility Receptor Information

Utility ID[1]	Description	Construction Material	Depth to Top of Structure	Diameter	Flow Direction (for liquids)	Year Installed	Backfill Material	Distance to Water Table
1	*Sanitary sewer main beneath S. Buchanan Street between 1st Ave. E. and 2nd Ave SE*	*PVC*	*10'*	*21 inches*	*South*	*2001-2002*	*Native soil*	*8'*
2	*Water main beneath S. Buchanan Street between 1st Ave. E. and 2nd Ave SE*	*Ductile Iron*	*7-8'*	*16 inches*	*North*	*2001-2002*	*Native soil*	*10'*
3	*Storm sewer beneath S. Buchanan Street between 1st Ave. E. and 2nd Ave SE*	*Concrete*	*4.5-5' ft*	*21 inches*	*South*	*unknown*	*Native soil*	*13'*
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

[1] ID should correspond to an identified utility line on the Potential Receptor Map.
Add more rows as needed.
Notes:

Utility ID[1]	Name, title, and telephone number for public entity contacted to obtain information or other source of information
1, 2, 3	As built drawings provided by utility locator with City of Cambridge.

[1] IDs should correspond to the same IDs in the above table.
Add more rows as needed.
Notes:

Table 19
Vapor Survey Results

Location ID[1]	Description[2]	Monitoring Date	PID Reading (ppm)	Percent of the LEL[3]
1	Storm Sewer catch basin	3/23/11	0	0
2	Storm Sewer manhole	3/23/11	0	0
3	Storm Sewer catch basin	3/23/11	0	0
4	Storm Sewer manhole	3/23/11	0	0
5	Storm Sewer catch basin	3/23/11	0	0
6	Storm Sewer catch basin	3/23/11	0	0
7	Storm Sewer catch basin	3/23/11	0	0
8	Storm Sewer manhole	3/23/11	0	0
9	Legion basement ambient	3/23/11	0	0

[1] Location IDs must match labeled locations on the Vapor Survey Map.
[2] Provide a brief description of the monitoring point (e.g., sump, basement corner, sanitary sewer manhole, storm sewer basin, etc.).
[3] LEL = Lower Explosive Limit.
Add additional rows as needed.
Notes:

Table 20
Results of Soil Gas Sampling for Vapor Intrusion Screening[1]

Sample ID[2]	**Vapor Pt 1**		**Vapor Pt 2**		**Vapor Pt 3**		**Subslab-1**				
Date	**1/21/2010**		**1/21/2010**		**1/21/2010**		**3/22/2011**				
Depth (feet)											
PID (ppm)											
COMPOUNDS	**Result**	**Report Limit**	**Result**	**Report Limit**	**Result**	**Report Limit**	**Result**	**Report Limit**	**Result**	**Report Limit**	**Residential Intrusion Screening Value[3]**
Acetone	<0.64	0.64	83.6	0.64	<0.64	0.64	64.4	0.86			31,000
Benzene	<0.87	0.87	84.6	0.87	<0.87	0.87	1.5	1.2			4.5
2-Butanone (MEK)							5.1	1.1			5000
1,3-Butadiene	<0.6	0.6	64.5	0.6	<0.6	0.6	<0.81	0.81			0.3
Carbon Disulfide	<0.84	0.84	3.7	0.84	<0.84	0.84	<1.1	1.1			700
Chloroform							10.2	1.8			100
Cyclohexane	<0.91	0.91	12.8	0.91	<0.91	0.91	3.2	1.2			6,000
Dichlorodifluoromethane							14.5	1.8			200
Ethanol	<2.5	2.5	15.0	2.5	<2.5	2.5	341	3.4			15,000
Ethylbenzene	<1.2	1.2	42.1	1.2	<1.2	1.2	5.7	1.6			1,000
4-Ethyltoluene	<3.4	3.4	7.4	3.4	<3.4	3.4	<4.5	4.5			NA
n-Heptane	<1.1	1.1	78	1.1	<0.96	0.96	4.5	1.5			NA
n-Hexane							12.2	1.3			2000
Methylene Chloride							13.8	1.3			20
2-Propanol							18.1	4.5			7000
Propylene							2.7	0.63			3000
Styrene	<1.2	1.2	44.7	1.2	<1.2	1.2	<1.6	1.6			1,000
Tolunene	<1.0	1.0	132	1.0	<1.0	1.0	22	1.4			5,000
1,2,4-Trimethylbenzene	<1.3	1.3	9.3	3.4	<3.4	3.4	<1.8	1.8			4
M&p-Xylene	<2.4	2.4	88.9	2.4	<2.4	2.4	24.8	3.2			100
o-Xylene	<1.2	1.2	27	1.2	<1.2	1.2	5.1	1.6			100

[1] Report results in µg/m^3.
[2] Sample IDs should correspond to labeled locations on the Vapor Intrusion Assessment Map.
[3] The Intrusion Screening Values can be found in Guidance Document 4-01a *Vapor Intrusion Assessments Performed during Site Investigations*.
Add additional rows as needed, and copy the entire table if more columns are needed.
Notes:

Appendix B

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

February 11, 2014

Katie Miller
Wenck Associates, Inc
1800 Pioneer Creek Center
P.O. BOX 249
Maple Plain, MN 55359

RE: Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Dear Katie Miller:
Enclosed are the analytical results for sample(s) received by the laboratory on February 03, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kabor Xiong

Kabor Xiong
kabor.xiong@pacelabs.com
Project Manager

Enclosures

cc: Adam P. Zobel, Wenck Associates, Inc

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

CERTIFICATIONS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Minnesota Certification IDs

1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Dept of Environmental Management #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: Pace
EPA Region 5 #WD-15J
Florida/NELAP Certification #: E87605
Georgia Certification #: 959
Hawaii Certification #Pace
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Louisiana Certification #: 03086
Louisiana Certification #: LA080009
Maine Certification #: 2007029
Maryland Certification #: 322
Michigan DEQ Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT CERT0092
Nebraska Certification #: Pace
Nevada Certification #: MN_00064
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Dakota Certification #: R-036
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Tennessee Certification #: 02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Virginia/DCLS Certification #: 002521
Virginia/VELAP Certification #: 460163
Washington Certification #: C754
West Virginia Certification #: 382
Wisconsin Certification #: 999407970

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Sample: MW-1 **Lab ID: 10256707001** Collected: 02/03/14 11:25 Received: 02/03/14 17:34 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
Diesel Range Organics	**1.3**	mg/L	0.11	1	02/04/14 07:12	02/05/14 11:39		T7
Surrogates								
n-Triacontane (S)	91	%.	50-150	1	02/04/14 07:12	02/05/14 11:39	638-68-6	
WIGRO GCV	Analytical Method: WI MOD GRO							
Benzene	**2.2**	ug/L	1.0	1		02/07/14 04:20	71-43-2	
Ethylbenzene	**20.8**	ug/L	1.0	1		02/07/14 04:20	100-41-4	
Gasoline Range Organics	**1430**	ug/L	100	1		02/07/14 04:20		
Toluene	ND	ug/L	1.0	1		02/07/14 04:20	108-88-3	
Xylene (Total)	**434**	ug/L	3.0	1		02/07/14 04:20	1330-20-7	
Surrogates								
a,a,a-Trifluorotoluene (S)	96	%.	80-125	1		02/07/14 04:20	98-08-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Sample: MW-6 **Lab ID: 10256707002** Collected: 02/03/14 13:20 Received: 02/03/14 17:34 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
Diesel Range Organics	**7.2**	mg/L	0.51	5	02/04/14 07:12	02/05/14 13:07		T7
Surrogates								
n-Triacontane (S)	87	%.	50-150	5	02/04/14 07:12	02/05/14 13:07	638-68-6	
WIGRO GCV	Analytical Method: WI MOD GRO							
Benzene	**2480**	ug/L	10.0	10		02/07/14 04:40	71-43-2	
Ethylbenzene	**1260**	ug/L	10.0	10		02/07/14 04:40	100-41-4	
Gasoline Range Organics	**20700**	ug/L	1000	10		02/07/14 04:40		
Toluene	**1710**	ug/L	10.0	10		02/07/14 04:40	108-88-3	
Xylene (Total)	**4170**	ug/L	30.0	10		02/07/14 04:40	1330-20-7	
Surrogates								
a,a,a-Trifluorotoluene (S)	107	%.	80-125	10		02/07/14 04:40	98-08-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Sample: MW-9 **Lab ID: 10256707003** Collected: 02/03/14 13:00 Received: 02/03/14 17:34 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
Diesel Range Organics	**6.2**	mg/L	0.54	5	02/04/14 07:12	02/05/14 13:23		T7
Surrogates								
n-Triacontane (S)	87	%.	50-150	5	02/04/14 07:12	02/05/14 13:23	638-68-6	
WIGRO GCV	Analytical Method: WI MOD GRO							
Benzene	**3950**	ug/L	10.0	10		02/07/14 04:59	71-43-2	
Ethylbenzene	**1460**	ug/L	10.0	10		02/07/14 04:59	100-41-4	
Gasoline Range Organics	**35600**	ug/L	5000	50		02/11/14 00:44		
Toluene	**6030**	ug/L	50.0	50		02/11/14 00:44	108-88-3	
Xylene (Total)	**6860**	ug/L	30.0	10		02/07/14 04:59	1330-20-7	
Surrogates								
a,a,a-Trifluorotoluene (S)	92	%.	80-125	10		02/07/14 04:59	98-08-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Sample: MW-10 **Lab ID: 10256707004** Collected: 02/03/14 14:30 Received: 02/03/14 17:34 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
Diesel Range Organics	**7.5**	mg/L	0.55	5	02/04/14 07:12	02/05/14 13:15		T7
Surrogates								
n-Triacontane (S)	91	%.	50-150	5	02/04/14 07:12	02/05/14 13:15	638-68-6	
WIGRO GCV	Analytical Method: WI MOD GRO							
Benzene	**249**	ug/L	10.0	10		02/07/14 05:18	71-43-2	
Ethylbenzene	**364**	ug/L	10.0	10		02/07/14 05:18	100-41-4	
Gasoline Range Organics	**12000**	ug/L	1000	10		02/07/14 05:18		
Toluene	**313**	ug/L	10.0	10		02/07/14 05:18	108-88-3	
Xylene (Total)	**1730**	ug/L	30.0	10		02/07/14 05:18	1330-20-7	
Surrogates								
a,a,a-Trifluorotoluene (S)	95	%.	80-125	10		02/07/14 05:18	98-08-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Sample: Duplicate-1 **Lab ID: 10256707005** Collected: 02/03/14 00:00 Received: 02/03/14 17:34 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
Diesel Range Organics	**5.9**	mg/L	0.55	5	02/04/14 07:12	02/05/14 13:31		T7
Surrogates								
n-Triacontane (S)	88	%.	50-150	5	02/04/14 07:12	02/05/14 13:31	638-68-6	
WIGRO GCV	Analytical Method: WI MOD GRO							
Benzene	**2760**	ug/L	10.0	10		02/07/14 05:38	71-43-2	
Ethylbenzene	**1330**	ug/L	10.0	10		02/07/14 05:38	100-41-4	
Gasoline Range Organics	**30100**	ug/L	1000	10		02/07/14 05:38		
Toluene	**4800**	ug/L	10.0	10		02/07/14 05:38	108-88-3	
Xylene (Total)	**6420**	ug/L	30.0	10		02/07/14 05:38	1330-20-7	
Surrogates								
a,a,a-Trifluorotoluene (S)	92	%.	80-125	10		02/07/14 05:38	98-08-8	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

QC Batch: GCV/11655 Analysis Method: WI MOD GRO
QC Batch Method: WI MOD GRO Analysis Description: WIGRO GCV Water
Associated Lab Samples: 10256707001, 10256707002, 10256707003, 10256707004, 10256707005

METHOD BLANK: 1620278 Matrix: Water
Associated Lab Samples: 10256707001, 10256707002, 10256707003, 10256707004, 10256707005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	1.0	02/06/14 21:35	
Ethylbenzene	ug/L	ND	1.0	02/06/14 21:35	
Gasoline Range Organics	ug/L	ND	100	02/06/14 21:35	
Toluene	ug/L	ND	1.0	02/06/14 21:35	
Xylene (Total)	ug/L	ND	3.0	02/06/14 21:35	
a,a,a-Trifluorotoluene (S)	%.	100	80-125	02/06/14 21:35	

LABORATORY CONTROL SAMPLE & LCSD: 1620279 1620280

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Benzene	ug/L	100	95.0	100	95	100	80-120	5	20	
Ethylbenzene	ug/L	100	97.6	102	98	102	80-120	5	20	
Gasoline Range Organics	ug/L	1000	987	1010	99	101	80-120	3	20	
Toluene	ug/L	100	96.7	101	97	101	80-120	5	20	
Xylene (Total)	ug/L	300	297	317	99	106	80-120	7	20	
a,a,a-Trifluorotoluene (S)	%.				98	98	80-125			

MATRIX SPIKE SAMPLE: 1622019

Parameter	Units	10256928009 Result	Spike Conc.	MS Result	MS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	ND	100	107	107	80-120	
Ethylbenzene	ug/L	ND	100	111	111	80-120	
Gasoline Range Organics	ug/L	ND	1000	1100	110	80-120	
Toluene	ug/L	ND	100	109	109	80-120	
Xylene (Total)	ug/L	ND	300	335	112	80-120	
a,a,a-Trifluorotoluene (S)	%.				97	80-125	

SAMPLE DUPLICATE: 1622020

Parameter	Units	10256928010 Result	Dup Result	RPD	Qualifiers
Benzene	ug/L	ND	ND		
Ethylbenzene	ug/L	ND	ND		
Gasoline Range Organics	ug/L	ND	ND		
Toluene	ug/L	ND	ND		
Xylene (Total)	ug/L	ND	ND		
a,a,a-Trifluorotoluene (S)	%.	102	100	2	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

QC Batch: OEXT/24289 Analysis Method: WI MOD DRO
QC Batch Method: WI MOD DRO Analysis Description: WIDRO GCS
Associated Lab Samples: 10256707001, 10256707002, 10256707003, 10256707004, 10256707005

METHOD BLANK: 1618946 Matrix: Water
Associated Lab Samples: 10256707001, 10256707002, 10256707003, 10256707004, 10256707005

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Diesel Range Organics	mg/L	ND	0.10	02/05/14 11:15	
n-Triacontane (S)	%.	88	50-150	02/05/14 11:15	

LABORATORY CONTROL SAMPLE & LCSD: 1618947 1618948

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
Diesel Range Organics	mg/L	2	1.6	1.7	81	84	75-115	3	20	
n-Triacontane (S)	%.				87	89	50-150			

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALIFIERS

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PRL - Pace Reporting Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

T7 Low boiling point hydrocarbons are present in the sample.

Pace Analytical Services, Inc.
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 3228-01 Former Union 76
Pace Project No.: 10256707

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10256707001	**MW-1**	WI MOD DRO	OEXT/24289	WI MOD DRO	GCSV/12786
10256707002	**MW-6**	WI MOD DRO	OEXT/24289	WI MOD DRO	GCSV/12786
10256707003	**MW-9**	WI MOD DRO	OEXT/24289	WI MOD DRO	GCSV/12786
10256707004	**MW-10**	WI MOD DRO	OEXT/24289	WI MOD DRO	GCSV/12786
10256707005	**Duplicate-1**	WI MOD DRO	OEXT/24289	WI MOD DRO	GCSV/12786
10256707001	**MW-1**	WI MOD GRO	GCV/11655		
10256707002	**MW-6**	WI MOD GRO	GCV/11655		
10256707003	**MW-9**	WI MOD GRO	GCV/11655		
10256707004	**MW-10**	WI MOD GRO	GCV/11655		
10256707005	**Duplicate-1**	WI MOD GRO	GCV/11655		

CHAIN-OF-CUSTODY / Analytical Request Document

Pace Analytical® www.pacelabs.com

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

1124/1125

10256707

Page: 1 of 1

1693633

Section A Required Client Information:

Company: ~~Kemptherm~~ Wenck Associates
Address: 1802 Wooddale Dr.
Suite 100, Woodbury MN 55125
Email To: Kmiller@wenck.com
Phone: 651-395-5228 Fax: 763-479-4260
Requested Due Date/TAT: Standard

Section B Required Project Information:

Report To: Kmiller@wenck.com
Copy To: azobel@wenck.com
Purchase Order No.:
Project Name: Former Union 76
Project Number: 3228-01

Section C Invoice Information:

Attention: Accounts Payable
Company Name: Wenck Associates
Address: P.O. Box 249, 1800 Pioneer Creek Centre, Maple Plain, MN 55359
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY: NPDES [X] GROUND WATER [ ] DRINKING WATER [ ] UST [ ] RCRA [ ] OTHER

Site Location STATE: Cambridge MN

Requested Analysis Filtered (Y/N)

ITEM #	Section D Required Client Information: SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COMPOSITE START TIME	COMPOSITE END/GRAB DATE	COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	DRO	GRO / BTEX	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	MW-1	WT	G	2/3/14	11:25	2/3/14	11:25		5				X					Y	X	X		10256707001
2	MW-6	WT	G	2/3/14	13:20	2/3/14	13:20		5				X					Y	X	X		002
3	MW-9	WT	G	2/3/14	13:00	2/3/14	13:00		5				X					Y	X	X		003
4	MW-10	WT	G	2/3/14	14:30	2/3/14	14:30		5				X					Y	X	X		004
5	Duplicate-1	WT	G	2/3/14	-	2/3/14	-		5				X					Y	X	X		005
6	Trip Blank	WT	-	2/3/14	-	2/3/14	-		1				X					Y		X		BTEX only
7	last line																					
8																						
9																						
10																						
11																						
12																						

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME
	Kathryn Miller / Wenck	2/3/14	18:00	AM/pace	2/3/14	1734

SAMPLE CONDITIONS: Temp in °C: 1.8 | Received on Ice (Y/N): Y | Custody Sealed Cooler (Y/N): N | Samples Intact (Y/N): ~~Y~~ N 2/3/14 AM

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Kathryn Miller

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 2/3/14

ORIGINAL

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 07Nov2013 Page 1 of 1
	Document No.: **F-MN-L-213-rev.08**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Wenck Associates

Project #: WO#: 10256707

10256707

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☑ Client ☐ Commercial ☐ Pace ☐ Other:

Tracking Number:

Custody Seal on Cooler/Box Present? ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☐ No **Optional:** Proj. Due Date: Proj. Name:

Packing Material: ☑ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☐ Yes ☑ No

Thermom. Used: ☐ 80512447 ☐ 72337080 ☐ B88A912167504 ☑ B88A9132521491 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

Cooler Temp Read (°C): 1.6 **Cooler Temp Corrected (°C):** 1.8 **Biological Tissue Frozen?** ☐ Yes ☐ No ☑ N/A

Temp should be above freezing to 6°C **Correction Factor:** Tm-2 **Date and Initials of Person Examining Contents:** 2/3/14 MM

				Comments:
Chain of Custody Present?	☑ Yes	☐ No	☐ N/A	1.
Chain of Custody Filled Out?	☑ Yes	☐ No	☐ N/A	2.
Chain of Custody Relinquished?	☑ Yes	☐ No	☐ N/A	3.
Sampler Name and/or Signature on COC?	☑ Yes	☐ No	☐ N/A	4.
Samples Arrived within Hold Time?	☑ Yes	☐ No	☐ N/A	5.
Short Hold Time Analysis (<72 hr)?	☐ Yes	☑ No	☐ N/A	6.
Rush Turn Around Time Requested?	☐ Yes	☑ No	☐ N/A	7.
Sufficient Volume?	☑ Yes	☐ No	☐ N/A	8.
Correct Containers Used?	☑ Yes	☐ No	☐ N/A	9.
-Pace Containers Used?	☑ Yes	☐ No	☐ N/A	
Containers Intact?	☐ Yes	☑ No	☐ N/A	10. Broken trip blanks
Filtered Volume Received for Dissolved Tests?	☐ Yes	☐ No	☑ N/A	11.
Sample Labels Match COC?	☐ Yes	☑ No	☐ N/A	12. Broken Trip Blanks.
-Includes Date/Time/ID/Analysis Matrix: WT				
All containers needing acid/base preservation have been checked? Noncompliances are noted in 13.	☐ Yes	☐ No	☑ N/A	13. ☐ HNO_3 ☐ H_2SO_4 ☐ NaOH ☐ HCl Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, HCl<2; NaOH>12)	☐ Yes	☐ No	☑ N/A	
Exceptions: VOA, Coliform, TOC, Oil and Grease, WI-DRO (water) DOC	☑ Yes	☐ No		Initial when completed: MM Lot # of added preservative:
Headspace in VOA Vials (>6mm)?	☐ Yes	☑ No	☐ N/A	14.
Trip Blank Present?	☑ Yes	☐ No	☐ N/A	15. Both Trip Blanks were broken.
Trip Blank Custody Seals Present?	☐ Yes	☑ No	☐ N/A	
Pace Trip Blank Lot # (if purchased):				

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐ Yes ☐ No

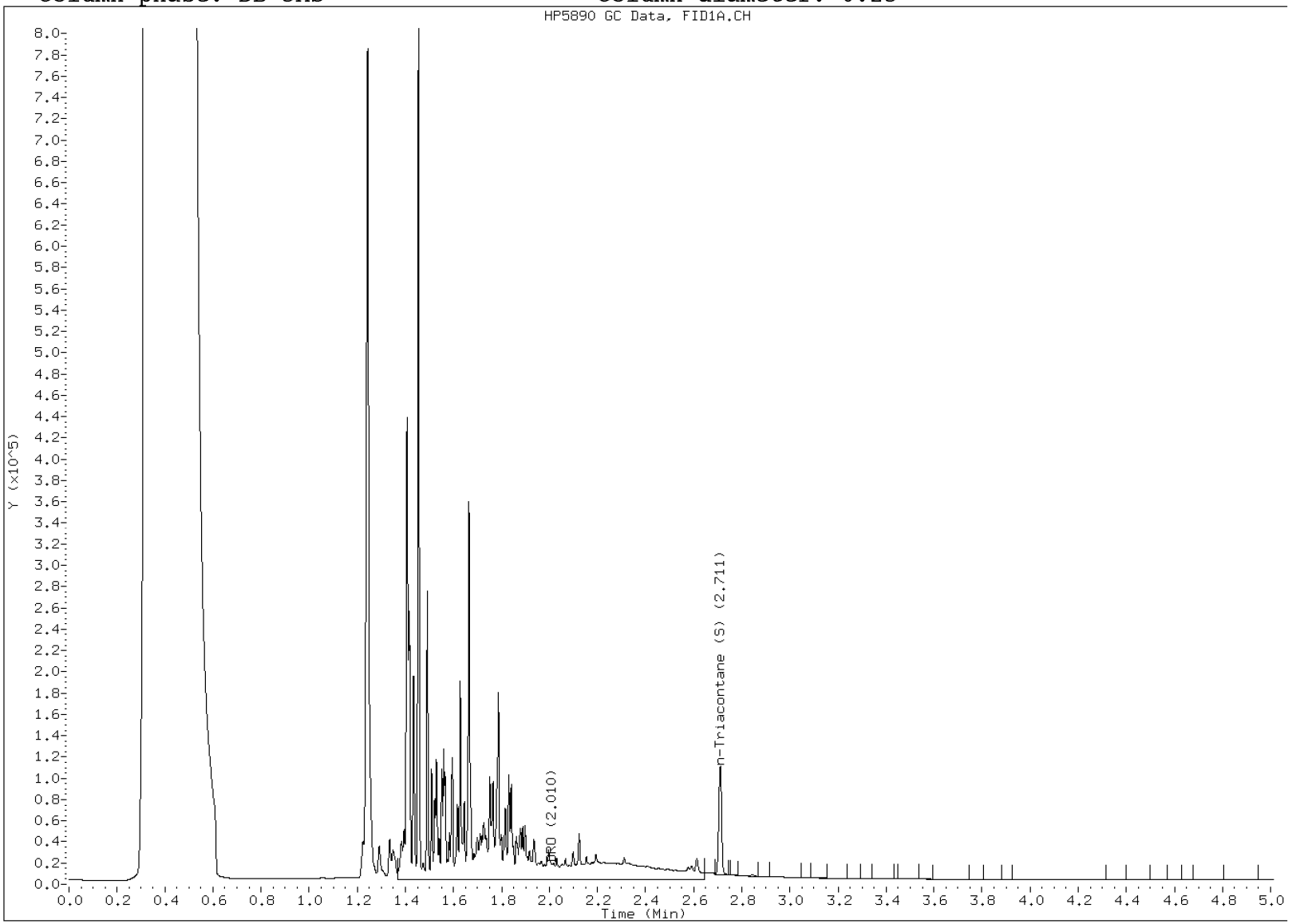
Person Contacted: Date/Time:

Comments/Resolution: Notified client about broken trip blanks.

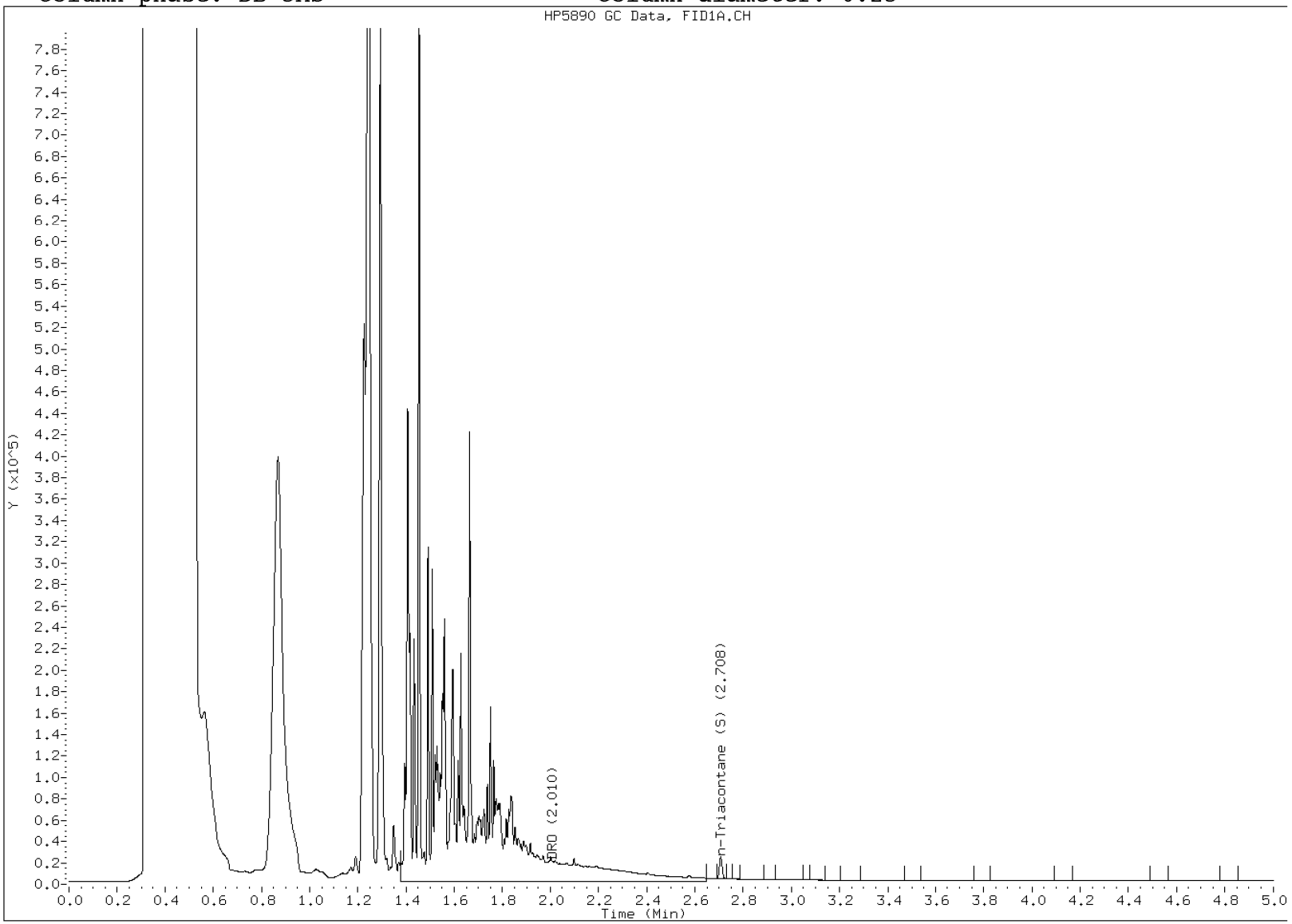
Project Manager Review: Kerlin Xiong **Date:** 2-4-14

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers)

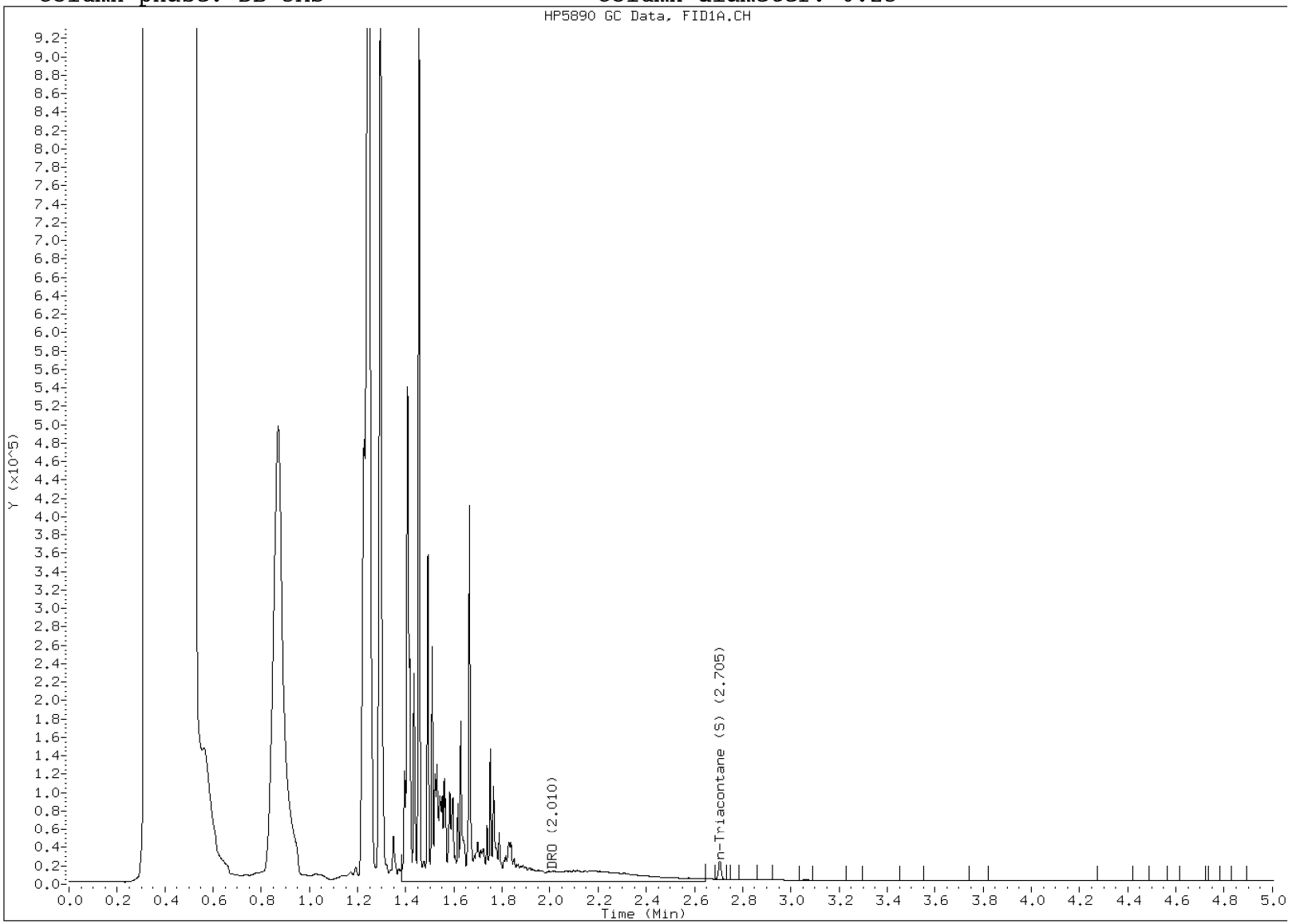
Data File: \\192.168.10.12\chem\10gcs4.i\020514dro.b/0205F017.D
Report Date: 02/05/2014
Sample ID: 10256707001
Client ID: Instrument: 10gcs4.i
Sample Information: 10256707001
Purge Volume: Operator: MT
Column phase: DB-5MS Column diameter: 0.25



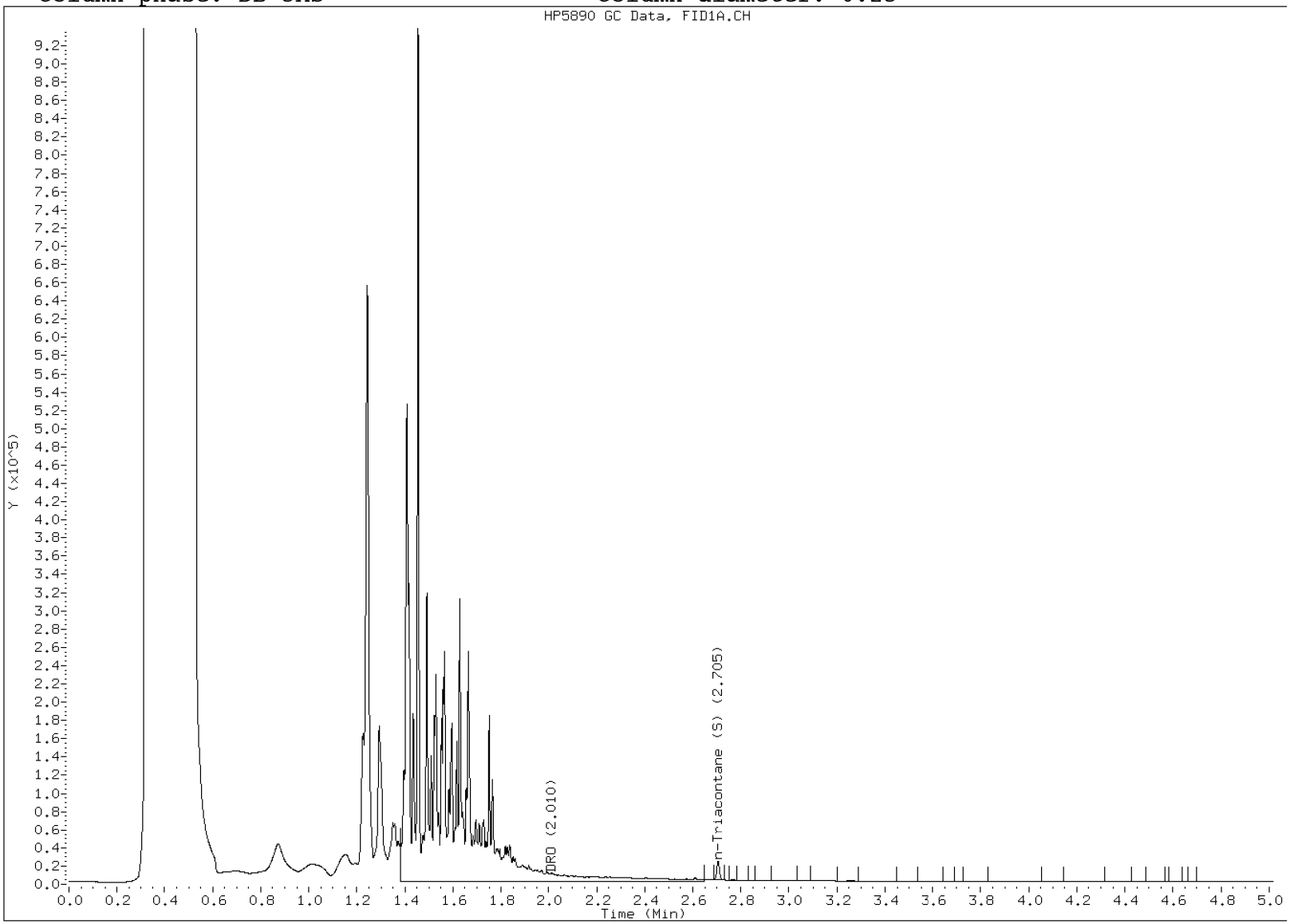
Data File: \\192.168.10.12\chem\10gcs4.i\020514dro.b/0205F028.D
Report Date: 02/05/2014
Sample ID: 10256707002
Client ID: Instrument: 10gcs4.i
Sample Information: 10256707002,5
Purge Volume: Operator: MT
Column phase: DB-5MS Column diameter: 0.25



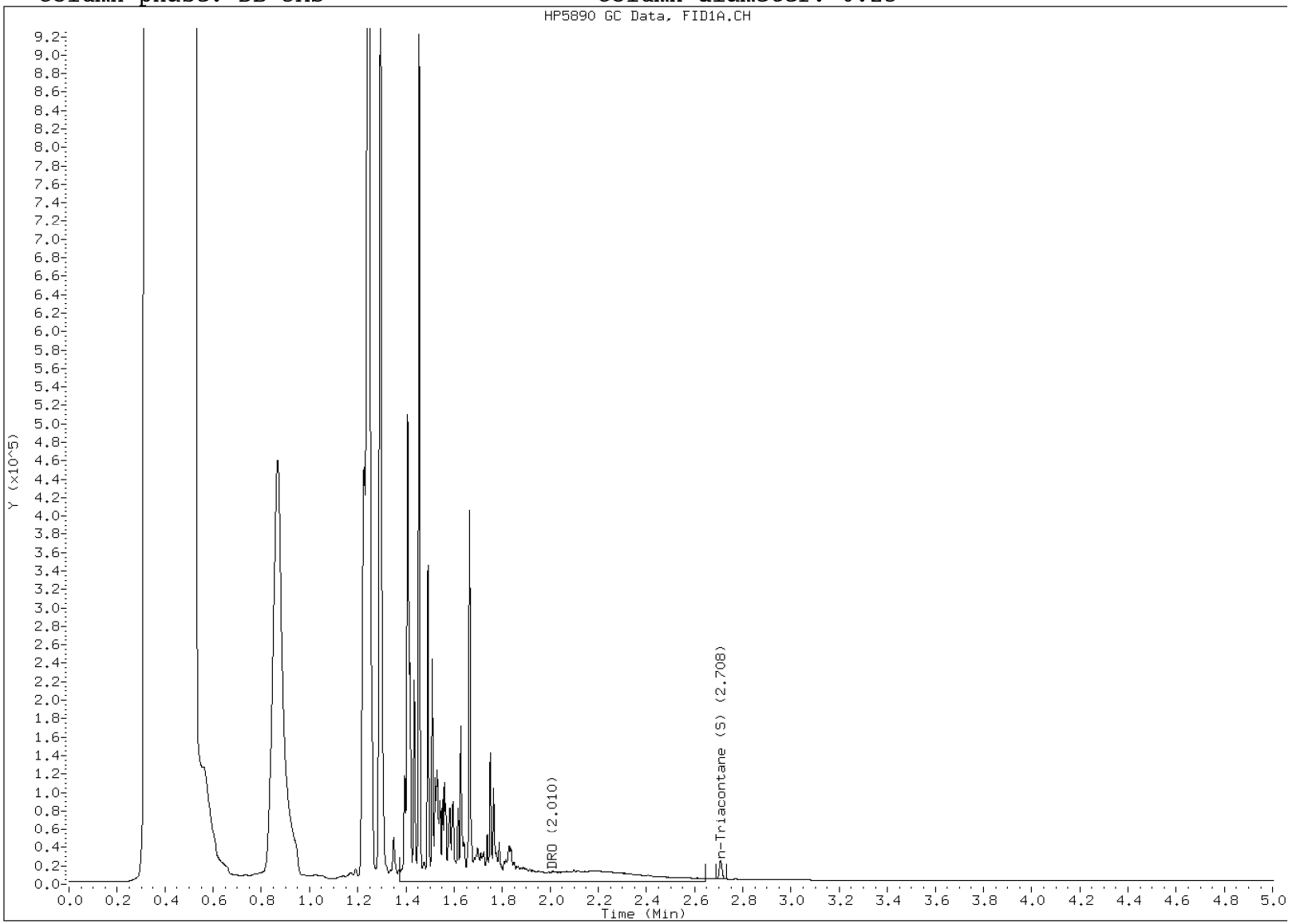
Data File: \\192.168.10.12\chem\10gcs4.i\020514dro.b/0205F030.D
Report Date: 02/05/2014
Sample ID: 10256707003
Client ID: Instrument: 10gcs4.i
Sample Information: 10256707003,5
Purge Volume: Operator: MT
Column phase: DB-5MS Column diameter: 0.25



Data File: \\192.168.10.12\chem\10gcs4.i\020514dro.b/0205F029.D
Report Date: 02/05/2014
Sample ID: 10256707004
Client ID: Instrument: 10gcs4.i
Sample Information: 10256707004,5
Purge Volume: Operator: MT
Column phase: DB-5MS Column diameter: 0.25



Data File: \\192.168.10.12\chem\10gcs4.i\020514dro.b/0205F031.D
Report Date: 02/05/2014
Sample ID: 10256707005
Client ID: Instrument: 10gcs4.i
Sample Information: 10256707005,5
Purge Volume: Operator: MT
Column phase: DB-5MS Column diameter: 0.25



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-1.b/G1-03742.d

Report Date: 02/08/2014

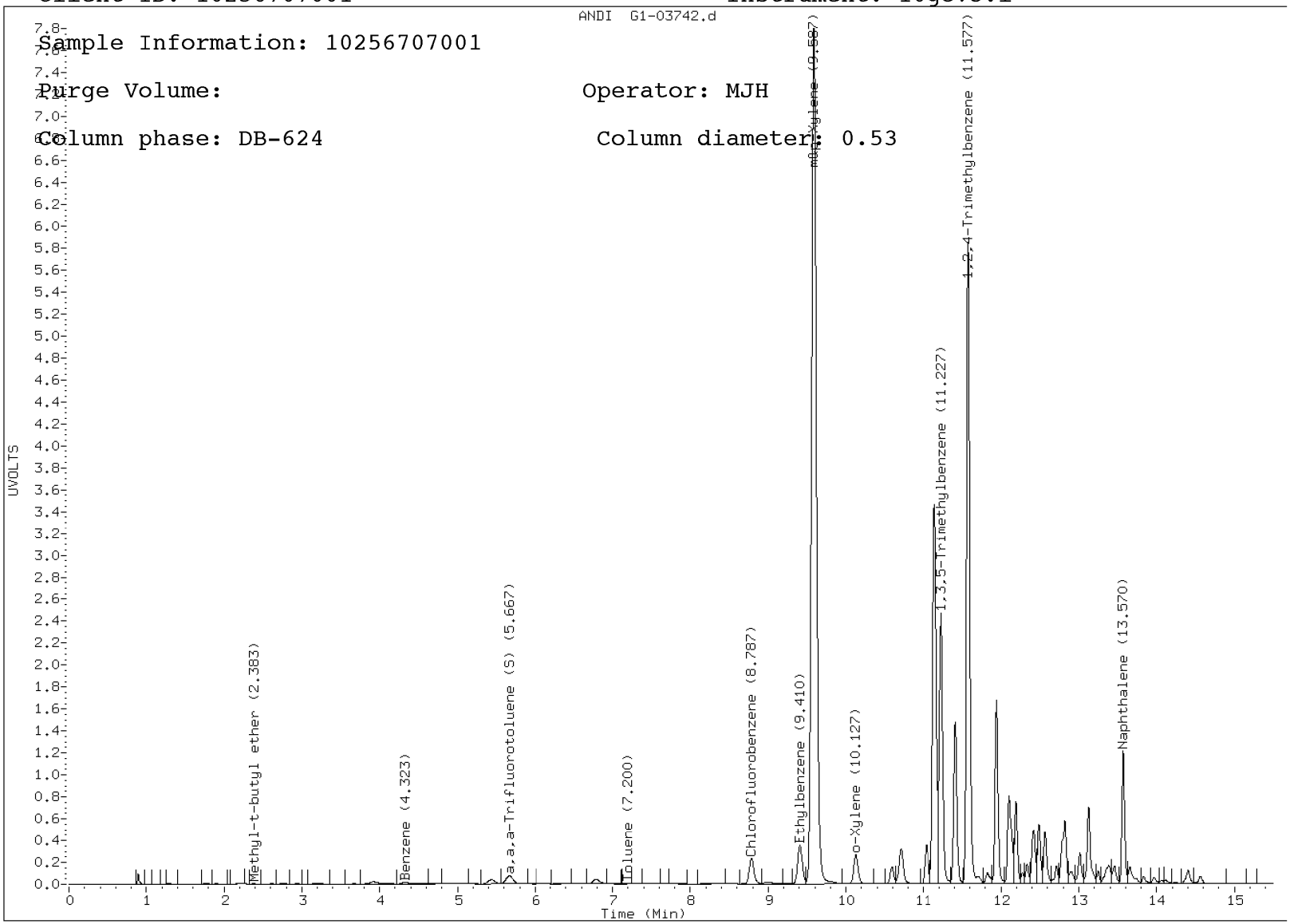
Sample ID: 10256707001

Client ID: 10256707001 Instrument: 10gcv3.i

Sample Information: 10256707001

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-2.b/G1-03742.d

Report Date: 02/08/2014

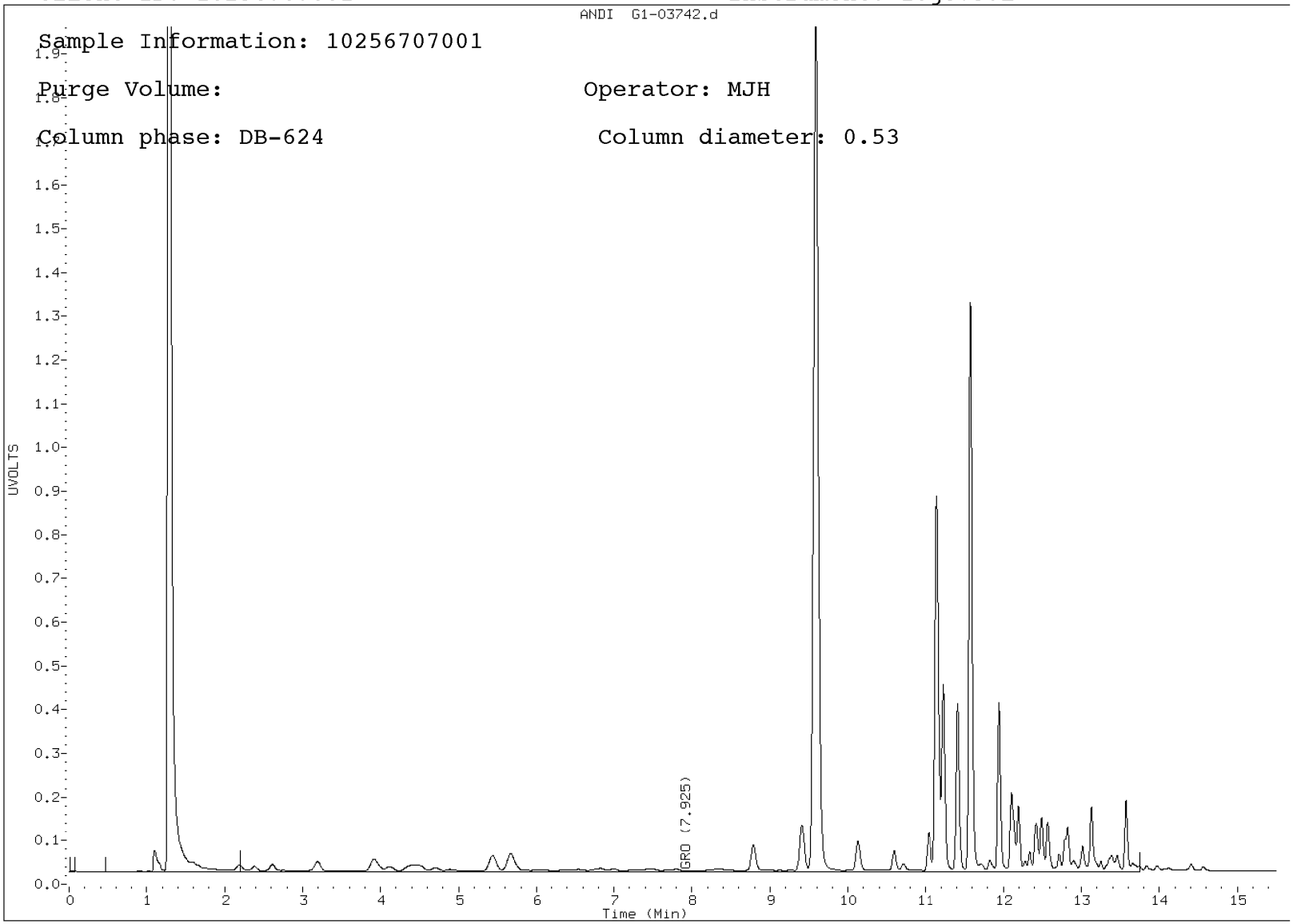
Sample ID: 10256707001

Client ID: 10256707001 Instrument: 10gcv3.i

Sample Information: 10256707001

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-1.b/G1-03743.d

Report Date: 02/08/2014

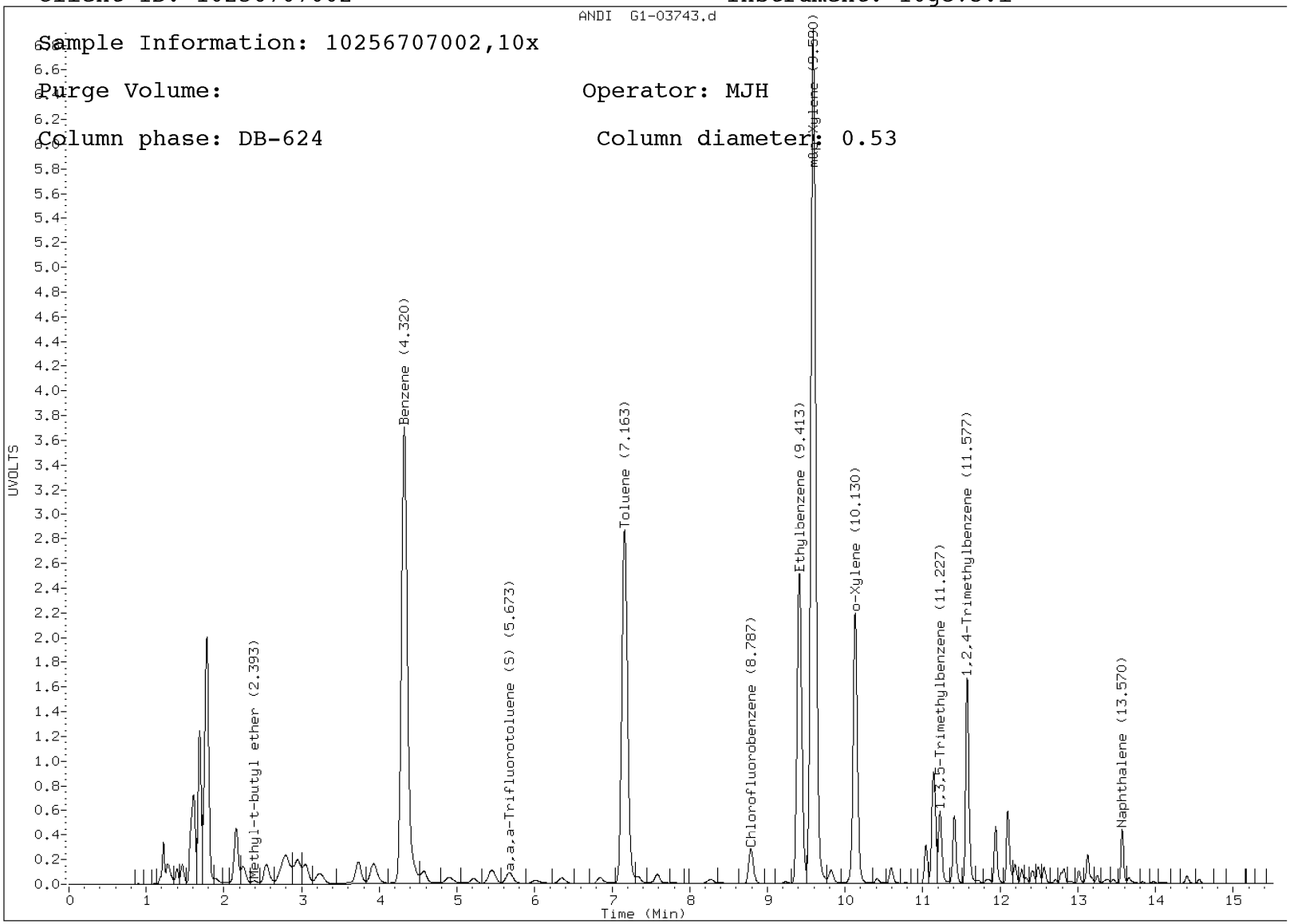
Sample ID: 10256707002

Client ID: 10256707002 Instrument: 10gcv3.i

Sample Information: 10256707002,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-2.b/G1-03743.d

Report Date: 02/08/2014

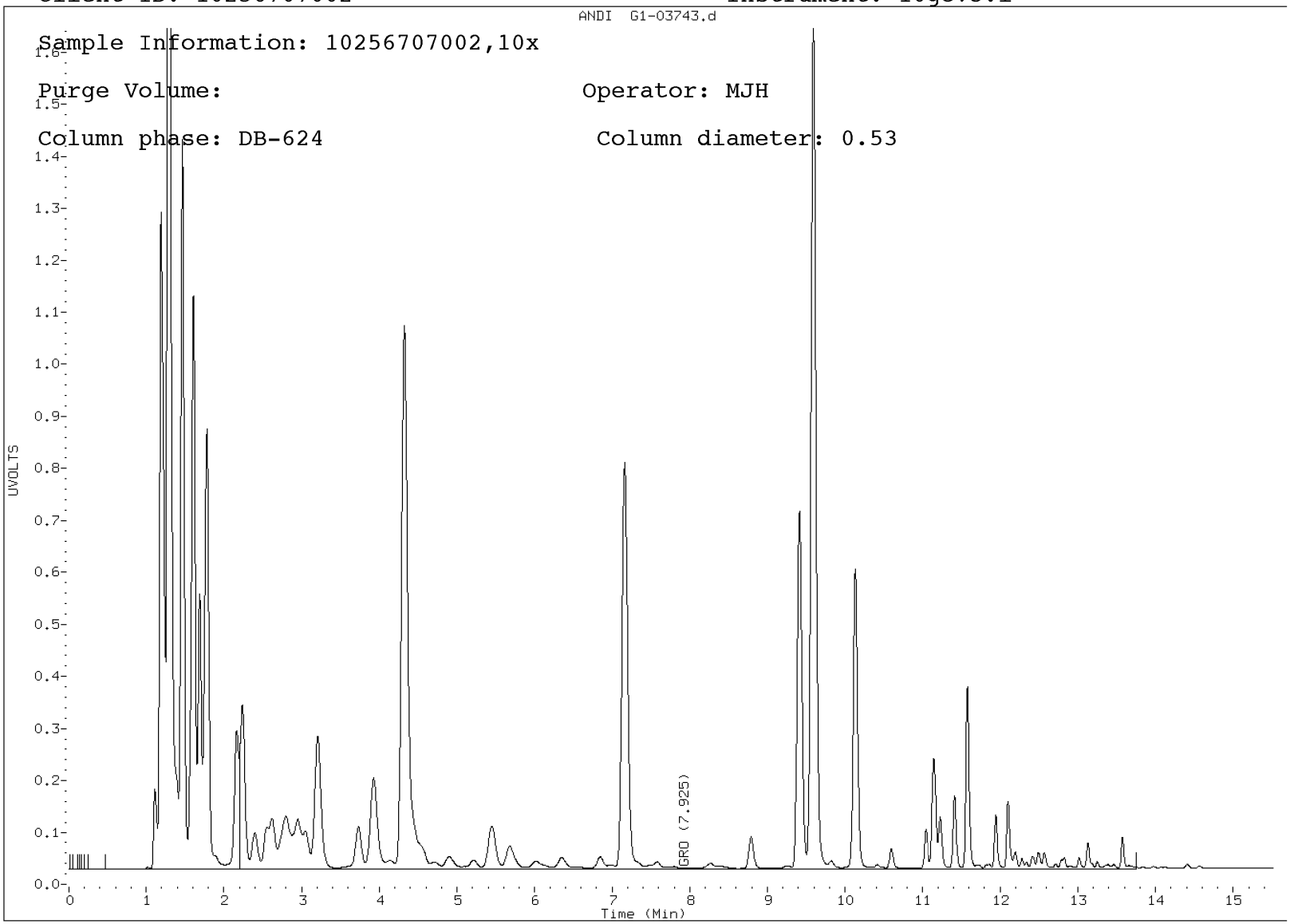
Sample ID: 10256707002

Client ID: 10256707002 Instrument: 10gcv3.i

Sample Information: 10256707002,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-1.b/G1-03744.d

Report Date: 02/11/2014

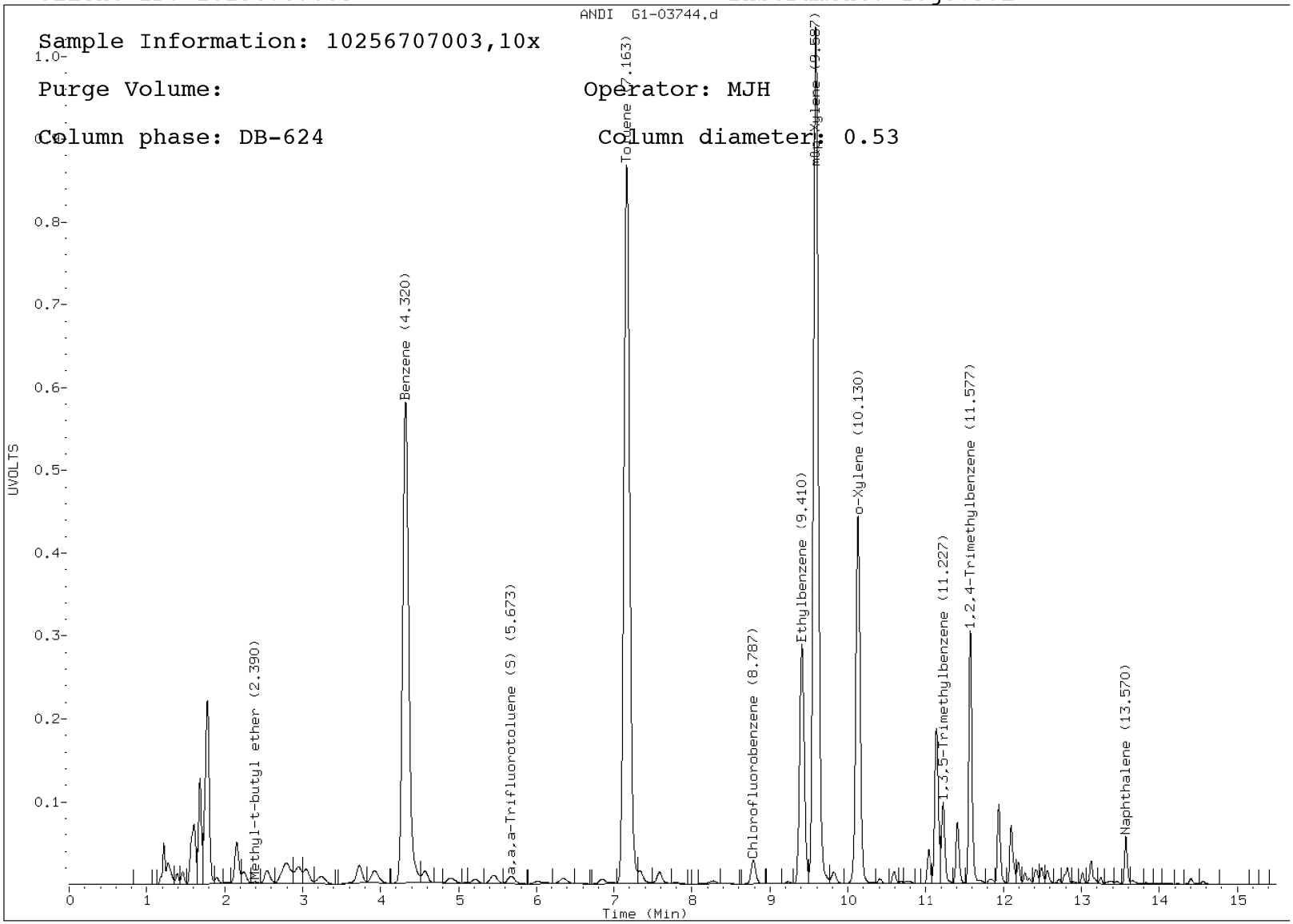
Sample ID: 10256707003

Client ID: 10256707003 Instrument: 10gcv3.i

Sample Information: 10256707003,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-2.b/G1-03744.d

Report Date: 02/11/2014

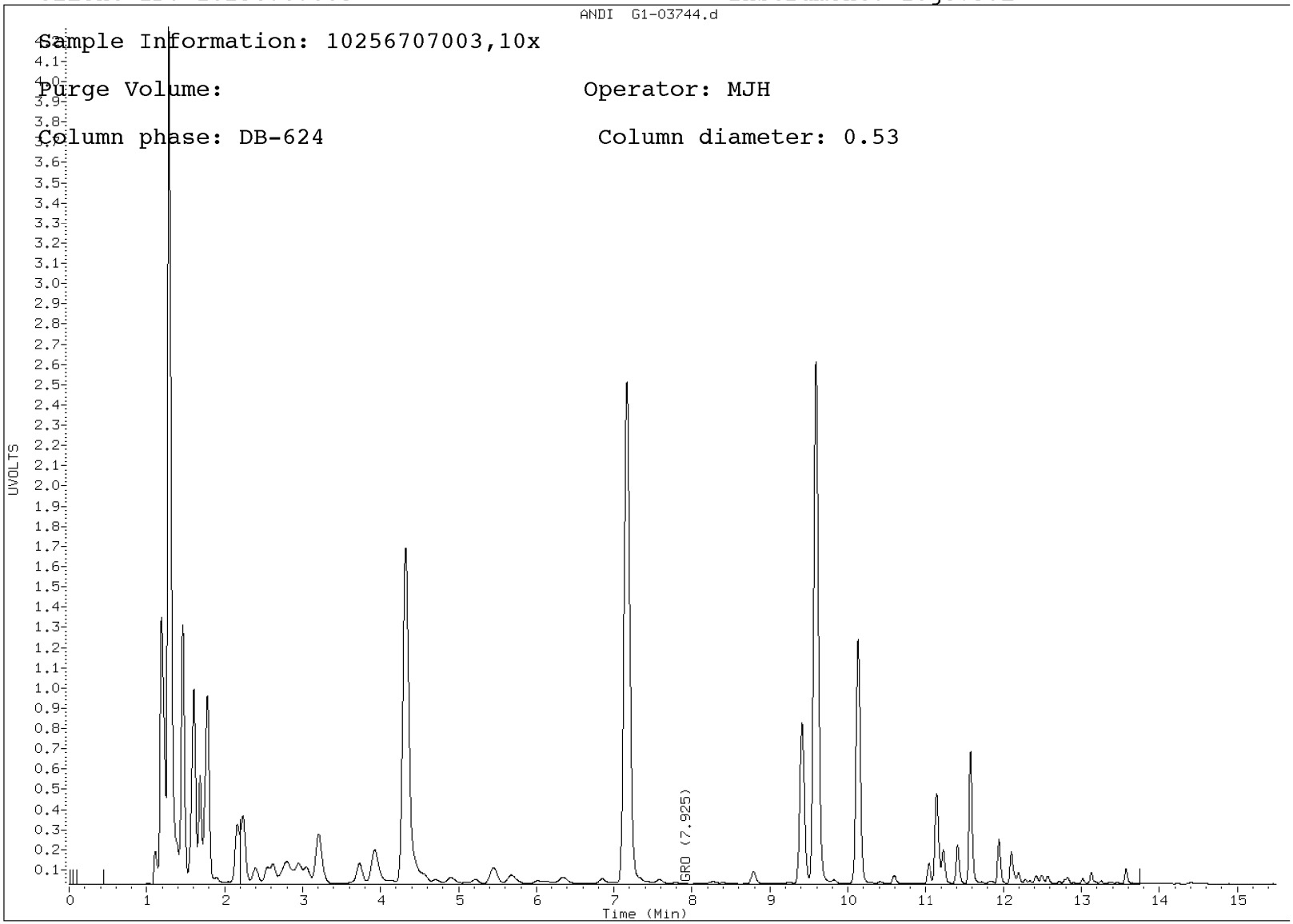
Sample ID: 10256707003

Client ID: 10256707003 Instrument: 10gcv3.i

Sample Information: 10256707003,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\021014b-1.b/G1-04142.d

Report Date: 02/11/2014

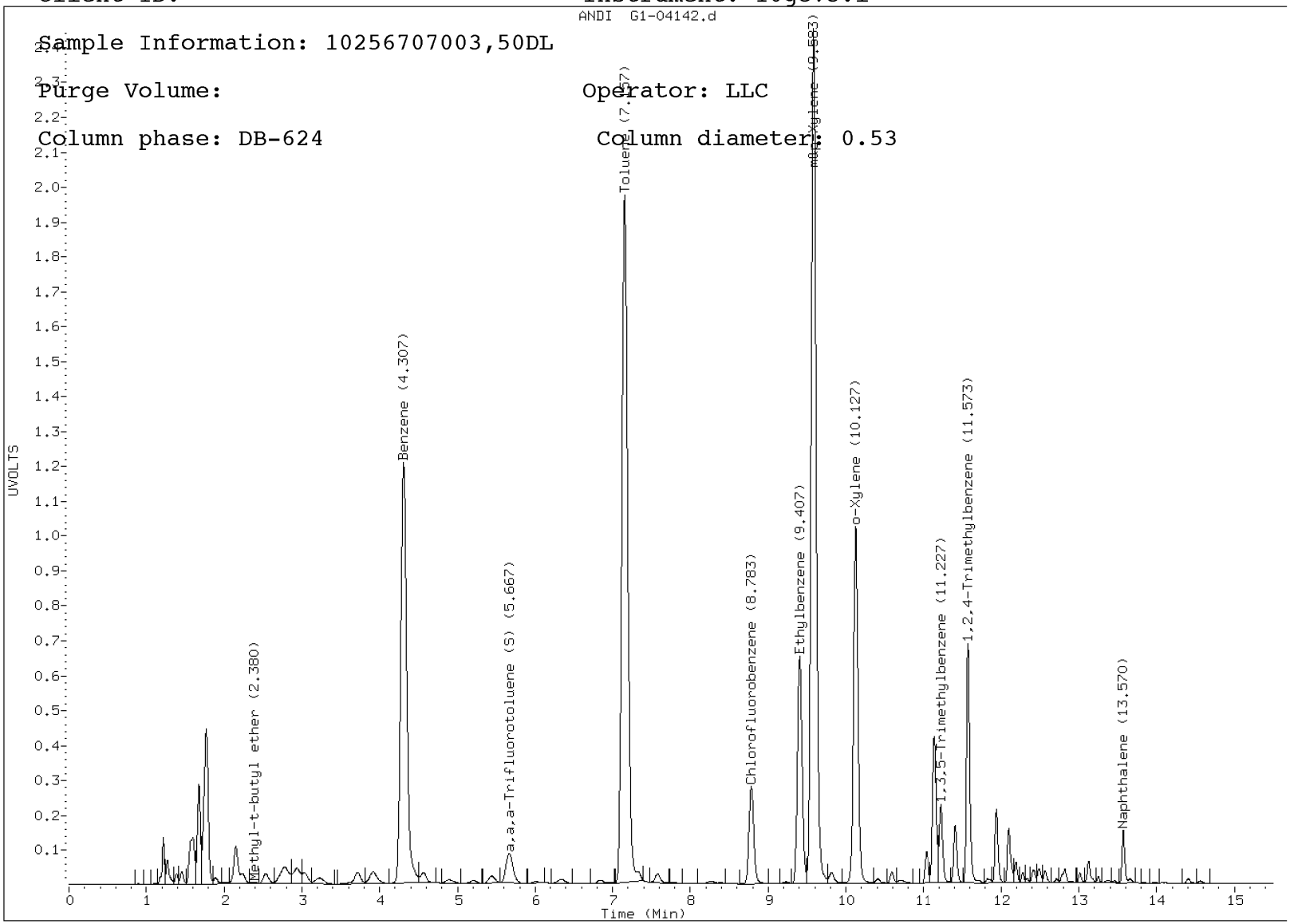
Sample ID: 10256707003

Client ID: Instrument: 10gcv3.i

Sample Information: 10256707003,50DL

Purge Volume: Operator: LLC

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\021014b-2.b/G1-04142.d

Report Date: 02/11/2014

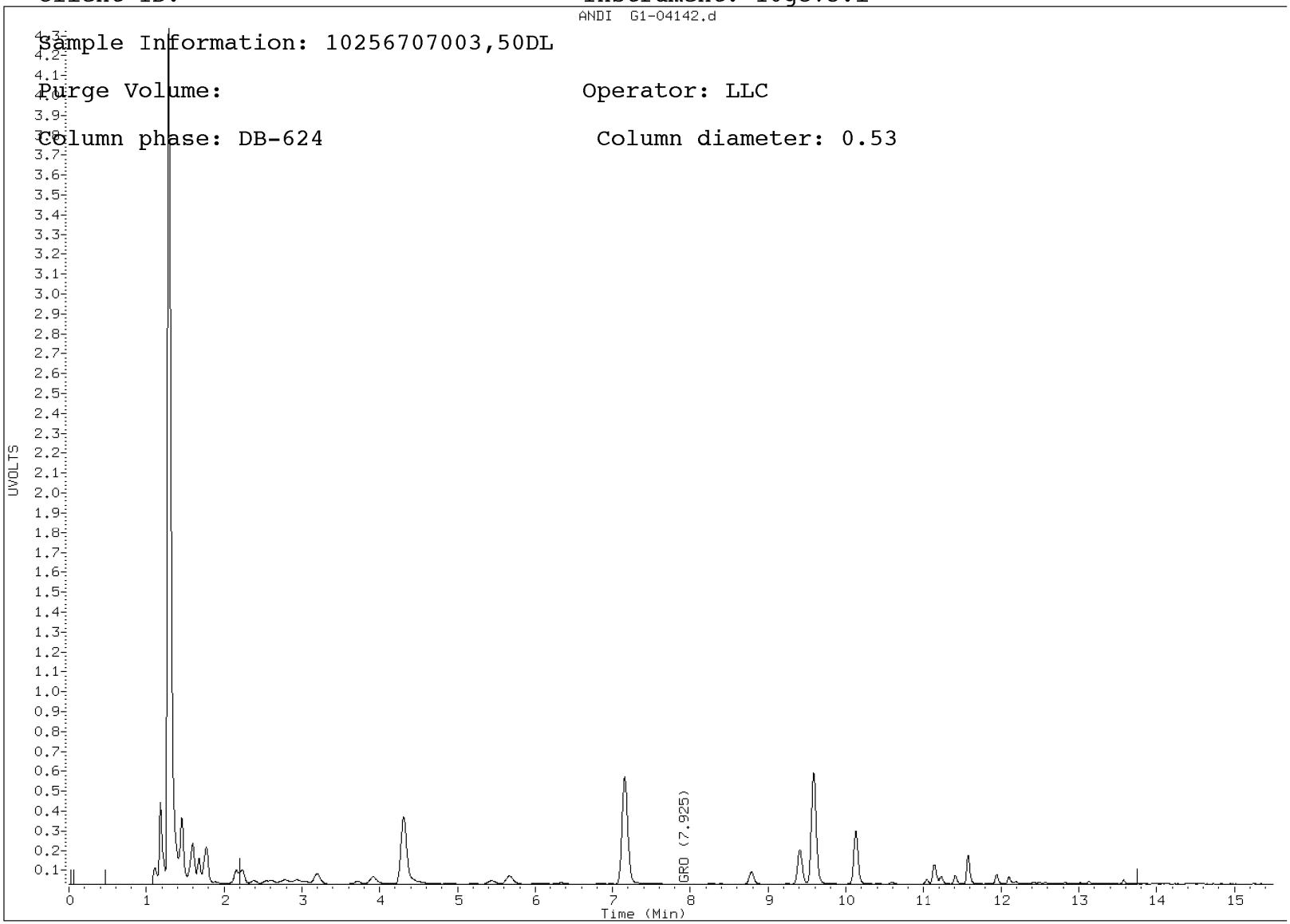
Sample ID: 10256707003

Client ID: Instrument: 10gcv3.i

Sample Information: 10256707003,50DL

Purge Volume: Operator: LLC

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-1.b/G1-03745.d

Report Date: 02/08/2014

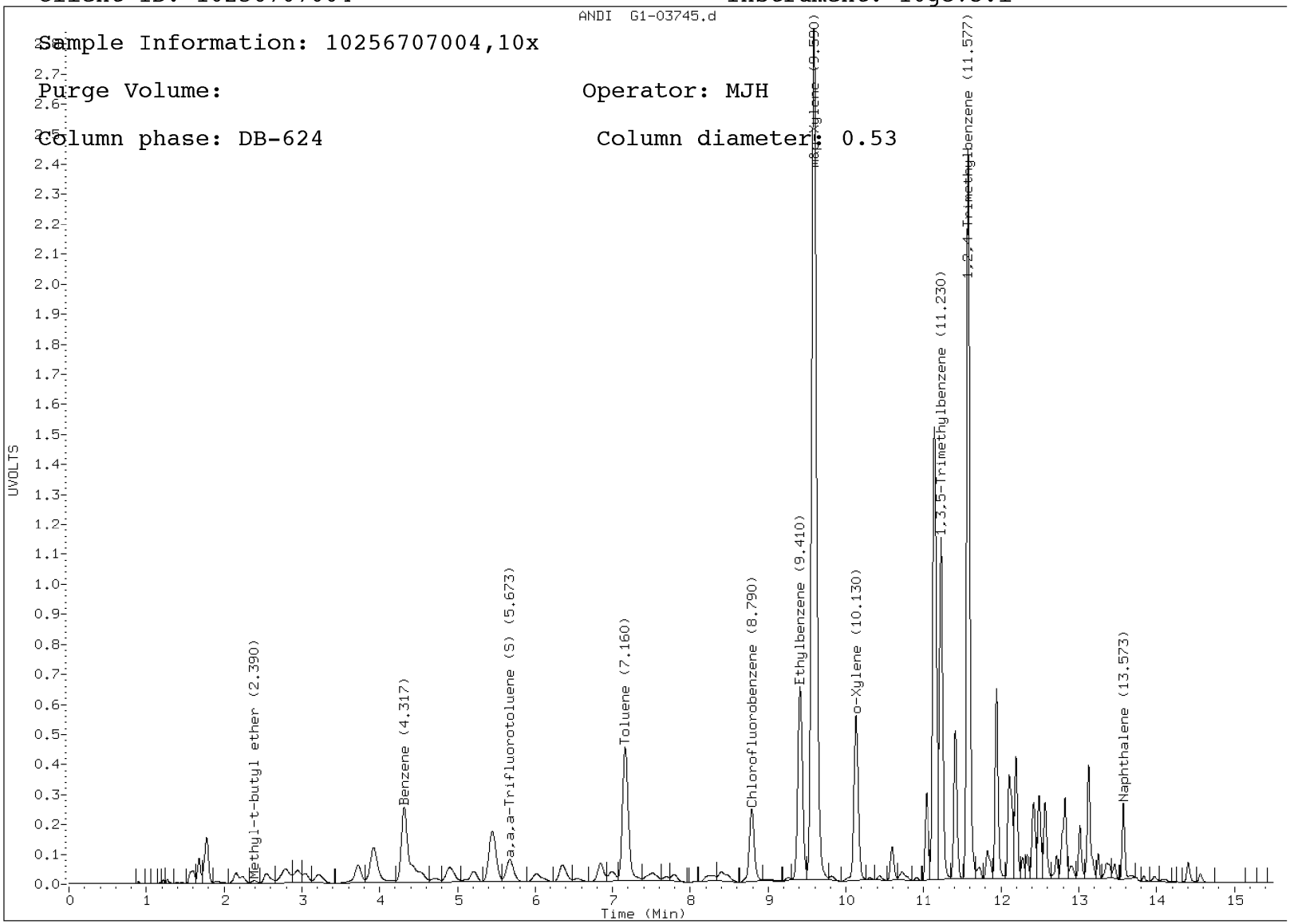
Sample ID: 10256707004

Client ID: 10256707004 Instrument: 10gcv3.i

Sample Information: 10256707004,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-2.b/G1-03745.d

Report Date: 02/08/2014

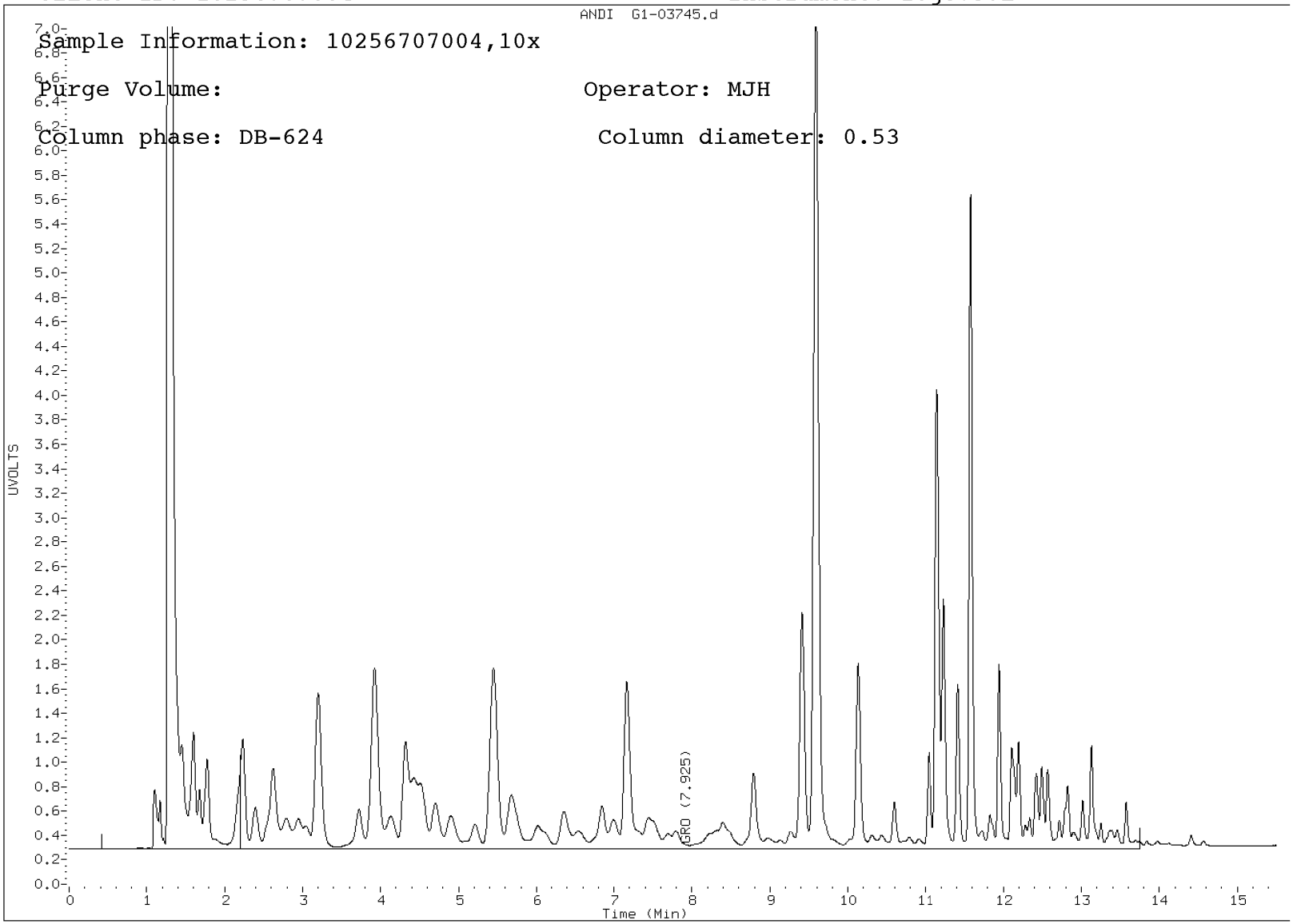
Sample ID: 10256707004

Client ID: 10256707004 Instrument: 10gcv3.i

Sample Information: 10256707004,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-1.b/G1-03746.d

Report Date: 02/08/2014

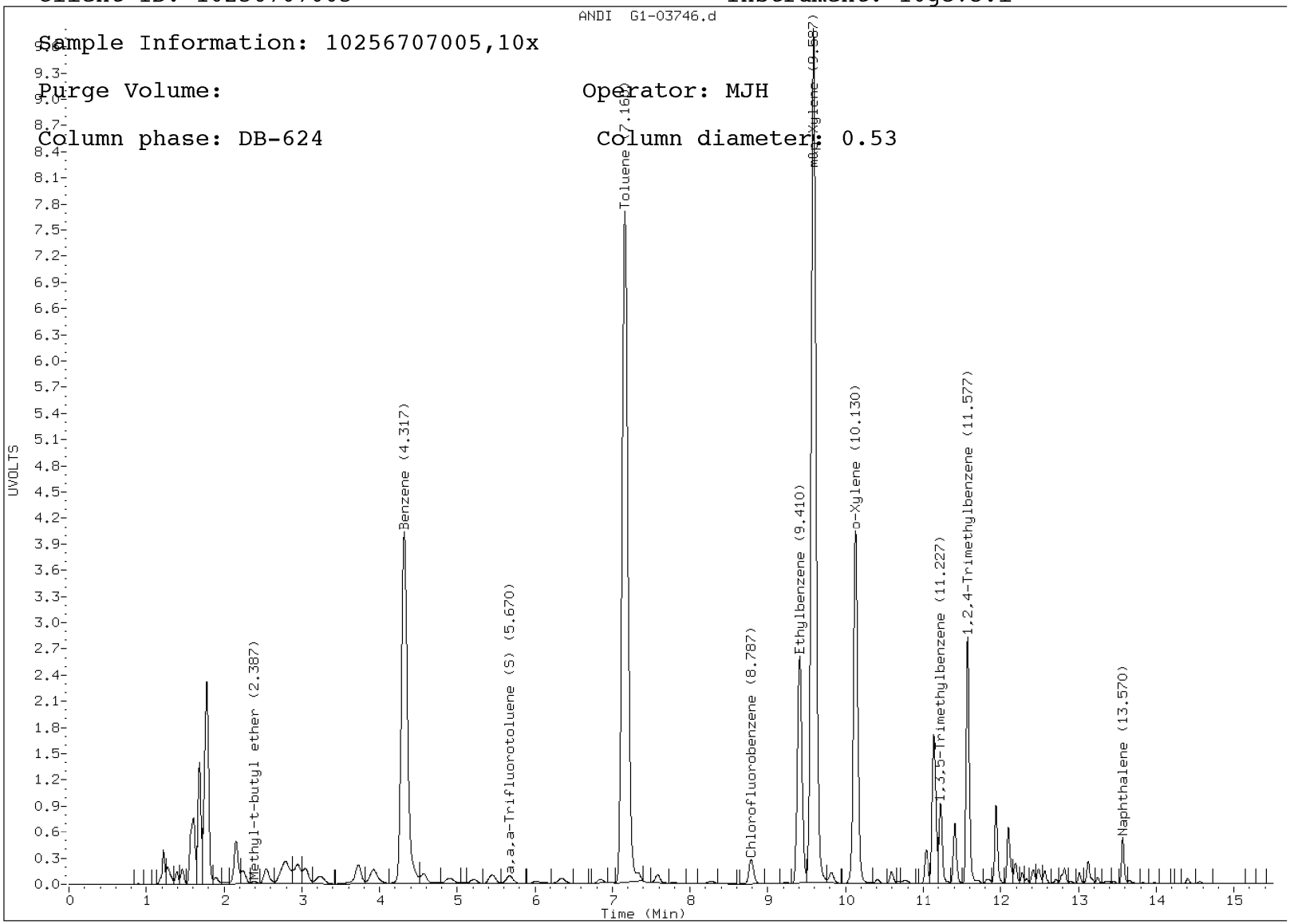
Sample ID: 10256707005

Client ID: 10256707005 Instrument: 10gcv3.i

Sample Information: 10256707005,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Data File: \\192.168.10.12\chem\10gcv3.i\020614b-2.b/G1-03746.d

Report Date: 02/08/2014

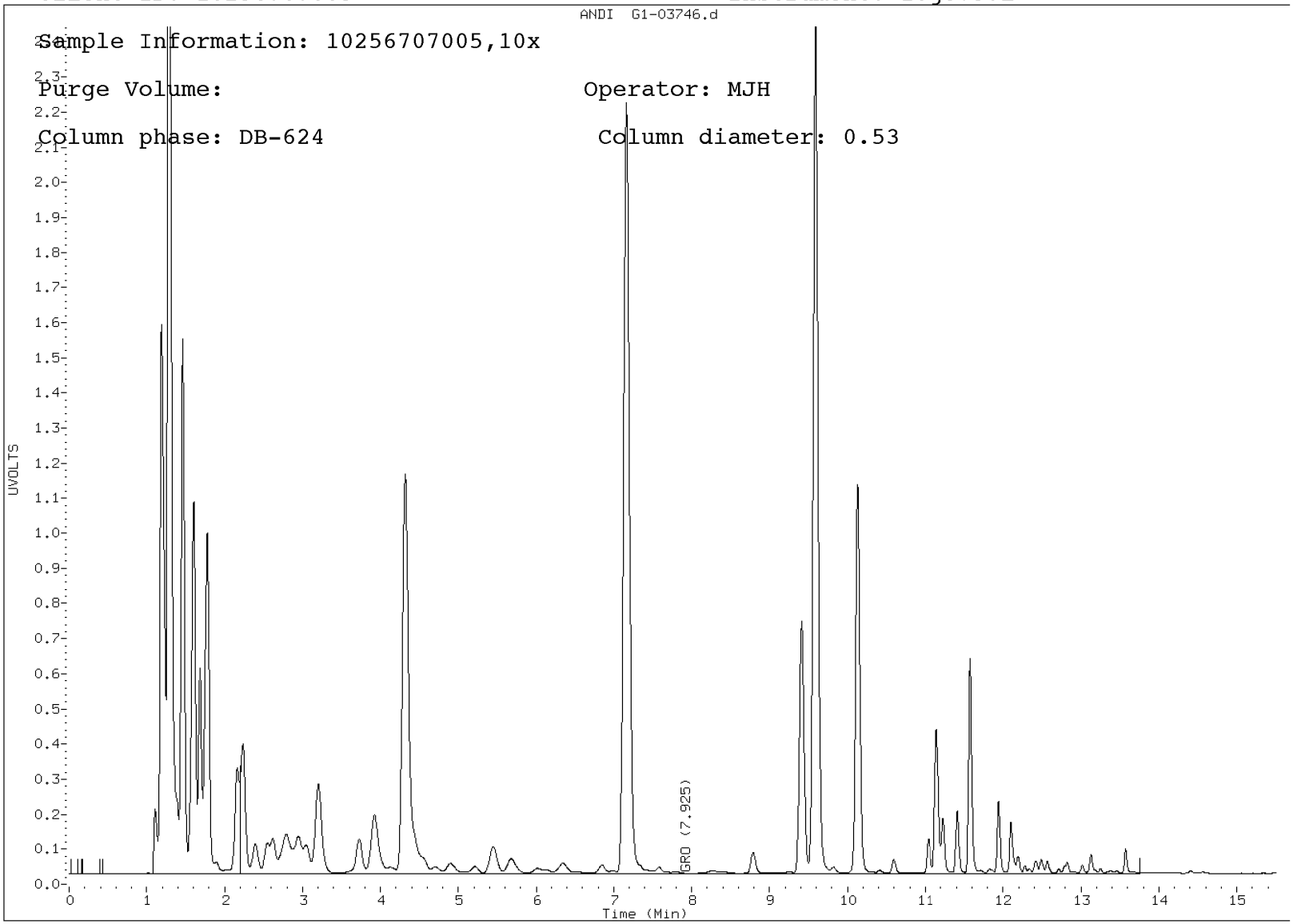
Sample ID: 10256707005

Client ID: 10256707005 Instrument: 10gcv3.i

Sample Information: 10256707005,10x

Purge Volume: Operator: MJH

Column phase: DB-624 Column diameter: 0.53



Wenck

Project Name: Former Union 76
Address: 102 main Street, Cambridge, MN 55008
Weather Conditions: 7° F Sunny Wind 4mph
Field Technician(s): KEM, AZ
Date: 2/3/14

Well Number:	MW-10	MW-3
MN Unique Well Number		
Top of Casing Elev. (ft above MSL)		
Depth to Water (ft)	22.92	Product 17.52
Depth to Bottom of Well (ft)	28.45	Water - 18.04
Groundwater Elev. (ft above MSL)		
Top of Screen Elev. (ft above MSL)		
Bottom of Screen Elev. (ft above MSL)		
Volume of Water in Casing (gals)	~1	
3 Well Volumes (gals)	~3	
Purging Device	Bailer	
Purge Start Time	14.00	
Purge Stop Time	14:20	
Average Purge Rate (gals/min)		
Volume Purged (gals)		
Purged Dry (Y/N)	N	
Sampling Device	Bailer	
Time Sample Collected	14:30	
Sample Field Filtered (Y/N)	N	
Color	Grey - cloudy	
Odor	petro oder	
Well Capped & Locked (Y/N)	Y	
Damage to Well? (Y/N)	N	

bailer in well

No Sample - product - line up w/ tree in boulevard + black drain tile coming down side of building

Wenck

Project Name: Former Union 76
Address: 102 Main Street, Cambridge, MN 55008
Weather Conditions: 7°F Sunny wind 4 mph
Field Technician(s): KEM, AZ
Date: 2/3/14

Well Number:	MW-9	MW-6
MN Unique Well Number		
Top of Casing Elev. (ft above MSL)		
Depth to Water (ft)	18.45'	19.61'
Depth to Bottom of Well (ft)	26.39'	26.40'
Groundwater Elev. (ft above MSL)		
Top of Screen Elev. (ft above MSL)		
Bottom of Screen Elev. (ft above MSL)		
Volume of Water in Casing (gals)	1.29	1.1
3 Well Volumes (gals)	~4 gal	3.5
Purging Device	Bailer	Bailer
Purge Start Time	12:35	12:45
Purge Stop Time	12:53	13:10
Average Purge Rate (gals/min)		
Volume Purged (gals)	4	
Purged Dry (Y/N)	N	
Sampling Device	Bailer	Bailer
Time Sample Collected	1:00	1:20
Sample Field Filtered (Y/N)	N	N
Color	N	N
Odor	strong petro. odor	slight petro odor
Well Capped & Locked (Y/N)	Y	Y
Damage to Well? (Y/N)	N	N

Dup-1 taken @ MW-9

bailer in the well MW-6

Wenck

Project Name: Union 76, Old
Address: 102 main Street, Cambridge, MN 55008
Weather Conditions: 7°F Sunny wind 4mph
Field Technician(s): KCM/AZ
Date: 2/3/14

19.97
water level

Well Number:	MW-S1	MW-7
MN Unique Well Number		
Top of Casing Elev. (ft above MSL)		
Depth to Water (ft)	19.97'	18.30 Product @ 18.28
Depth to Bottom of Well (ft)	23.89'	23.85'
Groundwater Elev. (ft above MSL)		
Top of Screen Elev. (ft above MSL)		
Bottom of Screen Elev. (ft above MSL)		
Volume of Water in Casing (gals)	0.64	
3 Well Volumes (gals)	~2	
Purging Device	Bailer	
Purge Start Time	11 am	
Purge Stop Time	11:21 am	
Average Purge Rate (gals/min)		
Volume Purged (gals)	2 gal	
Purged Dry (Y/N)	N	
Sampling Device	bailer	
Time Sample Collected	11:25	NO sample
Sample Field Filtered (Y/N)	N	
Color	Red-rust - brown	
Odor	strong petro smell	
Well Capped & Locked (Y/N)	Y	
Damage to Well? (Y/N)	Y	

MW-1
oil/water interface meter used, meter didn't detect free product

3.92
0.143

MW-7 Free Product
18.28 - Product
18.30 - H_2O

1.0 Groundwater Sampling Procedure

1.1 GENERAL

To collect representative groundwater samples, groundwater wells must be adequately purged prior to sampling. Purging will require the removal of at least three volumes of standing water in rapidly recharging wells, and at least one volume from wells with slow recharge rates. Shallow wells in which the screen intersects the water table should require a minimum amount of purging since the groundwater would flow through the screen and not be entrapped in the casing. Sampling will commence as soon as adequate recharge has occurred.

The samples will be labeled and shipped following standard corporate-wide procedures, and analyzed according to the analytical program outlined in the Work Plan.

1.2 WATER-LEVEL MEASUREMENTS

Prior to any well evacuation or sampling, initial static water levels will be measured and recorded for all wells. This is done to facilitate selection of the proper pump intake depths for purging and sampling and calculation of the ground water flow direction.

Field personnel will make water-level measurements at all applicable site monitoring wells and piezometers within the shortest time interval practical to provide comparable numbers by which to calculate the ground water gradient (typically within one hour).

Water level probes will be decontaminated by rinsing with clean control water and drying with a clean cloth before use in each well. Water levels will be measured with an electric water level sensor probe that records to the nearest 0.01 foot. The electric water level sensor probe will be lowered down the well until the meter sounds indicating contact of the probe with the water surface.

The depth-to-water will be referenced to the measuring point marked at the top of the innermost well casing. Where a measuring point has not been marked at the top of the casing, the measuring point will be assumed to be at the top of the innermost casing on the north side of the casing. When reporting absolute water level elevation, this measurement will be converted to water level elevation (“MSL”) from the surveyed elevation of the top of the well casing. Data will be entered in field book.

1.3 GROUNDWATER SAMPLE COLLECTION FOR LABORATORY ANALYSIS

1.3.1 Objectives and Considerations

During sampling, primary objectives and considerations include minimizing sample disturbance, avoiding sample exposure to air and extraneous contamination, and preserving sample integrity throughout collection.

1.3.2 Sample Collection Procedures

Groundwater sample collection procedures are as follows:

- Well sampling will be performed within 24 hours of purging. If a well does not yield sufficient volume for all required laboratory analytical testing (including quality control), then a decision will be made to prioritize analyses. If a well takes longer than 24 hours to recharge, then a decision will be made to prioritize analyses. If a well takes longer than 24 hours to recharge, then a decision will be made after consultation with MPCA whether or not the sample will be considered valid.
- All sample bottles will be labeled in the field using a waterproof permanent marker. Labels will include:

    - Site name
    - Sample identification code
    - Project number
    - Date/time
    - Sampler's initials
    - Preservation added (if any)
    - Analysis to be performed

- Before opening and filling sample containers, check the sampling area for potential sources of extraneous contamination. Remove any possible sources of contamination, including engine exhaust, blowing dust and organic fumes (e.g., gas cans) prior to sample collection. During sample collection, Wenck personnel will wear clean, disposable gloves. The gloves will be replaced for each sampling location or when the gloves are soiled or torn. Samples will be collected into lab-provided containers (containing required preservatives) and placed on ice in coolers for shipment to the analytical laboratory (discussed in Section 4.5.5). Once the first sample is collected the chain of custody (COC) will be initiated. COC procedures are discussed in Section 4.6.2.5.
- Sample containers shall remain closed until it is time to fill them. Immediately after opening the container add preservative (if required), fill the container, replace the cap,

label, and immediately place on ice in a cooler. Sample preservation is discussed in Section 4.6.2.4

1.3.2.1 Order of Filling Sample Containers

Field staff will collect sample parameters in the following order:

- Metals
- VOCs
- GRO
- Other non-volatile organics.

1.3.2.2 Trip Blanks, Field Blanks, and Field Duplicates

Sample blanks, will be collected to detect background or method contamination. Duplicate samples will be collected to evaluate variability in analytical methods. QA/QC samples will be collected at sampling points suspected to have relatively higher levels of contamination to provide meaningful information for blank or duplicate sample evaluation. All QA/QC samples will be collected in the same type of container as the corresponding primary samples. All QA/QC samples will be assigned identification aliases on the sample bottle label and on the chain of custody sheet to avoid alerting laboratories that the sample is a blank or duplicate sample. The true identity of the QA/QC samples will be recorded in the field book.
The collection schedule for QA/QC samples will be as follows:

- one (1) trip blank (composed of a minimum of one {1} replicate vial) for each cooler of VOC samples. Trip blanks will be provided by laboratory.
- one (1) field (equipment) blank will be collected each day by field personnel (or one field blank for every ten {10} samples collected).
- one (1) duplicate set for every ten sets of samples collected

1.3.2.3 Sample Preservation

Samples will be preserved as shown in the above table. All Chemical preservatives, added to containers in the laboratory or field will be produced and controlled within the laboratory's QA/QC program. Field supplies of preservatives and sample containers with pre-dosed preservatives will be discarded and replaced with fresh preservatives no later than 14 days after receipt from the laboratory. All samples will be thermally preserved in the field immediately after sample collection by placing the samples in an insulated ice chest containing uncontaminated ice cubes. The ice will be placed inside uncontaminated leak proof plastic containers and the COC record will be placed inside a plastic bag. The ice chest temperature will be checked by measuring the temperature of the water within the temperature blank container at the laboratory to verify whether or not samples were kept refrigerated at approximately 4 degrees C. Temperature will be noted on the COC.

1.4 SAMPLE METHODOLOGY

Analyte	Method	Sample Container	Field Preservation	Hold Time
Total RCRA Metals	Method 6010/7470	250 ml plastic	Nitric Acid	180 days
Diss. RCRA Metals	Method 6010/7470	250 ml plastic	None	180 days
PCBs	Method 8082	1 liter glass	None	7 days
PAHs	Method 8270	1 liter glass	None	7 days
DRO	WI Modified	1 liter glass	Hydrochloric Acid	7 days
GRO	WI Modified	(3) 40 ml glass	Hydrochloric Acid	14 days
Oil & Grease, Hydrocarbons	Method 418.1	1 liter glass	Hydrochloric Acid	28 days
Herbicides	Method 8151	1 liter glass	Sodium thiosulfate + hydrochloric acid	7 days
Pesticides (organophosphate compounds)	Method 8141	1 liter glass	None	7 days
Pesticides	Method 8081	1 liter glass	None	7 days
Total Organic Carbon	Method 415.1/9060	125 ml amber glass	Sulfuric Acid	28 days
Dissolved Solids	Method 161.1	250 ml plastic	None	7 days
Nitrate, Nitrite, Nitrate + Nitrite	Method 353.2	125 ml plastic	Sulfuric Acid	28 days
VOCs	Method 8260 465F	(3) 40 ml glass	Hydrochloric Acid	14 days

1.5 GROUNDWATER SAMPLING EQUIPMENT DECONTAMINATION PROCEDURES

All groundwater sampling equipment including pumps, flow-through cells, probes, etc. that come in contact with groundwater collected for laboratory analysis will be decontaminated prior to reuse using the following procedures:

1. Wash device/equipment in a bucket/tub filled with Alconox and water solution.
2. Rinse device/equipment in a bucket of potable water.
3. Rinse device/equipment in a second bucket of water.

Appendix C

Life Cycle Cost Sheet - SVE/Air Sparge

Description	Quantity	Price	Unit	Total
Access Agreements	4	$1,210	per property	$4,840
Pilot test work plan	1	$6,000	report	$6,000
Pilot test equipment	1	$3,000	equipment	$3,000
Pilot test holes for radius of influence	12	$1,000	per pilot hole	$12,000
Pilot test observation	5	$1,000	per day	$5,000
Pilot test report	1	$6,000	report	$6,000
Corrective Action Design	1	$6,000	report	$6,000
SVE/Sparge well install	24	$1,500	per well	$36,000
Well Installation Oversight	10	$1,000	per day	$10,000
Blower/skid fabrication, delivery	2	$24,000	system	$48,000
Trenching, electrical, construction	2	$45,000	lump sum	$90,000
Construction Oversight	10	$1,000	day	$10,000
Start-up/optimization	5	$1,000	day	$5,000
Start-up sampling	10	$250	per sample	$2,500
Installation Report	1	$6,000	report	$6,000
TOTAL CAPITOL				**$250,340**
Annual Monitoring (LIF sampling, monitoring well sampling, vent sampling)	3	$50,000	per year	$150,000
Annual Operation (Electrical, maintenance)	3	$5,000	lump sum	$15,000
TOTAL ANNUAL				**$165,000**
System shut-down oversight	10	$1,000	day	$10,000
Well sealing	24	$1,500	per well	$36,000
TOTAL SHUT-DOWN				**$46,000**
20% Contingency				$83,068
Total				**$544,408**

Life Cycle Cost Sheet - Dual Phase

Description	Quantity	Price	Unit	Total
Access Agreements	4	$1,210	per property	$4,840
Pilot test work plan	1	$6,000	report	$6,000
Pilot test equipment	1	$3,000	equipment	$3,000
Pilot test holes for radius of influence	12	$1,000	per pilot hole	$12,000
Pilot test observation	5	$1,000	per day	$5,000
Pilot test report	1	$6,000	report	$6,000
Corrective Action Design	1	$6,000	report	$6,000
SVE/Extraction well install	24	$1,500	per well	$36,000
Well Installation Oversight	10	$1,000	per day	$10,000
Blower/skid fabrication, delivery	2	$24,000	system	$48,000
Trenching, electrical, construction	2	$45,000	lump sum	$90,000
Construction Oversight	10	$1,000	day	$10,000
Start-up/optimization	5	$1,000	day	$5,000
Start-up sampling	10	$250	per sample	$2,500
Installation Report	1	$6,000	report	$6,000
TOTAL CAPITOL				**$250,340**
Annual Monitoring (LIF sampling, monitoring well sampling, montlhy adjustments of stinger tubes, vent sampling)	3	$65,000	per year	$195,000
Water recovery/disposal from system	1	$10,000	lump sum	$10,000
Annual Operation (Electrical, maintenance)	3	$5,000	lump sum	$15,000
TOTAL ANNUAL				**$220,000**
System shut-down oversight	10	$1,000	day	$10,000
Well sealing	24	$1,500	per well	$36,000
TOTAL SHUT-DOWN				**$46,000**
20% Contingency				$94,068
Total				**$610,408**

Life Cycle Cost Sheet

Excavation - Source area to water table

Description	Quantity	Price	Unit	Total
Soil trucking and disposal	6,650	$40	per ton	$266,000
Trucking and Backfill	6,650	$20	per ton	$133,000
Excavation Contractor	10	$1,000	per day	$10,000
Seal MW-3	1	$1,500	each	$1,500
Install new MW-3	1	$2,500	each	$2,500
Excavation Oversight	10	$1,500		$15,000
Excavation sample analysis	40	$65	per confirmation sample set (DRO/GRO/BTEX)	$2,600
Reporting	1	$5,000		$5,000
Quarterly sampling/monitoring with monthly LNAPL checks and annual report	3	$25,000	annual follow-up monitoring	$75,000
20% Contingency				$102,120
Total				**$612,720**