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February 22, 2018

Mr. Joseph Kelly
Project Manager
USEPA, Region 5
77 West Jackson Blvd.
LU-16J
Chicago, IL 60604-3590

Subject: Response to EPA Conditional Approval of Groundwater-Surface Water Interface Performance Monitoring Plan
Tecumseh Products Company, 100 East Patterson, Tecumseh, Michigan 49286
EPA ID#: MID005049440
AOC RCRA-05-2010-0012

Dear Mr. Kelly:

On September 11, 2017, Tecumseh Products Company (TPC) submitted the *Groundwater-Surface Water Interface Performance Monitoring Plan* (GSI PMP) for the former TPC site located at 100 East Patterson Street in Tecumseh, Michigan. The United States Environmental Protection Agency (USEPA) provided conditional approval of the GSI PMP in the January 23, 2018 letter titled *EPA Conditional Approval of Groundwater-Surface Water Interface Performance Monitoring Plan* which included several comments/conditions which require response. TPC, TRC Environmental Corporation (TRC) and USEPA discussed those comments/conditions during a conference call on February 1, 2018. As a follow up to that conversation, attached is the revised GSI PMP, as well as, the revised Table 7 of the February 2017 Revised Corrective Measures Proposal (CMP). The responses below summarize how USEPA's comments/conditions are addressed in the revised documents.

1. ***The Mixing Zone monitoring program shall include an evaluation of the data collected along the flow path from the source area to the compliance monitoring points (pore water monitoring network), inclusive for all of the parameters given limits in the Mixing Zone implementation letter.***

   TRC Response – Section 5.2.2 has been revised to clarify that GSI reporting will include an evaluation of data collected up gradient of the GSI area relative to the mixing zone-based cleanup levels summarized in Appendix A.

TPC must install monitoring wells proposed in the March 6, 2017 Revised Corrective Measures Proposal (CMP) and the September 11, 2017, GSI Monitoring Plan, along with those locations EPA requested including MW-44D , MW-48D, MW-49D , MW-51 (with both shallow and deep intervals) , MW-52 (both shallow and deep intervals), MW-61D, MW-62 (both shallow and deep intervals closer to source), MW-XX (shallow, intermediate, and deep intervals at SB-80), MW-YY (deep interval, source areas south of MW-33S, installed east of source), and MW-ZZI (intermediate depth along Maumee, between Cummins and Patterson, and include existing wells PRB-01S, PRB-15D, PRB-16S, MW-17S, MW-21, and MW-41 in the proposed monitoring.

TRC Response – Table 1 and Figure 8 have been revised to reflect the requested additional sampling locations as outlined above and subsequently discussed and agreed with USEPA. Specifically:

- Proposed additional wells MW-44d, MW-49d, MW-61d, MW-62d and MW-YY (designated MW-65d) have been added to the monitoring program.
- Proposed monitoring well MW-48d is located approximately 60 feet side gradient of proposed monitoring well MW-44d. In this area, concentrations in the deep area are relatively low (in the deepest sample collected at soil boring B-122, tetrachloroethene [PCE] was not detected and the trichloroethene [TCE] concentration was 68 μg/L). One deep well (MW-44d) is merited in this area to monitor potential changes in groundwater chemistry at depth as a result of groundwater treatment, but multiple deep wells in such close proximity are not necessary.
- The proposed monitoring program in the February 2017 CMP included a single well (MW-51) at the location of soil boring B-139. Based on the geology previously documented at that location, the anticipated saturated thickness at this location is only 7 feet. As such, if two wells were installed at this location, the screened intervals would have more than 50-percent overlap. As agreed with USEPA on February 1, 2018, only a single well will be installed at this location unless the saturated thickness encountered during well installation is greater than anticipated, i.e. at least 8.5 feet. As previously proposed, monitoring well MW-51 will be screened at the top of the clay, through the most impacted portion of the aquifer.
- The proposed monitoring program in the February 2017 CMP included a single well (MW-52) at the location of soil boring B-134. Based on the geology previously documented at that location, the anticipated saturated thickness at this location is only 9.5 feet. TPC has agreed to install both a shallow well (MW-52s) and a deep well (MW-52d) at this location. The well screens at these locations are expected to overlap by less than 1 foot. If the saturated thickness encountered during well installation is less than anticipated, i.e. less than 8.5 feet, only a single well will be installed at this location.

- As requested previously proposed monitoring well MW-62s has been moved closer to the source area (Figure 8).
- The location of proposed monitoring wells MW-XXs, MW-XXi, and MW-XXd is approximately 60 feet north of existing wells MW-20s and MW-20d. As discussed during the February 1, 2018 call, the purpose of these monitoring locations would be to verify plume stability beyond the active treatment area and ensure that concentrations do not increase along the plume boundary. The location of monitoring wells MW-20s and MW-20d is better suited to that purpose. Therefore, rather than install another well nest in near proximity to an existing well nest, TPC has agreed to install an intermediate well in the MW-20 well nest. All three of the wells in MW-20 well nest are included in the revised compliance monitoring program (Table 1).
- Proposed well MW-ZZI has not been added to the monitoring program due to physical site constraints. Maumee Street between Patterson Street and Cummins Street has numerous subsurface utilities on both sides of the street (including multiple fiber optic and gas lines) which make well installation at the proposed location very difficult, and potentially unsafe.
- Existing wells PRB-01s, PRB-15d, PRB-16s, MW-17s, MW-21, and MW-41 have been added to the monitoring program.

Wells related to the GSI Monitoring Plan must be installed as soon as practicable (i.e., during the current quarter) and monitoring is expected to begin thereafter and including the additional assumptions below;

TRC Response – Wells included in the GSI Monitoring Plan are already installed. As discussed during the February 1, 2018 project call, TPC has scheduled the installation of the proposed wells located along the site boundary, downgradient of the southern source area (MW-45d, MW-48s, MW-50s, MW-50i, MW-50d, MW-51, MW-52s, MW-52d and PRB-02i) for March 2018. The GSI sample locations, as well as these new wells, will be sampled in March 2018 following well installation. As discussed, the schedule for installation of the remaining new wells will be determined with USEPA in the future based on project milestones and needs. Ideally on-site wells will be installed after the site owner completes demolition activities and provides TPC with a final grading plan. Off-site groundwater chemistry in the north is not expected to change until after active groundwater treatment begins in the north. Off-site wells in the northern area may be installed in a single mobilization or in a stepwise manner based on the anticipated timeline for changes in groundwater chemistry at those locations.

2. ***The Frequency and Duration of monitoring outlined in Sections 2.3, 3.3, and 4.3, must be revised to quarterly for the first two years of monitoring to establish a baseline in all of the***

new wells/seeps/pore-water locations, after which, TCP can request to reduce frequency from EPA if the data is consistent and shows no seasonality.

TRC Response – Sections 2.3, 3.3 and 4.3 have been revised to include quarterly monitoring for at least eight sampling events to establish baseline conditions.

3. ***EPA notes apparent increases in groundwater concentrations at MW-45s at the end of 2017, following the tetrachloroethene (PCE) source removal, based on information in the January 2018 Quarterly Report. The monitoring program to continue until all stresses to the groundwater flow system have ceased or the source area and downgradient data are near the lowest monitoring zone criteria (chronic, within an order of magnitude, trending down), after which TCP can request to cease GSI compliance monitoring.***

   TRC Response – Sections 2.3, 3.3 and 4.3 have been revised to clarify that GSI monitoring will continue until 1) active groundwater treatment in the southern area (e.g. up gradient stresses on the groundwater flow system) is complete; 2) up gradient groundwater concentrations are stable or decreasing; 3) up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values; and 4) USEPA approves the cessation of GSI monitoring.

4. ***Under RCRA and MDEQ's Part 111, self-implementing work that would be appropriate for a Part 201 site is not appropriate.***

   TRC Response – Sections 2.3, 3.3 and 4.3 have been revised to clarify that adjustments to the frequency and duration of GSI monitoring will be made with USEPA approval.

5. ***The long-term documentation of natural attenuation requires monitoring for the following geochemical parameters on an annual or biannual basis from within the plumes once treatment begins: Dissolved Oxygen, Nitrate, Fe(II), Fe(III), Sulfate, Methane, Alkalinity, Oxidation-Reduction Potential, pH, Chloride, Ethene***

   TRC Response – Table 1 has been revised to clarify that the geochemical parameters specified above will be collected from within the plumes on an annual basis once treatment begins.

6. ***TPC must revise the second sentence of the second full paragraph of Section 1.2 to state (edits in italics): "This GSI Monitoring Plan serves as a revision to the proposed monitoring program described in Section 13.2.4 of the February 2017 Corrective Measures Proposal (CMP) and summarized in Table 1 and Figure 8, with modifications to monitoring locations/depths requested by EPA as summarized in its December 18, 2017, Conditional Approval of the Revised Corrective Measures Proposal letter."***

TRC Response – The second sentence of the second full paragraph of Section 1.2 has been revised to read: "This *Revised* GSI Monitoring Plan *was prepared to meet the conditions of that approval, and* serves as a revision to the proposed monitoring program described in Section 13.2.4 of the February 2017 *Revised* Corrective Measures Proposal (CMP) as summarized in Table 1 and Figure 8, with modifications to monitoring locations/depths requested by USEPA, as summarized in its December 18, 2017 Conditional Approval of the Revised Corrective Measures Proposal letter *and subsequently discussed and agreed to with USEPA on February 1, 2018*." Further TRC edits are in italics.

7. ***Table 7 of the February 2017 CMP must be revised to reflect information in the three tables from the Mixing Zone Implementation letter by MDEQ, and utilizing Table 1 that was revised by Michigan Department of Environmental Quality in their September 5, 2017 email to EPA and TRC Environmental Corporation.***

TRC Response – Table 7 of the February 2017 CMP has been revised as requested, and is attached. As discussed on February 1, 2018, the USEPA will insert the revised Table 7 into the previously submitted February 2017 CMP. Similarly, TRC and TPC will update our files and the public repository with the revised table. Due to the document size, complete copy of the CMP, with Revised Table 7, will not be resubmitted USEPA.

Please let us know if you have questions or comments regarding the revised documents.

Sincerely,

TRC Environmental Corporation

Graham Crockford, CPG
Sr. Project Manager

Stacy Metz, PE
Project Engineer

Attachments
Revised Groundwater-Surface Water Interface Performance Monitoring Plan
Revised Table 7 of the 2017 Revised Corrective Measures Proposal

cc: Dale Bridgford, MDEQ
Joseph Victory, MDEQ
Jason Smith – Tecumseh Products Company
Doug McClure – Conlin, McKenney & Philbrick, PC
Stacy Metz – TRC

Groundwater-Surface Water Interface Performance Monitoring Plan

Former Tecumseh Products Company Site
Tecumseh, Michigan

September 2017, Revised February 2018

Groundwater-Surface Water Interface Performance Monitoring Plan

Former Tecumseh Products Company Site
Tecumseh, Michigan

September 2017, Revised February 2018

Prepared For
Tecumseh Products Company

Stacy Metz, P.E.
Project Engineer, License No. 6201062767

Graham Crockford, C.P.G.
Project Manager

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Section 1
Introduction

This Revised *Groundwater-Surface Water Interface Performance Monitoring Plan* (Revised GSI Monitoring Plan) has been prepared by TRC Environmental Corporation (TRC) for Tecumseh Products Company (TPC). The United States Environmental Protection Agency (USEPA) facility identification number for the Former TPC Site in Tecumseh, Michigan (Site) is MID-005-049-440 and the Administrative Order on Consent (AOC) identification number is RCRA-05-2010-0012.

On September 8, 2016, TPC and TRC met with the Michigan Department of Environmental Quality (MDEQ) to discuss the unique groundwater to surface water migration pathway, and to gain an understanding of how MDEQ policies and practices would be applied to that groundwater discharge regime. Joseph Kelly of the USEPA participated by phone. As an outcome of that meeting, TRC prepared the October 20, 2016 Technical Memorandum titled *Groundwater to Surface Water Migration Pathway and Mixing Zone Request, Former Tecumseh Products Company Site in Tecumseh, Michigan* (Mixing Zone Request). The Mixing Zone Request provides a description of the nature and extent of contamination, the current risk assessment, and anticipated corrective measures. The Mixing Zone Request also serves as a cover for the MDEQ Facility Information Forms for each of the receiving water bodies (the River Raisin and the adjacent wetland), so that the cleanup objectives discussed during that meeting could be made official.

On June 27, 2017, MDEQ and USEPA responded to the Mixing Zone Request in letters titled *Implementation of the Mixing Zone – Clarification; Former Tecumseh Products Company; MID 005 049 440* (MDEQ Response) and *Mixing Zone Implementation; Tecumseh Products Company, 100 East Patterson, Tecumseh, Michigan 49286; EPA ID #: MID005049440; AOC RCRA-05-2010-0012* (USEPA Response). The MDEQ and USEPA Responses specify that TPC must develop a compliance monitoring plan to verify that constituents of concern meet the criteria identified in the MDEQ Response. TPC responded with questions/a request for clarification via email on July 10, 2017. MDEQ provided a partial response via email on August 1, 2017. Further clarification was provided by MDEQ via email on September 5, 2017. On September 11, 2017, TRC submitted the Groundwater-Surface Water Interface Performance Monitoring Plan (GSI Monitoring Plan) in response to the USEPA and MDEQ Responses dated June 27, 2017, as amended via MDEQ emails dated August 1, 2017 and September 5, 2017. Tables which summarize the mixing-zone based cleanup criteria provided in the MDEQ response, as amended, are provided in Appendix A. The USEPA provided conditional approval of the GSI Monitoring Plan in the January 23, 2018 letter titled *EPA Conditional Approval of Groundwater-*

Surface Water Interface Performance Monitoring Plan which included several comments/conditions which require that the GSI Monitoring Plan be revised. This Revised GSI Monitoring Plan reflects revisions made to address the USEPA comments/ conditions outlined in the January 23, 2018 letter, and subsequently discussed with USEPA during a conference call on February 1, 2018.

1.1 Project Description / Background

TPC retained TRC to investigate soil and groundwater conditions at the Site located in Tecumseh, Michigan (Figure 1). Groundwater affected by chlorinated volatile organic compounds (CVOCs) originating at the Site migrates to the east toward the River Raisin, the nearest body of water, located 1,500 to 2,500 feet east of the Site. Between 2014 and 2016, these investigation activities included High Resolution Site Characterization (HRSC) activities to collect high density data to supplement existing site characterization data and more precisely document the nature and extent of CVOCs in groundwater. In particular, investigation activities were completed to support a human health and ecological risk assessment for the area, and to support risk management decision making as it relates to the groundwater to surface water migration pathway.

Investigation locations are illustrated on Figure 2. HRSC investigation activities included groundwater profile sampling to determine the horizontal and vertical extent of the contaminant plume. The lateral extent of contamination above MDEQ Part 201 generic groundwater-surface water interface (GSI) criteria is illustrated on Figure 3. As illustrated on Figure 3, groundwater affected above generic GSI criteria is discharging to the River Raisin and associated wetland area east of the Site, immediately north of Blood Road. As illustrated on Figure 4, groundwater elevation data indicate that affected groundwater originating from southern portion of the Site is funneled to this comparatively narrow discharge area. Figure 2 illustrates cross section locations. Figure 5 includes a cross section illustrating geology from the Site to the discharge area (A-A') and another cross section along the downgradient property boundary (B-B').

Investigation activities found that affected groundwater migrating from the Site discharges to surface water through three different migration pathways:

- **Direct groundwater discharge to the River Raisin:** As illustrated on Cross Section A-A' (Figure 5), a portion of affected groundwater migrates under the wetland to discharge to the River Raisin directly. A series of drive point wells (B-108 through B-114) were installed to determine where groundwater concentrations along the up gradient boundary of the wetland exceed generic GSI criteria (Figure 6). Lithological data from these wells was used to prepare a geologic cross section perpendicular to groundwater flow along the up gradient wetland boundary (Figure 7). Table B1 in Appendix B provides groundwater sample data in the vicinity of the GSI discharge Area. Data from up gradient sample locations (e.g., B-86, B-87, MW-21, MW-22 and MW-31) are included in Table B1 of Appendix B for informational purposes only. Trichloroethene (TCE), cis-1,2-dichloroethene (cis-DCE) and vinyl chloride concentrations exceed generic GSI criteria in groundwater collected from one or more of these drive point wells. The discharge rate of groundwater venting into the River Raisin is conservatively estimated to be 1.9 x 10^{-4} cubic feet per second (cfs).

- **Upwelling of Affected Groundwater through Wetland Soils:** The wetland soils are less permeable than the underlying sand unit. Nevertheless, the potential for upwelling of groundwater affected above generic GSI criteria into the wetland soils is possible. This migration pathway was evaluated through pore water sampling at the pore water sample locations (designated PW-XX) illustrated on Figure 6. Pore water sampling events were completed in April 2016, July 2016, November 2016, and October 2017. Pore water sample data are provided in Table B2 of Appendix B. CVOC concentrations in pore water samples were below generic GSI criteria, with the exception of vinyl chloride at pore water sample location PW-07, which exceeded the generic criterion (13 micrograms per liter [µg/L]) during the July 2016 sampling event (20 µg/L). The generic GSI criterion for vinyl chloride is determined by the MDEQ Rule 57 Non-drinking water Human Cancer Value. The reported vinyl chloride concentration is well below the Rule 57 Final Chronic Value (930 µg/L), the Rule 57 Aquatic Maximum Value (8,400 µg/L) and the Rule 57 Final Acute Value (17,000 µg/L). The upwelling of groundwater through the wetland soils does not appear to be a significant migration pathway.
- **Seepage and Overland Flow:** During pore water sampling activities, TRC staff identified three areas where groundwater was discharging through the embankment along the up gradient wetland boundary. Groundwater from these seeps coalesces into three distinct flow channels which flow overland to the River Raisin, as illustrated on Figure 6. Samples (SP-01, SP-02, and SP-03) were collected along the up gradient end of each flow channel. Seep sample data are provided in Table B2 of Appendix B. TCE and cis-DCE concentrations have exceeded generic GSI criteria at these locations. Field observations indicate that virtually all of this water discharges to the River Raisin without infiltrating the wetland. The estimated total flux to the River Raisin through the seeps in this area is 4.0 x 10^{-2} cfs, based on tracer-dye testing.

1.2 Purpose of GSI Monitoring Plan

The GSI Monitoring Plan was prepared to meet the terms of the mixing zone implementation. As such the GSI Monitoring Plan includes:

- Groundwater, surface water and pore water sample locations
- Field and laboratory procedures
- Data evaluation and reporting

As outlined above, the GSI Monitoring Plan was submitted to USEPA and MDEQ for approval on September 11, 2017 and was conditionally approved on January 23, 2018. This Revised GSI Monitoring Plan was prepared to meet the conditions of that approval, and serves as a revision to the proposed monitoring program described in Section 13.2.4 of the February 2017 Revised Corrective Measures Proposal (CMP) as summarized in Table 1 and Figure 8, with modifications to monitoring locations/depths requested by USEPA, as summarized in its December 18, 2017 Conditional Approval of the Revised Corrective Measures Proposal letter, and subsequently discussed and agreed to with USEPA on February 1, 2018. This Revised GSI Monitoring Plan is only one component of the monitoring program for site-wide corrective measures. The sample locations outlined in this Revised GSI Monitoring Plan were selected to monitor groundwater, surface water and pore water concentrations at the point of GSI compliance. As summarized in Table 1 and illustrated on Figure 8, the monitoring program for site-wide corrective measures includes a number of additional monitoring points to evaluate groundwater conditions up gradient of the GSI discharge area, including 33 on-site wells to monitor groundwater conditions in the vicinity of the southern groundwater treatment area and 15 off-site wells located throughout the southern groundwater plume between the Site and the GSI discharge area. This Revised GSI Monitoring Plan will be incorporated into the overall performance monitoring plan for site-wide corrective measures.

Section 2
Groundwater Monitoring Program

2.1 Groundwater Monitoring Well Network

The Revised GSI Monitoring Plan includes groundwater monitoring at monitoring wells which exhibit concentrations above generic GSI criteria. The following wells will be included in the groundwater monitoring program:

- MW-42s, previously B-108 (3-6′)
- MW-42d (5.6-8.6′)
- MW-46d, previously B-113 (5-8′)
- MW-47d, previously B-114 (7.4-10.4′)

Monitoring at these locations will be performed to evaluate progress toward attainment of cleanup levels and verify that concentrations do not exceed the values provided in Table 2 of the MDEQ Response. Sample locations are illustrated on Figure 6. Note that these sample locations are only inclusive of those monitoring points which represent points of compliance for groundwater discharge to the River Raisin. As documented in the CMP, summarized in Table 1 and illustrated on Figure 8, additional up gradient monitoring wells will be monitored to document source removal and concentration reductions through the up gradient contaminant plume, including monitored natural attenuation parameters.

2.2 Monitoring Well Construction

Soils boring logs and monitoring well construction details are provided in Appendix C. Table 2 provides a summary of monitoring well construction and elevation information. All monitoring wells are clearly labeled, visible throughout the year, and sealed with a locking j-plug.

2.3 Sample Parameters, Frequency and Duration

Sample locations, parameters, frequency and duration are described below.

- **Locations:** The following wells will be included in the groundwater monitoring program: MW-42d, MW-42d, MW-46d, and MW-47d.
- **Parameters:** Groundwater samples will be analyzed for volatile organic compounds (VOCs) by USEPA Method 8260B. Table 3 provides summary of sample parameters, analytical methods, holding times, sample preservation, and reporting limits.
- **Frequency:** Samples will be collected on a quarterly basis until at least eight sampling events have been completed (Table 1). Quarterly sampling will be used to establish baseline conditions and determine if groundwater conditions in the GSI area exhibit seasonality. Once baseline conditions are established, TRC will submit a request to USEPA

that the sample frequency be reduced to semi-annual or annual. Ongoing quarterly monitoring is not expected to be necessary based on the following site conditions:

  - Current concentrations at these monitoring locations are well below the mixing zone-based limits, e.g., final acute values (FAVs), provided in Table 2 of the MDEQ Response (Appendix A).
  - Current concentrations at off-site, up gradient monitoring locations are also well below the mixing zone-based limits. Therefore there is no reasonable expectation that groundwater concentrations discharging to the River Raisin will exceed these values in the future.
  - No notable seasonal concentration trends have been identified in these or other wells on-site.
  - Sample locations are sufficiently downgradient of the Site that changes in groundwater chemistry, due to on-site groundwater treatment, are expected to occur gradually over several years, rather than on a timescale of months which would require more frequent monitoring.

  Following completion of active groundwater treatment, TRC may submit a request to USEPA that the sample frequency at these locations be reduced further once the following conditions are met:

  - Up gradient groundwater concentrations are stable or decreasing; and
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values.

- **Duration:** Quarterly sampling began during the fourth quarter of 2017. Sampling (quarterly, semi-annual or annual) will continue until the following conditions are met:

  - Up gradient active groundwater corrective measures (e.g. enhanced *in situ* bioremediation in the southern treatment area) are complete;
  - Up gradient groundwater concentrations are stable or decreasing;
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values; and
  - VOC concentrations at these locations are at or below chronic GSI values (as listed in Table 1 of Appendix A) for four (4) consecutive sampling events or statistical techniques indicate compliance with these chronic GSI values.

  Once these conditions are met, TRC will submit a request to USEPA that GSI monitoring be discontinued.

Section 3
Surface Water Monitoring Program

3.1 Surface Water Monitoring Network

The Revised GSI Monitoring Plan includes surface water monitoring at each of the flow channels which flow overland to the River Raisin, as illustrated on Figure 6. Samples will be collected along the up gradient end of each flow channel, at previously sampled locations, where surface water concentrations are above chronic GSI values:

- SP-01
- SP-02
- SP-03

Monitoring at these locations will be performed to evaluate progress toward cleanup levels and ensure that concentrations do not exceed values provided in Table 2 of the MDEQ Response (Appendix A) during the implementation of groundwater corrective measures. Sample locations are illustrated on Figure 6.

3.2 Procedures to Ensure Consistent Sample Locations

Each of the surface water sample locations is marked in the field with a high visibility fiberglass rod in order to ensure that the sample collection point along each flow channel is consistent between sampling events. Coordinates of these sample locations have been collected with a hand-held Global Positioning System (GPS) unit so that they can be re-located if the fiberglass rod is removed or damaged. These coordinates are documented in Table 2.

3.3 Sample Parameters, Frequency and Duration

Sample locations, parameters, frequency and duration are described below.

- **Locations:** Samples will be collected from SP-01, SP-02, and SP-03.
- **Parameters:** Surface water samples will be analyzed for VOCs by USEPA Method 8260B. Table 3 provides summary of sample parameters, analytical methods, holding times, sample preservation, and reporting limits.
- **Frequency:** Samples will be collected on a quarterly basis until at least eight sampling events have been completed (Table 1). Quarterly sampling will be used to establish baseline conditions and determine if surface water conditions in the GSI area exhibit seasonality. Once baseline conditions are established, TRC will submit a request to USEPA that the sample frequency be reduced to semi-annual or annual. Ongoing quarterly monitoring is not expected to be necessary based on the following site conditions:

  - Current concentrations at these surface water sampling locations are well below the mixing zone-based limits, e.g., FAVs, provided in Table 2 of the MDEQ Response (Appendix A).
  - Current concentrations at off-site, up gradient monitoring locations are also well below the mixing zone-based limits. Therefore there is no reasonable expectation that surface water concentrations discharging to the River Raisin will exceed these values in the future.
  - No notable seasonal concentration trends have been identified in groundwater or surface water.
  - Sample locations are sufficiently downgradient of the Site that changes in groundwater chemistry, due to on-site groundwater treatment, are expected to occur gradually over several years, rather than on a timescale of months which would require more frequent monitoring.

Following completion of active groundwater treatment, TRC may submit a request to USEPA that the sample frequency at these locations be reduced further once the following conditions are met:

  - Up gradient groundwater concentrations are stable or decreasing; and
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values.

- **Duration:** Quarterly sampling began during the fourth quarter of 2017. Sampling (quarterly, semi-annual or annual) will continue until the following conditions are met:
  - Up gradient active groundwater corrective measures (e.g. enhanced *in situ* bioremediation in the southern treatment area) are complete;
  - Up gradient groundwater concentrations are stable or decreasing;
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values; and
  - VOC concentrations at these locations are at or below chronic GSI values (as listed in Table 1 of Appendix A) for four (4) consecutive sampling events or statistical techniques indicate compliance with these chronic GSI values.

Once these conditions are met, TRC will submit a request to USEPA that GSI monitoring be discontinued.

Section 4
Pore Water Monitoring Program

4.1 Pore Water Monitoring Network

The Revised GSI Monitoring Plan includes pore water monitoring through the wetland area between the embankment and the River Raisin. Samples will be collected from three locations, including the one location where the pore water concentration was above the generic GSI criterion for vinyl chloride during one sampling event:

- PW-01
- PW-04
- PW-07

Monitoring at these locations will be performed to verify concentrations remain below both the acute values provided in Table 2 (Final Acute Values) and the chronic GSI values provided in Table 1 of the MDEQ Response during the implementation of groundwater corrective measures (Appendix A). Sample locations are illustrated on Figure 6.

4.2 Procedures to Ensure Consistent Sample Locations

Each of the pore water sample locations is marked in the field with a high visibility fiberglass rod in order to ensure that the sample collection points are consistent between sampling events. Coordinates of these sample locations have been collected with a hand-held GPS unit so that they can be re-located if the fiberglass rod is removed or damaged. These coordinates are documented in Table 2.

4.3 Sample Parameters, Frequency and Duration

Sample locations, parameters, frequency and duration are described below.

- **Locations:** Samples will be collected from PW-01, PW-04, and PW-07.
- **Parameters:** Pore water samples will be analyzed for VOCs by USEPA Method 8260B. Table 3 provides summary of sample parameters, analytical methods, holding times, sample preservation, and reporting limits.
- **Frequency:** Samples will be collected on a quarterly basis until at least eight sampling events have been completed (Table 1). Quarterly sampling will be used to establish baseline conditions and determine if surface water conditions in the GSI area exhibit seasonality. Once baseline conditions are established, TRC will submit a request to USEPA that the sample frequency be reduced to semi-annual or annual (Table 1). Ongoing quarterly monitoring is not expected to be necessary based on the following site conditions:

  - Current concentrations at these pore water sampling locations are well below the acute mixing zone-based values listed in Table 1 of the MDEQ Response (Appendix A).
  - No notable seasonal concentration trends have been identified in groundwater or surface water.
  - Sample locations are sufficiently downgradient of the Site that changes in pore water chemistry, due to on-site groundwater treatment, are expected to occur gradually over several years, rather than on a timescale of months which would require more frequent monitoring.

  Following completion of active groundwater treatment, TRC may submit a request to USEPA that the sample frequency at these locations be reduced further once the following conditions are met:

  - Up gradient groundwater concentrations are stable or decreasing; and
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values.

- **Duration:** Quarterly sampling began during the fourth quarter of 2017. Sampling (semi-annual or annual) will continue until the following conditions are met:
  - Up gradient active groundwater corrective measures (e.g. enhanced *in situ* bioremediation in the southern treatment area) are complete;
  - Up gradient groundwater concentrations are stable or decreasing;
  - Up gradient groundwater concentrations are within an order of magnitude of the chronic GSI values; and
  - VOC concentrations at these locations are at or below chronic GSI values (as listed in Table 1 of Appendix A) for four (4) consecutive sampling events or statistical techniques indicate compliance with these chronic GSI values.

  Once these conditions are met, TRC will submit a request to USEPA that GSI monitoring be discontinued.

Section 5
Data Evaluation and Reporting

5.1 Data Evaluation

During each sampling event groundwater, surface water, and pore water samples collected at the locations described in Sections 2, 3 and 4 will be collected for VOCs analysis. Sample data will be tabulated and compared to the chronic and acute mixing zone-based GSI criteria provided in the MDEQ Response (Appendix A), following each sampling event. Any detected parameters which are not included in Tables 1, 2 or 3 of the MDEQ Response will be compared to generic GSI criteria.

5.2 Reporting

At a minimum, sample data from the GSI Monitoring Program will be reported in a Technical Memorandum on an annual basis. Note that sampling for the GSI Monitoring Program is expected to be completed concurrent with other groundwater sampling as described in the February 2017 CMP. The Technical Memorandum prepared will typically also include sample results and the other associated content related to this additional groundwater sampling (e.g., a single combined report).

5.2.1 Schedule

Typically, the Technical Memorandum will be submitted to USEPA and MDEQ as an attachment to the fourth quarter progress report, due January 15 each year. However, if the fourth quarter sampling event is completed near the end of the quarter, sample data may not be available when the quarterly progress report is due. In this situation, the technical memorandum will be submitted within 30 days of receiving the final laboratory report. During the active on-site groundwater treatment period, reporting is likely to be completed on a more frequent basis (quarterly or semi-annually).

Data evaluation will be completed following each sampling event. If that evaluation identifies groundwater or surface water concentrations that are inconsistent with previous sample data and/or that require remedial action (e.g. data above FAVs), sample results will be reported within 60 days of receiving the final laboratory report.

5.2.2 Content

Each technical memorandum will include the following:

- A brief description of field activities, including any deviations from the sampling program described in the GSI Monitoring Plan;
- Data tables, inclusive of historical data, comparing the concentrations of detected compounds to the chronic and acute mixing zone-based GSI criteria provided in the MDEQ Response (Appendix A);
- A figure illustrating sample locations;
- A review of data quality and usability;
- A copy of the laboratory report(s);
- An evaluation of sample data including a discussion of any exceedences of applicable chronic and acute mixing zone-based GSI criteria;
- If concentrations at pore water or surface water sample locations exceed chronic mixing zone-based criteria, a discussion of source removal/source control measures including an estimate of the quantity of source material removed and an evaluation of data from sample locations along the flow path between the source area and the compliance monitoring points;[1]
- If acute mixing zone-based GSI criteria are exceeded, an explanation of and timeline for anticipated remedial action; and
- A description of any requested changes to the sampling program during the next sampling event.

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[1] Current surface water concentrations exceed these chronic GSI values and are expected to continue to exceed these values for some time after on-site groundwater treatment is complete.

Section 6
Field Procedures

6.1 Monitoring Well Identification

Each permanent monitoring well included in the GSI Monitoring Plan will be identified as follows: MW-xxy. The variable xx will be filled in with the well identification number. Monitoring wells will be numbered consecutively, or in the event that the new wells are nested with a preexisting well(s), the number of the pre-existing well will be applied to the new well. The "y" suffix will indicate monitoring well depth: "s" indicates a shallow water table well, "i" indicates a well screened in the intermediate portion of the aquifer, and "d" indicates a deep well screened at or near the top of the lower clay unit. Note that proposed groundwater sampling locations include three drive point wells that were installed as temporary monitoring wells that have been converted to permanent wells and renamed in accordance with the naming scheme described above: B-108 (3-6'), now MW-42s; B-113 (5-8'), now MW-46d; and B-114 (7.4-10.4'), now MW-47d.

6.2 Access

Access to the monitoring locations identified in this Revised GSI Monitoring Plan are governed by site access agreement(s) with off-site property owners. Notifications and arrangements for site access will be performed in accordance with those agreements by TRC and TPC.

6.3 Pre-Sample Procedures

The field personnel will obtain all necessary field sampling forms (see Appendix D) to complete the fieldwork. In addition, sample bottles, trip blanks, and deionized water will be obtained from the contract laboratory prior to sample collection. Potential contaminants from the rinse water will be minimized by using deionized water during all decontamination procedures.

6.4 Groundwater Sampling Procedures

6.4.1 Monitoring Well Inspection

Prior to opening any groundwater monitoring well, field personnel will visually inspect the well for damage and wear. Visual observations of the integrity of the wells will be recorded in the field notes. Field personnel will notify TPC of any damage to the monitoring wells. Field personnel will ensure that all wells are clearly and properly labelled and visible throughout the year.

6.4.2 Static Water Level Measurements

After visual inspection of the monitoring well, the well will be unlocked and opened to the atmosphere. If required, static water level measurements will be recorded using an electronic water level meter accurate to 0.01 foot, from each on-site well prior to purging and sampling. All water level measurements will be recorded within a 24-hour time period to avoid temporal variations that may occur.

Field personnel will measure water levels from an identified reference point on the well and record the measurement in the field notes. Depth-to-water measurements from the top-of-casing (TOC) will be subtracted from the TOC elevation to determine the potentiometric elevation, in reference to the United States Geologic Survey (USGS) elevation relative to the National Geodetic Vertical Datum of 1988 (NAVD88).

The static water level meter will be cleaned prior to and between each monitoring well according to the decontamination procedures described below.

6.4.3 Field Readings

Physically or chemically unstable analytes will be measured in the field. Field measurements for turbidity, temperature, pH, specific conductance, oxidation reduction potential (ORP), and/or dissolved oxygen may be collected at each sampling point using the appropriate field probe or meter during purging and sampling procedures. A Hydrolab Quanta multimeter, or similar (*e.g.,* QED MP-20, YSI Series 6000), will be utilized.

Operation and maintenance instructions and procedures will comply with manufacturers' specifications. Field instrument calibration procedures will be performed a minimum of once per day. A log of meter calibrations and checks will be maintained for each sampling event. Field readings will be documented in accordance with standard TRC field sampling forms. Examples of field data sheets, meter calibration logs, and field note forms are provided in Appendix D.

6.4.4 Purging Procedures

TRC field personnel will use a peristaltic pump to obtain samples from the monitoring wells using the following procedures:

- By utilizing the difference in the depth to water and the total depth of the well, along with the length of the well screen, the intake of the polyethylene/ polypropylene tubing will be placed in the well at the center of the screened interval, or at the center of the water column if the groundwater elevation intersects the well screen.

- Connect the pump discharge tubing to the flow-through cell containing pre-calibrated instruments.
- Purge at an initial rate of 0.5 liter or less per minute. Reduce flow rate if water is very turbid or water level is being rapidly drawn down. Check drawdown every 1 to 5 minutes to ensure drawdown does not exceed 1 foot until drawdown stabilizes. If flow is reduced to lowest possible rate (~0.05 to 0.1 liters per minute) and drawdown continues, continue with purging at the lowest possible rate.
- Once an appropriate purge rate is achieved, continue purging until stabilization is achieved. Stabilization is complete when the temperature change is ≤ 0.5°C, conductivity change is ≤ 10 percent, pH is ± 0.1 pH unit, and turbidity change is ± 10 percent (or less than 10 Nephelometric Turbidity Units [NTUs]) between three successive 3-5 minute purging intervals.
- Field measurements and readings will be conducted utilizing a flow-through cell as detailed above. A Hydrolab Quanta multimeter (or a comparable alternative) and a flow cell system will be used to collect these readings.
- In addition, to providing basic groundwater quality characterization information, the groundwater sample may also be field-analyzed for ORP and/or dissolved oxygen. ORP and dissolved oxygen will be measured using the flow-through cell and the Hydrolab Quanta multimeter (or a comparable alternative).
- After stability is reached, disconnect the flow-through cell from the pump outlet line and fill all of the sampling bottles for the appropriate parameters.
- Well purging information will be recorded on TRC sampling form(s). An example is included in Appendix D.

Decontamination procedures for non-dedicated sampling equipment are described in Section 6.7 below.

6.4.5 Groundwater Sample Collection and Handling

After purging the appropriate volume based upon the measured stabilized readings, the wells will be sampled utilizing the following procedures:

- Samples will be placed in new bottles provided by the laboratory. Those samples requiring the use of field preservatives will be placed into pre-preserved bottles.
- Whenever possible, locations are sampled from relatively “clean” to relatively “dirty.”
- Take precautions to ensure that the sampling equipment does not come into contact with the sample bottles, the purge container, or any potentially contaminated surface. Vehicle engines are shut off during purging and sampling.
- Obtain and record final readings of the field parameters when sampling.

  - Prepare bottles by writing the date, the sampler's name, and the time of day in the sampler section.
  - When sampling is complete, place the dedicated sample tubing back in the well and move on to the next location. Typically it is not necessary to decontaminate the flow-through cell between sampling points.
  - Samples will be immediately stored on ice in coolers for transport to the laboratory. Each sample collected will be recorded on a Water Sample Log and on a chain-of-custody form, and transported to the laboratory for analysis. Should circumstances prevent the immediate transport to the lab, samples will be stored in their designated cooler and/or a dedicated sample refrigeration unit, maintained under chain-of-custody procedures, and kept cool until final deposition at the laboratory.

Because subsurface geologic conditions at some wells may not recharge a well quickly enough to keep up with even very low purge rates, a well may be purged dry before obtaining stabilization. If this occurs, samples will be collected using the same pump and dedicated tubing after the well has recharged sufficiently to allow for the sample containers to be filled.

A new pair of protective gloves will be used at each well. The gloves will be changed if they become contaminated or damaged during purging or sample collection activities at any given well.

6.5 Surface Water Sample Collection Procedures

Field personnel will collect surface water samples from the seep sample locations using a clean sample container or cup as described below.

- Samples will be collected in a new, disposable sample cup or new sample bottles provided by the laboratory. Those samples requiring the use of field preservatives will be placed into the pre-preserved bottles.
- Field personnel will document sample collection procedures on field data forms. Documentation will include color, odor and a visual assessment of sample turbidity.
- Prepare bottles by writing the sample collection date, the sampler's name, and the time of day in the sampler section.
- Samples will be immediately stored on ice in coolers for transport to the laboratory. Data for each sample collected will be recorded on a Water Sample Log and on a chain-of-custody form, and transported to the laboratory for analysis. Should circumstances prevent the immediate transport to the laboratory, samples will be stored in their designated cooler and/or a dedicated sample refrigeration unit, maintained under chain of custody procedures, and kept cool until final deposition at the laboratory.

A new pair of protective gloves will be used at each well. The gloves will be changed if they become contaminated or damaged during sample collection activities at any given sample point.

6.6 Pore Water Sample Collection Procedures

Similar to the adjacent monitoring wells at the wetland boundary (MW-42s/d, MW-46d, and MW-47d) where silt- and organic-rich soils with low hydraulic conductivities were also encountered, pore water recovery is limited. Collection of the pore water samples will be performed in general accordance with USEPA Region 4 standard operating procedures and summarized below (USEPA 2013). Decontamination procedures for non-dedicated sampling equipment are described in Section 6.7.

6.6.1 Purging Procedures

Pore water will be purged as practical from the sampling points using a peristaltic pump or syringe at a slow rate to minimize turbidity as follows:

- Gently insert the push point sampler (e.g., PushPoint™ sampler or equivalent) into the wetland soil until the top of the screen is a minimum of 12 inches below the ground surface, then remove the guard rod. Care must be taken not to disturb the soil immediately surrounding the push point sampler.
- Connect new flexible tubing to the top of the sampler and purge out all air from the sampler using a peristaltic pump or syringe (if using a syringe, a new syringe will be used at each sampling location). Withdraw pore water as practical until it appears non-turbid.
- Pore water sample point purging information will be recorded on the sampling form(s) included in Appendix D.

6.6.2 Pore Water Sample Collection and Handling

After purging the pore water sample point as outlined above, the sampler will extract the pore water sample using a peristaltic pump or syringe, placing adequate sample volume in the laboratory provided sample container(s) utilizing the following procedures:

- Samples will be placed in new bottles provided by the laboratory. Those samples requiring the use of field preservatives will be placed into pre-preserved bottles.
- Take precautions to ensure that the sampling equipment does not come into contact with the sample bottles, the purge container, or any potentially contaminated surface.

- Prepare bottles by writing the date, the sampler's name, and the time of day in the sampler section.
- Samples will be immediately stored on ice in coolers for transport to the laboratory. Each sample collected will be recorded on a Water Sample Log and on a chain-of-custody form, and transported to the laboratory for analysis. Should circumstances prevent the immediate transport to the laboratory, samples will be stored in their designated cooler and/or a dedicated sample refrigeration unit, maintained under chain of custody procedures, and kept cool until final deposition at the laboratory.

Because subsurface geologic conditions at some pore water sampling locations may not recharge quickly enough to keep up with even very low purge rates, a sample point may be purged dry before the purge water appears non-turbid. If this occurs, samples will be collected using the same pump/syringe and dedicated tubing after the point has recharged sufficiently to allow for the sample containers to be filled.

A new pair of protective gloves will be used at each pore water sampling location. The gloves will be changed if they become contaminated or damaged during purging or sample collection activities at any given sample location.

6.6.3 Field Readings

Subsequent to collecting the sample, if sufficient pore water volume is encountered, the sampler may remove an aliquot of pore water and field measure pH, temperature, ORP, total dissolved solids (TDS) and/or specific conductivity using a Myron 6P Water Quality Meter or similar.

Operation and maintenance instructions and procedures will comply with manufacturers' specifications. Field instrument calibration procedures will be performed a minimum of once per day. A log of meter calibrations and checks will be maintained for each sampling event. Field readings will be documented in accordance with standard TRC field sampling forms. Examples of field data sheets, meter calibration logs, and field note forms are given in Appendix D.

6.6.4 Standing Water

Standing water is not typically observed in the wetland area. Therefore, surface water intrusion is not expected to be a concern during pore water sampling. If surface water is encountered at a sampling location, surface water will also be purged from the push point sampler as described in the purging procedures above and field readings will be conducted prior to sample collection. In addition, surface water field data (e.g., pH, temperature, conductivity) will be collected immediately before and after pore water sample collection and compared to the pore water field data to assess potential surface water infiltration. Lastly, if standing water is present, the static water level in the pore water will also be measured relative to surface water to determine the relative gradient (positive or negative).

6.7 Decontamination Procedures

The following describes the specific field cleaning/decontamination procedures that will be utilized for non-dedicated equipment that may be used during sampling. The purpose of the decontamination procedures is to reduce the potential for cross-contamination between sites and between sampling locations and to obtain representative samples for analysis.

6.7.1 Electronic Water Level Meter

Water level measurement equipment, including the permanent line/cable, will be cleaned/decontaminated by washing with deionized water prior to and between each monitoring well.

6.7.2 Water Quality Meter

The meter will be rinsed with deionized water between monitoring wells. The water quality meter will be removed from the sample collection train prior to the collection of laboratory samples.

6.7.3 Pumps

Typically a peristaltic pump with dedicated or disposable tubing will be used for the collection of groundwater and pore water samples. Using this methodology, none of the materials in contact with the sample are shared between samples. Therefore decontamination is not required. However, if an alternative, non-dedicated submersible pump, e.g. a bladder pump, is used for sample collection, that bladder pump will be decontaminated before use in each monitoring well. The bladder pump used will be decontaminated by dismantling the pump and disposing of the used bladder. The pump, screen and O-rings are then placed in a container (large enough to allow the entire length of the pump to be submerged) with laboratory-grade soap and water. The pump is then scrubbed with soapy water. Following this, the pump will be rinsed in a separate clean container of distilled water.

All equipment that will come into contact with the groundwater will be final-rinsed with deionized water prior to being lowered into any monitoring well.

6.8 Field Quality Control Samples

Field quality control (QC) sample collection will include blind field duplicates, trip blanks and matrix spike and matrix spike duplicate samples (MS/MSD). Theses quality control samples will be analyzed for the same constituents as the associated samples. No shared, sampling equipment will be used when completing field activities associated with the GSI Monitoring Program. Therefore no field equipment blanks will be collected. Trip blanks will only be analyzed for VOCs.

Field quality control samples are collected to assess the quality of the analytical data and to evaluate sampling and analytical reproducibility (precision). Field quality control samples will consist of duplicate samples and trip blanks. Acceptance criteria for these samples will be in accordance with the current version of the Laboratory Quality Assurance/Quality Control QA/QC Manual (Appendix E). Note that sampling for the GSI Monitoring Plan is expected to be completed concurrent with other groundwater sampling as described in the CMP and summarized in Table 1. QC samples will be completed for the project as a whole. Duplicate, blank, and MS/MSD samples will be collected at the appropriate rates outlined below. However, the location of these QC samples may not always align with the GSI sampling locations.

6.8.1 Blind Field Duplicates

Blind field duplicate samples will be collected one per 20 samples or less per similar media, e.g. water. The results will be used to evaluate sampling and analytical reproducibility (precision). Points where duplicate samples are to be collected will be selected by the field personnel to provide a range of expected contamination concentrations in the field, and will be submitted as blind duplicates to the laboratory.

The first three characters “DUP,” followed by a 2-digit number, to be assigned in the sequence collected, will identify field duplicate samples. Therefore, during each sampling event the first duplicate sample will be identified as “DUP-01,” and the second duplicate sample will be identified as “DUP-02,” etc.

6.8.2 Trip Blanks

Trip blanks will be analysed to assess the possible cross-contamination of aqueous samples resulting from diffusion of VOCs through the septa during sample shipment, as well as possible contamination from fugitive VOCs in the atmosphere at the Site. Trip blanks are prepared in the laboratory. Trip blank samples consist of 40-mL vials that are filled with deionized water in the laboratory prior to going to the field. Trip blanks will accompany the VOC water sample bottles from the laboratory to the field and will be returned with the VOC samples to the laboratory. A separate trip blank will be included in every shipping container that includes a sample intended for VOC analysis.

Trip blank identifiers will consist of the letters "TB" followed by a 2-digit number assigned in sequence similar to duplicate numbers. Therefore, during each sampling event, the first trip blank will be labelled as "TB-01," the second will be labelled "TB-02," etc.

6.8.3 Matrix Spike and Matrix Spike Duplicate Samples

MS/MSD samples will be analysed to provide information about the effect of the sample matrix on the digestion and measurement methodology. MS/MSD samples are laboratory rather than field quality control samples. MS/MSD samples are collected in the field to ensure a sufficient sample volume is available to complete these laboratory QC samples.

Points where MS/MSD samples are to be collected will be selected by the field personnel and with the sampling location identified. The MS/MSD sample will be collected using the same equipment as the associated primary sample, *e.g.* a pump, syringe, or sample cup, and will be collected immediately after the primary sample is collected. Typically MS/MSD samples will be collected at a rate of 1 per 20 water samples. If only one or a few samples are collected, field personnel may not collect a MS/MSD sample. However, laboratory batch MS/MSD samples are analysed, as required, at a rate of one per 20 samples or less per similar media will be included in the analytical report regardless of whether the MS/MSD sample was collected at the Site.

Assigning the name of the sampling point with the suffix "MS/MSD" will identify MS/MSD samples. Therefore, a MS/MSD sample collected from "MW-01s"will be identified as "MW-01s MS/MSD".

6.9 Sample Transportation

Method of Transport – Typically, samples will be delivered directly to the laboratory upon completion of sampling activities. If shipment is necessary, the method of transport used should be one that will ensure that the samples will be delivered to the laboratory overnight, such as FedEx. The laboratory will be notified of sample shipment the day before the samples are to arrive.

Transport Container and Packaging – The container in which the samples will be transported will be an appropriately sized cooler. Typical sample packaging procedures will include packaging the sample containers with sufficient cushioning to prevent breakage during transport. Plastic bags will be filled with ice, and placed on top of the samples. The completed Chain-of-Custody Record will be placed in a resealable bag, and taped to the inside cover of the cooler. If the cooler is shipped, the cooler drain will be taped shut and the cooler will be completely wrapped with tape in at least two locations. Upon receipt of the cooler at the laboratory, the laboratory will measure the temperature of the samples and record the temperature on the Chain-of-Custody Record or sample log.

6.10 Sample Chain-of-Custody

The possession of samples must be traceable from the time of collection through delivery to the laboratory using of Chain-of-Custody procedures. Specific Chain-of-Custody Records will accompany all sample shipping containers to document the transfer of the shipping containers and samples from the field collection point to the laboratory that is receiving the samples for analysis. The procedures to be implemented are as follows:

- Properly identify and label each sample in the field.
- Complete Chain-of-Custody Records in the field, indicating sample identification, the number of containers filled, the sampling date, the sampling time, and the sample collector's name.
- Pack the shipping containers with the samples, the Chain-of-Custody Records, and ice, as appropriate. Each set of containers to be shipped together is assigned a Chain-of-Custody Record, which travels with the sample containers.
- Seal and ship the containers to the appropriate laboratory. Common carriers or intermediate individuals will be identified on the Chain-of-Custody Record, and copies of all bills-of-lading will be retained.
- Receive and check the containers in the laboratory for broken seals or damaged sample containers.

If an error is discovered on a sample Chain-of-Custody Record, the person who made the error should correct it when possible. No erroneous material is to be erased. Rather, a single line will be drawn through mistakes. The date and the initials of the person that is making the correction will be written beside the correction. This procedure applies to words or figures that are inserted or added to a previously recorded statement.

If a Chain-of-Custody Record is damaged in shipment, the field technician will prepare a written statement detailing the pertinent information, including how the sample was collected. The statement should include information such as field logbook entries regarding the sample.

6.10.1 Field Chain-of-Custody Procedures

Field Chain-of-Custody procedures are as follows:

- Appoint the field sampler as the person who is responsible for the care and the custody of the samples until they are transferred or properly dispatched. Ensure that as few people as possible handle the samples.
- Tag all bottles with sample numbers and locations.
- Complete sample tags for each sample using waterproof ink, unless prohibited by weather conditions.
- Appoint the project manager or designee as the person who reviews all field activities to determine whether proper custody procedures were followed during the fieldwork and to decide if additional samples are required.

6.10.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage and numbering; tracking during sample preparation and analysis; and storage of data are described in the Laboratory QA/QC Manual, provided in Appendix E of this Revised GSI Monitoring Plan. A copy of the Chain-of-Custody Records will be included in the final laboratory report.

6.10.3 Final Evidence Files Custody Procedures

Electronic copies of the field records and Chain-of-Custody Records will be maintained on the TRC network as a permanent record of the sample collection activities.

6.11 Field Records

Field records will be maintained on field information forms (*e.g.*, Static Water Level forms, Sample Collection forms, Stabilization forms, Chain-of-Custody forms, *etc.*), and will be legibly written in indelible ink and will provide a clear record of all field activities. The field records will also be used to document samples that are collected, the sampling date and time, sample identification, and any other relevant information. Electronic copies of the field records will be maintained on the TRC network.

Section 7
Laboratory Analysis

Laboratory Quality Assurance and Quality Control (QA/QC) procedures will be performed and documented in accordance with the Laboratory QA/QC Manual included in Appendix E. Additional QA/QC procedures, *i.e.*, duplicate sample collection, field data forms, and Chain-of-Custody procedures, are described in Section 6 of this Revised GSI Monitoring Plan.

Section 8
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Tables

Table 1
Site-Wide Performance Monitoring Plan
Sampling Locations, Sampling Parameters and Sampling Frequency
Tecumseh Products Company Site
Tecumseh, Michigan

Groundwater / Surface Water Sample Location	Approximate Screened Interval (ft bgs)	Estimated Depth to Top of Aquifer (ft)	Estimated Depth to Clay (ft)	Purpose (See Notes)	During Implementation of EISB and 2 Year Verification Period			MNA & Post Verification		
					Water Level	VOCs	MNA	Water Level	VOCs	MNA
Groundwater On-Site North										
*NEW-01	19-32	14	32	1, 2, 3	Q	Q	Q			
NEW-02	28-46	23	46	1, 2	Q	Q	Q			
*MW-02s	23-28	23	45	1, 2, 3	Q	SA		SA	SA	
*MW-02i	32-37	23	45	1, 2, 3	Q	Q		SA	SA	
*MW-03s	9-14	9	28	3	Q	SA		SA	SA	
*MW-03d	23-28	9	28	3	Q	Q		SA	SA	
*MW-04s	15-20	15	35	1, 2, 3	Q	Q		SA	SA	
*MW-04i	21.5-26.5	15	35	1, 2, 3	Q	Q		SA	SA	
MW-32s	23-28	23	39	1, 2	Q	SA		SA	SA	
MW-32d	35-40	23	39	1, 2	Q	SA		SA	SA	
MW-36s	16.3-21.3	16	35	4	Q	SA		SA	SA	
MW-36d	31-36	16	35	4	Q	SA		SA	SA	
MW-53s	23-28	23	48	1, 2	Q	Q	SA	SA	SA	
MW-53i	27-32	23	48	1, 2	Q	Q	SA	SA	SA	
MW-53d	43-48	23	48	1, 2	Q	Q	SA	SA	SA	
*MW-54s	21-26	21	41	1, 2, 3	Q	Q		SA	SA	
*MW-54i	27-32	21	41	1, 2, 3	Q	Q		SA	SA	
MW-55s	21-26	21	44	1, 2	Q	Q	SA	SA	SA	
MW-55i	28-33	21	44	1, 2	Q	Q	SA	SA	SA	
MW-55d	39-44	21	44	1, 2	Q	Q	SA	SA	SA	
*MW-56s	13-18	13	32	1, 2, 3	Q	Q	SA	SA	SA	
*MW-56i	19-24	13	32	1, 2, 3	Q	Q	SA	SA	SA	
*MW-56d	27-32	13	32	1, 2, 3	Q	Q	SA	SA	SA	
*MW-57s	7-12	7	30	3	Q	Q		SA	SA	
*MW-57d	TBD*	7	30	3	Q	Q		SA	SA	

Notes:

Purpose:

1) Monitoring point to evaluate the progress of conditions favorable to EISB through treatment cells. Objective is to observe DO, ORP, pH favorable to ERD.
2) Monitoring point to verify contaminant mass reduction within the EISB recirculation cell. Cleanup objective is to observe decreasing constituent of concern concentrations.
3) At downgradient / side gradient property boundary. Point of compliance to verify effectiveness of active on-site soil and groundwater treatment. Cleanup levels are protective of off-site vapor intrusion pathway.
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MNA = Monitored Natural Attenuation. MNA parameters will include dissolved oxygen, oxidation-reduction potential, pH, dissolved ferrous and ferric iron, alkalinity, chloride, sulfate, nitrate, dissolved methane, dissolved ethane, and dissolved ethene.

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Table 1
Site-Wide Performance Monitoring Plan
Sampling Locations, Sampling Parameters and Sampling Frequency
Tecumseh Products Company Site
Tecumseh, Michigan

Groundwater / Surface Water Sample Location	Approximate Screened Interval (ft bgs)	Estimated Depth to Top of Aquifer (ft)	Estimated Depth to Clay (ft)	Purpose (See Notes)	During Implementation of EISB and 2 Year Verification Period			MNA & Post Verification		
					Water Level	VOCs	MNA	Water Level	VOCs	MNA
Groundwater On-Site North (Continued)										
MW-62s	21-26	21	35	4	Q	Q		SA	SA	
MW-62d	30-35	21	35	4	Q	Q		SA	SA	
MW-65d	34-39	20	39	1, 2	Q	Q		SA	SA	
Groundwater Off-Site North										
MW-10d	14-19	10	19	5	SA	A		SA	A	
MW-12s	12-17	12	38	5	SA	A		SA	A	
MW-12d	33-38	12	38	5	SA	A		SA	A	
MW-23	17-22	15	24	6	SA	SA		SA	SA	
MW-24s	18.5-23.5	19	44	5	SA	A		SA	A	
MW-24d	39-34	19	44	5	SA	A		SA	A	
MW-30s	11-16	10	30.5	5	SA	A		SA	A	
MW-30d	25.5-30.5	10	30.5	5	SA	A		SA	A	
MW-43s	9-14	13	39	6	SA	SA		SA	SA	
MW-58s	15-20	15	44	6	SA	SA		SA	SA	
MW-59s	14-19	14	35	6	SA	SA	A	SA	SA	A
MW-59i	22-27	14	35	6	SA	SA	A	SA	SA	A
MW-59d	30-35	14	35	6	SA	SA	A	SA	SA	A
MW-60s	12-17	12	35	6	SA	SA	A	SA	SA	A
MW-60i	22-27	12	35	6	SA	SA	A	SA	SA	A
MW-60d	30-35	12	35	6	SA	SA	A	SA	SA	A
MW-61s	12-17	12	29	6	SA	SA		SA	SA	
MW-61i	18-23	12	29	6	SA	SA		SA	SA	
MW-61d	24-29	12	29	6	SA	SA		SA	SA	

Notes:

Purpose:

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					Water Level	VOCs	MNA	Water Level	VOCs	MNA
Groundwater On-Site South										
SEW-01	23-48	18	48	1, 2, 3	Q	Q	Q			
*SEW-02	12-36	7	36		Q	Q	Q			
SEW-03	23-38	18	38	1, 2, 3	Q	Q	Q			
MW-34s	23-28	23	49	1, 2	Q	SA		SA	SA	
MW-35i	20.7-22.7	15	44.5	1, 2	Q	SA		SA	SA	
MW-35d	42.8-44.8	15	44.5	1, 2	Q	SA		SA	SA	
MW-37s	25.4-30.4	24	35	1, 2	Q	SA		SA	A	
MW-39s	15.7-20.7	15	39	1, 2	Q	SA		SA	SA	
MW-39d	34.1-39.1	15	39	1, 2	Q	SA		SA	SA	
MW-44s	8.5-13.5	8	38	1, 2	Q	Q	SA	SA	SA	
MW-44i	19.4-24.1	8	38	1, 2	Q	Q	SA	SA	SA	
MW-44d	33-38	8	38	1, 2	Q	Q	SA	SA	SA	
*MW-45s	7-12	7	35	1, 2, 3				SA	SA	
*MW-45i	18.1-23.1	7	35	1, 2, 3				SA	SA	
*MW-45d	30-35	7	35	1, 2, 3				SA	SA	
*MW-48s	7-12	7	37	1, 2, 3	Q	Q		SA	SA	
MW-49i	21-26	9	40	1, 2	Q	Q		SA	SA	
MW-49d	35-40	9	40	1, 2	Q	Q		SA	SA	
MW-63s	20-25	20	49	1, 2	Q	Q	SA	SA	SA	
MW-63i	29-34	20	49	1, 2	Q	Q	SA	SA	SA	
MW-63d	44-49	20	49	1, 2	Q	Q	SA	SA	SA	
MW-64s	17-22	17	44	1, 2	Q	Q		SA	SA	
MW-64i	25-30	17	44	1, 2	Q	Q		SA	SA	
MW-64d	38-43	17	44	1, 2	Q	Q		SA	SA	

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					Water Level	VOCs	MNA	Water Level	VOCs	MNA
Groundwater On-Site South (Continued)										
*PRB-01s	6-11	7	35	3	Q	SA		SA	SA	
*PRB-02s	6-11	7	33	3	Q	SA		SA	SA	
*PRB-02i	16-21	7	33	3	Q	Q		SA	SA	
*PRB-08s	6-11	7	34	3	Q	SA		SA	SA	
*PRB-08d	18.5-23.5	7	34	3	Q	SA		SA	SA	
*PRB-11s	15-20	16	50	3	Q	SA		SA	SA	
*PRB-12s	15-20	16	50	1, 2, 3	Q	SA		SA	SA	
PRB-15d	29-34	16	47	1, 2	Q	SA		SA	SA	
PRB-16s	5-10	7	34	2	Q	SA		SA	SA	
Groundwater Off-Site South										
MW-14d	37.5-42.5	30	42.5	5	SA	A		SA	A	
MW-17s	3-8	5	6	5	SA	A		SA	A	
MW-20s	6-11	5	43.5	6	SA	SA		SA	SA	
MW-20i	22-27	5	43.5	6	Q	Q		SA	SA	
MW-20d	38.5-43.5	5	43.5	6	SA	SA		SA	SA	
MW-21	28.5-33.5	29	32	6	SA	A		SA	A	
MW-38s	9-14	9	14	6	SA	A		SA	SA	
MW-38d	28.8-33.8	15	33.5	6	SA	A		SA	SA	
MW-41	3.3-6.3	2	7	5	SA	SA		SA	A	
MW-50s	13-18	13	38	6	Q	Q	A	SA	SA	A
MW-50i	26-31	13	38	6	Q	Q	A	SA	SA	A
MW-50d	33-38	13	38	6	Q	Q	A	SA	SA	A
MW-51	31-36	29	36	6	Q	Q	A	SA	SA	A
MW-52s	29-34	29	38.5	6	Q	Q	A	SA	SA	A
MW-52d	33.5-38.5	29	38.5	6	Q	Q	A	SA	SA	A

Notes:

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					Water Level	**VOCs**	**MNA**	**Water Level**	**VOCs**	**MNA**
Surface Water Compliance										
MW-42s	3.0-6.0	0	8.6	6, 7	Q	Q		SA	SA	
MW-42d	5.6-8.6	0	8.6	6, 7	Q	Q		SA	SA	
MW-46d	5.0-8.0	0	8.0	6, 7	Q	Q		SA	SA	
MW-47d	7.4-10.4	0	10.4	6, 7	Q	Q		SA	SA	
PW-01	1-2	0	NA	5, 7		Q			SA	
PW-04	1-2	0	NA	5, 7		Q			SA	
PW-07	1-2	0	NA	5, 7		Q			SA	
SP-01	NA	NA	NA	6, 7		Q			SA	
SP-02	NA	NA	NA	6, 7		Q			SA	
SP-03	NA	NA	NA	6, 7		Q			SA	

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Table 2
GSI Performance Monitoring Plan
Sample Location Survey and Well Construction Data
Tecumseh Products Company Site
Tecumseh, Michigan

Sample Location	Coordinates (1)		Top of Casing (ft MSL) (2)	Ground Surface (ft MSL) (2)	Screen Elevation		Well Total Depth (ft BGS)	Screen Length (feet)
	North (feet)	East (feet)			Top (ft MSL) (2)	Bottom (ft MSL) (2)		
Groundwater Sample Locations (3)								
MW-42s	180796.22	13241185.14	744.11	741.8	738.8	735.8	6.0	3.0
MW-42d	180795.57	13241186.74	746.12	741.9	736.3	733.3	8.6	3.0
MW-46d	180732.65	13241149.69	743.03	740.8	735.8	732.8	8.0	3.0
MW-47d	180846.9	13241232.31	745.25	742.8	735.4	732.4	10.4	3.0
Pore Water Sample Locations (4)								
PW-01	180815.96	13241277.38	NA	NM	NM	NM	1.0	1.0
PW-04	180791.47	13241391.71	NA	NM	NM	NM	1.0	1.0
PW-07	180779.41	13241179.32	NA	NM	NM	NM	1.0	1.0
Surface Water Sample Locations (4)								
SP-01	180731.002	13241125.24	NA	739.42	NA	NA	0.0	NA
SP-02	180810.071	13241149.40	NA	739.42	NA	NA	0.0	NA
SP-03	180876.659	13241198.48	NA	742.32	NA	NA	0.0	NA

Notes:

1) Site features are located horizontally using the state plane coordinate system relative to the North American Datum of 1983 (NAD83), international feet, Michigan Zone South.

2) Vertical measurements are relative to the National Geodetic Vertical Datum of 1988 (NAVD88)

3) Monitoring wells were professionally surveyed by Midwestern Consulting, Inc. of Ann Arbor, Michigan on December 11, 2015.

4) Survey information for pore water and surface water sample locations was collected by TRC Environmental.

ft MSL: Feet Mean Sea Level

ft BGS: Feet Below Ground Surface

NA: Not Available

NM: Not Measured

Table 3
GSI Performance Monitoring Plan
Analytical Methods, Detection Limits, and Holding Times
Tecumseh Products Company Site
Tecumseh, Michigan

Parameter	Analytical Method	Reporting Limit (ug/L)	Sample Preservation [1]	Holding Time	Filter
Acetone	8260B	20	HCl to pH <2	14 days	no
Acrylonitrile	8260B	2	HCl to pH <2	14 days	no
Benzene	8260B	1	HCl to pH <2	14 days	no
Bromobenzene	8260B	1	HCl to pH <2	14 days	no
Bromochloromethane	8260B	1	HCl to pH <2	14 days	no
Bromodichloromethane	8260B	1	HCl to pH <2	14 days	no
Bromoform	8260B	1	HCl to pH <2	14 days	no
Bromomethane	8260B	5	HCl to pH <2	14 days	no
n-Butylbenzene	8260B	1	HCl to pH <2	14 days	no
sec-Butylbenzene	8260B	1	HCl to pH <2	14 days	no
tert-Butylbenzene	8260B	1	HCl to pH <2	14 days	no
2-Butanone (MEK)	8260B	5	HCl to pH <2	14 days	no
Carbon Disulfide	8260B	1	HCl to pH <2	14 days	no
Carbon Tetrachloride	8260B	1	HCl to pH <2	14 days	no
Chlorobenzene	8260B	1	HCl to pH <2	14 days	no
Chloroethane	8260B	5	HCl to pH <2	14 days	no
Chloroform	8260B	1	HCl to pH <2	14 days	no
Chloromethane	8260B	5	HCl to pH <2	14 days	no
Dibromochloromethane	8260B	1	HCl to pH <2	14 days	no
1,2-Dibromo-3-chloropropane	8260B	5	HCl to pH <2	14 days	no
1,2-Dibromoethane	8260B	1	HCl to pH <2	14 days	no
Dibromomethane	8260B	1	HCl to pH <2	14 days	no
1,2-Dichlorobenzene	8260B	1	HCl to pH <2	14 days	no
1,3-Dichlorobenzene	8260B	1	HCl to pH <2	14 days	no
1,4-Dichlorobenzene	8260B	1	HCl to pH <2	14 days	no
Dichlorodifluoromethane	8260B	5	HCl to pH <2	14 days	no
1,1-Dichloroethane	8260B	1	HCl to pH <2	14 days	no
1,2-Dichloroethane	8260B	1	HCl to pH <2	14 days	no
1,1-Dichloroethene	8260B	1	HCl to pH <2	14 days	no
cis-1,2-Dichloroethene	8260B	1	HCl to pH <2	14 days	no
trans-1,2-Dichloroethene	8260B	1	HCl to pH <2	14 days	no
1,2-Dichloropropane	8260B	1	HCl to pH <2	14 days	no
cis-1,3-Dichloropropene	8260B	1	HCl to pH <2	14 days	no
trans-1,3-Dichloropropene	8260B	1	HCl to pH <2	14 days	no
trans-1,4-Dichloro-2-butene	8260B	1	HCl to pH <2	14 days	no
Ethyl Ether	8260B	5	HCl to pH <2	14 days	no
Ethylbenzene	8260B	1	HCl to pH <2	14 days	no
2-Hexanone	8260B	5	HCl to pH <2	14 days	no
Iodomethane	8260B	1	HCl to pH <2	14 days	no
Isopropylbenzene	8260B	1	HCl to pH <2	14 days	no
4-Isopropyltoluene	8260B	5	HCl to pH <2	14 days	no

Notes:
ug/L = micrograms per liter
[1] All samples will be cooled to 4°C as part of sample preservation

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Analytical Methods, Detection Limits, and Holding Times
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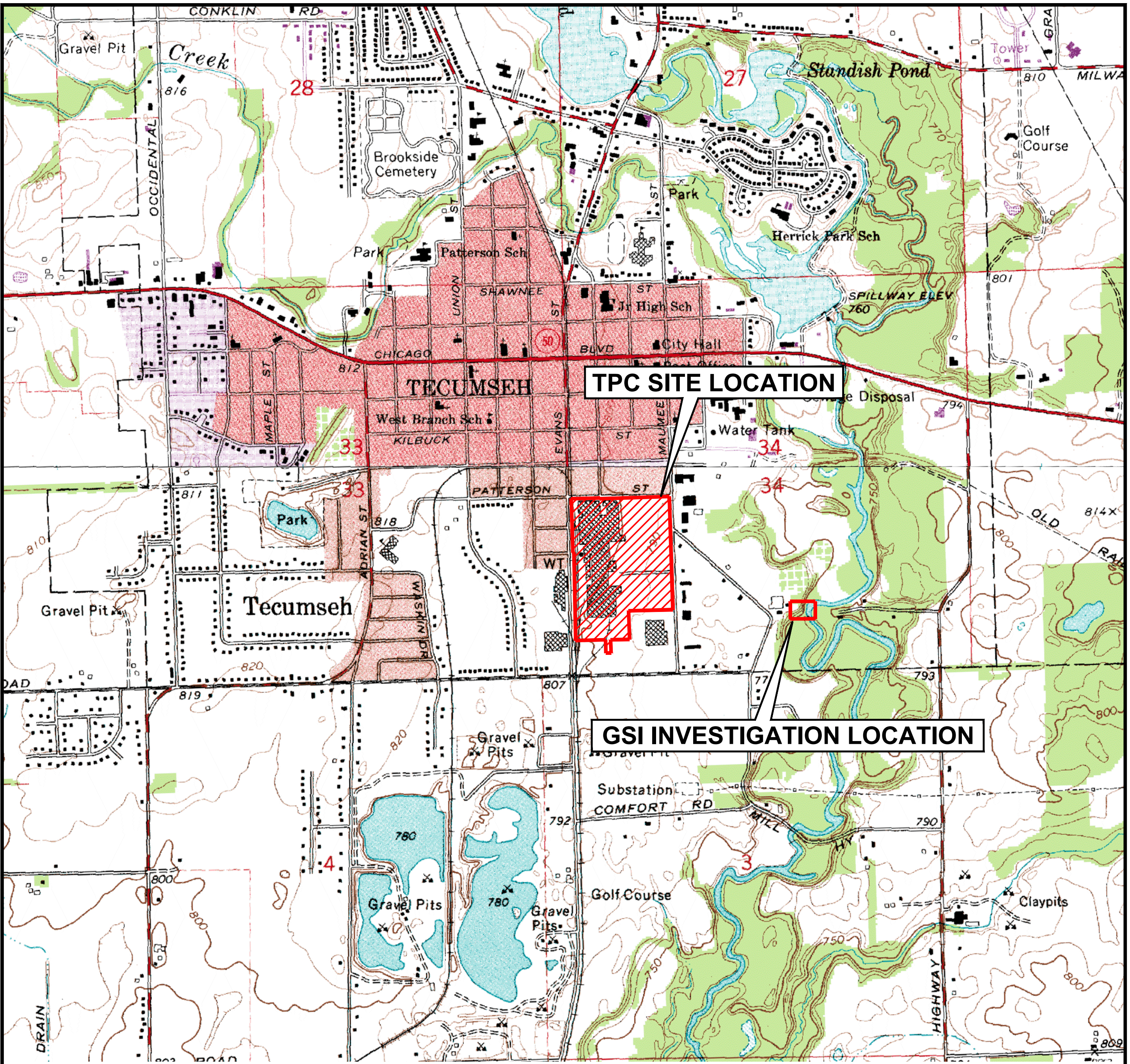
4-Methyl-2-pentanone (MIBK)	8260B	5	HCl to pH <2	14 days	no
Methyl tert-Butyl Ether	8260B	5	HCl to pH <2	14 days	no
Methylene Chloride	8260B	5	HCl to pH <2	14 days	no
2-Methylnaphthalene	8260B	5	HCl to pH <2	14 days	no
Naphthalene	8260B	5	HCl to pH <2	14 days	no
n-Propylbenzene	8260B	1	HCl to pH <2	14 days	no
Styrene	8260B	1	HCl to pH <2	14 days	no
1,1,1,2-Tetrachloroethane	8260B	1	HCl to pH <2	14 days	no
1,1,2,2-Tetrachloroethane	8260B	1	HCl to pH <2	14 days	no
Tetrachloroethene	8260B	1	HCl to pH <2	14 days	no
Tetrahydrofuran	8260B	5	HCl to pH <2	14 days	no
Toluene	8260B	1	HCl to pH <2	14 days	no
1,2,3-Trichlorobenzene	8260B	5	HCl to pH <2	14 days	no
1,2,4-Trichlorobenzene	8260B	5	HCl to pH <2	14 days	no
1,1,1-Trichloroethane	8260B	1	HCl to pH <2	14 days	no
1,1,2-Trichloroethane	8260B	1	HCl to pH <2	14 days	no
Trichloroethene	8260B	1	HCl to pH <2	14 days	no
Trichlorofluoromethane	8260B	1	HCl to pH <2	14 days	no
1,2,3-Trichloropropane	8260B	1	HCl to pH <2	14 days	no
1,2,4-Trimethylbenzene	8260B	1	HCl to pH <2	14 days	no
1,3,5-Trimethylbenzene	8260B	1	HCl to pH <2	14 days	no
Vinyl Chloride	8260B	1	HCl to pH <2	14 days	no
Xylene, Meta + Para	8260B	2	HCl to pH <2	14 days	no
Xylene, Ortho	8260B	1	HCl to pH <2	14 days	no

Notes:
ug/L = micrograms per liter
(1) All samples will be cooled to 4°C as part of sample preservation

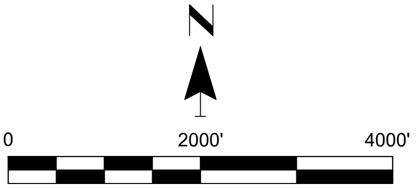
Figures



MAP SOURCE:

BASE MAP DEVELOPED FROM THE
TECUMSEH NORTH AND SOUTH 7.5 MINUTE
U.S.G.S. TOPOGRAPHIC QUADRANGLE
MAPS, DATED 1967, PHOTOREVISED 1975.

QUADRANGLE LOCATION



APPROXIMATE SCALE IN FEET

1540 Eisenhower Place
Ann Arbor, MI 48108
Phone: 734.971.7080
www.trcsolutions.com

PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

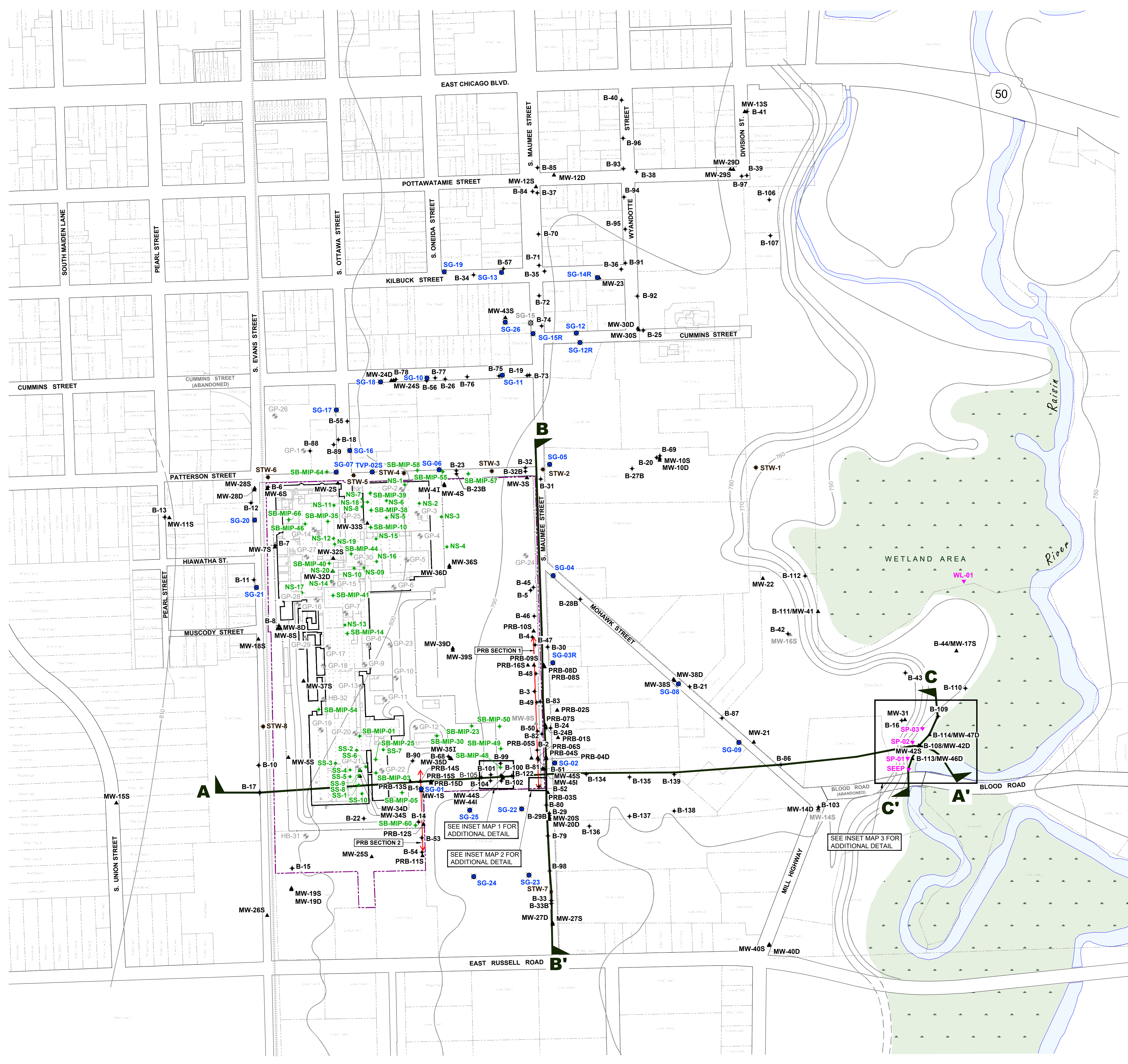
TITLE:

SITE LOCATION MAP

DRAWN BY:	D.STEHLE
CHECKED BY:	S.METZ
APPROVED BY:	G.CROCKFORD
DATE:	AUGUST 2017
PROJ. NO.:	254864.0000.01
FILE:	254864.0000.01.01.dwg

FIGURE 1

8.5x11 --- ATTACHED XREFS: --- ATTACHED IMAGES: Tecumseh North Michigan; Tecumseh South Michigan;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.01.dwg --- PLOT DATE: August 30, 2017 - 7:37AM --- LAYOUT: FIG01 Site Location



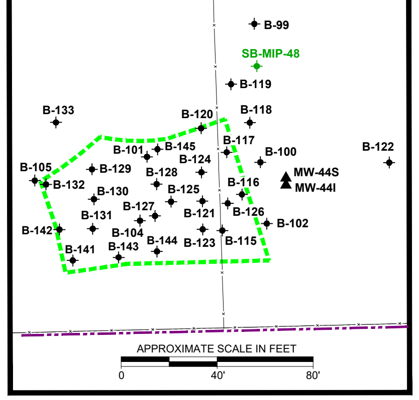
LEGEND

	FORMER TECUMSEH PRODUCTS SITE BOUNDARY
	PARCEL BOUNDARY
	RAILROAD TRACKS (APPROXIMATE LOCATION)
750	APPROXIMATE GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP
B-2 ✦	PERIMETER / OFF-SITE INVESTIGATION SOIL BORING LOCATION AND NUMBER
MW-4S ▲	MONITORING WELL LOCATION AND NUMBER
MW-9S ▲	DECOMMISSIONED MONITORING WELL LOCATION AND NUMBER
SS-2 ✦	SOURCE AREA INVESTIGATION BORING LOCATION AND NUMBER
SG-02 ⊗	SOIL GAS SAMPLE LOCATION AND NUMBER
SG-15 ⊗	DECOMMISSIONED SOIL GAS SAMPLE LOCATION AND NUMBER
STW-2 ✦	STORM WATER SEWER SAMPLE LOCATION AND NUMBER
WL-01 ▼	APPROXIMATE SURFACE WATER SAMPLE LOCATION AND NUMBER
PW-03 ▽	PORE WATER SAMPLE LOCATION AND NUMBER
GP-2 ⊕	ATC PHASE II ESA BORING LOCATION AND NUMBER
🟩	FLOODPLAIN / WOODED WETLAND AREA
↔	PRB LOCATION
—x—x—	FENCE LINE
	LATERAL EXTENT OF PCE SOIL SOURCE REMOVED (SEE INSET MAP 1)
	CROSS-SECTION LOCATION LINE

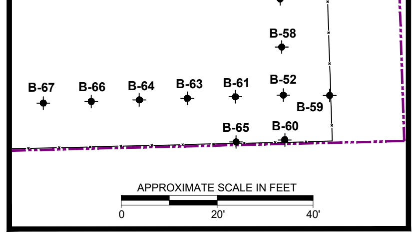
NOTES

1. BASE MAP DEVELOPED FROM SITE PLAN PROVIDED BY THE CITY OF TECUMSEH, DRAWING NO. CITY.DWG, MARCH 2009.
2. GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S TOPOGRAPHIC QUADRANGLE MAP AND GROUND SURVEY DATA.
3. SURFACE WATER FEATURES TAKEN FROM GEOREFERENCED HIGH RESOLUTION GOOGLE EARTH IMAGERY, DATED APRIL 2013. FEATURES SHOWN ARE APPROXIMATE.
4. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.
5. ON-SITE SAMPLE DENSITY IS TOO GREAT TO ILLUSTRATE ALL ON-SITE SAMPLE LOCATIONS. SEE FIGURE 12 OF THE REVISED CORRECTIVE MEASURES PROPOSAL FOR AN ON-SITE SAMPLE LOCATION MAP.

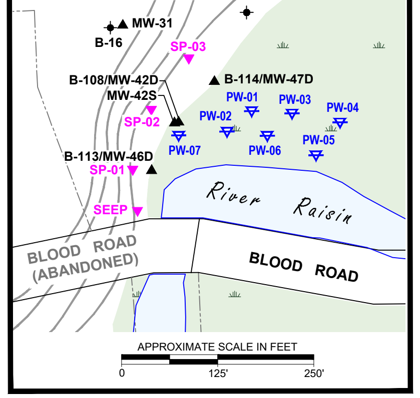
INSET MAP 1

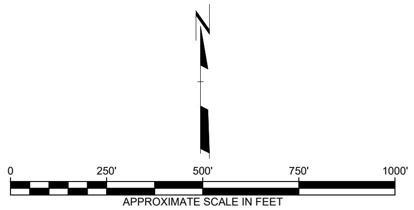


INSET MAP 2



INSET MAP 3





NO.	BY	DATE	REVISION	APP'D.
2	DGS	02/13/17	ADD 2016 MONITORING WELLS, PCE EXCAVATION AREA, NOTE 5	SEM
1	DGS	5/18/16	ADD B-134 THROUGH B-139, ADJUST RIVER LOCATION	SEM

PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:

OFF-SITE SAMPLE LOCATIONS AND CROSS-SECTION LOCATION MAP

DRAWN BY: D.STEHLE
CHECKED BY: S.METZ
APPROVED BY: G.CROCKFORD
DATE: AUGUST 2017
PROJ. NO.: 254684.0000.01

FIGURE 2

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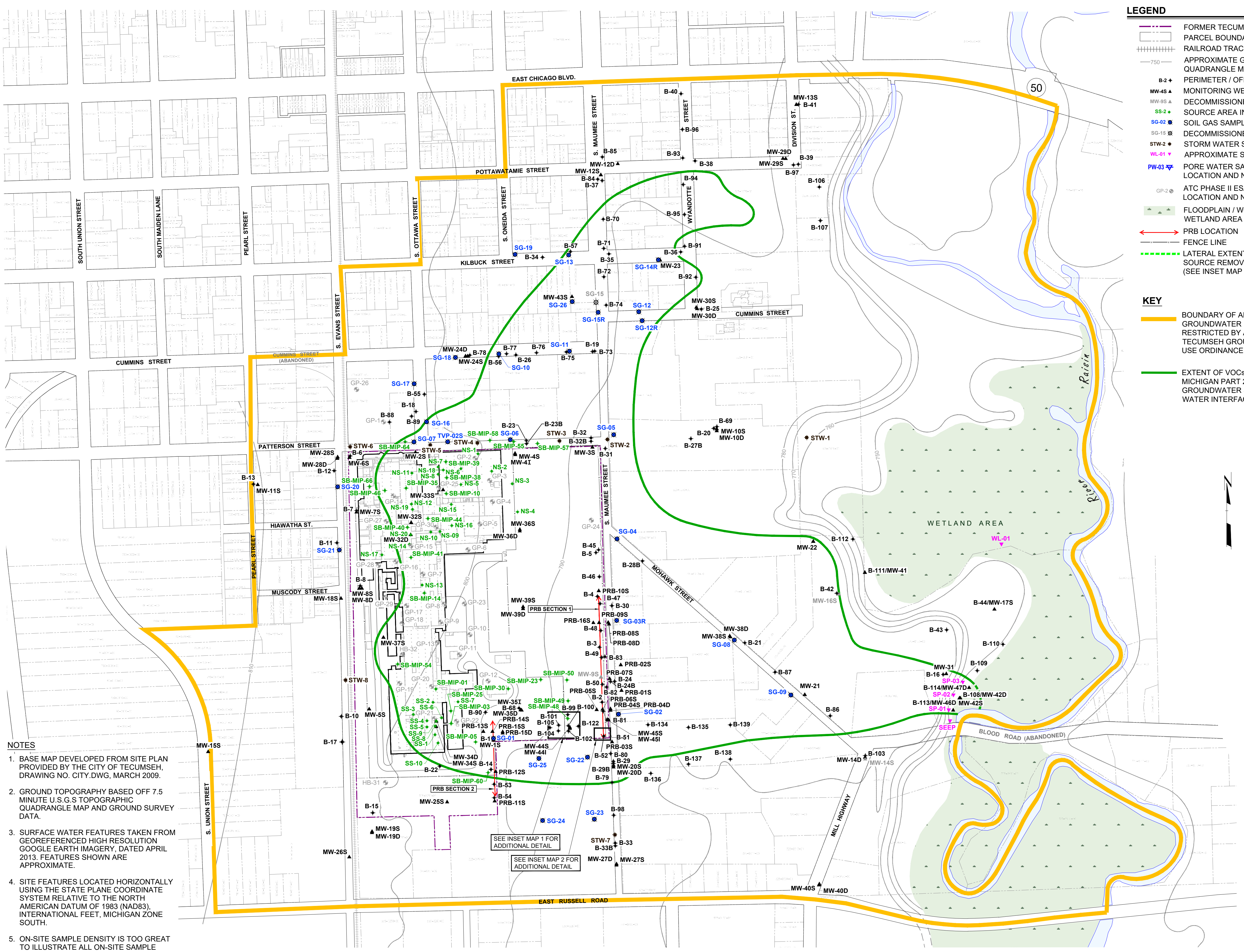
FILE NO.: 254684.0000.01.02.01.DWG

22x34 --- ATTACHED XREF'S: bm100110 (Filled) --- ATTACHED IMAGES: TCE_Page_1; VOCs;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.02.dwg --- PLOT DATE: August 30, 2017 - 7:41AM --- LAYOUT: FIG02 Samples & XS Map



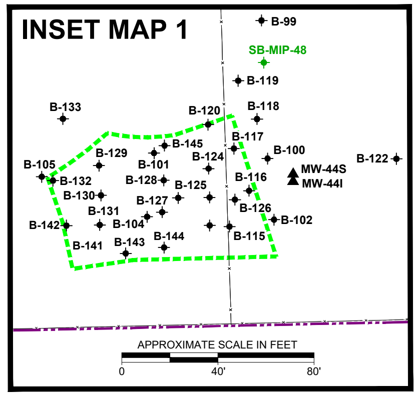
LEGEND

	FORMER TECUMSEH PRODUCTS SITE BOUNDARY
	PARCEL BOUNDARY
	RAILROAD TRACKS (APPROXIMATE LOCATION)
750	APPROXIMATE GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP
B-2 ✦	PERIMETER / OFF-SITE INVESTIGATION SOIL BORING LOCATION AND NUMBER
MW-4S ▲	MONITORING WELL LOCATION AND NUMBER
MW-9S ▲	DECOMMISSIONED MONITORING WELL LOCATION AND NUMBER
SS-2 ✦	SOURCE AREA INVESTIGATION BORING LOCATION AND NUMBER
SG-02 ●	SOIL GAS SAMPLE LOCATION AND NUMBER
SG-15 ⊗	DECOMMISSIONED SOIL GAS SAMPLE LOCATION AND NUMBER
STW-2 ◆	STORM WATER SEWER SAMPLE LOCATION AND NUMBER
WL-01 ▼	APPROXIMATE SURFACE WATER SAMPLE LOCATION AND NUMBER
PW-03 ▽	PORE WATER SAMPLE LOCATION AND NUMBER
GP-2 ⊘	ATC PHASE II ESA BORING LOCATION AND NUMBER
	FLOODPLAIN / WOODED WETLAND AREA
↔	PRB LOCATION
	FENCE LINE
	LATERAL EXTENT OF PCE SOIL SOURCE REMOVED (SEE INSET MAP 1)

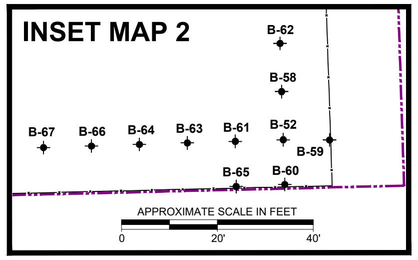
KEY

🟧	BOUNDARY OF AREA WITH GROUNDWATER USE RESTRICTED BY A CITY OF TECUMSEH GROUNDWATER USE ORDINANCE
🟩	EXTENT OF VOCs ABOVE MICHIGAN PART 201 GROUNDWATER SURFACE WATER INTERFACE CRITERIA

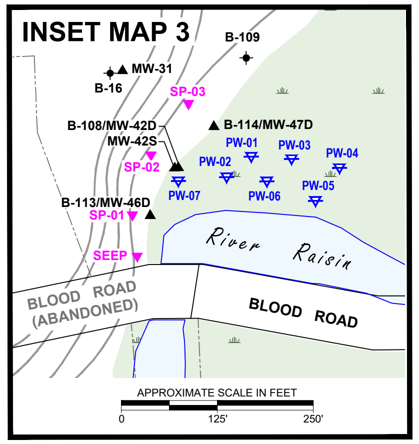
INSET MAP 1



INSET MAP 2



INSET MAP 3



0 250' 500' 750' 1000'
APPROXIMATE SCALE IN FEET

NOTES

1. BASE MAP DEVELOPED FROM SITE PLAN PROVIDED BY THE CITY OF TECUMSEH, DRAWING NO. CITY.DWG, MARCH 2009.
2. GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S TOPOGRAPHIC QUADRANGLE MAP AND GROUND SURVEY DATA.
3. SURFACE WATER FEATURES TAKEN FROM GEOREFERENCED HIGH RESOLUTION GOOGLE EARTH IMAGERY, DATED APRIL 2013. FEATURES SHOWN ARE APPROXIMATE.
4. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.
5. ON-SITE SAMPLE DENSITY IS TOO GREAT TO ILLUSTRATE ALL ON-SITE SAMPLE LOCATIONS. SEE FIGURE 12 OF THE REVISED CORRECTIVE MEASURES PROPOSAL FOR AN ON-SITE SAMPLE LOCATION MAP.

NO.	BY	DATE	REVISION	APP'D.
2	DGS	02/21/17	ADJUST TO SHOW SL EXCEEDANCES; 2016 BASE MAP UPDATES	SEM
1	DGS	05/18/16	ADD B-134 THROUGH B-139, ADJUST RIVER LOCATION	SEM

PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:

EXTENT OF VOCs ABOVE MICHIGAN PART 201 GSI CRITERIA

DRAWN BY:	D.STEHLE	PROJ. NO.:	254864.0000.01
CHECKED BY:	S.METZ	FIGURE 3	
APPROVED BY:	G.CROCKFORD		
DATE:	AUGUST 2017		

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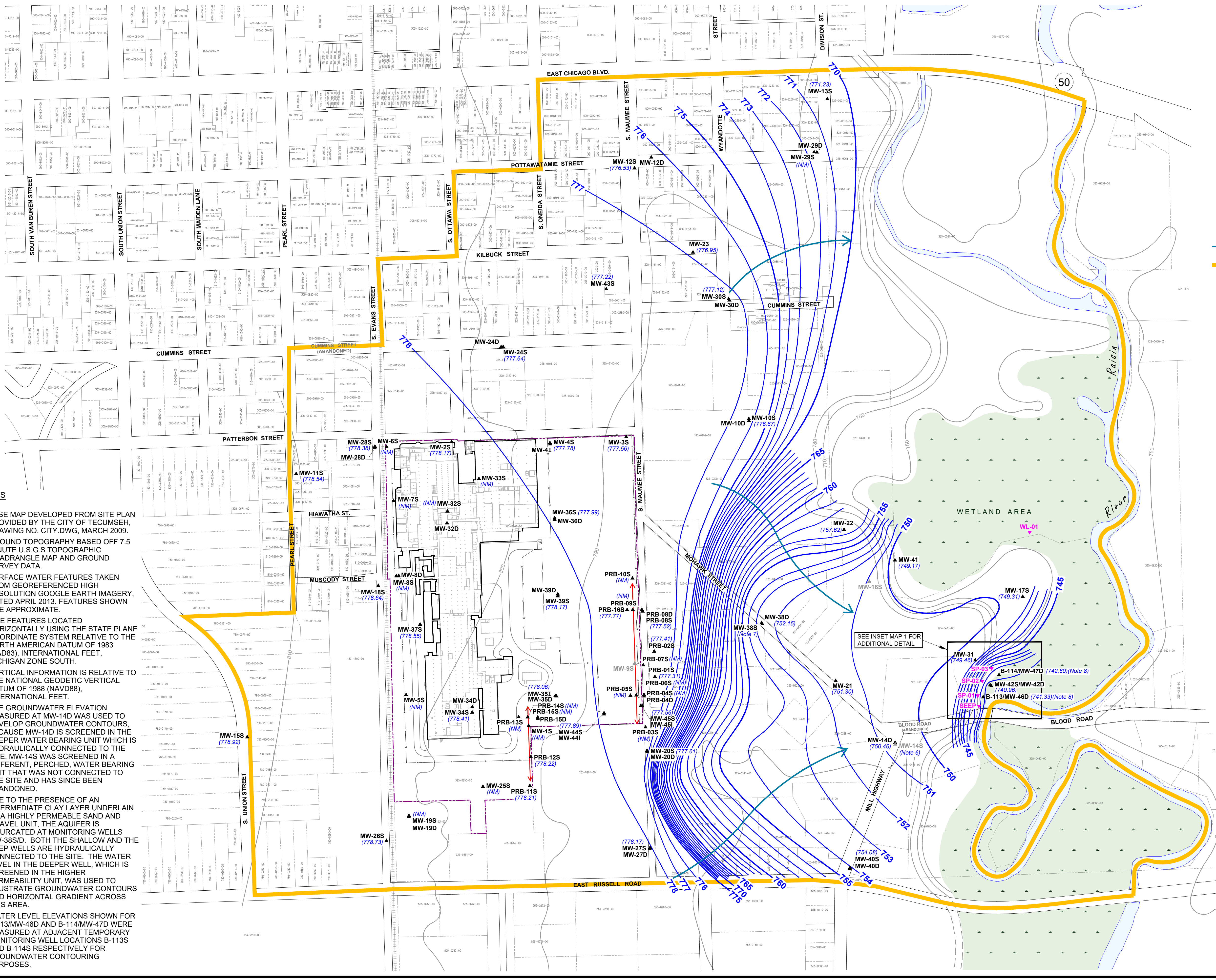
FILE NO.: 254864.0000.01.03.DWG

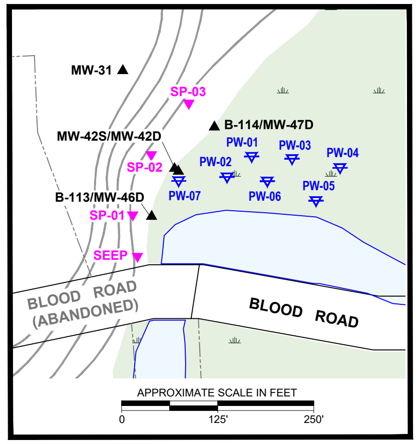
22x34 --- ATTACHED XREF'S: bm100110 (Filled) --- ATTACHED IMAGES: TCE_Page_1; VOCs;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.03.dwg --- PLOT DATE: August 30, 2017 - 7:49AM --- LAYOUT: FIG03 VOCs Above MI Part 201 GSI



LEGEND

	FORMER TECUMSEH PRODUCTS SITE BOUNDARY
	PARCEL BOUNDARY
	RAILROAD TRACKS (APPROXIMATE LOCATION)
750	APPROXIMATE GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP
MW-4S ▲	MONITORING WELL LOCATION AND NUMBER
MW-9S ▲	DECOMMISSIONED MONITORING WELL LOCATION AND NUMBER
WL-01 ▼	SURFACE WATER SAMPLE LOCATION AND NUMBER
PW-01 ▽	POREWATER SAMPLE LOCATION AND NUMBER
🟩	FLOODPLAIN / WOODED WETLAND AREA
↔	PRB LOCATION
	FENCE LINE
770	5 FOOT GROUNDWATER CONTOUR LINE
771	1 FOOT GROUNDWATER CONTOUR LINE
(780.26)	GROUNDWATER ELEVATION
(NM)	WATER LEVEL NOT MEASURED
→	GROUNDWATER FLOW DIRECTION
🟨	BOUNDARY OF AREA WITH GROUNDWATER USE RESTRICTED BY A CITY OF TECUMSEH GROUNDWATER USE ORDINANCE

INSET MAP 1



0 250' 500' 750' 1000'
APPROXIMATE SCALE IN FEET

NOTES

1. BASE MAP DEVELOPED FROM SITE PLAN PROVIDED BY THE CITY OF TECUMSEH, DRAWING NO. CITY.DWG, MARCH 2009.
2. GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S TOPOGRAPHIC QUADRANGLE MAP AND GROUND SURVEY DATA.
3. SURFACE WATER FEATURES TAKEN FROM GEOREFERENCED HIGH RESOLUTION GOOGLE EARTH IMAGERY, DATED APRIL 2013. FEATURES SHOWN ARE APPROXIMATE.
4. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.
5. VERTICAL INFORMATION IS RELATIVE TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1988 (NAVD88), INTERNATIONAL FEET.
6. THE GROUNDWATER ELEVATION MEASURED AT MW-14D WAS USED TO DEVELOP GROUNDWATER CONTOURS, BECAUSE MW-14D IS SCREENED IN THE DEEPER WATER BEARING UNIT WHICH IS HYDRAULICALLY CONNECTED TO THE SITE. MW-14S WAS SCREENED IN A DIFFERENT, PERCHED, WATER BEARING UNIT THAT WAS NOT CONNECTED TO THE SITE AND HAS SINCE BEEN ABANDONED.
7. DUE TO THE PRESENCE OF AN INTERMEDIATE CLAY LAYER UNDERLAIN BY A HIGHLY PERMEABLE SAND AND GRAVEL UNIT, THE AQUIFER IS BIFURCATED AT MONITORING WELLS MW-38S/D. BOTH THE SHALLOW AND THE DEEP WELLS ARE HYDRAULICALLY CONNECTED TO THE SITE. THE WATER LEVEL IN THE DEEPER WELL, WHICH IS SCREENED IN THE HIGHER PERMEABILITY UNIT, WAS USED TO ILLUSTRATE GROUNDWATER CONTOURS AND HORIZONTAL GRADIENT ACROSS THIS AREA.
8. WATER LEVEL ELEVATIONS SHOWN FOR B-113/MW-46D AND B-114/MW-47D WERE MEASURED AT ADJACENT TEMPORARY MONITORING WELL LOCATIONS B-113S AND B-114S RESPECTIVELY FOR GROUNDWATER CONTOURING PURPOSES.

PROJECT:
FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:
GROUNDWATER CONTOUR MAP
NOVEMBER 2017

DRAWN BY:	D.STEHLE	PROJ. NO.:	004304.0001.02
CHECKED BY:	M.POWERS-TAYLOR	**FIGURE 4**	
APPROVED BY:	S.METZ		
DATE:	FEBRUARY 2018		

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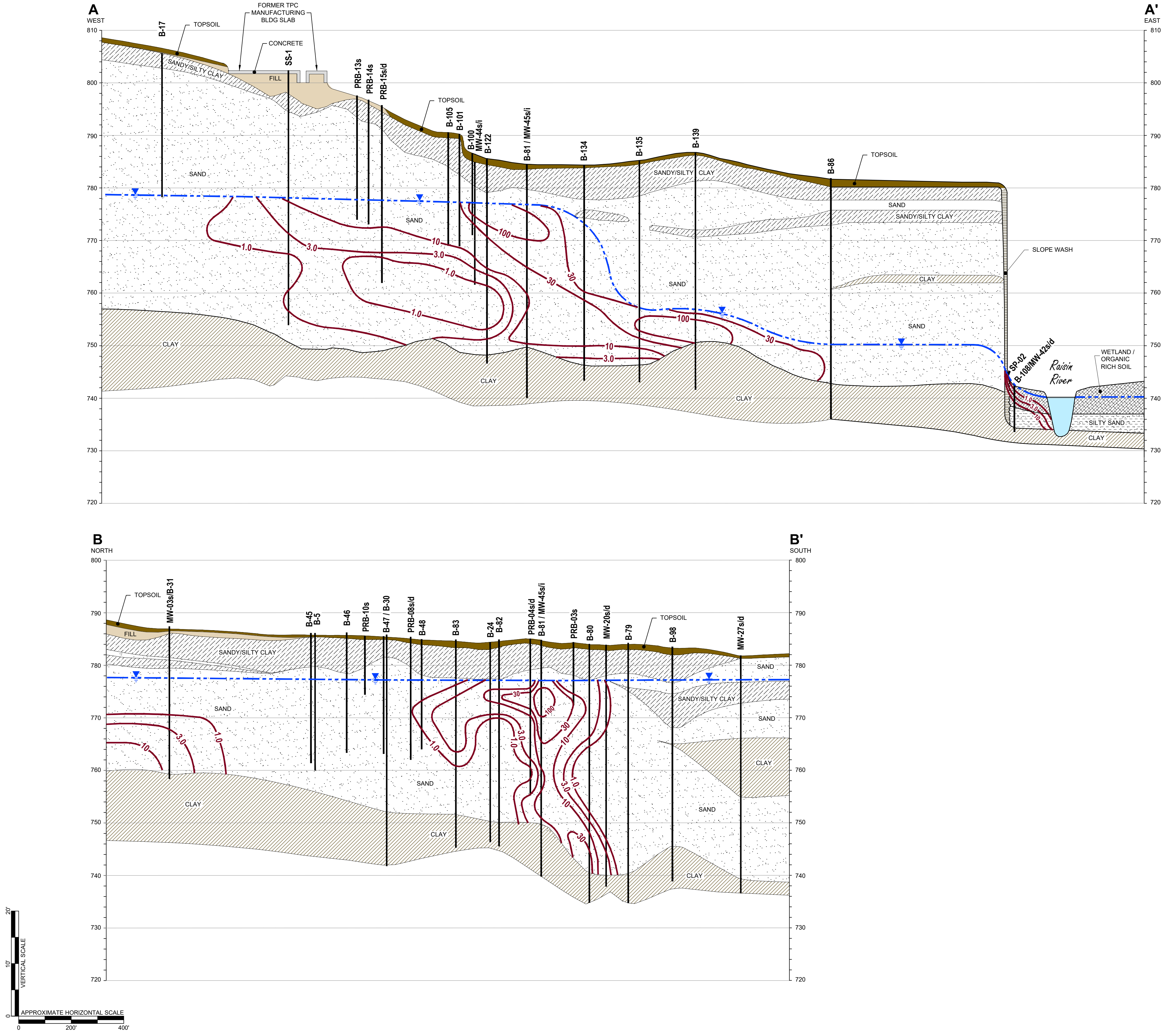
FILE NO.: 254864.0000.01.04.dwg

22x34 --- ATTACHED XREF'S: bm100110 (Filled) --- ATTACHED IMAGES:
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.04.dwg --- PLOT DATE: February 22, 2018 - 11:35AM --- LAYOUT: FIG04 GW Cont Map 4Q2017



22x34 --- ATTACHED XREF'S: --- ATTACHED IMAGES: TPC XSs_Page_1; TPC XSs_Page_2; TPC XSs_Page_3;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.05.dwg --- PLOT DATE: August 30, 2017 - 7:53AM --- LAYOUT: FIG05 XS AA-BB

LEGEND

▆	TOPSOIL	▒	SILTY SAND
▆	FILL	▤	SLOPE WASH
▒	SAND	☐	CONCRETE
▨	CLAY		
▨	SANDY / SILTY CLAY		
▩	ORGANIC RICH WETLAND SOIL / MUCK		

▼ APPROXIMATE GROUNDWATER ELEVATION

—100— TOTAL CHLORINATED ETHENES ISOCONCENTRATION LINE (SEE NOTES 2, 3 AND 4)

NOTES

1. GROUNDWATER ELEVATIONS REFLECT ELEVATION DATA COLLECTED DURING THE MAY 2015 SAMPLING EVENT.
2. SEE ASSOCIATED TABLES FOR FURTHER SAMPLE INFORMATION (SAMPLE COLLECTION DATE, SAMPLE DEPTH, ETC.). AT SAMPLE LOCATIONS WITH MULTIPLE SAMPLING EVENTS, THE MOST RECENT SAMPLE DATA AS OF SEPTEMBER 2015 WAS USED.
3. ISOCONCENTRATION LINES WERE DEVELOPED USING ENVIRONMENTAL VISUALIZATION SYSTEM (EVS) SOFTWARE OUTPUTS AND KNOWLEDGE OF SITE GEOLOGY/HYDROGEOLOGY.
4. ISOCONCENTRATION LINES REPRESENT THE TOTAL CONCENTRATION (IN MICROMOLES PER LITER [uM]) OF CHLORINATED ETHENES (TETRACHLOROETHENE [PCE], TRICHLOROETHENE [TCE], cis-1,2-DICHLOROETHENE [cis-DCE], AND VINYL CHLORIDE [VC]) IN GROUNDWATER. MOLAR CONCENTRATIONS ARE USEFUL IN ILLUSTRATING TOTAL CONTAMINANT MASS. THE TABLE BELOW PROVIDES A COMPARISON BETWEEN MOLARITY AND MASS BASED CONCENTRATION UNITS.

MOLAR CONCENTRATION	PCE (ug/L)	TCE (ug/L)	cis-DCE (ug/L)	VC (ug/L)
1.0 uM	166	131	97.0	62.5
3.0 uM	497	394	291	188
10 uM	1,660	1,310	970	625
30 uM	4,970	3,940	2,910	1,880
100 uM	16,600	13,100	9,700	6,250

5. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.
6. VERTICAL INFORMATION IS RELATIVE TO THE NATIONAL GEODETIC VERTICAL DATUM OF 1988 (NAVD88), INTERNATIONAL FEET.

NO.	BY	DATE	REVISION	APP'D.
2	DGS	02/13/17	ADD MW-44s/i AND MW-45s/i	SEM
1	DGS	05/18/16	ADD B-134 THROUGH B-135, ADJUST RIVER LOCATION	SEM

PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:

CROSS-SECTIONS A-A' AND B-B'

DRAWN BY:	D.STEHLE	PROJ. NO.:	254864.0000.01
CHECKED BY:	S.METZ		
APPROVED BY:	G.CROCKFORD	FIGURE 5	
DATE:	AUGUST 2017		

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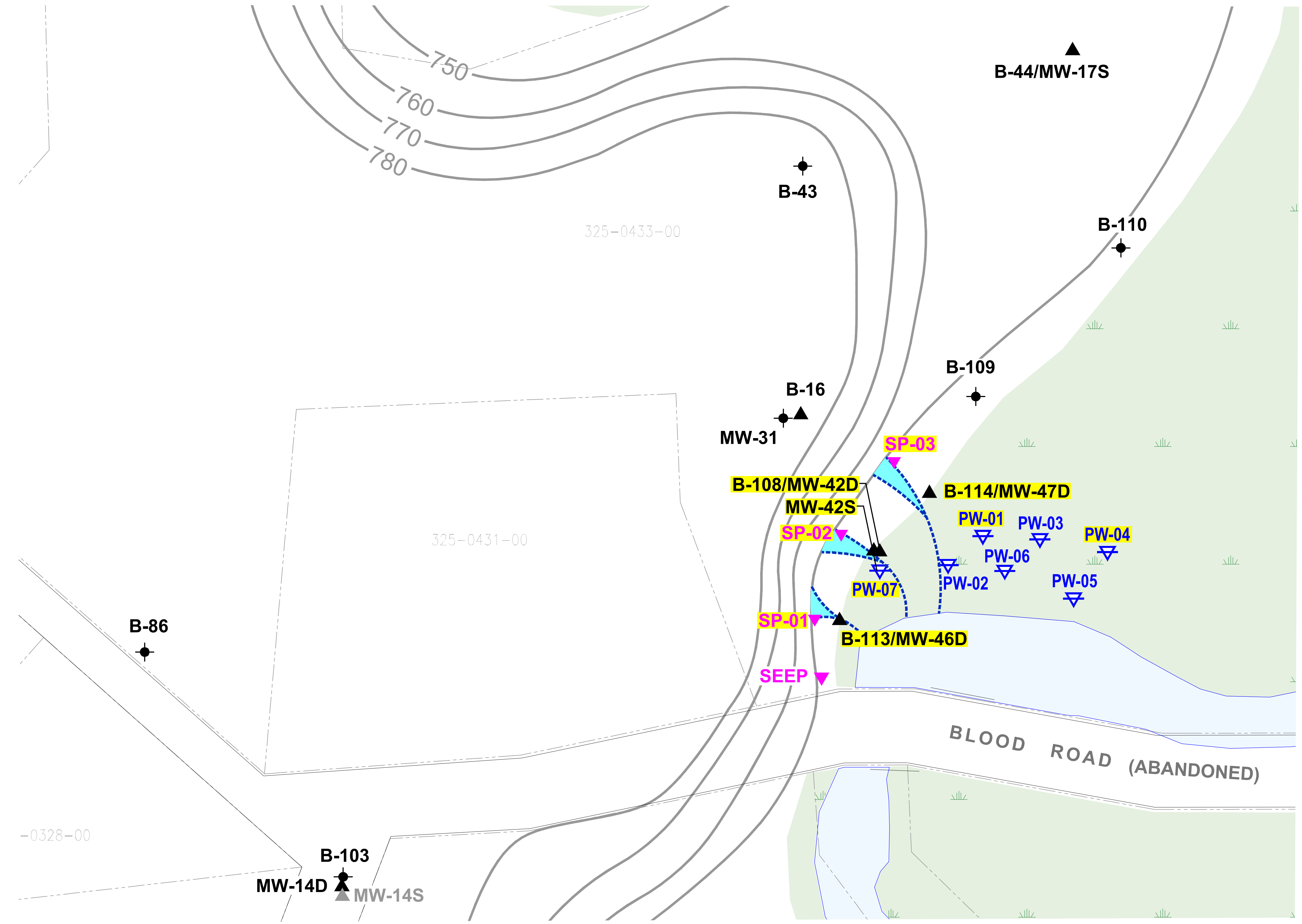
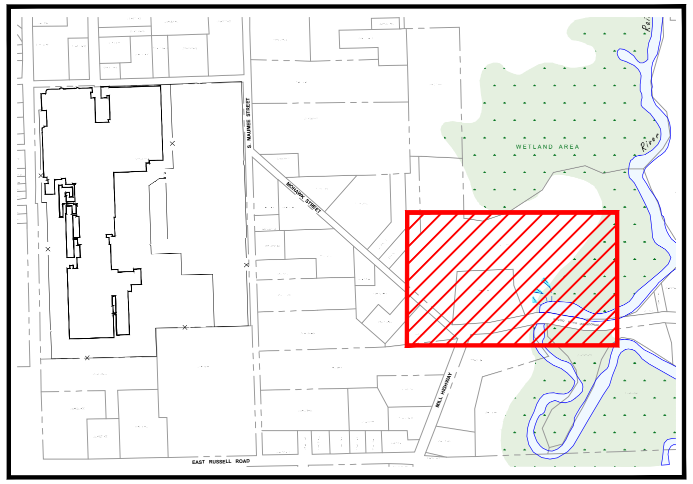
FILE NO.: 254864.0000.01.05.dwg



MAP AREA



LEGEND

⬚	PARCEL BOUNDARY
—750—	APPROXIMATE GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP
B-2 ⌖	PERIMETER / OFF-SITE INVESTIGATION SOIL BORING LOCATION AND NUMBER
MW-4S ▲	MONITORING WELL LOCATION AND NUMBER
MW-9S ▲	DECOMMISSIONED MONITORING WELL LOCATION AND NUMBER
WL-01 ▼	APPROXIMATE SURFACE WATER SAMPLE LOCATION
PW-03 ▽	PORE WATER SAMPLE LOCATION AND NUMBER
SP-01	YELLOW HIGHLIGHTED SAMPLE LOCATION INCLUDED IN PROPOSED GSI MONITORING PROGRAM
🟩	FLOODPLAIN / WOODED WETLAND AREA
▨	SEEPAGE FLOW PATHS

0 100' 200'

APPROXIMATE SCALE IN FEET

NOTES

1. BASE MAP DEVELOPED FROM SITE PLAN PROVIDED BY THE CITY OF TECUMSEH, DRAWING NO. CITY.DWG, MARCH 2009.
2. GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S TOPOGRAPHIC QUADRANGLE MAP AND GROUND SURVEY DATA.
3. SURFACE WATER FEATURES TAKEN FROM GEOREFERENCED HIGH RESOLUTION GOOGLE EARTH IMAGERY, DATED APRIL 2013. FEATURES SHOWN ARE APPROXIMATE.
4. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.

PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:

GSI INVESTIGATION AREA
AND SAMPLE LOCATIONS

DRAWN BY:	D.STEHLE	PROJ NO.:	254864.0000.01
CHECKED BY:	S.METZ	**FIGURE 6**	
APPROVED BY:	G.CROCKFORD		
DATE:	AUGUST 2017		

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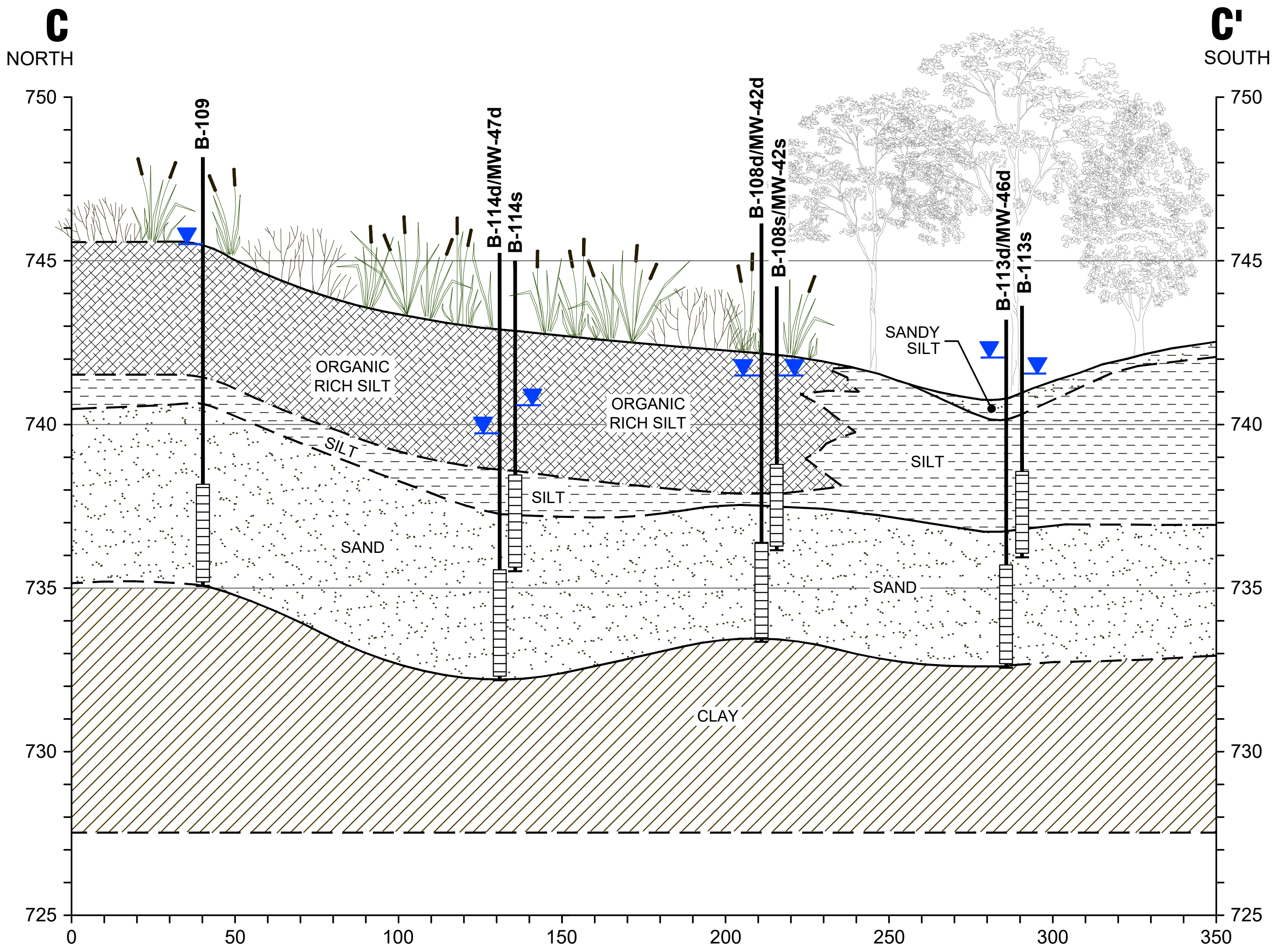
FILE NO.: 254864.0000.01.06.dwg

11x17 --- ATTACHED XREF'S: bm100110 (Filled) --- ATTACHED IMAGES: TCE_Page_1; VOCs;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.06.dwg --- PLOT DATE: August 30, 2017 - 7:56AM --- LAYOUT: FIG06 GSI Inv Area & Samples

Version: 2017-07-21



LEGEND

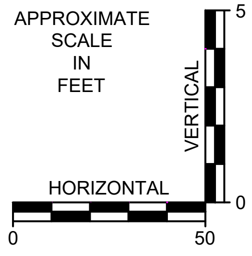
STRATIGRAPHIC BOUNDARY BASED ON NEAREST SOIL BORING OR MONITORING WELL (DASHED WHERE INFERRED)

▼ GROUNDWATER ELEVATION (NOVEMBER 30 - DECEMBER 1, 2015)

WELL SCREEN INTERVAL

Lithology Key

▨	SAND	▨	SILTY SAND
▨	CLAY	▨	ORGANIC RICH SILT



PROJECT:

FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:

CROSS-SECTION C-C'

DRAWN BY:	D.STEHLE	PROJ NO.:	254864.0000.01
CHECKED BY:	S.METZ	**FIGURE 7**	
APPROVED BY:	G.CROCKFORD		
DATE:	AUGUST 2017		

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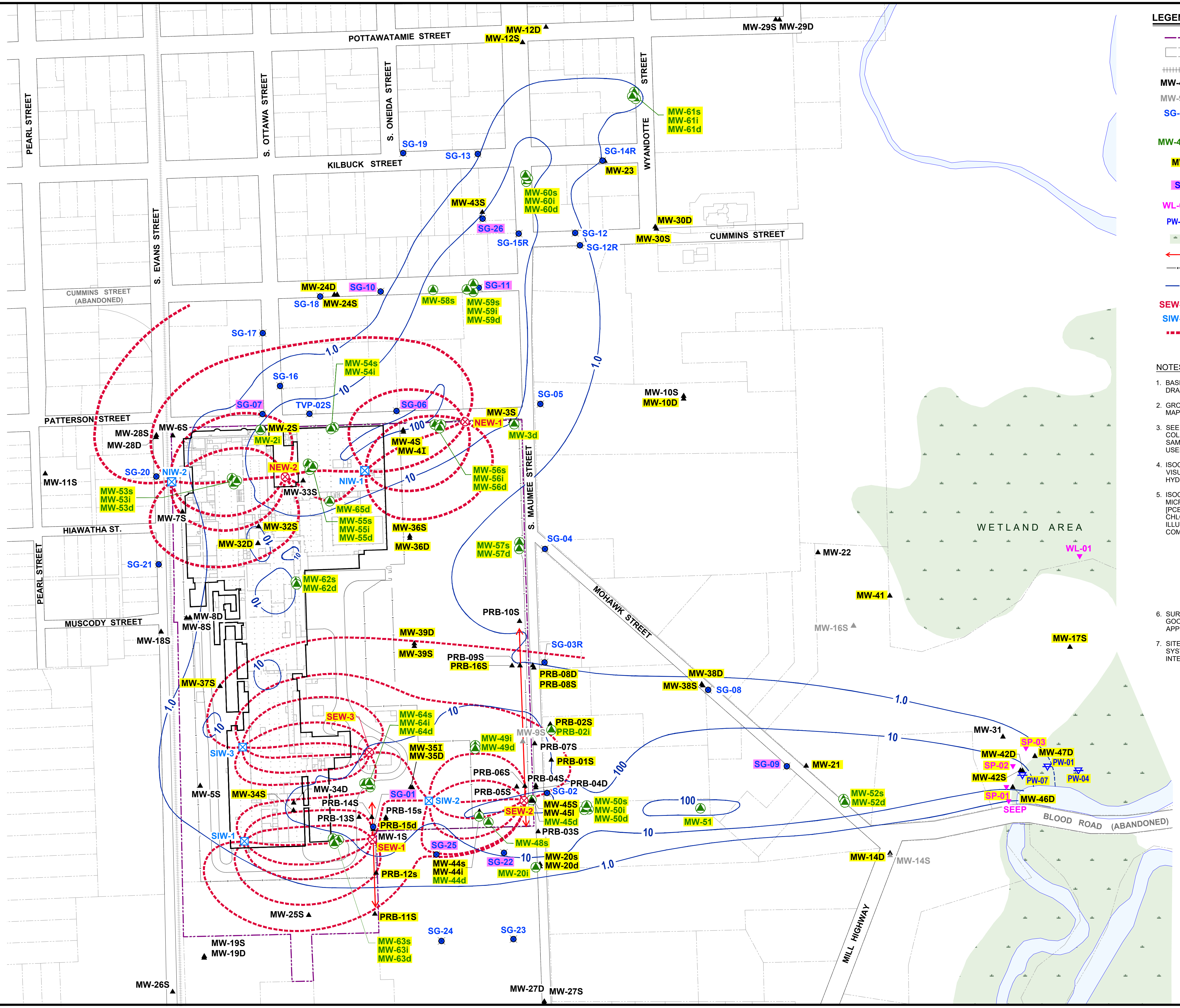
FILE NO.: 254864.0000.01.07.dwg

11x17 --- ATTACHED XREF'S: --- ATTACHED IMAGES: mp xxxxxxxxxx-03162016112249;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.07.dwg --- PLOT DATE: August 30, 2017 - 7:57AM --- LAYOUT: FIG07 XS CC

Version: 2017-07-21



LEGEND

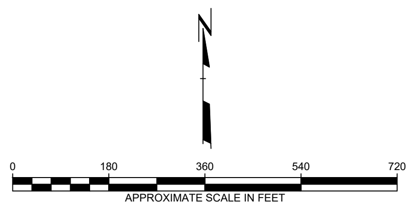
	FORMER TECUMSEH PRODUCTS SITE BOUNDARY
	PARCEL BOUNDARY
	RAILROAD TRACKS (APPROXIMATE LOCATION)
MW-4S ▲	MONITORING WELL LOCATION AND NUMBER
MW-9S ▲	DECOMMISSIONED MONITORING WELL LOCATION AND NUMBER
SG-02 ●	SOIL GAS SAMPLE LOCATION AND NUMBER
	DECOMMISSIONED SOIL GAS SAMPLE LOCATION AND NUMBER
MW-48i ▲	PROPOSED WELL LOCATION AND NUMBER
MW-30S	YELLOW HIGHLIGHTED SAMPLE LOCATION INCLUDED IN PROPOSED GROUNDWATER SAMPLING PROGRAM
SG-26	PINK HIGHLIGHTED SAMPLE LOCATION INCLUDED IN PROPOSED SOIL GAS SAMPLING PROGRAM
WL-01 ▼	APPROXIMATE SURFACE WATER SAMPLE LOCATION
PW-04 ▽	PORE WATER SAMPLE LOCATION AND NUMBER
🟩	FLOODPLAIN / WOODED WETLAND AREA
↔	PRB LOCATION
—x—x—	FENCE LINE
—10—	TOTAL CHLORINATED ETHENE ISOCONCENTRATION LINE (SEE NOTES 3, 4 AND 5)
SEW-2 ⊗	PROPOSED EXTRACTION WELL LOCATION AND NUMBER
SIW-2 ☒	PROPOSED INJECTION WELL LOCATION AND NUMBER
■■■■■■	APPROXIMATE FLOW LINE FOR ENHANCED IN-SITU BIOREMEDIATION FLOW CELLS

NOTES

1. BASE MAP DEVELOPED FROM SITE PLAN PROVIDED BY THE CITY OF TECUMSEH, DRAWING NO. CITY.DWG, MARCH 2009.
2. GROUND TOPOGRAPHY BASED OFF 7.5 MINUTE U.S.G.S TOPOGRAPHIC QUADRANGLE MAP AND GROUND SURVEY DATA.
3. SEE ASSOCIATED TABLES FOR FURTHER SAMPLE INFORMATION (SAMPLE COLLECTION DATE, SAMPLE DEPTH, ETC.). AT SAMPLE LOCATIONS WITH MULTIPLE SAMPLING EVENTS, THE MOST RECENT SAMPLE DATA AS OF SEPTEMBER 2015 WAS USED.
4. ISOCONCENTRATION LINES WERE DEVELOPED USING ENVIRONMENTAL VISUALIZATION SYSTEM (EVS) SOFTWARE AND KNOWLEDGE OF SITE GEOLOGY/ HYDROGEOLOGY.
5. ISOCONCENTRATION LINES REPRESENT THE TOTAL CONCENTRATION (IN MICROMOLES PER LITER [uM]) OF CHLORINATED ETHENES (TETRACHLOROETHENE [PCE], TRICHLOROETHENE [TCE], cis-1,2-DICHLOROETHENE [cis-DCE], AND VINYL CHLORIDE [VC]) IN GROUNDWATER. MOLAR CONCENTRATIONS ARE USEFUL IN ILLUSTRATING TOTAL CONTAMINANT MASS. THE TABLE BELOW PROVIDES A COMPARISON BETWEEN MOLARITY AND MASS BASED CONCENTRATION UNITS.

MOLAR CONCENTRATION	PCE (ug/L)	TCE (ug/L)	cis-DCE (ug/L)	VC (ug/L)
1.0 uM	166	131	97.0	62.5
10 uM	1,660	1,310	970	625
100 uM	16,600	13,100	9,700	6,250

6. SURFACE WATER FEATURES TAKEN FROM GEOREFERENCED HIGH RESOLUTION GOOGLE EARTH IMAGERY, DATED APRIL 2013. FEATURES SHOWN ARE APPROXIMATE.
7. SITE FEATURES LOCATED HORIZONTALLY USING THE STATE PLANE COORDINATE SYSTEM RELATIVE TO THE NORTH AMERICAN DATUM OF 1983 (NAD83), INTERNATIONAL FEET, MICHIGAN ZONE SOUTH.



NO.	BY	DATE	REVISION	APP'D.
1	DGS	02/19/18	UPDATED PROPOSED GROUNDWATER MONITORING PROGRAM PER USEPA COMMENTS	SEM

PROJECT:
FORMER TECUMSEH PRODUCTS SITE
TECUMSEH, MICHIGAN

TITLE:
PROPOSED RECIRCULATION CELL LAYOUT AND MONITORING PROGRAM

DRAWN BY: D.STEHLE
CHECKED BY: J.LI
APPROVED BY: S.METZ
DATE: FEBRUARY 2018
PROJ. NO.: 254864.0000.01

FIGURE 8

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 254864.0000.01.08.dwg

22x34 --- ATTACHED XREF'S: bm100110 (Filled) --- ATTACHED IMAGES: TCE_Page_1;
DRAWING NAME: J:_TRC\Tecumseh Products\Tecumseh MI\254864\0000\01_Monitoring Plan\ 254864.0000.01.08.dwg --- PLOT DATE: February 22, 2018 - 11:31AM --- LAYOUT: FIG08 Recirc Cell & Monitoring

Appendix A
Mixing Zone-Based Cleanup Levels

Appendix A - Table 1

Mixing Zone-Based GSI Values for Plume Venting to Seeps and into Wetland
Tecumseh Products Company Site
Tecumseh, Michigan

Parameter	Chronic GSI Value	Reported Worst Case Maximum Site Concentration
Units	**ug/L**	**ug/L**
Acetone	1,700	13,000
2-Butanone (Methyl Ethyl Ketone)	2,200	17,000
1,1- Dichloroethane	740	2,100
1,1-Dichloroethene	130	920
cis-1,2-Dichloroethene	620	8,300
Ethylbenzene	18	9,300
Tetrachloroethene	60	76,000
Toluene	270	85,000
1,1,1-Trichloroethane	89	8,500
Trichloroethene	200	12,000
1,2,4-Trimethylbenzene	17	64
Xylene	49	59,000
Vinyl Chloride	13	2,600

Notes:

ug/L = micrograms per liter

Mixing Zone-Based Groundwater/Surface Water Interface (GSI) Criteria for the Seeps and Wetland as provided in Table 1 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017 and September 5, 2017.

Appendix A - Table 2

Mixing Zone-Based GSI Values for Plume Venting to River Raisin
Tecumseh Products Company Site
Tecumseh, Michigan

Parameter	Final Acute Value	Reported Worst Case Maximum Site Concentration
Units	**ug/L**	**ug/L**
2-Butanone (Methyl Ethyl Ketone)	40,000	17,000
1,1- Dichloroethane	13,000	2,100
1,1-Dichloroethene	2,300	920
cis-1,2-Dichloroethene	11,000	830
Ethylbenzene	320	9,300
Tetrachloroethene	2,900	76,000
Toluene	2,600	85,000
1,1,1-Trichloroethane	1,600	8,500
Trichloroethene	3,500	12,000
1,24-Trimethylbenzene	310	64

Notes:

ug/L = micrograms per liter

Mixing Zone-Based Groundwater/Surface Water Interface (GSI) Criteria for the Seeps and Wetland as provided in Table 2 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017 and September 5, 2017.

Appendix A - Table 3
Parameters Not Likely to Exceed Water Quality Standards to River Raisin
Tecumseh Products Company Site
Tecumseh, Michigan

Parameter	Final Acute Value	Reported Worst Case Maximum Site Concentration
Units	**ug/L**	**ug/L**
Acetone	30,000	13,000
Vinyl Chloride	17,000	2,600
Xylene	890	59,000

Notes:

ug/L = micrograms per liter

Parameters Not Likely to Exceed Water Quality Standards to River Raisin as provided in Table 3 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017 and September 5, 2017.

Appendix B
Historical Data

Table B1
Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area
Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone[(1)]	1,1-Dichloro-ethane	1,1-Dichloro-ethene[(1)]	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene[(1)]	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria[(2)]		NC	40,000	13,000	2,300	11,000	1,500[(3)]	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
B-86 (28.5-31.5')	5/14/2015	<4,000	<4,000	<100	<100	**240**	<100	<100	<100	**1,100**	<100
B-86 (31-34')	5/14/2015	<5,000	<5,000	<130	<130	**420**	<130	<130	<130	**2,400**	<130
B-86 (33.5-36.5')	5/14/2015	<8,000	<8,000	<200	<200	**310**	<200	<200	<200	**2,800**	<200
B-86 (36-39')	5/14/2015	<5,000	<5,000	<130	<130	**250**	<130	<130	**140**	**2,600**	<130
B-87 (29-32')	5/15/2015	<800	<800	<20	<20	**150**	<20	<20	**34**	**500**	<20
B-87 (32-35')	5/15/2015	<2,000	<2,000	<50	<50	**280**	<50	<50	**69**	**1,400**	<50
B-87 (35-38')	5/15/2015	<2,000	<2,000	<50	<50	**250**	<50	<50	<50	**1,200**	<50
B-87 (35-38') (DUP-09)	5/15/2015	<400	<400	**15**	<10	**270**	<10	<10	**50**	**1,200**	<10
B-103 (29.5-32.5')	6/5/2015	<40	<40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B-103 (32.5-35.5')	6/5/2015	<40	<40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B-103 (35.5-38.5')	6/5/2015	<40	<40	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B-108 (3-6')	12/1/2015	<400	<100	<20	<20	**1,700**	<20	<20	<20	<20	**36**
B-108 (5.6-8.6')	9/1/2015	<200	<50	**15**	<10	**1,100**	**11**	<10	**25**	**1,200**	**23**
B-108 (5.6-8.6')	12/1/2015	<200	<50	**16**	<10	**1,500**	**14**	<10	**22**	**1,100**	**23**
B-109 (7.4-10.4')	9/1/2015	<20	<5.0	**6.5**	<1.0	**6.9**	<1.0	<1.0	<1.0	**2.7**	<1.0
B-109 (7.4-10.4') (DUP-01)	9/1/2015	<20	<5.0	**6.6**	<1.0	**7.1**	<1.0	<1.0	<1.0	**2.8**	<1.0
B-110 (7.3-10.3')	9/1/2015	**41**	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B-111 (3.3-6.3')	9/1/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
B-112 (4.4-7.4')	9/1/2015	**25**	<5.0	<1.0	<1.0	<1.0	<1.0	**1.1**	<1.0	<1.0	<1.0
B-113 (2-5')	12/1/2015	<400	<100	<20	<20	**1,600**	<20	<20	<20	**86**	<20
B-113 (5-8')	12/1/2015	<200	<50	<10	<10	**1,400**	**12**	<10	**12**	**120**	<10
B-114 (4-7')	12/1/2015	<20	<5.0	**15**	<1.0	**11**	<1.0	<1.0	<1.0	<1.0	**1.3**
B-114 (7.4-10.4')	12/1/2015	<50	<12	**25**	<2.5	**57**	<2.5	<2.5	<2.5	**270**	<2.5

Notes:

ug/L = micrograms per liter

NA = Not analyzed

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

Bold font denotes concentrations detected above laboratory reporting limits

🟩 Denotes concentrations above one or more criteria

1) Compound may exhibit characteristic ignitability as defined in 40 C.F.R. § 261.21

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3) MDEQ did not provide a mixing zone-based GSI criterion for trans-1,2-dichloroethene. Therefore the GSI criterion provided in the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013 applies.

4) The average temperature in this sample shipment exceeded the recommended temperature range. Sample results are approximate.

5) Quality control results for trichloroethene are outside the established control limits, the result is approximate.

6) Headspace present in the sample, results are approximate.

Table B1
Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area
Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloro-ethane	1,1-Dichloro-ethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW-14d (37.5-42.5') Depth to Groundwater Approx. 30 - 31'	3/23/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/14/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	9/3/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/16/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	2/16/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/9/2011(4)	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/21/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/5/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/4/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/2/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/4/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	6/12/2013	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/14/2013	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/22/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/16/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/20/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/23/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/28/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/2/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/26/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/23/2017	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/27/2017	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
DUP-01 (MW-14d)	2/16/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/9/2011(4)	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/21/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/5/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/4/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/2/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/4/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DUP-02 (MW-14d)	6/12/2013	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/22/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/20/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/23/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/26/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MW-14s (4-9') Depth to Perched Groundwater Approx. 3 - 7'	5/14/2009	NA	NA	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/8/2009	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/15/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/12/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	9/3/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/20/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	2/16/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/11/2011(4)	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/21/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/7/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/4/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/5/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloro-ethane	1,1-Dichloro-ethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW-17s (3-8') Depth to Groundwater Approx. 6'	7/23/2009	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/7/2009	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/18/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/12/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/16/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	2/15/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/11/2011(4)	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/21/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/4/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/5/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/2/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/28/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/22/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/11/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/19/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/4/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/22/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

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NA = Not analyzed

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

Bold font denotes concentrations detected above laboratory reporting limits

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1) Compound may exhibit characteristic ignitability as defined in 40 C.F.R. § 261.21

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3) MDEQ did not provide a mixing zone-based GSI criterion for trans-1,2-dichloroethene. Therefore the GSI criterion provided in the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013 applies.

4) The average temperature in this sample shipment exceeded the recommended temperature range. Sample results are approximate.

5) Quality control results for trichloroethene are outside the established control limits, the result is approximate.

6) Headspace present in the sample, results are approximate.

Table B1
Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area
Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone[1]	1,1-Dichloro-ethane	1,1-Dichloro-ethene[1]	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene[1]	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria[2]		NC	40,000	13,000	2,300	11,000	1,500[3]	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW-21 (28.5-33.5') Depth to Groundwater Approx. 29 - 30'	12/8/2009	<200	<50	**31**	<10	**59**	<10	<10	**54**	**840**	<10
	1/13/2010	<200	<50	**28**	<10	**62**	<10	<10	**56**	**730**	<10
	3/23/2010	<20	<5.0	**33**	**2.2**	**81**	**7.5**	<1.0	**62**	**850**	<1.0
	5/18/2010	<200	<50	**35**	<10	**89**	<10	<10	**63**	**830**	<10
	10/15/2010	<200	<50	**26**	<10	**80**	<10	<10	**59**	**810**	<10
	12/22/2010	<200	<50	**25**	<10	**69**	<10	<10	**55**	**730**	<10
	2/24/2011	<200	<50	**25**	<10	**66**	<10	<10	**52**	**730**	<10
	5/11/2011(4)	<200	<50	**24**	<10	**65**	<10	<10	**49**	**740**	<10
	7/28/2011	<200	<50	**22**	<10	**77**	<10	<10	**54**	**1,000**	<10
	10/6/2011	<200	<50	**22**	<10	**74**	<10	<10	**55**	**960**	<10
	1/10/2012	<200	<50	**27**	<10	**79**	<10	<10	**64**	**990**	<10
	4/4/2012	<200	<50	**25**	<10	**81**	<10	<10	**55**	**980**	<10
	7/11/2012	<200	**58**	**25**	<10	**85**	<10	<10	**63**	**1,000**	<10
	10/8/2012	<200	<50	**22**	<10	**65**	<10	<10	**47**	**850**	<10
	3/6/2013	<200	<50	**26**	<10	**90**	<10	<10	**50**	**760**	<10
	6/11/2013	<200	<50	**26**	<10	**100**	<10	<10	**60**	**1,100**	<10
	8/29/2013	<200	<50	**28**	<10	**130**	<10	<10	**68**	**1,500**	<10
	11/12/2013	<200	<50	**31**	<10	**130**	<10	<10	**76**	**1,300**	<10
	3/27/2014	<200	<50	**25**	<10	**150**	<10	<10	**64**	**1,000**	<10
	5/19/2014	<200	<50	**20**	<10	**170**	<10	<10	**62**	**1,100**	<10
	7/18/2014	<200	<50	**17**	<10	**170**	<10	<10	**63**	**1,300**	<10
	11/26/2014	<200	<50	**16**	<10	**180**	<10	<10	**71**	**1,600**	<10
	3/25/2015	<200	<50	**14**	<10	**170**	<10	<10	**55**	**1,100**	<10
	5/21/2015	<200	<50	**15**	<10	**180**	<10	<10	**53**	**1,200**	<10
	12/4/2015	<200	<50	**11**	<10	**160**	<10	<10	**48**	**1,100**	<10
	4/22/2016	<200	<50	**13**	<10	**170**	<10	<10	**44**	**1,000**	<10
	7/29/2016	<200	<50	**13**	<10	**190**	<10	<10	**38**	**1,100**	<10
	12/2/2016	<200	<50	**12**	<10	**160**	<10	<10	**41**	**950(5)**	<10
	1/26/2017	<200	<50	**12**	<10	**160**	<10	<10	**36**	**920**	<10

Notes:

ug/L = micrograms per liter

NA = Not analyzed

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

Bold font denotes concentrations detected above laboratory reporting limits

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1) Compound may exhibit characteristic ignitability as defined in 40 C.F.R. § 261.21

2) Mixing Zone-Based Groundwater/Surface Water Interface (GSI) Criteria for the River Raisin as provided in Tables 2 and 3 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017.

3) MDEQ did not provide a mixing zone-based GSI criterion for trans-1,2-dichloroethene. Therefore the GSI criterion provided in the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013 applies.

4) The average temperature in this sample shipment exceeded the recommended temperature range. Sample results are approximate.

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6) Headspace present in the sample, results are approximate.

Table B1
Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area
Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloro-ethane	1,1-Dichloro-ethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
DUP-01 (MW-21)	8/29/2013	<200	<50	**28**	<10	**130**	<10	<10	**67**	**1,500**	<10
	3/27/2014	<200	<50	**26**	<10	**150**	<10	<10	**68**	**1,100**	<10
	7/18/2014	<200	<50	**15**	<10	**150**	<10	<10	**54**	**1,100**	<10
DUP-02 (MW-21)	3/23/2010	<20	<5.0	**33**	**2.2**	**79**	**7.8**	<1.0	**61**	**810**	<1.0
	7/29/2016	<200	<50	**14**	<10	**190**	<10	<10	**44**	**1100**	<10
	12/2/2016	<200	<50	**11**	<10	**150**	<10	<10	**47**	**980**	<10
DUP-03 (MW-21)	2/24/2011	<200	<50	**24**	<10	**66**	<10	<10	**50**	**740**	<10
	5/11/2011(4)	<200	<50	**24**	<10	**66**	<10	<10	**49**	**750**	<10
	7/28/2011	<200	<50	**23**	<10	**78**	<10	<10	**57**	**1,000**	<10
	10/6/2011	<200	<50	**21**	<10	**73**	<10	<10	**52**	**910**	<10
	1/10/2012	<200	<50	**27**	<10	**85**	<10	<10	**66**	**1,000**	<10
	4/4/2012	<200	<50	**24**	<10	**81**	<10	<10	**61**	**970**	<10
	7/11/2012	<200	<50	**25**	<10	**80**	<10	<10	**59**	**1,000**	<10
	6/11/2013	<200	<50	**26**	<10	**110**	<10	<10	**76**	**1,100**	<10
	11/12/2013	<200	<50	**32**	<10	**120**	<10	<10	**75**	**1,300**	<10
	5/19/2014	<200	<50	**19**	<10	**170**	<10	<10	**64**	**1,100**	<10
DUP-04 (MW-21)	11/26/2014	<200	<50	**17**	<10	**170**	<10	<10	**70**	**1,400**	<10

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Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area
Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloro-ethane	1,1-Dichloro-ethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW-22 (25-30') Depth to Groundwater Approx. 25 - 26'	12/7/2009	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**10**
	3/18/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**8.5**
	5/18/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.0**
	9/10/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**4.3**
	12/22/2010	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**3.0**
	2/24/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.3**
	5/11/2011(4)	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**1.4**
	7/21/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.8**
	10/4/2011	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**6.2**
	1/9/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**8.4**
	4/5/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**12**
	7/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**13**
	10/3/2012	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**18**
	5/29/2013	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**21**
	3/28/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**29**
	5/22/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**23**
	7/17/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**20**
	11/11/2014	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**24**
	3/23/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**25**
	5/19/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**23**
	4/22/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**26**
	7/28/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**26**
	11/29/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**27**
	1/24/2017	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**26**

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Former Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloroethane	1,1-Dichloroethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
MW-31 (33.3-38.3') Depth to Groundwater Approx. 32 - 33'	6/18/2010	<20	<5.0	**14**	<1.0	**19**	**2.2**	<1.0	**20**	**180**	<1.0
	9/17/2010	<40	<10	<2.0	<2.0	**15**	<2.0	<2.0	**48**	**220**	**2.5**
	12/22/2010(6)	<40	<10	**16**	<2.0	**29**	**2.9**	<2.0	**27**	**260**	<2.0
	2/24/2011	<40	<10	**16**	<2.0	**31**	**3.1**	<2.0	**26**	**300**	<2.0
	5/11/2011(4)	<40	<10	**15**	<2.0	**24**	**3.0**	<2.0	**22**	**250**	<2.0
	7/21/2011	<20	<5.0	**7.4**	<1.0	**14**	**1.2**	<1.0	**11**	**130**	<1.0
	10/4/2011	<20	<5.0	**18**	<1.0	**40**	**3.4**	<1.0	**28**	**340**	<1.0
	1/10/2012	<40	<10	**17**	<2.0	**35**	**3.1**	<2.0	**24**	**290**	<2.0
	4/5/2012	<40	<10	**16**	<2.0	**36**	**3.1**	<2.0	**24**	**290**	<2.0
	7/17/2012	<80	<20	**16**	<4.0	**34**	<4.0	<4.0	**23**	**310**	<4.0
	10/3/2012	<50	**16**	**15**	<2.5	**40**	**3.4**	<2.5	**26**	**340**	<2.5
	3/6/2013	<50	<12	**13**	<2.5	**32**	**2.9**	<2.5	**23**	**270**	<2.5
	5/29/2013	<50	<12	**15**	<2.5	**39**	**2.9**	<2.5	**23**	**300**	<2.5
	8/29/2013	<50	<12	**16**	<2.5	**47**	**2.6**	<2.5	**24**	**320**	<2.5
	3/28/2014	<50	<12	**16**	<2.5	**34**	<2.5	<2.5	**27**	**300**	<2.5
	5/22/2014	<50	<12	**16**	<2.5	**34**	<2.5	<2.5	**24**	**280**	<2.5
	7/17/2014	<50	<12	**13**	<2.5	**33**	<2.5	<2.5	**20**	**260**	<2.5
	11/11/2014	<50	<12	**14**	<2.5	**40**	<2.5	<2.5	**22**	**310**	<2.5
	3/23/2015	<50	**13**	**16**	<2.5	**46**	<2.5	<2.5	**25**	**340**	<2.5
	5/19/2015	<50	<12	**15**	<2.5	**41**	<2.5	<2.5	**22**	**320**	<2.5
	4/22/2016	<50	<12	**13**	<2.5	**51**	**2.5**	<2.5	**22**	**290**	<2.5
	7/28/2016	<50	<12	**11**	<2.5	**65**	**2.6**	<2.5	**20**	**290**	<2.5
	11/29/2016	<50	<12	**10**	<2.5	**66**	<2.5	<2.5	**21**	**270**	<2.5
	1/24/2017	<50	<12	**9.4**	<2.5	**65**	**2.6**	<2.5	**21**	**300**	<2.5

Notes:

ug/L = micrograms per liter

NA = Not analyzed

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

Bold font denotes concentrations detected above laboratory reporting limits

🟩 Denotes concentrations above one or more criteria

1) Compound may exhibit characteristic ignitability as defined in 40 C.F.R. § 261.21

2) Mixing Zone-Based Groundwater/Surface Water Interface (GSI) Criteria for the River Raisin as provided in Tables 2 and 3 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017.

3) MDEQ did not provide a mixing zone-based GSI criterion for trans-1,2-dichloroethene. Therefore the GSI criterion provided in the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013 applies.

4) The average temperature in this sample shipment exceeded the recommended temperature range. Sample results are approximate.

5) Quality control results for trichloroethene are outside the established control limits, the result is approximate.

6) Headspace present in the sample, results are approximate.

Table B1

Summary of Detected Volatile Organic Compounds in Groundwater in the Vicinity of the GSI Discharge Area

Former Tecumseh Products Company Site

Tecumseh, Michigan

Analyte		Acetone	2-Butanone(1)	1,1-Dichloro-ethane	1,1-Dichloro-ethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Toluene(1)	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Mixing Zone-Based GSI Criteria(2)		NC	40,000	13,000	2,300	11,000	1,500(3)	2,600	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
DUP-01 (MW-31)	6/18/2010	<20	<5.0	**12**	<1.0	**19**	**2.3**	<1.0	**21**	**170**	<1.0
	7/28/2016	<50	<12	**11**	<2.5	**58**	**2.5**	<2.5	**20**	**260**	<2.5
	11/29/2016	<50	<12	**9.7**	<2.5	**62**	<2.5	<2.5	**22**	**280**	<2.5
	1/24/2017	<50	<12	**9.4**	<2.5	**65**	**2.5**	<2.5	**23**	**290**	<2.5
MW-41 (3.3-6.3') Depth to Groundwater Approx. 0 - 1'	9/1/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/4/2015	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/22/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/28/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**2.4**	<1.0
	11/30/2016	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/24/2017	<20	<5.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
MW-42S (3-6') Depth to Groundwater Approx. 0'	12/1/2015	<400	<100	<20	<20	**1,700**	<20	<20	<20	<20	**36**
	11/21/2017	<200	<50	**14.6**	<10	**1,440**	**12.7**	<10	<10	<10	**70.6**
MW-42D (5.6-8.6') Depth to Groundwater Approx. 0'	9/1/2015	<200	<50	**15**	<10	**1,100**	**11**	<10	**25**	**1,200**	**23**
	12/1/2015	<200	<50	**16**	<10	**1,500**	**14**	<10	**22**	**1,100**	**23**
	4/22/2016	<200	<50	**16**	<10	**1,200**	**15**	<10	**22**	**970**	<10
	7/28/2016	<200	<50	**15**	<10	**1,200**	**15**	<10	**24**	**1,100**	<10
	11/29/2016	<200	<50	**13**	<10	**1,200**	**15**	<10	**21**	**840**	<10
	1/24/2017	<200	<50	**13**	<10	**1,200**	**15**	<10	**23**	**970**	<10
	11/21/2017	<200	<50	**12.9**	<10	**1,010**	**12.6**	<10	**21.7**	**911**	<10
MW-46D (5-8') Depth to Groundwater Approx. 0'	12/1/2015	<200	<50	<10	<10	**1,400**	**12**	<10	**12**	**120**	<10
	11/21/2017	<100	<25	**5.6**	<5	**698**	**7.9**	<5	**7.2**	**163**	<5
MW-47D (7.4-10.4') Depth to Groundwater Approx. 0'	12/1/2015	<50	<12	**25**	<2.5	**57**	<2.5	<2.5	<2.5	**270**	<2.5
	11/21/2017	**33.7**	<5.0	**23.1**	<1.0	**83.8**	**2.2**	<1.0	<1.0	**11.1**	**7.6**

Notes:

ug/L = micrograms per liter

NA = Not analyzed

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

Bold font denotes concentrations detected above laboratory reporting limits

🟩 Denotes concentrations above one or more criteria

1) Compound may exhibit characteristic ignitability as defined in 40 C.F.R. § 261.21

2) Mixing Zone-Based Groundwater/Surface Water Interface (GSI) Criteria for the River Raisin as provided in Tables 2 and 3 of the Michigan Department of Environmental Quality (MDEQ) letter titled "Implementation of the Mixing Zone - Clarification; Former Tecumseh Products Company; MID 005 049 440," dated June 27, 2017, as amended via email August 1, 2017.

3) MDEQ did not provide a mixing zone-based GSI criterion for trans-1,2-dichloroethene. Therefore the GSI criterion provided in the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013 applies.

4) The average temperature in this sample shipment exceeded the recommended temperature range. Sample results are approximate.

5) Quality control results for trichloroethene are outside the established control limits, the result is approximate.

6) Headspace present in the sample, results are approximate.

Table B2
Summary of Chlorinated Volatile Organic Compounds and 1,4-Dioxane at Surface Water Sample Locations
Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		1,1-Dichloroethane	1,2-Dichloroethane	1,1-Dichloroethene(1)	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Chronic GSI Criteria for Seeps/Wetland(2)		740	360(3)	130	620	1,500(3)	60	89	200	13
Acute GSI Criteria for Seeps/Wetland(2)		13,000	16,000(3)	2,300	11,000	28,000(3)	2,900	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
PW-01	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	**1.1**	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/21/2017	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-01 (DUP-01)	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/21/2017	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-02	4/4/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-03	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-03 (DUP-01)	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-04	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	**1.1**	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/21/2017	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-04 (DUP-01)	7/26/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-05	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-06	4/5/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/26/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PW-07	4/4/2016	**5.2**	<1.0	<1.0	**18**	**1.1**	<1.0	<1.0	**3.1**	**10**
	7/26/2016	**4.6**	<1.0	<1.0	**44**	**1.4**	<1.0	<1.0	**5.6**	**20**
	11/29/2016	**3.3**	<1.0	<1.0	**35**	<1.0	<1.0	<1.0	**8.1**	**9.1**
	11/21/2017	**2.2**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
SEEP	4/3/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/10/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/4/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	6/12/2013	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/12/2013	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/22/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/11/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/19/2015	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/2/2015	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/22/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

ug/L = micrograms per liter

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

NA = Not analyzed

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3) MDEQ did not provide mixing zone-based GSI criteria for this parameter. Therefore the chronic GSI criterion is taken from the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013, and the acute GSI criterion is the Final Acute Value provided in the MDEQ Surface Water Assessment Rule 57 Water Quality Values, October 21, 2016.

4) Frozen, no sample collected.

Table B2
Summary of Chlorinated Volatile Organic Compounds and 1,4-Dioxane at Surface Water Sample Locations
Tecumseh Products Company Site
Tecumseh, Michigan

Analyte		1,1-Dichloroethane	1,2-Dichloroethane	1,1-Dichloroethene[1]	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Tetrachloroethene	1,1,1-Trichloroethane	Trichloroethene	Vinyl Chloride
Chronic GSI Criteria for Seeps/Wetland[2]		740	360[3]	130	620	1,500[3]	60	89	200	13
Acute GSI Criteria for Seeps/Wetland[2]		13,000	16,000[3]	2,300	11,000	28,000[3]	2,900	1,600	3,500	NC
Units		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
SP-01	4/22/2016	**6.6**	<1.0	<1.0	**560**	**8.5**	<1.0	**11**	**61**	<1.0
	7/26/2016	<5.0	<5.0	<5.0	**620**	<5.0	<5.0	**5.0**	**83**	<5.0
	11/29/2016	<25	<25	<25	**3,300**	**28**	<25	<25	**790**	<25
	5/16/2017	<20	<20	<20	**1,700**	<20	<20	<20	**600**	<20
	11/21/2017	<20	<20	<20	**2,100**	**33.3**	<20	<20	**675**	<20
SP-02	4/22/2016	**16**	<1.0	**2.1**	**1,600**	**15**	<1.0	**16**	**1,000**	<1.0
	7/26/2016	**9.8**	<5.0	<5.0	**120**	<5.0	<5.0	**24**	**710**	<5.0
	11/29/2016	**21**	<10	<10	**330**	<10	<10	**57**	**1,400**	<10
	5/16/2017	**16**	<10	<10	**250**	<10	<10	**49**	**1,200**	<10
	11/21/2017	**18.7**	<10	<10	**292**	<10	<10	**42.4**	**1,110**	<10
SP-03	4/22/2016	**9.5**	<1.0	<1.0	**74**	**1.8**	<1.0	**23**	**360**	<1.0
	7/26/2016	**4.8**	<2.5	<2.5	**69**	<2.5	<2.5	**13**	**300**	<2.5
	11/29/2016	**9.9**	<5.0	<5.0	**110**	<5.0	<5.0	**25**	**470**	<5.0
	5/16/2017	**14**	<10	<10	**170**	<10	<10	**52**	**1,000**	<10
	11/21/2017	**14.5**	<10	<10	**238**	<10	<10	**49.7**	**1,340**	<10
WL-01	4/6/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	6/18/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	9/8/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	12/10/2010[4]	--	--	--	--	--	--	--	--	--
	2/25/2011[4]	--	--	--	--	--	--	--	--	--
	5/11/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1/5/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/2/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	7/3/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	10/3/2012	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/29/2013	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	3/28/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/22/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/11/2014	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	5/19/2015	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	4/22/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	11/29/2016	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Notes:

ug/L = micrograms per liter

NC = No mixing zone-based GSI criterion, parameter not likely to exceed water quality standards

NA = Not analyzed

-- = No data

Bold font denotes concentrations detected above laboratory reporting limits

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3) MDEQ did not provide mixing zone-based GSI criteria for this parameter. Therefore the chronic GSI criterion is taken from the MDEQ RRD Part 201 Generic Cleanup Criteria/Part 213 Risk Based Cleanup Levels, December 30, 2013, and the acute GSI criterion is the Final Acute Value provided in the MDEQ Surface Water Assessment Rule 57 Water Quality Values, October 21, 2016.

4) Frozen, no sample collected.

Appendix C
Soil Boring Logs and Well Construction Diagrams

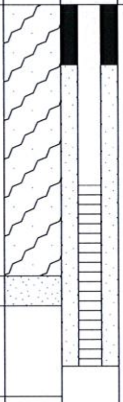
WELL CONSTRUCTION LOG

WELL NO. B-108s/ MW-42s

Page 1 of 1

Facility/Project Name: TPC Supplemental GSI		Date Drilling Started: 11/30/15	Date Drilling Completed: 11/30/15	Project Number: 220003.0001
Drilling Firm: Terra Probe, Inc.	Drilling Method: Hand Auger	Surface Elev. (ft) 741.80	TOC Elevation (ft) 744.11	Total Depth (ft bgs) 6.0 / Borehole Dia. (in) 3
Boring Location: N: 180796.22 E: 13241185.14		Personnel Logged By - M. Powers Driller - J. Fojtik		Drilling Equipment: Hand Auger
Civil Town/City/or Village: Tecumseh	County: Lenawee / State: MI	Water Level Observations: While Drilling: Date/Time 11/30/15 00:00 ▽ Depth (ft bgs) 0.0 After Drilling: Date/Time 12/1/15 10:55 ▼ Depth (ft bgs) 0.18		

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
			0	▼ **SILT** mostly silt, trace fine sand, very dark brown (10YR 2/2), no odor, saturated, very loose, organic rich, roots.		Geology logged at B-108d. Temporary well blind pushed to target depth.
			2		SM	
1 NR ○	0					
			4	Changes to trace coarse sand, very dark grayish brown (10YR 3/2), medium dense to dense at 4.0 feet.		
				POORLY GRADED SAND mostly fine to medium sand, trace to few silt, trace clay, very dark gray (10YR 3/1), no odor, saturated, dense.	SP	
			6	Stainless steel drive point well hand driven to 6.0 feet. End of boring at 6.5 feet.		Shallow monitorin well installed to total depth of 6.0 feet.
			8			
			10			
			12			
			14			
			16			
			18			

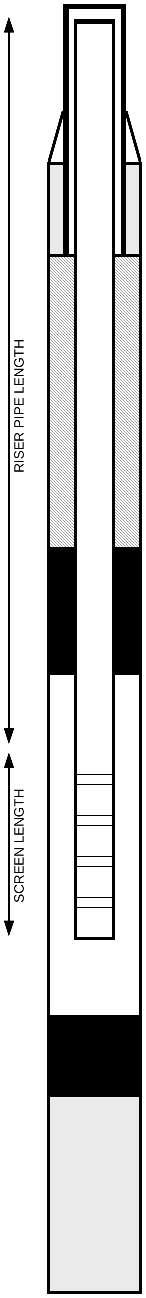


Signature:

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: TPC GSI Well Installation
WELL ID: **B-108s/ MW-42s**
PROJ. NO: 220003.0001
DATE INSTALLED: 11/30/2015
INSTALLED BY: M. Powers
CHECKED BY: J. Reed



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
744.11	2.3	TOP OF CASING
741.8	0.0	GROUND SURFACE
	NA	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL NA
5.3		GROUT/BACKFILL METHOD NA
	NA	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	1.0	BENTONITE SEAL
738.8	3.0	TOP OF SCREEN
3.0		FILTER PACK MATERIAL NATURAL COLLAPSE
735.8	6.0	BOTTOM OF SCREEN
	6.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
735.3	6.5	HOLE BOTTOM

NOTES:

NO PROTECTIVE COVER INSTALLED.
WELL PURGED DRY FOUR TIMES DURING DEVELOPMENT.

CASING AND SCREEN DETAILS

TYPE OF RISER: 1-INCH STAINLESS STEEL
PIPE SCHEDULE: NA
PIPE JOINTS: THREADED O-RINGS
SCREEN TYPE: 1-INCH STAINLESS STEEL
SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 4 IN. FROM 0 TO 6.5 FT.
IN. FROM TO FT.

SURF. CASING DIAMETER: 1.25 IN. FROM 0 TO 6 FT.
IN. FROM TO FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: PUMP
TIME DEVELOPING: 0.25 HOURS
WATER REMOVED: 1.5 GALLONS
WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: TURBID
COLOR BEFORE: VERY DARK GRAYISH BROWN
CLARITY AFTER: VERY SLIGHTLY TURBID
COLOR AFTER: VERY LIGHT GRAYISH BROWN

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	8.30	T/PVC	11/30/2015	13:10
DTB AFTER DEVELOPING:	8.30	T/PVC	11/30/2015	13:30
SWL BEFORE DEVELOPING:	4.63	T/PVC	11/30/2015	13:10
SWL AFTER DEVELOPING:	8.28	T/PVC	11/30/2015	13:30
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

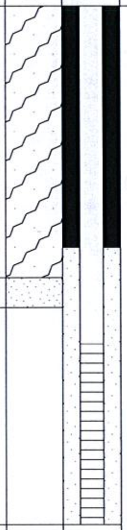
PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO
LOCK INSTALLED? ☑ YES ☐ NO
LOCK KEY NUMBER: 3120

WELL CONSTRUCTION LOG

WELL NO. B-108d/ MW-42d

Page 1 of 1

Facility/Project Name: TPC Supplemental GSI		Date Drilling Started: 8/25/15	Date Drilling Completed: 8/25/15	Project Number: 220003.0001
Drilling Firm: Terra Probe, Inc.	Drilling Method: Hand Auger	Surface Elev. (ft): 742.10 TOC Elevation (ft): 746.12	Total Depth (ft bgs): 8.6	Borehole Dia. (in): 3
Boring Location: N: 180795.57 E: 13241186.74		Personnel Logged By - M. Powers Driller - J. Fojtik	Drilling Equipment: Hand Auger	
Civil Town/City/or Village: Tecumseh	County: Lenawee State: MI	Water Level Observations: While Drilling: Date/Time 8/25/15 00:00 ▽ Depth (ft bgs) 0.0 After Drilling: Date/Time 9/1/15 11:10 ▼ Depth (ft bgs) -0.2		



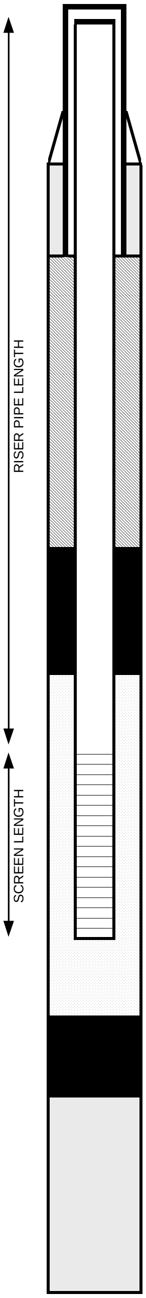
SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	COMMENTS
1 HA	100		0–1	**SILT** mostly silt, trace fine sand, very dark brown (10YR 2/2), no odor, saturated, very loose, organic rich, roots.	SM	
2 HA	100		1–2			
3 HA	100		2–3			
4 HA	100		3–4			
5 HA	75		4–5	Changes to trace coarse sand, very dark grayish brown (10YR 3/2), medium dense to dense at 4.0 feet.		
			4.75	**POORLY GRADED SAND** mostly fine to medium sand, trace to few silt, trace clay, very dark gray (10YR 3/1), no odor, saturated, dense.	SP	Slough prevented hand auger advancement past 5.0 feet.
6 NR	0		5–8.6	Stainless steel drive point well hand driven from approximately 5.0 to 8.6 feet.		Refusal due to density change at 8.6 feet.
			8.6	End of boring at 8.6 feet below ground surface, refusal.		Deep monitoring well installed to total depth of 8.6 feet.

Signature: Melissa Powers

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	TPC GSI Well Installation	WELL ID:	**B-108d/ MW-42d**
PROJ. NO: 220003.0001	DATE INSTALLED: 8/25/2015	INSTALLED BY: M. Powers	CHECKED BY: S. Holmstrom



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
746.12	4.0	TOP OF CASING
742.1	0.0	GROUND SURFACE
	NA	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL NA
		GROUT/BACKFILL METHOD NA
9.6'		
	NA	GROUT
		BENTONITE SEAL MATERIAL MEDIUM CHIPS
	4.0	BENTONITE SEAL
736.5	5.6	TOP OF SCREEN
3.0'		FILTER PACK MATERIAL NATURAL COLLAPSE
733.5	8.6	BOTTOM OF SCREEN
	8.6	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL NA
733.5	8.6	HOLE BOTTOM

NOTES:

NO PROTECTIVE COVER INSTALLED.

CASING AND SCREEN DETAILS

TYPE OF RISER: 1-INCH STAINLESS STEEL

PIPE SCHEDULE: NA

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 1-INCH STAINLESS STEEL

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:	3	IN.	FROM	0	TO	6.0	FT.
	1	IN.	FROM	6.0	TO	8.6	FT.
SURF. CASING DIAMETER:	1.25	IN.	FROM	0	TO	8.6	FT.
		IN.	FROM		TO		FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 1 HOURS

WATER REMOVED: 5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: SLIGHTLY TURBID

COLOR BEFORE: LIGHT GRAY

CLARITY AFTER: CLEAR

COLOR AFTER: COLORLESS

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	12.6	T/PVC	8/26/2015	12:45
DTB AFTER DEVELOPING:	12.6	T/PVC	8/26/2015	13:45
SWL BEFORE DEVELOPING:	4.0	T/PVC	8/26/2015	12:45
SWL AFTER DEVELOPING:	4.0	T/PVC	8/26/2015	13:45
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

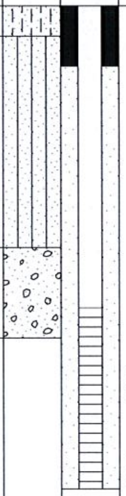
REVISED 11/2013

WELL CONSTRUCTION LOG

WELL NO. B-113d/ MW-46d

Page 1 of 1

Facility/Project Name: TPC Supplemental GSI		Date Drilling Started: 11/30/15		Date Drilling Completed: 11/30/15	Project Number: 220003.0001
Drilling Firm: Terra Probe, Inc.	Drilling Method: Hand Auger	Surface Elev. (ft) 740.80	TOC Elevation (ft) 743.03	Total Depth (ft bgs) 8.5	Borehole Dia. (in) 3
Boring Location: N: 180732.65 E: 13241149.69		Personnel Logged By - M. Powers Driller - J. Fojtik		Drilling Equipment: Hand Auger	
Civil Town/City/or Village: Tecumseh	County: Lenawee	State: MI	Water Level Observations: While Drilling: Date/Time 11/30/15 00:00 ▽ Depth (ft bgs) 0.0 After Drilling: Date/Time 12/1/15 12:24 ▼ Depth (ft bgs) -1.13		



SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	▼ ▽ LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 HA	100			**SILTY SAND** mostly fine to coarse sand, little to some silt, trace to few clay, dark gray (10YR 4/1), no odor, saturated, dense.	SM			
2 HA	100			**SANDY SILT** mostly silt, some fine sand, trace to few clay, trace medium to coarse sand, very dark grayish brown (10YR 3/2), no odor, saturated, medium dense to dense.	ML			
3 HA	100		2					
4 HA	100							
5 HA	100		4	**WELL GRADED SAND WITH GRAVEL** mostly fine to coarse sand, little to some fine to coarse gravel, few silt, trace clay, dark gray (10YR 4/1), no odor, saturated, medium dense to dense.	SW			
6 HA	50							
7 NR ○	0		6	Stainless steel drive point well hand driven from approximately 5.5 to 8.5 feet.				Slough prevented hand auger advancement past 5.5 feet. Deep monitoring well installed to total depth of 8.0 feet.
			8					
				End of boring at 8.5 feet below ground surface, refusal.				Refusal due to density change at 8.5 feet.
			10					
			12					
			14					
			16					
			18					

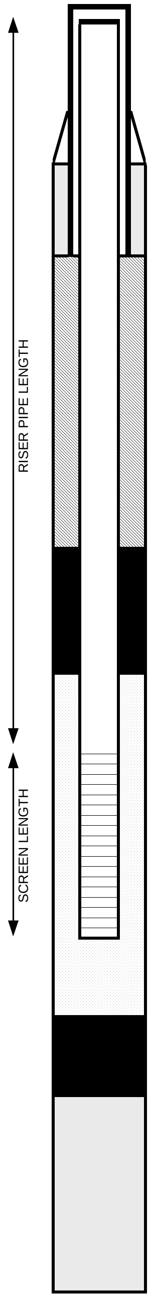
SOIL BORING WELL CONSTRUCTION LOG 220003_2015_GSI.GPJ TRC_CORP.GDT 220003.0001 9/5/17

Signature: Mellissa Powers

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME: TPC GSI Well Installation		WELL ID:	**B-113d/ MW-46d**
PROJ. NO: 220003.0001	DATE INSTALLED: 11/30/2015 INSTALLED BY: M. Powers		CHECKED BY: J. Reed



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
743.03	2.2	TOP OF CASING
740.8	0.0	GROUND SURFACE
	NA	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
7.2		
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	1.0	BENTONITE SEAL
735.8	5.0	TOP OF SCREEN
		FILTER PACK MATERIAL: NATURAL COLLAPSE
3.0		
732.8	8.0	BOTTOM OF SCREEN
	8.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
732.3	8.5	HOLE BOTTOM

NOTES:

NO PROTECTIVE COVER INSTALLED.

CASING AND SCREEN DETAILS

TYPE OF RISER: 1-INCH STAINLESS STEEL

PIPE SCHEDULE: NA

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 1-INCH STAINLESS STEEL

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER:
4 IN. FROM 0 TO 5.5 FT.
1.25 IN. FROM 5.5 TO 8 FT.

SURF. CASING DIAMETER:
1.25 IN. FROM 0 TO 8 FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: PUMP

TIME DEVELOPING: 0.25 HOURS

WATER REMOVED: 5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: TURBID

COLOR BEFORE: VERY DARK GRAYISH BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: COLORLESS

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	9.54	T/PVC	11/30/2015	12:40
DTB AFTER DEVELOPING:	9.54	T/PVC	11/30/2015	12:55
SWL BEFORE DEVELOPING:	0.85	T/PVC	11/30/2015	12:40
SWL AFTER DEVELOPING:	5.10	T/PVC	11/30/2015	12:55
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

REVISED 11/2013

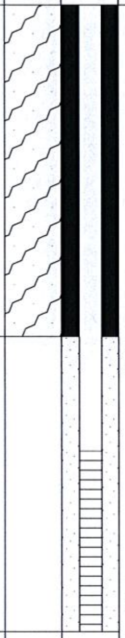
WELL CONSTRUCTION LOG

WELL NO. B-114d/ MW-47d

Page 1 of 1

Facility/Project Name: TPC Supplemental GSI		Date Drilling Started: 11/30/15	Date Drilling Completed: 11/30/15	Project Number: 220003.0001
Drilling Firm: Terra Probe, Inc.	Drilling Method: Hand Auger	Surface Elev. (ft) 742.80	TOC Elevation (ft) 745.25	Total Depth (ft bgs) 10.4
				Borehole Dia. (in) 3
Boring Location: N: 180846.90 E: 13241232.31		Personnel Logged By - M. Powers Driller - J. Fojtik		Drilling Equipment: Hand Auger
Civil Town/City/or Village: Tecumseh	County: Lenawee	State: MI		

Water Level Observations:
While Drilling: Date/Time 11/30/15 00:00 ▽ Depth (ft bgs) 0.0
After Drilling: Date/Time 12/1/15 10:28 ▼ Depth (ft bgs) 2.64

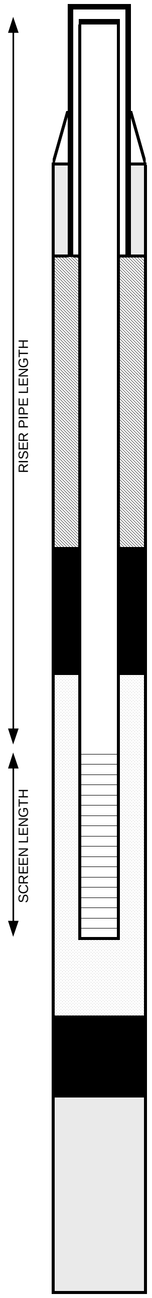
SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
			▽					
1 HA	100			**SILT** mostly silt, trace fine sand, trace to few clay, very dark grayish brown (10YR 3/2), no odor, saturated, dense, organic rich. Changes to no sand at 1.0 foot.				
2 HA	100		2					
3 HA	100		▼		ML			
4 HA	100		4	Changes to few to little clay at 4.0 feet.				
5 HA	100							
6 HA	50							
7 NR	0		6	Stainless steel drive point well hand driven from approximately 5.5 to 10.4 feet.				Slough prevented hand auger advancement past 5.5 feet.
			8					
			10					Refusal due to density change at 10.4 feet.
				End of boring at 10.4 feet below ground surface, refusal				Deep monitoring well installed to total depth of 10.4 feet.
			12					
			14					
			16					
			18					

Signature: Melissa Powers

Firm: TRC Environmental Corporation
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	TPC GSI Well Installation	WELL ID:	**B-114d/ MW-47d**
PROJ. NO: 220003.0001	DATE INSTALLED: 11/30/2015 INSTALLED BY: M. Powers		CHECKED BY: J. Reed



ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
745.25	2.5	TOP OF CASING
742.8	0.0	GROUND SURFACE
	NA	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
9.9		GROUT/BACKFILL METHOD: NA
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	5.5	BENTONITE SEAL
735.4	7.4	TOP OF SCREEN
3.0		FILTER PACK MATERIAL: NATURAL COLLAPSE
732.4	10.4	BOTTOM OF SCREEN
	10.4	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NA
732.4	10.4	HOLE BOTTOM

NOTES:

NO PROTECTIVE COVER INSTALLED.
WELL PURGED DRY THREE TIMES DURING DEVELOPMENT.
SLOW RECHARGE, NO RECOVERY IN 15 MIN.

CASING AND SCREEN DETAILS

TYPE OF RISER: 1-INCH STAINLESS STEEL

PIPE SCHEDULE: NA

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 1-INCH STAINLESS STEEL

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 4 IN. FROM 0 TO 10.4 FT.
___ IN. FROM ___ TO ___ FT.

SURF. CASING DIAMETER: 1.25 IN. FROM 0 TO 10.4 FT.
___ IN. FROM ___ TO ___ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 1.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: TURBID

COLOR BEFORE: VERY DARK GRAYISH BROWN

CLARITY AFTER: TURBID

COLOR AFTER: LIGHT BROWN

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	13.10	T/PVC	11/30/2015	13:35
DTB AFTER DEVELOPING:	13.10	T/PVC	11/30/2015	14:00
SWL BEFORE DEVELOPING:	10.55	T/PVC	11/30/2015	13:35
SWL AFTER DEVELOPING:	13.10	T/PVC	11/30/2015	14:00
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: 3120

REVISED 11/2013

Appendix D
Sample Field Forms

PAGE _______ OF _______

PROJECT NAME: TPC GSI Sampling

PROJECT NUMBER: 254864.0000 Ph 2

PROJECT MANAGER: Graham Crockford

SITE LOCATION: Tecumseh MI

DATES OF FIELDWORK: TO

PURPOSE OF FIELDWORK:

WORK PERFORMED BY:

SIGNED DATE

CHECKED BY DATE

REVISED 06/2011

PAGE _______ OF _______

GENERAL NOTES

PROJECT NAME: TPC GSI Sampling	DATE:	TIME ARRIVED:
PROJECT NUMBER: 254864.0000 Ph 2	AUTHOR:	TIME LEFT:

WEATHER

TEMPERATURE: _______ °F WIND: _______ MPH VISIBILITY: _______

WORK / SAMPLING PERFORMED

PROBLEMS ENCOUNTERED	CORRECTIVE ACTION TAKEN

COMMUNICATION

NAME	REPRESENTING	SUBJECT / COMMENTS

INVESTIGATION DERIVED WASTE SUMMARY

WASTE MATRIX	QUANTITY	COMMENTS

SIGNED DATE

CHECKED BY DATE

REVISED 06/2011

EQUIPMENT SUMMARY

PROJECT NAME:	TPC GSI Sampling	SAMPLER NAME:
PROJECT NO.:	254864.0000 Ph 2	

WATER LEVEL MEASUREMENTS COLLECTED WITH:

HERON DIPPER-T	TRC A2
NAME AND MODEL OF INSTRUMENT	SERIAL NUMBER (IF APPLICABLE)

PRODUCT LEVEL MEASUREMENTS COLLECTED WITH:

NA	NA
NAME AND MODEL OF INSTRUMENT	SERIAL NUMBER (IF APPLICABLE)

DEPTH TO BOTTOM OF WELL MEASUREMENTS COLLECTED WITH:

HERON DIPPER-T	TRC A2
NAME AND MODEL OF INSTRUMENT	SERIAL NUMBER (IF APPLICABLE)

PURGING METHOD

PERISTALTIC PUMP	TRC A2
NAME AND MODEL OF PUMP OR TYPE OF BAILER	SERIAL NUMBER (IF APPLICABLE)

SAMPLING METHOD

PERISTALTIC PUMP	TRC A2
NAME AND MODEL OF PUMP OR TYPE OF BAILER	SERIAL NUMBER (IF APPLICABLE)
NA	NA
NAME AND MODEL OF FILTERATION DEVICE	FILTER TYPE AND SIZE
DISPOSABLE POLY TUBING	☑ LOW-FLOW SAMPLING EVENT
TUBING TYPE	

PURGE WATER DISPOSAL METHOD

☐ GROUND ☑ DRUM ☐ POTW ☐ POLYTANK ☐ OTHER ________________

DECONTAMINATION AND FIELD BLANK WATER SOURCE

STORE BOUGHT	STORE BOUGHT
POTABLE WATER SOURCE	DI WATER SOURCE

SIGNED DATE

CHECKED BY DATE

PAGE _______ OF _______

TRC

WATER QUALITY METER CALIBRATION LOG

PROJECT NAME:	TPC GSI Sampling	MODEL: Myron 6P	SAMPLER:
PROJECT NO.:	254864.0000 Ph 2	SERIAL #: RENTAL	DATE:

PH CALIBRATION CHECK

pH 7 (LOT #): (EXP. DATE):	pH 4 / 10 (LOT #): (EXP. DATE):	CAL. RANGE	TIME
POST-CAL. READING / STANDARD	POST-CAL. READING / STANDARD		
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	

SPECIFIC CONDUCTIVITY CALIBRATION CHECK

CAL. READING (LOT #): (EXP. DATE):	TEMPERATURE (°CELSIUS)	CAL. RANGE	TIME
POST-CAL. READING / STANDARD			
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	

ORP CALIBRATION CHECK

CAL. READING (LOT #): (EXP. DATE):	TEMPERATURE (°CELSIUS)	CAL. RANGE	TIME
POST-CAL. READING / STANDARD			
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	

D.O. CALIBRATION CHECK

CAL. READING	TEMPERATURE (°CELSIUS)	CAL. RANGE	TIME
POST-CAL. READING /SATURATED AIR			
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	
/		☐ WITHIN RANGE	

TURBIDITY CALIBRATION CHECK

CALIBRATION READING (NTU)		CAL. RANGE	TIME
(LOT #): (EXP. DATE):	(LOT #): (EXP. DATE):		
POST-CAL. READING / STANDARD	POST-CAL. READING / STANDARD		
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	
/	/	☐ WITHIN RANGE	

COMMENTS

☐ **AUTOCAL SOLUTION**	☐ **STANDARD SOLUTION (S)**
(LOT #): **(EXP. DATE):**	LIST LOT NUMBERS AND EXPIRATION DATES UNDER CALIBRATION CHECK
CALIBRATED PARAMETERS	**CALIBRATION RANGES [1]**
☐ pH	pH: +/- 0.2 S.U.
☐ COND	COND: +/- 1% OF CAL. STANDARD
☐ ORP	ORP: +/- 25 mV
☐ D.O.	D.O.: VARIES
☐ TURB	TURB: +/- 5% OF CAL. STANDARD
☐ ______________	[1] CALIBRATION RANGES ARE SPECIFIC TO THE MODEL OF THE WATER QUALITY METER
☐ ______________	

NOTES

PROBLEMS ENCOUNTERED	CORRECTIVE ACTIONS

SIGNED ______________________ DATE

CHECKED BY ______________________ DATE

REVISED 06/2011

PAGE ______ OF ______

WATER LEVEL DATA

PROJECT NAME:	TPC GSI Sampling	DATE:	11/30/2015
PROJECT NUMBER:	254864.0000 Ph 2	AUTHOR:	

WELL LOCATION	TIME	REFERENCE	DEPTH TO WATER (FEET)	DEPTH TO BOTTOM (FEET)	DEPTH TO PRODUCT (FEET)	WATER ELEVATION
MW-42s		TOC			NA	
MW-42d		TOC			NA	
MW-46d		TOC			NA	
MW-47d		TOC			NA	

ALL WATER LEVELS MUST INCLUDE REFERENCE POINT AND TAPE CORRECTION FACTOR (E.G., 1.1 + 0.00 T/PVC).

SIGNED DATE

CHECKED DATE

PAGE _______ OF _______

TRC

WATER SAMPLE LOG

PROJECT NAME: TPC - GW Monitoring		PREPARED	CHECKED
PROJECT NUMBER: 004304.0001.0000		BY:	DATE:

Note: PREPARED and CHECKED each have BY: and DATE: fields.

SAMPLE ID: MW-	WELL DIAMETER: ☐ 2" ☐ 4" ☐ 6" ☑ OTHER 1"
WELL MATERIAL: ☑ PVC ☐ SS ☐ IRON ☐ GALVANIZED STEEL	☐ OTHER ___________
SAMPLE TYPE: ☑ GW ☐ WW ☐ SW ☐ DI ☐ LEACHATE	☐ OTHER ___________

PURGING TIME: DATE:	SAMPLE TIME: DATE:
PURGE METHOD: ☑ PUMP PERISTALTIC PUMP ☐ BAILER ___________	PH: _________ SU CONDUCTIVITY: ___________ umhos/cm ORP: _________ mV DO: ________ mg/L
DEPTH TO WATER: _________ T/ PVC	TURBIDITY: ________ NTU
DEPTH TO BOTTOM: _________ T/ PVC	☐ NONE ☐ SLIGHT ☐ MODERATE ☐ VERY
WELL VOLUME: **NM** ☐ LITERS ☐ GALLONS	TEMPERATURE: _________ °C OTHER: ___________
VOLUME REMOVED: _________ ☑ LITERS ☐ GALLONS	COLOR: ___________ ODOR: ___________
COLOR: ___________ ODOR: __________	FILTRATE (0.45 um) ☐ YES ☐ NO
TURBIDITY ☐ NONE ☐ SLIGHT ☐ MODERATE ☐ VERY	FILTRATE COLOR: ___________ FILTRATE ODOR: ___________
	QC SAMPLE: ☐ MS/MSD ☐ DUP- _________
DISPOSAL METHOD: ☐ GROUND ☑ DRUM ☐ OTHER	COMMENTS:

TIME	PURGE RATE (ML/MIN)	PH (SU)	CONDUCTIVITY (umhos/cm)	ORP (mV)	D.O. (mg/L)	TURBIDITY (NTU)	TEMPERATURE (°C)	WATER LEVEL (FEET)	CUMULATIVE PURGE VOLUME (GAL OR L)
									INITIAL

NOTE: STABILIZATION TEST IS COMPLETE WHEN 3 SUCCESSIVE READINGS ARE WITHIN THE FOLLOWING LIMITS:

pH: +/- **10 %** COND.: +/- **10 %** ORP: +/- **10 %** D.O.: +/- **10 %** TURB: +/- **10 %** or </= **5** TEMP.: +/- **0.5°C**

BOTTLES FILLED PRESERVATIVE CODES A - NONE B - HNO3 C - H2SO4 D - NaOH E - HCL F - _______

NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED	NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED
	40 mL	VOA	E	☐ Y ☑ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N

SHIPPING METHOD: Courier	DATE SHIPPED: ___________	AIRBILL NUMBER: NA
COC NUMBER: ___________	SIGNATURE: ___________	DATE SIGNED: ___________

REVISED 06/2011

TRC

SURFACE WATER SAMPLE LOG

PROJECT NAME:	TPC GSI Sampling	PREPARED		CHECKED	
PROJECT NUMBER:	254864.0000 Ph 2	BY:	DATE:	BY:	DATE:

SAMPLE ID:

Sample ID:	Date:	Sample Time:	Color	Odor	Notes:
SP-01					
SP-02					
SP-03					

BOTTLES FILLED PRESERVATIVE CODES A - NONE B - HNO3 C - H2SO4 D - NaOH E - HCL F - _______

Sample ID:	NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED	Analysis
SP-01	4	40 mL	VOA	E	☐ Y ☑ N	VOCs
SP-02	4	40 mL	VOA	E	☐ Y ☑ N	VOCs
SP-03	4	40 mL	VOA	E	☐ Y ☑ N	VOCs
		40 mL	VOA	E	☐ Y ☐ N	
		40 mL	VOA	E	☐ Y ☐ N	

Notes:

SHIPPING METHOD: ____________	DATE SHIPPED: ____________	AIRBILL NUMBER: ____________
COC NUMBER: ____________	SIGNATURE: ____________	DATE SIGNED: ____________

PAGE _______ OF _______

TRC

PORE WATER SAMPLE LOG

PROJECT NAME:	TPC GSI Sampling	PREPARED		CHECKED	
PROJECT NUMBER:	254864.0000 Ph 2	BY:	DATE:	BY:	DATE:

SAMPLE ID: **PW-**

WELL DIAMETER: ☐ 2" ☐ 4" ☐ 6" ☑ OTHER **1/8-inch**

PUSH POINT SAMPLE ☑ 1/8" Stainless Steel Henry Sampler ☐ OTHER ____________________

SAMPLE TYPE: ☑ Pore Water ☐ OTHER ____________________

SAMPLE	TIME:	DATE:

Analysis: VOCs

PURGE METHOD: ☑ Syringe ____________________

Surface Water Present?

DEPTH TO TOP OF SCREEN: BGS

COLOR: ____________ ODOR: ________________

TURBIDITY

☐ NONE ☐ SLIGHT ☐ MODERATE ☐ VERY

QC SAMPLE: ☐ MS/MSD ☐ DUP- _________

DISPOSAL METHOD: ☑ GROUND ☐ DRUM ☐ OTHER

SAMPLE TYPE	TIME	PH (SU)	CONDUCTIVITY (umhos/cm)	ORP (mV)	TDS	TEMPERATURE (°C)	
PORE WATER							
SURFACE WATER							

Notes:

SAMPLE	SURFACE WATER QUALITY PARAMETERS
PH: _________ SU CONDUCTIVITY _________ umhos/cm	PH: _________ SU CONDUCTIVITY: _________ umhos/cm
ORP: _________ mV TEMPERATURE _________ °C	ORP: _________ mV TEMPERATURE: _________ °C
TOTAL DISSOLVED SOLIDS: _________	TDS: ________
COMMENTS:	COMMENTS:

BOTTLES FILLED	PRESERVATIVE CODES A - NONE B - HNO3 C - H2SO4 D - NaOH E - HCL F - _______								
NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED	NUMBER	SIZE	TYPE	PRESERVATIVE	FILTERED
	40 mL	VOA	E	☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N
				☐ Y ☐ N					☐ Y ☐ N

SHIPPING METHOD: ________________ DATE SHIPPED: ________________ AIRBILL NUMBER: ________________

COC NUMBER: ________________ SIGNATURE: ________________ DATE SIGNED: ________________

PAGE _______ OF _______

WELL INSPECTION REPORT

PROJECT NAME:	TPC GSI Sampling
PROJECT NO.:	254864.0000 Ph 2

SAMPLER NAME:

DATE:

WELL ID	PROTECTIVE CASING	SURFACE SEAL	DEGREE OF IMMOBILITY OF PROTECTIVE CASING	PERMANENT LEGIBLE LABELS	LOCK	WELL CAP	EASE OF INSERTING / REMOVING BAILER	SEDIMENT IN WELL	COMMENT

SIGNED DATE

CHECKED BY DATE

REVISED 06/2011

Appendix E
Laboratory QA/QC Manual

Pace Analytical®

September 1, 2016

Dear Valued Client:

We are pleased to announce the recently completed acquisition of TriMatrix Laboratories (TriMatrix) by Pace Analytical Services. Effective immediately the laboratory located at 5560 Corporate Exchange Ct SE in Grand Rapids, MI, is being operated by Pace Analytical Services, Inc.

Pace Analytical Services started in 1978 and has grown into the second largest environmental testing lab network in the US. TriMatrix has been serving environmental markets for over 42 years and appreciates the loyal customers it has worked with during that time. TriMatrix and Pace share the essential principles of providing excellent service and high quality data. We look forward to being able to discuss the wider range of services that we can now offer you.

Everything about contacting TriMatrix services remains unchanged. You will continue to contact your same Project Manager at the same phone number and email for your laboratory needs. As we progress through this transition, we will notify you of any pertinent changes. We are contacting many TriMatrix clients about this transition; we ask your help in this process by distributing this notification to staff in your organization that utilizes TriMatrix services.

If you have any questions about the acquisition and what it will mean for you, please contact any of us at any time. We look forward to continuing to grow our business relationship with you.

Sincerely,

Karl Anderson

Karl Anderson
Sr. General Manager
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TRIMATRIX
LABORATORIES

Quality Assurance Manual

Analytical Services

Release Date March, 2016

Prepared by:
TriMatrix Laboratories, Inc.
5560 Corporate Exchange Court
Grand Rapids, MI 49512
616-975-4500

1.0 TITLE PAGE

QUALITY ASSURANCE MANUAL

Policies and Procedures Required of the Personnel Employed by TriMatrix Laboratories, Inc., Including the Organic, Inorganic, and Metals Laboratory Areas

Revision Number: 8.1

Effective Date: March 2016

Initial Approvals:

Quality Assurance Manager: ____________________ Date: 3/30/16

Laboratory President: ____________________ Date: 3/30/2016

Subsequent Approvals:

Quality Assurance Manager: ____________________ Date: ____________

Quality Assurance Manager: ____________________ Date: ____________

Quality Assurance Manager: ____________________ Date: ____________

Quality Assurance Manager: ____________________ Date: ____________

2.0 TABLE OF CONTENTS

CHAPTER 3 FIGURES

8.0 GLOSSARY OF TERMS

3.0 QUALITY SYSTEM

3.1 INTRODUCTION: THE TriMatrix QUALITY SYSTEM

3.1.1 Manual Purpose

The purpose of this manual is to outline the organization, specify the procedures, and define the technical requirements utilized by TriMatrix Laboratories, Inc. The goal is to ensure that all data generated is of the required quality, reproducible, and generated in a timely manner. This manual details a Quality Assurance/Quality Control (QA/QC) program encompassing the entire analytical efforts at TriMatrix, from project initiation to report generation. Some areas are covered with only a cursory discussion while others are covered in detail or are included in more than one section, depending on their importance. This manual describes the realistic functions of the quality programs in place, with an understanding that not every situation is covered nor every contingency explored.

3.1.2 The Need for Analytical Quality Assurance/Quality Control

In the increasingly competitive business of environmental laboratory services, the primary tenet of continued success is to efficiently provide results of the necessary quality. TriMatrix agrees with this tenet, considers analytical quality assurance and quality control to be of prime importance, and has incorporated it as the central pillar of our efforts to remain on the leading edge of the environmental laboratory field. The requirements we place on ourselves are in concert with the needs and agendas of other organizations, such as the Environmental Protection Agency (EPA), governmental and industrial clients, and various state and local regulatory agencies.

Quality assurance and quality control (QA/QC) functions absorb nearly fifty percent of the available effort involved in routine analysis and continues to evolve and grow in importance. This level of quality is absolutely essential for two reasons: accurate analytical data is obtained only with the concurrent use of extensive QA/QC to regulate and monitor the many process variables that can potentially introduce errors into chemical analyses, and clients make crucial business decisions based on the data supplied by the laboratory. Lab data not properly supported by adequate quality assurance/quality control practices and procedures can be questionable at best, and can lead to faulty or erroneous decisions in the field. In the overall analytical effort the additional time spent for QA/QC is time necessarily spent.

3.1.3 Definition of Terms

3.1.3.1 Quality Assurance

Quality Assurance (QA) is defined as those operations and procedures undertaken to provide measurement data of documentable quality that have a stated probability of being accurate. The measurement system part of the quality assurance program must be in statistical control to justify this probability statement.

The operations and procedures established as part of the overall quality assurance program encompass all aspects of the laboratory operations, including but not limited to: organizational structure, human resources, physical resources, methodology, analyst training and certification, data reduction, data validation, and instrument maintenance and troubleshooting. All aspects of QA are organized, implemented, and monitored through written standard operating procedures.

3.1.3.2 Quality Control

Quality control is defined as the basic checks necessary to produce a good measurement program. These checks include but are not limited to: proper calibration and calibration verification, statistical monitoring of accuracy and precision, quality control samples (e.g. blanks, blank spikes, duplicates, matrix spikes, etc.), interference monitoring, and reagent control.

Adequate records are maintained to support data quality, to locate assignable causes in measurement problems, to improve the accuracy and precision of the measurement system, and to provide a historical record of traceability.

3.1.3.3 Quality Assessment

Quality assessment is defined as those specific steps utilized to evaluate the quality of the measurement process. These steps include use of control charts to plot multiple data points over time, monitoring parameters by statistical control, internal performance audits, external performance audits, certification programs conducted by individual states, and performance evaluation sample programs.

3.2 QUALITY POLICY STATEMENTS FROM MANAGEMENT

As communicated from top management through the entire organization, TriMatrix Laboratories, Inc. is driven by the following quality objectives and commitments.

3.2.1 Corporate Quality Objectives

- To create and maintain a uniform and controlled pattern for performing routine tasks within the organization, based on standard operating procedures.

- To generate legally defensible, scientifically sound laboratory data of documented quality.

- To build quality into the workplace; ensuring services contributing to successful relationships with our customers, employees, and vendors.

- To develop, deliver, and maintain, excellence in all operational areas.

- To provide a service that consistently meets or exceeds client expectations.

3.2.2 Corporate Quality Commitments

- To support quality by underwriting the substantial cost of the quality commitment even though such expenses do not result in increased productivity or a tangible product.

- To maintain a work environment in which all employees are free from commercial pressures in the performance of their duties.

- To maintain a work environment in which all employees are free from internal organization or external client related pressures that may influence the quality of their work.

- To educate all employees in fraud prevention and their ethical responsibilities associated with analytical and data reporting activities.

- To ensure that client confidentiality and information are strictly protected.

- To implement on-going improvement in every area of laboratory activity.

- To create and maintain a Quality Environment with an all-encompassing determination to meet the needs and quality objectives of our clients.

- To commit and adhere to the requirements specified in ISO/IEC 17025.

- To commit and adhere to the requirements specified by the TNI Standards.

- To commit and adhere to the requirements specified by the DoD QSM.

Included with these improvements and commitments is an annual review process where the management of TriMatrix Laboratories performs a comprehensive review of the quality system. This review monitors the effectiveness of the quality system and provides feedback for on-going improvement. Policy changes made as a result of the annual review will be reflected in the QA Manual and laboratory standard operating procedures.

3.3 ORGANIZATION AND RESPONSIBILITIES

An efficient organizational operation requires a quality control program facilitating a high level of multi-directional communication and information flow. Each person in the TriMatrix organization inputs and receives information from the quality system. This information flow optimizes management directives with minimum disruption, and provides the means for creating improvements.

3.3.1 Corporate Structure

Flow of both administrative and quality control information is presented in Figure 3-1. This diagram graphically displays the corporate philosophy concerning the interaction of QA/QC and the generation of analytical data. The general flow of data in this format gives QA/QC independence in fulfilling its function while still acting as a liaison with the administrative staff. To further explain this interaction, a detailed description of roles and responsibilities is presented for each key laboratory position.

3.3.2 Laboratory President

Responsibilities of the Laboratory President are directed at the overall operation and management of the laboratory. Primary responsibilities include, but are not limited to: 1) develop and meet budgets established for the laboratory, 2) manage analytical services productivity and quality, 3) oversee and develop new business activities including client relations development, 4) plan analytical services organization, leadership and management programs, 5) develop and manage human resources including career path planning, and 6) performing duties as Deputy Technical Director when necessary or when the Technical Director will be absent for more than 15 days.

3.3.3 Quality Assurance Manager

The Quality Assurance Manager is primarily responsible for the implementation, maintenance, reporting, and development of all QA/QC activities performed within the laboratory. Duties include, but are not limited to: 1) QA/QC systems development and monitoring, 2) coordination of all documentation procedures including the development and control of standard operation procedures, 3) monitoring method and quality control requirements as published by regulatory agencies, ISO/IEC 17025, the Department of Defense QSM, and the TNI Standards, 4) performing internal lab audits, 5) maintaining in-house QA/QC monitoring procedures and policies, and 6) providing quality assurance guidance and training to all staff members. The

Quality Assurance Manager has the authority to stop work as a result of poor data quality and process deviations.

3.3.4 Technical Director

The Technical Director is responsible for the overall technical capabilities and direction of the laboratory. Specific responsibilities include: 1) organization and management of new analytical technologies developed by the laboratory, 2) adherence to ISO/IEC 17025, the Department of Defense QSM, and the TNI Standards, 3) equipment procurement management.

3.3.5 Health and Safety Officer

The Health and Safety Officer is responsible for development and maintenance of health and safety programs and manuals. Specific responsibilities include: 1) the implementation, monitoring, and maintenance of all laboratory safety and chemical hygiene programs, 2) monitoring and managing laboratory waste disposal.

3.3.6 Deputy Quality Assurance Manager/Deputy Technical Director

The Deputy Quality Assurance Manager/Deputy Technical Director is an integral part of the Quality Team. The position assists in performing QA/QC and technical functions at the level established by management for the position, including: 1) helps verify that QA and QC systems are commensurate with client expectations, 2) centralizes data related to Quality Assurance for the purpose of preparing weekly, monthly and annual reports, 3) monitors, via the quality control system, the quality assurance of work performed by the laboratory and subcontractors, 4) complies with policies and procedures in all areas impacting the business, including operational, commercial, financial, administrative, and HR practices, 5) adheres to all legislative requirements associated with laboratory operations, 6) maintains the highest ethical standards in dealing with all persons, 7) supports the quality team and proposes alternative courses of action, wherever possible, to facilitate and expedite continuous quality improvement, 8) assists in reviewing laboratory work, 9) assists in internal and external third-party auditing, and responses, 10) supports laboratory supervisors by developing/designing relevant quality procedures and quality plans of action, 11) supports training and mentoring of laboratory personnel by transfer of knowledge, 12) performs similar, other, or related duties when assigned by laboratory Management. The Deputy Quality Assurance Manager/Deputy Technical Director reports to the Quality Assurance Manager.

3.3.7 Project Chemist

Working independently or under minimal supervision of the client services manager, sales manager, or laboratory president, the project chemist is responsible to act as the primary interface with the client. The Project Chemist works directly with the sales manager to establish relationships with new clients as well as increase business from existing clients.

3.3.8 Laboratory Computer Systems Administrator

The Laboratory Computer Systems Administrator is responsible for managing the laboratory computer network. This includes internet access, hardware, and all software including the laboratory LIMS system. The Laboratory Computer Systems Administrator Manager is also responsible for reviewing laboratory computer applications and processes, including instrument computer interfaces, data transmission and archiving, and technical review, guidance, and training in current and future laboratory computer applications.

3.3.9 Purchasing Manager

Purchasing is coordinated through the Purchasing Manager. The Purchasing Manager maintains records on all vendors exhibiting poor performance on either their service or product, ensuring only accepted and approved vendors are used.

3.3.10 Sales and Marketing Staff

The Sales and Marketing Staff are responsible for all marketing, business development, and client maintenance activities. These activities include but are not necessarily limited to: 1) market research/gathering market intelligence, 2) consulting with company management to develop a corporate business strategy and plan, 3) development and implementation of a corporate image campaign, 4) development and distribution of marketing materials (corporate literature, etc.), 5) client prospecting, 6) presenting/introducing company services to prospective clients, 7) account development, management and maintenance (in conjunction with Project Chemists), 8) development of corporate pricing guidelines, 9) development of proposals, quotations, bids and qualifications summaries, and 10) contract review, negotiation and execution.

3.3.11 Organizational Chart

Presented in Figure 3-2 is an organizational chart illustrating the personnel structure within the laboratory.

3.4 RELATIONSHIPS

Relationships within the analytical laboratory are organized through management into three main categories: Technical Operations, Support Services, and the Laboratory Quality System. The relationships between management and these operations define and maintain the delicate balance in a cost-effective, highly-technical, quality laboratory operation. An overview of each relation is presented below:

3.4.1 Management-Technical Operations

The relationship between management and technical operations is illustrated in Figure 3-3. In this relationship, the main role of management is to provide guidance and financial support to the programs and directives of the Technical Director. Through this structure, technical operational enhancements and developments occur and are applied through the laboratory staff.

3.4.2 Management-Support Services

The relationship between management and support services is illustrated in Figure 3-4. In this relationship, management's role is substantial in the day-to-day operation of each service.

The primary laboratory support groups are Client Services, Sales and Marketing, and LIMS system support. These groups report directly to the Laboratory President for all aspects of their daily activities.

Secondary relationships are maintained with the Laboratory Administrative Assistant, Laboratory Receptionist, Accounting, and the Human Resources Department. Some groups within this secondary category maintain relationships not only with the Laboratory President, but also with other management groups within the TriMatrix organization.

3.4.3 Management-Quality System

The relationship between management and the laboratory quality system is illustrated in Figure 3-5. In this relationship, management plays a secondary role in the overall scheme. This secondary role provides the quality assurance manager with guidance, company perspective, and structured support in the development, implementation, and maintenance of quality system programs and activities.

This relationship is vital to the success of TriMatrix Laboratories. Without a cost-effective quality system, the overall caliber of laboratory data and the success of all laboratory operations would be jeopardized.

A relationship also exists between management, the quality system, the laboratory support, and the HR staff. This relationship includes but is not limited to: laboratory management directives, and human resources/personnel activities. These activities are implemented and maintained without disruption to the quality system, and are depicted via the dashed lines on Figure 3-5.

3.5 JOB DESCRIPTIONS

The strength of a laboratory lies in the experience and dedication of its employees. TriMatrix hires quality personnel based both on attitude and past job experience. Job descriptions have been written to define the employee qualifications required for each position.

3.5.1 Management Staff Members

Managerial positions are responsible for the development of their respective employees. These positions have specific minimum requirements for years of experience.

3.5.1.1 Laboratory President

Job Description

The Laboratory President (LP) directs the laboratory. Responsibilities include data quality improvements, overall productivity, staff development, safety/training programs, and overall profitability. This position has profit/loss accountability. Budgets are developed annually with senior management. The LP is also directly involved in business development/sales activities, and the sales staff reports directly to him.

Background/Educational Requirements

The LP possesses minimally a bachelor's degree in science, preferably chemistry. The LP has a minimum of 10 years direct work experience in the environmental testing industry. This work experience includes having conducted environmental analyses and several years of demonstrated supervisory experience.

Duties and Responsibilities

1. Development and fulfillment of budgets.
2. Management of total laboratory productivity and quality.
3. Management of proposal preparation.
4. Development of new business and maintenance of client relationships.
5. Development of laboratory organization, leadership, and management planning.
6. Working with the Human Resources department to develop staff members and their career paths.

3.5.1.2 Quality Assurance Manager

Job Description

The Quality Assurance (QA) Manager is responsible for the development, implementation, improvement, and maintenance of all quality systems at TriMatrix. The QA Manager monitors all the analytical methods and procedures performed by the laboratory, and assures compliance with regulatory agency requirements.

Background/Educational Requirements

The QA Manager possesses a B.S. in science, preferably chemistry, and suitable work experience. Work experience must include several years of analytical work and a demonstrated ability to work with and train staff members. A strong working knowledge of quality assurance and statistical quality control procedures, specifically as they apply to analytical protocols, is required.

Duties and Responsibilities

1. Development and implementation of systems to measure and monitor laboratory data quality.
2. Maintenance of the documentation system for generation, control, and archiving laboratory forms, SOPs, and protocols.
3. Approving SOPs and monitoring their compliance with regulatory agency requirements.
4. Maintaining and updating the laboratory Quality Assurance Manual.
5. On-going investigation for optimizing procedures to minimize out-of-control data.
6. Maintenance of national, federal, state, and industrial certifications and accreditations as required.
7. Monitoring internal quality programs within the laboratory and reporting their status to management.
8. Training, training documentation, and evaluation of the effectiveness of training for all staff members in all aspects of the laboratory quality system.
9. Ensuring communication takes place at all levels within the laboratory regarding the effectiveness of the quality system.
10. Perform other duties as deemed necessary by management.

3.5.1.3 Technical Director

Job Description

The Technical Director (TD) is responsible for the development and improvement of technical operations within the laboratory division. The TD oversees the investigation of all new instruments and equipment, method development, and general technical advancement of the laboratory. The TD is also responsible for informing the Deputy TD of current and pending projects and activities.

Background/Educational Requirements

The TD possesses a B.S. in science, preferably chemistry, and suitable work experience. Such work experience includes several years of analytical work and a demonstrated ability to work with and train staff members. A strong working knowledge of instruments and methodologies, specifically as they apply to analytical protocols, is required.

Duties and Responsibilities

1. On-going technical development of the TriMatrix Laboratory pertaining to current and future analytical practices.
2. Overseeing the technical development of TriMatrix staff in the areas of method comprehension and implementation.
3. Development of new analytical procedures within the laboratory.
4. Providing technical advice regarding all equipment and apparatus procurement, and acquisitions.
5. Performing technical review of all Quality Assurance Project Plans (QAPPs).
6. Perform other duties as deemed necessary by management.

3.5.1.4 Laboratory Computer Systems Administrator

Job Description

Provide technical review, guidance, and training in current and future laboratory computer applications.

Background/Educational Requirements

Requires a degree in computer sciences with an emphasis in a chemistry or general science curriculum.

Duties and Responsibilities

1. Developing a complete understanding of the Laboratory Information Management System (LIMS).
2. Reviewing laboratory computer applications and processes, including instrument computer interfaces, data transmission/archiving processes, and document control.
3. Providing database maintenance support activities for the LIMS system.
4. Providing technical direction and orchestrating implementation of electronic storage systems for the laboratory.
5. Providing technical training of the laboratory staff in software applications and basic computer operational activities.
6. Perform other duties as deemed necessary by management.

3.5.2 Technical Staff Members

Technical staff members are classified into chemist or technician levels dependant on job type, education, and years of experience. Level Classifications are Chemist I-V and Senior Chemist, Project Chemist I-V and Senior Project Chemist, Technician I-V and Senior Technician. In addition, qualified candidates are also eligible for group leader status. Classification descriptions are provided in Appendix A. Differences between the levels are printed in bold italicized text. The various classifications are also used by the employee and by management for career path development at TriMatrix.

3.6 MANAGEMENT RESUMES

Laboratory President
Quality Assurance Manager
Human Resources Manager

DOUGLAS E. KRISCUNAS **Laboratory President**

EDUCATION

B.S., Environmental Sciences, Grand Valley State University, 1976

PROFESSIONAL SUMMARY

Mr. Kriscunas is responsible for the accuracy and integrity of all analytical data finalized at this location. He is continuously available for client support to resolve analytical issues as they pertain to environmental problems.

PROFESSIONAL EXPERIENCE

- **Detroit, Michigan**. Laboratory Supervisor for a field laboratory established at the Detroit Wastewater Treatment Plant. The project involved a one-year pilot study of the overall operation and plant performance to upgrade and modify existing treatment processes to meet current and future discharge limits. Approximately 20,000 samples were analyzed by seven full-time analysts.

- **Edmore, Michigan. Hitachi Magnetics Corporation.** Participated in the development and implementation of an on-site, flow-through bioassay of the plant discharge. The study was performed in conjunction with the Michigan Department of Natural Resources, Water Quality Division.

- **Grand Rapids, Michigan. EDI Laboratory Certification.** Direct responsibility for the inorganic parameters analysis and quality control measures necessary for laboratory certification under the Safe Drinking Water Act (SDWA) of 1974. Certification involved both analysis of unknown control samples and corresponding on-site evaluation by the U.S. EPA Region V laboratory certification team.

- **Muskegon, Michigan. Uniroyal Chemical Company.** Participated in the soil survey and on-site evaluation of potential soil contamination from deposited chemical waste materials produced by a major chemical company. On-site sample analyses for select parameters were made to locate and detail the extent of contamination.

- **Edmore, Michigan. Hitachi Magnetics Corporation.** Participated in the implementation of a treatability study to effectively remove cobalt and samarium from industrial waste. The study results led to the design and installation of treatment facilities.

- **Columbia, Missouri. A.B. Chance Corporation**. Responsible for implementing a treatment study for effective removal of heavy metals from process wastewater in order to achieve acceptable discharge limits.

- **Kent County, Michigan. Mill Creek Watershed Management Project**. Participated in the collection, mapping, and interpretation of environmental characteristics to be used as prototype guidelines for the management of area wide streams in the Great Lakes Basin. The project was funded by the Environmental Protection Agency.

- **Three Rivers, Michigan. Hydramatic Division, General Motors Corporation.** Responsible for the analytical services conducted on a survey of process wastewater for an automotive transmission manufacturer. The project involved data collection and analytical services including grab samples, setting automatic samplers on an hourly basis for a seven-day period, and installing recording meters for continuous pH monitoring.

- **Grand Rapids, Michigan. Michigan Department of Public Health Laboratory Certification.** Supervised analytical, bacteriological, and quality control activities involved in achieving certification status for the analysis of potable water supplies in Michigan.

- **Higgins Lake, Michigan. Ralph MacMullan Conference Center**. Served on a three-member panel before a meeting of the Northern Michigan Environmental Health Association. The topic of discussion was an overview of organic chemicals now found in much of Michigan's ground waters. A representative from industry and the MDPH laboratory completed the panel.

- **Grand Rapids, Michigan. Haviland Chemical Company.** Coordinated a static bioassay performed on a water-based detergent utilizing fathead minnows in the 96-hour static test.

- **Sparta, Michigan**. Conducted a dendrological survey of a proposed oil drilling site. The survey was incorporated in an overall environmental assessment of the proposed drilling site.

- **Caledonia, Michigan**. Conducted a dendrological survey of riparian vegetation types located along the banks of the Thornapple River in the area of the Labarge Dam.

- **Grand Haven, Michigan**. Conducted a limnological investigation of the estuary waters of the Grand River watershed near Grand Haven. The collected limnological data were evaluated for potential eutrophication problems resulting from nutrient discharges upstream.

- **Kalamazoo, Michigan. American Cyanamid Company**. Supervised laboratory work required in assisting a major chemical manufacturer with a permit application for existing facility hazardous waste management operation to administratively complete four supplemental technical attachments, multidisciplinary services were required in the areas of hydrogeologic investigation, environmental assessment, failure mode assessment, and engineering review. Field work was completed in 19 days with a report to the client in 25 days to meet scheduled deadlines.

- **Kent County, Michigan**. Coordination of field and laboratory services in conjunction with Act 641 monitoring requirements at two county-owned and operated refuse sites. Specialized studies were also conducted to identify possible use of landfill gases for electric power generation and the source identification of volatile organic contaminants typical of most municipal landfills.

- **Cascade Township, Michigan. Cascade Resource Recovery/Waste Management, Inc.** Implementation of two separate tracer studies aimed at pinpointing possible cracks or defects in the clay liners of four hazardous waste disposal trenches. The study utilized a low absorptivity fluoroscene water soluble dye introduced to each trench. Samples collected from each liner failure detection system were then analyzed for the fluorescent characteristics of the dye.

- **Cascade Township, Michigan. Cascade Resource Recovery/Waste Management, Inc.** Coordination of field and laboratory services in connection with Michigan

Department of Natural Resources Act 64 and U.S. EPA RCRA monitoring requirements. Each sampling event involves collection of ground waters, surface waters, and leak detection monitoring sites.

- **Cascade Township, Michigan. Cascade Resource Recovery/Chemical Waste Management, Inc.** Acted as project chemist and field services coordinator for activities involved in the excavation and site decontamination of an Act 64/RCRA hazardous waste disposal facility. The decontamination program involved the analysis of soils collected in and around each disposal trench after the removal of approximately 20,000 cubic yards of waste materials.

- **Cincinnati, Ohio. Rumpke Waste Systems, Inc.** Acting project manager for a large waste disposal firm headquartered in Ohio, with 20+ landfills located in a 5 state geographical area. Mr. Kriscunas is responsible for coordination of laboratory activities in conjunction with all ground water, surface water, and NPDES monitoring requirements.

RICK D. WILBURN **Quality Assurance Manager**

EDUCATION

B.A., Environmental Studies, Earlham College, 1985

PROFESSIONAL SUMMARY

Mr. Wilburn is responsible for all aspects of the laboratory Quality Control/Quality Assurance Program. Primary responsibilities include conducting internal and external auditing of the laboratory, procurement and maintenance of state and federal certifications, and ensuring that all facets of the quality control program remain at the highest level possible. Mr. Wilburn also manages the external and internal Quality Control check sample programs.

PROFESSIONAL EXPERIENCE

- **TRACE Analytical Laboratories, Inc. – Quality Assurance Manager, 12/95 – 10/96.** Responsible for designing, implementing, and monitoring a formal quality control program. The program included: conducting internal and hosting external audits, implementing corrective actions resulting from any deficiencies, scheduling and reporting performance evaluation sample results, and the review of all Level 5 data packages.

- **EARTH TECH – Organic Laboratory Manager, 10/95 – 12/95.** As Organic Laboratory Manager, Mr. Wilburn was responsible for the day-to-day operations of the organic laboratory, including volatile and semi-volatile analyses by gas chromatography and gas chromatography/mass spectrometry. His responsibilities included scheduling, instrument maintenance, the writing and implementation of standard operating procedures, quality assurance, analytical data review, the technical development of all the organic laboratory personnel, and project management. Mr. Wilburn was also responsible for research and development in the organic laboratory, focusing on ways to automate and improve sample analysis, data quality, and turnaround time.

- **EARTH TECH (Formerly WW Engineering & Science) – Semi-Volatile Laboratory Supervisor, 1/94 – 10/95.** Responsible for the daily operation of the semi-volatile laboratory. The semi-volatile laboratory utilizes gas chromatography, gas chromatography/mass spectrometry, and high performance liquid chromatography in the analysis of semi-volatile organic compounds.

- **WW Engineering & Science – Supervisor, Organic Extraction Laboratory, 4/93 – 1/94.** Supervisor of the staff of chemists responsible for all organic extractions. Accountable for the processing, quality, and turn around of a wide variety of samples involving many extraction techniques and methodologies. Continually experimenting with automation and new technologies to improve extraction quality and turn around time, including solid phase and supercritical fluid extractions.

- **WW Engineering & Science – Supervisor, Mass Spectrometry Laboratory, 9/89 – 1/94.** Supervisor of the staff of chemists analyzing samples for semi-volatile organics in the mass spectrometry laboratory. Oversee all analysis and daily activities involved with the mass spectrometry laboratory. Evaluate, recommend, and implement new technologies. Implementations of these include sub-ambient injections using a Varian SPI injector, sub-ambient temperature programs for optimized chromatography, and the use of ion trap mass spectrometers for lower operating detection limits

- **IT Corporation, (formerly PEI Associates, Inc.) – Chemist, Level 3, GC/MS Semi-Volatile Team Leader, 7/88 – 9/89.** Along with daily analysis of samples, responsible for coordinating the efforts of the three analysts and three instruments used for semi-volatile analysis. This included scheduling each instrument/analyst to make sure analyses were completed correctly and on time, training new personnel, instrument maintenance, data checking, and reporting project results to management for client distribution. Leader of GC/MS Quality Circle group.

- **PEI Associates, Inc. – Chemist, Level 2, GC/MS Analyst, 12/86 – 7/88.** Primary responsibilities included analyzing soil, water, and other media with an Extrel ELQ-400 mass spectrometer system. Analyses performed included semi-volatile and volatile organics listed on the EPA's Toxic Compounds List according to the Contract Laboratory Program protocol. Also analyzed various other non - Toxic Compounds List compounds using appropriate methods.

- **PEI Associates, Inc. – Chemist, Level 1, GC Analyst, 7/85 – 12/86.** Carried out a variety of organic analyses in a wide range of matrixes. Was a primary analyst conducting CLP testing for pesticides and PCBs, and was the primary analyst for routine and non-routine testing for herbicides, and volatile organics.

STACY K. VANDEN AKKER **Human Resources/Business Manager**

EDUCATION

B.S. Business Management, Davenport Business College, 1996.

PROFESSIONAL SUMMARY

As Business Manager, Ms. Vanden Akker is responsible for the record keeping and review of all financial data for the company. She manages accounts payable, accounts receivable, cash flow, and the generation of financial statements and other management reports. She maintains accurate records for potential audit or other review.

Ms. Vanden Akker also manages all Human Resource functions for TriMatrix Laboratories. She processes payroll on a biweekly basis, coordinates employee benefits, handles internal employee questions and concerns, assures compliance with all federal, state, and local employment laws and regulations, and maintains complete and accurate personnel data files.

PROFESSIONAL EXPERIENCE

- **EARTH TECH – Environmental Laboratory Business Office, Administrative Assistant, 9/95 – 1/97.** Responsible for assisting the Business Office Manager with accounts receivable, accounts payable, and the daily input of purchases and invoices.

- **EARTH TECH – Lowell Wastewater Treatment Plant Operator/Laboratory Technician, 8/93 – Present.** Responsible for sample collection, equipment maintenance, and the daily laboratory analysis of suspended solids, CBOD, ammonia, zinc, fecal coliform, pH, residual chlorine, and phosphates. She is also responsible for the correct input of all results into the reports required by the State of Michigan Department of Environmental Quality.

- **EARTH TECH – Lowell Wastewater Treatment Plant Assistant Laboratory Technician, 8/90 – 8/93.** Assisted the Laboratory Technician in the laboratory analysis of suspended solids, CBOD, ammonia, zinc, fecal coliform, pH, residual chlorine, and phosphates.

3.7 APPROVED SIGNATORIES

Designated laboratory staff members have the responsibility of validating laboratory documents on behalf of the laboratory organization. General categories and documents requiring a valid signature are presented below.

3.7.1 Client/Invoice Reports

All laboratory reports compiled and mailed contain at least one representative signature validating the contents of the laboratory report. By default, a report is signed by the appropriate project chemist. Alternate and/or additional signatures include the Laboratory President, Technical Director, and Quality Assurance Manager. No other individuals are approved to perform signatory approval of client/invoice reports.

3.7.2 Proposals, Price Quotations, and Laboratory Contracts

Proposals or price quotations for laboratory services contain at least one representative signature, validating the pricing, terms, and conditions of the quotation. At least one representative signature is required. Approved signatures for proposals and price quotations include the Laboratory President, project chemists, and a sales or marketing representative.

Required signatures for laboratory contracts are the Laboratory President and a Sales or Marketing representative.

3.7.3 Quality Assurance Project Plans (QAPP)

Quality Assurance Project Plans contain representative signatures of several responsible parties outside the laboratory, and typically the laboratory QA Manager and Project Chemist. The QA Manager and the project chemist have designated QA/QC responsibilities that are fully documented in QAPP documents. All QAPPs are signed prior to submission to a governing body or client.

Signatures on the QAPP ensure all procedures, materials, quality control practices and project reports meet the predefined goals of the plan.

3.7.4 Purchase Orders and Agreements

Because the laboratory spends a significant portion of its annual budget on supplies and equipment, guidelines have been established to document and control purchasing.

Purchasing of general supplies is handled through a contracted vendor within the budgetary guidelines established for each laboratory area.

For major purchases such as equipment, service assessments, or building renovations in excess of $500.00, purchase orders or agreements must be approved by the Laboratory President or CEO.

3.7.5 Binding Statements - Laboratory Certification Documents or Accreditation

Many certification or accreditation programs require the laboratory to provide items and statements regarding details on the laboratory's operations and staff. In some cases these statements must be presented to the certifying body accompanied by a binding signature of the Laboratory President or CEO.

3.8 CAPABILITIES, CERTIFICATIONS, ACCREDITATIONS, AND PROFICIENCY TESTING PROGRAMS

3.8.1 Capabilities

TriMatrix conducts analytical laboratory services in support of all major environmental regulations, including CERCLA, RCRA, CWA, CAA, and TSCA.

The laboratory is capable of routinely analyzing a variety of sample matrices, including drinking water, surface water, wastewater, soil, groundwater, solid waste(s), and sludge(s). In addition, analyses have been performed on fish tissue, biota, and air samples.

TriMatrix routinely performs a wide array of environmental and non-environmental, chemical and physical analyses. A list of methods currently utilized by TriMatrix is provided in Appendix B. To maintain a quality system of analytical protocols, TriMatrix uses written Standard Operating Procedures (SOPs) derived from methodology specified by the United States

Environmental Protection Agency, other federal and state agencies, and professional compendia.

When requested by the client, samples for analyses outside the analytical scope of TriMatrix can be subcontracted to another laboratory. Unless otherwise specified or required by the client, samples will be subcontracted to a TNI accredited or ISO-17025 certified laboratory.

3.8.2 Laboratory Certification - Federal, State, and Independent

TriMatrix has been formally recognized for its commitment to quality. The laboratory maintains certification through various federal agencies, as well as several state regulatory agencies and private entities. As required by most of the programs, including TNI and ANSI-ASQ, certification and accreditation claims must be made in such a manner as to not imply certification or accreditation beyond that given on the laboratory's actual scope of accreditation. Generic certification or accreditation claims must not be made. Accreditations are analyte/analyses specific. Any analyte tested or analysis performed without corresponding NELAC accreditation is flagged as such in the Statement of Data Qualifications section of the report. The use of symbols and other forms of accreditation must always be analyte and/or method specific. Certification programs in which TriMatrix currently participates are available on request.

3.8.3 Proficiency Testing Studies

An integral part of most certification programs are the participation in Proficiency Testing (PT) Studies. PT studies are second party prepared "blind" or "double blind" spiked samples that contain specific (known only to the administrators of the study) concentrations of target analytes. The laboratory analyzes the samples and reports the results to the agency or firm administering the PT study. The results are evaluated and the laboratory's performance graded based on a comparison of the reported values with the known analyte concentrations. A report is prepared and submitted to the laboratory, certifying programs, and agencies or private entities that subscribe to the program.

TriMatrix routinely participates in the following proficiency testing programs:

- Water Supply (WS)
- Water Pollution (WP)
- Soil / Hazardous Waste
- USEPA DMRQA

3.9 LABORATORY FACILITIES, EQUIPMENT, AND SUPPLIES

3.9.1 Physical Plant

3.9.1.1 Laboratory Demographics

The TriMatrix Laboratories facility, located at 5560 Corporate Exchange Court SE, Grand Rapids, Michigan, was constructed in 1999. The 20,000 square foot structure was designed predominantly by the laboratory staff, with careful consideration given to the strict analytical testing requirements of today's environmental marketplace. Special attention was given to the sample preparation areas and the segregation of non-compatible areas such as semi-volatile and volatile organics. Samples are stored according to type, with a large centrally located walk-in cooler used for the storage of all non-volatile, non-hazardous waste samples, to which both the sample receiving personnel and the laboratory staff have ready access. Office areas were incorporated into the building design to provide space for data review, report compilation, and technical review discussions. A breakdown of each general area of analysis and the space allocated is as follows:

Laboratory Area	**Space Allotted, ft^2**
Wet Chemistry/Microbiology	Approx. 2000
Atomic Absorption/Emission	Approx. 2000
Volatile Organics	Approx. 1600
Semi-Volatile Organics	Approx. 2300
Sample Processing & Storage	Approx. 2400

Administrative Offices	Approx. 4200
Organic Pretreatment	Approx. 1300
Miscellaneous Space	Approx. 4200

The attached facility layout (Figure 3-6) shows the general lab areas and other space allocations.

Access to all laboratory areas including sample storage, sample container preparation, sample preparation, sample disposal, documents storage and clients files are secured. Non-authorized personnel may enter these areas only if escorted by a staff member.

Project initiation, sample control, and analysis, are all controlled using a Laboratory Information Management System (LIMS).

Under the direction of the Laboratory President, TriMatrix is organized into the following operating areas and support services.

Laboratory Administration

Client Services
Sales/Marketing
Project Management
Health and Safety
Quality Assurance
Computer Services

Analytical Operations

- Inorganic Laboratory
  - Wet Chemistry Laboratory
  - Metals Laboratory
  - Metals Preparation Laboratory
- Organic Laboratory
  - Volatile Organic Laboratory
  - Semi-Volatile Organic Laboratory

Semi-Volatile Organic Preparation Laboratory

(Refer to Figure 3-2 for a graphical representation of the Laboratory Organization Chart)

3.9.1.2 Reagent Water Systems

Laboratory water originates from the Grand Rapids potable water distribution system. At the laboratory, the water is softened and filtered through activated carbon to remove residual chlorine. The water then enters a reverse osmosis system where approximately 90% of the dissolved constituents are removed. The water is temporarily stored in a 150 gallon holding tank until demand activates a mechanical pump that transfers the water through two mixed bed deionizing canisters. The water now meets the requirements of ASTM Type II. Depending on procedural requirements further treatment is accomplished via distillation or the use of a Milli-Q Advantage A-10 Water Purification System.

Each water system is monitored for specific quality requirements. The water is tested daily for total organic carbon and resistivity, weekly for pH, hardness, total residual chlorine and conductivity, and monthly for heterotrophic plate count.

Responsibility for monitoring the TriMatrix reagent water systems is carried out by the Quality Assurance Department and inorganic laboratory personnel.

3.9.1.3 Ventilation Systems

The laboratory ventilation system was specifically designed to minimize or eliminate airborne contamination. Externally, the air conditioning unit intakes were located taking into consideration prevailing wind patterns, positioning them upwind of the fume hood exhaust stacks. Taking into account wind-shifts, the exhaust stacks were equipped with high velocity fans to disperse potential contaminants well above the building. Internally, the air-handling systems controlling heating, cooling, and humidity, also maintain maximum cfm air turnover. Additionally, the air-handling systems are monitored and controlled via a NOVAR computer controller.

3.9.1.4 Compressed Air

Compressed air must be free of dirt, water, and oil. Compressed air purchased from vendors is high purity grade (breathing air). Compressed air produced in the laboratory uses filters at the compressor to remove water from the delivery lines. For the gas chromatographs and atomic absorption spectrophotometers, additional filters are located on each instrument to remove any residual oil at the point of use.

3.9.1.5 Electrical Services

The electrical system in use at TriMatrix was designed specifically for a laboratory environment. Special attention was paid to instrument requirements, including isolated lines for critical applications like GC, GC/MS, atomic absorption, and automated analyzers.

All laboratory benches, hoods, and work areas were designed with sufficient outlets to accommodate a variety of laboratory applications, such as distillations, digestions, and extractions.

Surge protection devices are in place for all laboratory computing equipment. The laboratory LIMS system is also protected by an Uninterrupted Power Supply (UPS). This UPS allows for a sequenced shutdown of the LIMS system in the event of a power failure.

3.9.2 Equipment, Supplies, and Chemical Procurement; Reception, Storage, and Inventory

For an environmental testing laboratory where trace analyses are routinely performed, certain specifications for laboratory equipment, supplies, and chemicals are critical to quality. A minimum specification for accuracy and precision is required for the purchase of equipment and supplies. The Technical Director, in conjunction with the Laboratory President and laboratory area supervisors, are responsible for determining minimum specifications and approving purchases. Approval is documented on the purchasing department's order sheets (Appendix C). Purchasing is coordinated through the purchasing department. Records are also maintained on all vendors exhibiting poor performance on either their service or product (Appendix D). Relationships will be terminated with any vendor whose records indicate sub-standard performance.

3.9.2.1 Equipment Management/Maintenance/Inventory

Adequacy of equipment for its intended purpose must be verified before use. A sufficient inventory of equipment is available to prevent testing delays resulting from equipment failure. A stock supply of common spare parts is also maintained.

Service is performed on equipment on a scheduled or as needed basis. Maintenance logbooks are kept to document maintenance procedures on major equipment, allowing preventive maintenance frequency and requirements to be determined. Maintenance procedures are discussed in the various analytical SOPs.

A complete listing of Laboratory Equipment is presented in Appendix E of this manual.

3.9.2.2 Glassware

Only glassware providing the required precision is used for a particular analytical procedure. TriMatrix purchases Class A pipets, burettes, and volumetric flasks to meet this specification. A standard operating procedure is utilized for cleaning each type of glassware. Cleaning of glassware is performed according to the analysis being conducted and the sample matrix involved, but certain general rules apply to all glassware washing procedures:

- Use hot water to wash away water-soluble substances.

- Use detergent, dichromate solution, organic solvent, nitric acid, or aqua regia to remove other materials according to the specific glassware cleaning procedures.
- Avoid using detergents on glassware to be used for phosphate determinations.
- Use ammonia-free water for ammonia and kjeldahl nitrogen analyses.
- Do not oven dry volumetric glassware over 90° C.

For all analyses, it is advisable to rinse glassware with tap water followed by deionized water immediately after use, as residue allowed to dry on glassware is more difficult to remove.

3.9.2.3 Reagents, Solvents, and Gases

Reagents, solvents, and gases are available from vendors in a broad range of purity, from technical to ultra pure grades. The analysis, as well as the sensitivity and specificity of the method, must be considered when choosing a grade. Analytical reagent (AR) grade is suitable for most inorganic analyses. Trace organic analyses frequently require ultra pure grades. AR grade is the minimum approved for reagents used in organic analysis. The absence of certain impurities is required for some GC detectors - notably sulfur and phosphorus in an FID detector. Trace metals analyses including atomic emission and atomic absorption spectroscopy usually require spectro-quality reagents, although AR grade may be suitable in some cases. Florisil, silica gel, and alumina used as absorbents in organic extract cleanups must be checked for interfering components and activated according to the analytical method.

Compressed gases are available in various purities, usually expressed as a percent (e.g. 99.999). Gases are filtered in the laboratory delivery lines to remove moisture, oil, and other contaminants. Refer to the analytical method and instrument manufacturers operating manual for gas purity requirements.

Purchasing of reagents, solvents, and gases are carefully controlled through an ordering system that maintains a minimum level of quality in the testing process. Upon receipt Certificates of Analysis are scanned and stored. Each laboratory area will monitor the proper storage and the eventual removal of reagents, solvents, and gases, when their shelf life has expired. All consumable reagents and chemicals must be labeled with the date received to ensure a First-In-First-Out (FIFO) system of use.

Provided they are available, expiration dates of unopened chemicals are based on the date specified by the manufacturer. They may also be derived from the analytical method. The following guidelines are utilized in assigning expiration dates.

Order	Bulk Chemicals[1]	Purchased Stock Solutions[2]	Laboratory Prepared Stock Solutions[1, 3]	Laboratory Prepared Working Solutions[1, 3]
Primary	Manufacturer	Manufacturer	Method	Method
Secondary	5-Years	1-Year	1-Year	6-Months
Tertiary	Method	Method		
Note 1	The expiration date of bulk chemicals and prepared solutions must be re-evaluated when the chemical or solution amount/volume has reached 1/3 of the original amount/volume based on frequency of use and evidence of degradation and/or contamination.			
Note 2	Ampules of purchased stock solutions designed for a single use expire upon opening and may not be stored for more than immediate use.			
Note 3	The expiration date of laboratory prepared solutions may not exceed the expiration date of any chemical, standard, or reagent used in the preparation.			
Note 4	Ethers have an expiration date of 45 days after opening due to the potential for peroxide formation. Peroxide checking is performed after opening.			

3.9.2.4 Certified Standards

The purity and traceability of standards used in the analytical process are crucial to the quality of the data generated. Only high quality standards certified by established vendors are to be utilized. Calibration standards must be of the purity required by the method for a particular analysis. All purchased standards are entered into the LIMS system and labeled with a unique identifier and an expiration date. Stock and working standards are likewise labeled.

All calibration standards are validated against a second source standard. A second source standard is analyzed with every initial calibration. The quantitated value is compared to laboratory established limits. Recovery must fall within these limits for the calibration and calibration standard to be considered acceptable. Stock and working standards are also monitored for visible signs of deterioration (precipitates, color change, volume change).

3.9.2.5 Chemical / Reagent Storage

Bulk chemicals and reagents are stored in a several locations and under a wide variety of conditions within the laboratory. Specific storage conditions for many reagents are presented in each laboratory testing SOP. Additional storage information is referenced in both the TriMatrix Laboratory Safety Manual and the TriMatrix Chemical Hygiene Plan. For general purposes, the following storage conditions are used:

Chemical /Reagent Type	General Storage Requirements	Location/Lab Area
1) Bulk Dry Chemicals	Dry Chemical Storage Cabinets	Inorganic Laboratory
2) Inorganic Acids	Vented Acid Storage Cabinets	Metals Laboratory
3) Organic Solvents-Flammable	Vented Flammable Cabinets	Inorganic & Prep Laboratory
4) Organic Solvents-Nonflammable	Vented Storage Cabinets	Inorganic & Prep Laboratory
5) Compressed Gases	Secured Gas Storage Area	Garage & Outside Storage
6) Bacteriological Materials	Reagent Refrigerator	Inorganic Laboratory
7) Aqueous Standards	Reagent Refrigerators	All Laboratory Areas
8) Organic Standards-Flammable	Explosion Proof Refrigerators and Freezers	Organic Laboratory Areas
9) Organic Standards-Nonflammable	Standards Refrigerator & Freezers	Organic Laboratory Areas
10) Sample Extracts	Extract Freezers	Organic Laboratory Areas
11) Digestates-Metals	Vented Acid Storage Cabinets	Metals Laboratory

3.10 TRAINING

Proper training of laboratory personnel is an essential part of staff development. Training procedures include documentation of training activities completed and serve as a guideline for continual staff development. All testing personnel must familiarize themselves with the laboratory’s training procedure (TriMatrix SOP GR-10-109) and implement all associated policies and procedures.

Personnel files contain the training documentation related to the development of each laboratory employee. Included are in-house training, external training certificates, safety training, ethics training, and other materials specific to the employee. The quality assurance department maintains the training file system.

3.10.1 Training Orientation

The human resources department initiates training orientation for each new employee on the first day of employment. Orientation includes completion of various training checklists (Appendix F). These checklists provide documentation of the orientation after being signed by the new analyst and the trainer and become a part of the employee’s permanent training record.

3.10.2 Code of Ethics/Data Integrity Training

It is the intent of TriMatrix Laboratories, Inc. to consistently report data of the highest quality. For this to be possible, analysts are instructed in accordance with the level of data quality desired and are provided with an environment conducive to its achievement. Besides providing the analyst with all necessary supplies and equipment, the work environment is maintained as free from undue pressures as possible. Such pressures may internal, through peer pressure or deadlines, or external, through customer complaints or priority requests. It is the responsibility of management to insulate the analyst from such pressures as much as possible. Data quality cannot be compromised, and the analyst will not be reprimanded for adhering to established quality protocols in the face of such pressures.

During orientation human resources will explain these policies and the employee will be required to review and sign a Code of Ethics/Data Integrity Policy Agreement (Appendix G). This agreement documents the understanding between management and the new employee concerning management’s position on data quality, sample analysis and data reporting, and the consequences of improper actions. The signed agreement is retained as part of the employee’s permanent record.

3.10.3 Document Storage

All essential laboratory documents are stored on the laboratory's intranet drive designated L:\ Library. During orientation, the new employee is shown how to access these documents and instructed on which ones are required reading. These include the Quality Assurance Manual, Chemical Hygiene Plan, Safety Manual, Employee Handbook, error correction, and standard operating procedures. Forms are signed documenting the employee has read and understood the documents.

3.10.4 Demonstrations of Capability (DoC)

All analysts, and every new instrument used for sample analysis, must complete a successful Initial Demonstration of Capability (IDC) prior to performing any sample analysis. Additionally, all analysts must complete annual Continuing Demonstrations of Capability (CDC). All DoCs are documented, reviewed, and signed in accordance with the TriMatrix SOP for analyst training (GR-10-109). All supporting data necessary to reproduce the DoC is archived and available. Sample analysis may not begin without the successful completion of an appropriate DoC and submission of all associated paperwork to the Quality Assurance Department.

3.10.4.1 Initial Demonstration of Capability (IDC)

After orientation and training, each analyst must successfully complete a one time IDC study (an IDC must again be repeated whenever a significant procedural change occurs). Conduct the IDC study by preparing four replicate blank spikes (for any procedure with a pre-treatment) or four replicate calibration verifications (for any procedure without a pre-treatment) at a concentration less than or equal to the mid-point of the calibration curve or analytical range. For analyses where a spiking standard is not an option, the acceptable analysis of a single blind PT sample will suffice. Alternatively, the analyst may analyze four replicates of a client sample against four replicates of the same sample analyzed by an experienced analyst for statistical comparison.

Process the four spikes, PT sample, or replicates, following every step in the preparative and/or analytical procedure concurrently or over a period of no more than 72 hours. Enter all four results into the Appendix H IDC spreadsheet, or all eight replicates into the Appendix I IDC spreadsheet. The spreadsheet will calculate average percent recovery and relative standard deviation then evaluate against default acceptance criteria (which may need changed to fit the procedure). If all acceptance criteria pass, the analysis of actual samples may begin. If the DoC is performed as part of a new instrument validation, the New Instrument Information form (Appendix J) is also required.

When one or more analytes fail any criterion, the study is unacceptable for the failed analyte. Locate and correct the source of the problem then successfully repeat the study for the failing analyte. If none of the options presented above are possible (such as with the TCLP pre-treatment), the analyst must perform and submit an acceptable method blank with acceptance being that all analytes are at or below the detection limit.

When complete, forward the IDC spreadsheet, the NELAC Demonstration of Capability Certification Statement (Appendix K), the Laboratory Training Checklist (Appendix L), the DL study (when one was necessary - Appendix M), and/or PT results to the Quality Assurance department for review and archival.

3.10.4.2 Continuing Demonstration of Capability (CDC)

Annually a Continuing Demonstration of Capability is required to document continued proficiency in an analysis. The CDC is typically accomplished through the analysis of an acceptable PT sample. Alternatively the IDC can be repeated. The runs used in this IDC can be dedicated spikes, the last four results of a DL study, or four consecutive blank spikes. All analyses must be performed exclusively by the analyst.

When complete, forward a copy of all applicable data necessary to reconstruct and validate the study to the Quality Assurance department for archival.

3.10.5 Continuing Training and Education

TriMatrix Laboratories, Inc. is committed to education and training on a continual basis for employees. There are various ways in which continuing education may occur, including:

- seminars
- cross-training for additional job responsibilities
- retraining
- method and technology updates

3.10.6 SOP Revision Checklist

SOPs are reviewed annually and updated when necessary. When an update is released, the appropriate form from Appendix L or N must be completed to record that the applicable analysts have read, understood and agree to follow the revised SOP.

3.11 DETECTION LIMITS

The process of quantifying an analyte in an environmental matrix using specific analytical procedures must use detection limits as a point of reference. The three levels of analytical detection are described below.

3.11.1 Instrument Detection Limit - IDL

Most analytical instruments produce a signal even during a blank analysis. This signal is referred to as the noise level. The IDL is the analyte concentration required to produce a signal greater than three times the standard deviation of the instrument noise level.

The IDL is performed through analysis of reagent blanks. Seven blanks are run each day over three non-consecutive days. Each measurement should be performed as though it were a separate analytical sample followed by a rinse and/or any other analytical step normally performed between the analyses of separate samples. The IDL is estimated by calculating the average of the standard deviations of the twenty-one runs (if the instrument does not give a signal for the blank, perform the study using standards at the expected IDL concentration).

The IDL only defines an instrument's limitations and does not take into consideration sample processing in preparation for the analysis. As such, it may not be used to estimate the detection limit (Figure 3-7). IDL studies are only performed when specified by the analytical method reference.

3.11.2 Detection Limit - DL

The DL is defined as the minimum concentration of a substance that can be detected and reported with 99 percent confidence (statistically) that the value is above zero. The DL is calculated from matrix specific spiked blanks carried through the entire sample preparation and analytical scheme. All calculated DL values must be verified.

The DL procedure used at TriMatrix Laboratories follows the guidance specified in 40 Code of Federal Regulations, Part 136, Appendix B, as described in TriMatrix SOP GR-10-125, where seven replicate aliquots of laboratory reagent water (for an aqueous methodology) are spiked with every analyte of interest at the estimated Limit of Quantitation (LOQ). For a solid methodology, in lieu of laboratory reagent water an inert substance or empty vessel is spiked.

It is essential that all sample preparative, cleanup, and analytical steps be included in the DL study. Calculate DL study results based on all computations required to achieve the final result in sample-designated units.

To calculate the DL, all seven results are entered into the DL spreadsheet located on the Library drive. The spreadsheet calculates the DL by multiplying the standard deviation by 3.143 which is the one-sided t-distribution for seven samples (with six degrees of freedom) for a 99% confidence interval. There must be no zero percent recoveries in the dataset and the concentration spiked must be between 1 and 5 times the DL value.

When instructed to spike lower by the spreadsheet (as a result of too much of a response), repeat the study at a lower concentration (down to 5 times lower than the lowest requested reporting limit). Repeat the study at a higher concentration if the spreadsheet flags the DL value as “FAIL”. Re-estimate the actual DL based on the failed DL value before repeating the study.

All DL studies must be verified. The DL verification is accomplished by analysis of a method blank and blank spike. Prepare the blank spike at a concentration between 1 – 4 times the calculated DL value. If the blank spike response is greater than or equal to three times that found in the method blank, the DL verification passes and the calculated DL value is acceptable.

Note: The DL procedure is not complete until a DL verification study has also been successfully completed.

If the blank spike response is less than three times that found in the blank, the DL value is too low. Repeat the DL study using the concentration necessary to produce a response equal to or greater than three times the method blank. Only the DL value or DL verification that passes the DL verification criterion may be used as the calculated DL.

Once established, the DL for all analytes in aqueous and solid methodologies requires quarterly verification to maintain DoD accreditation, and annual verification for all others. The DL must be re-established whenever the verification fails or significant modification is made to the procedure.

Appendix M shows an example of the DL spreadsheet used to calculate and verify DL values and LOQs.

3.11.3 Limit of Quantitation - LOQ

The LOQ is defined as the minimum concentration of an analyte that can be quantitatively reported (versus qualitatively detected) within specified precision and accuracy limits under normal laboratory operating conditions. (Figure 3-7).

The minimum LOQ is the concentration spiked in an acceptable DL study. The minimum LOQ should be at least 3 times the DL.

Once established, the LOQ for all analytes in aqueous and solid methodologies requires quarterly verification to maintain DoD accreditation, and annual verification for all others. The LOQ must be re-established whenever the verification fails or significant modification is made to the procedure.

Note: Quantitation limits actually achieved for any given sample analysis will be highly dependent on the matrix and/or required dilutions.

3.12 PROCEDURES FOR ACCEPTING NEW WORK/TESTS

3.12.1 New Test Requests, Development, and Approval

Client Services must submit a request for new analyses to each impacted laboratory area where the request will be formally processed. Evaluation of the request will include the suitability of the analyte for quantitation, availability of existing test methods, instrumentation, capacity, standard materials, etc. The Technical Director and/or Group Leader will provide a prompt response to client services to ensure client needs can be addressed.

All newly developed procedures are reviewed by the laboratory Technical Director and must comply with all requirements outlined in section 3.10.4.

Figure 3-1

Quality Control Chain of Command Flow Chart

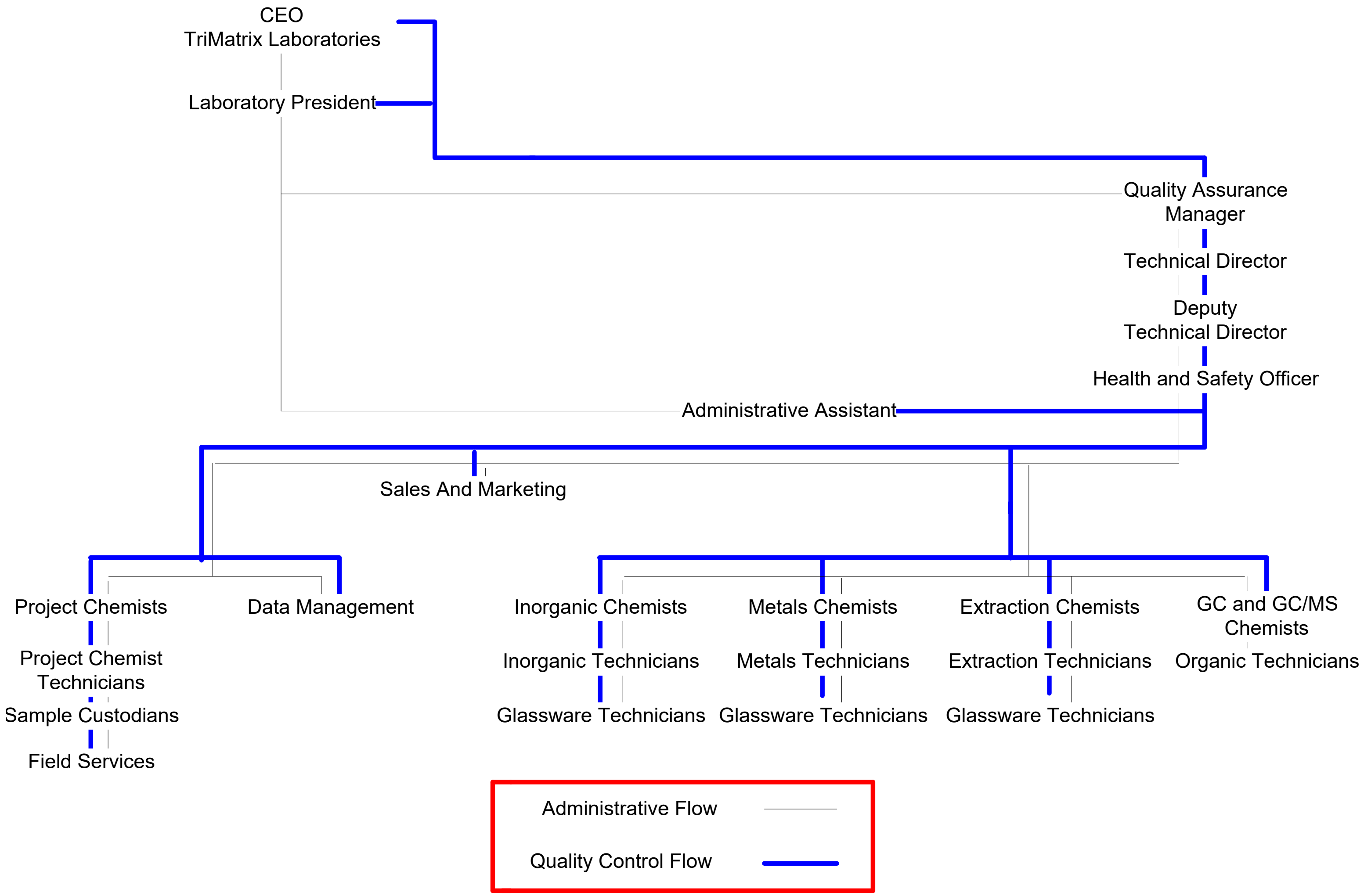
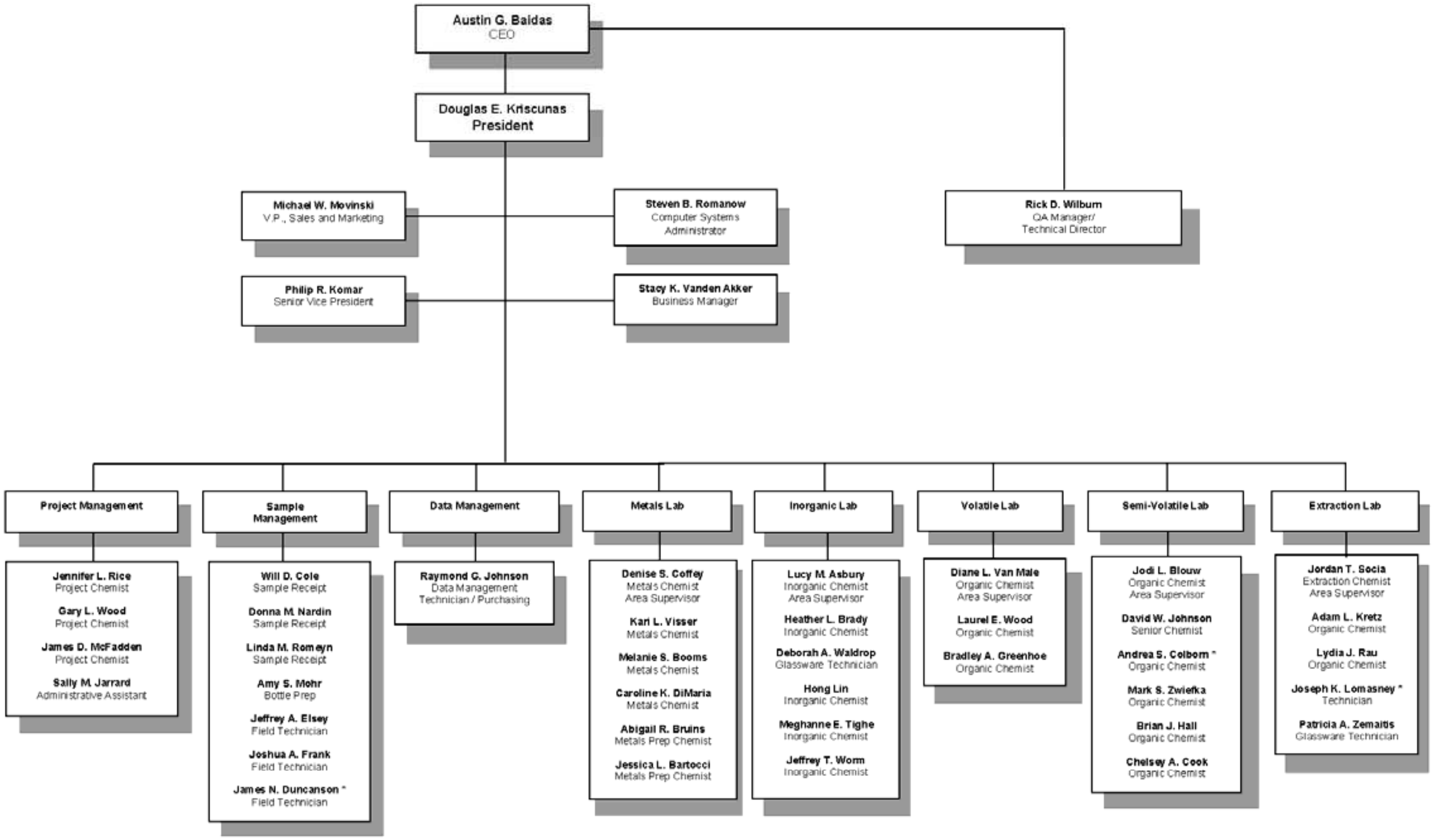


Figure 3-2

Organizational Chart

TRIMATRIX LABORATORIES



*Denotes part time employee

Figure 3-3
RELATIONSHIPS
Management to Technical Services

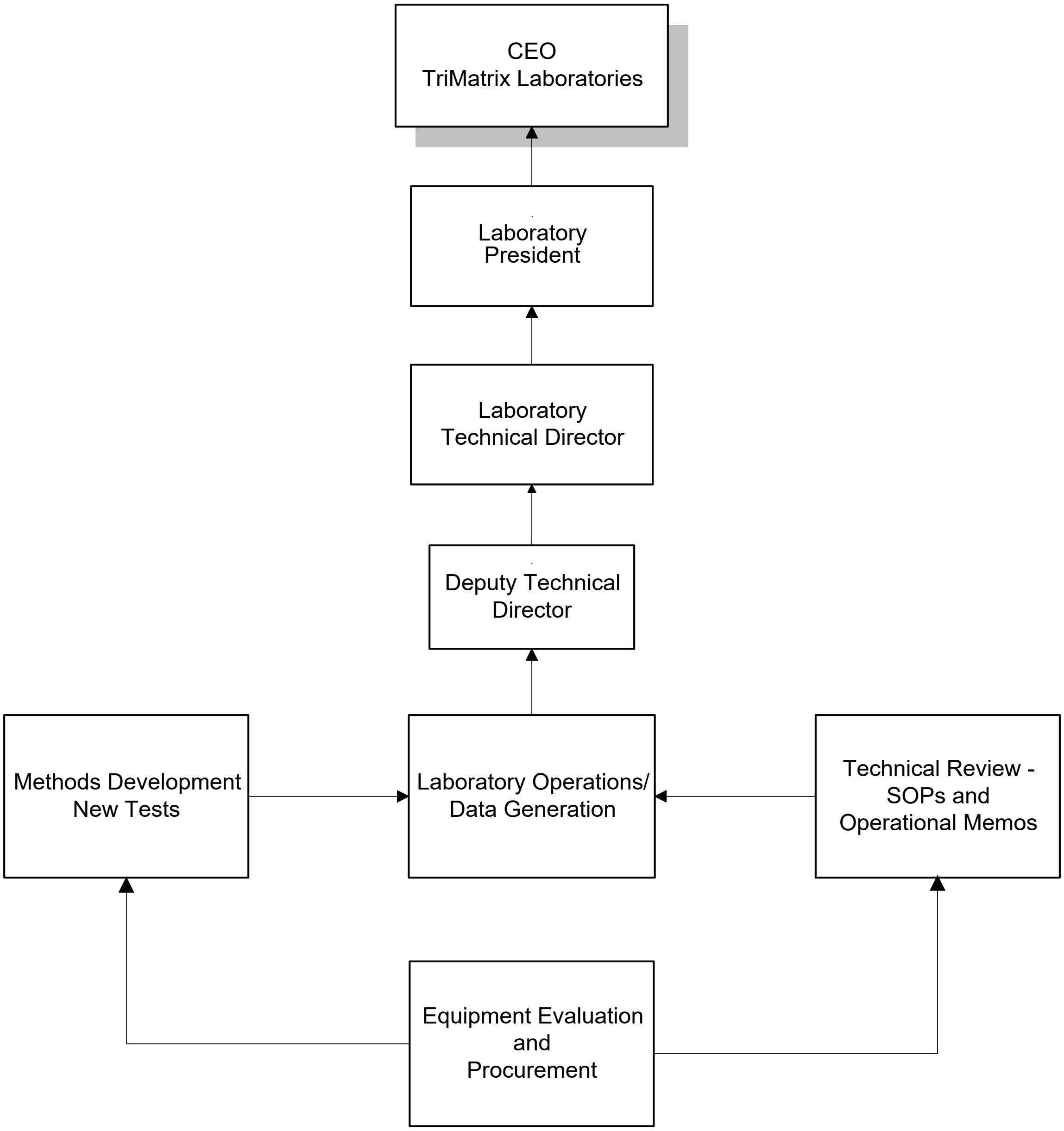


Figure 3-4

RELATIONSHIPS

Management to Support Services

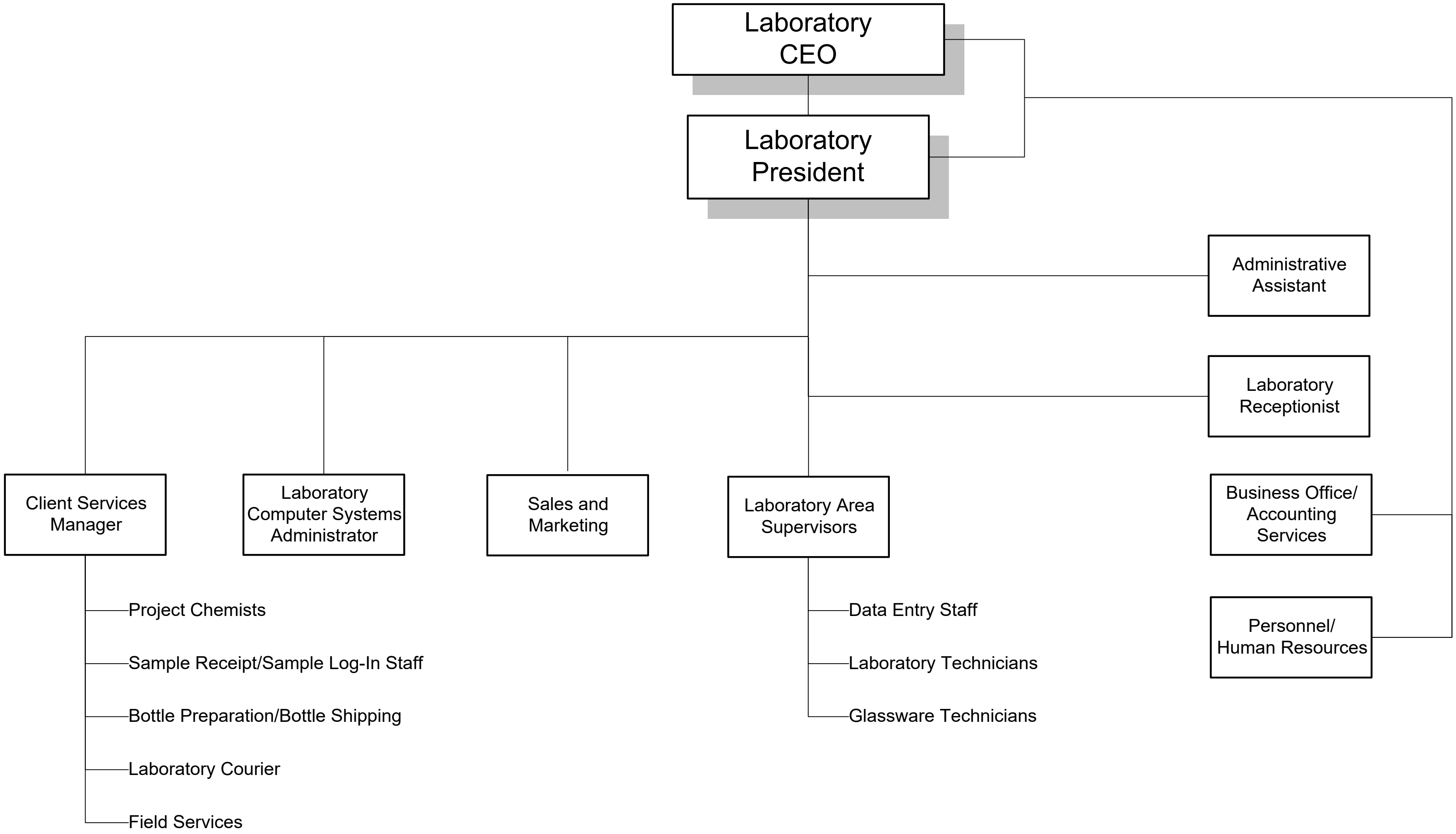


Figure 3-5

RELATIONSHIPS

Management to Quality System

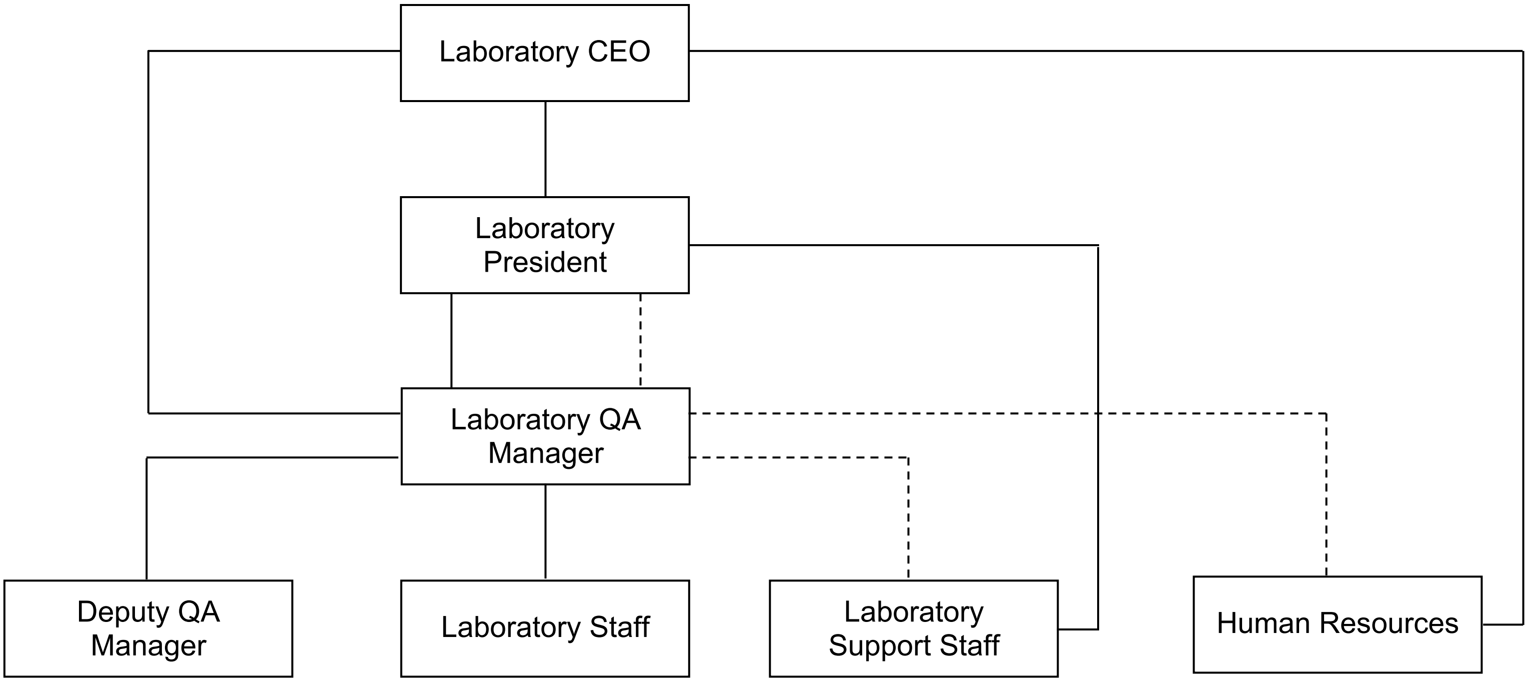


Figure 3-6

Laboratory Layout/Diagram

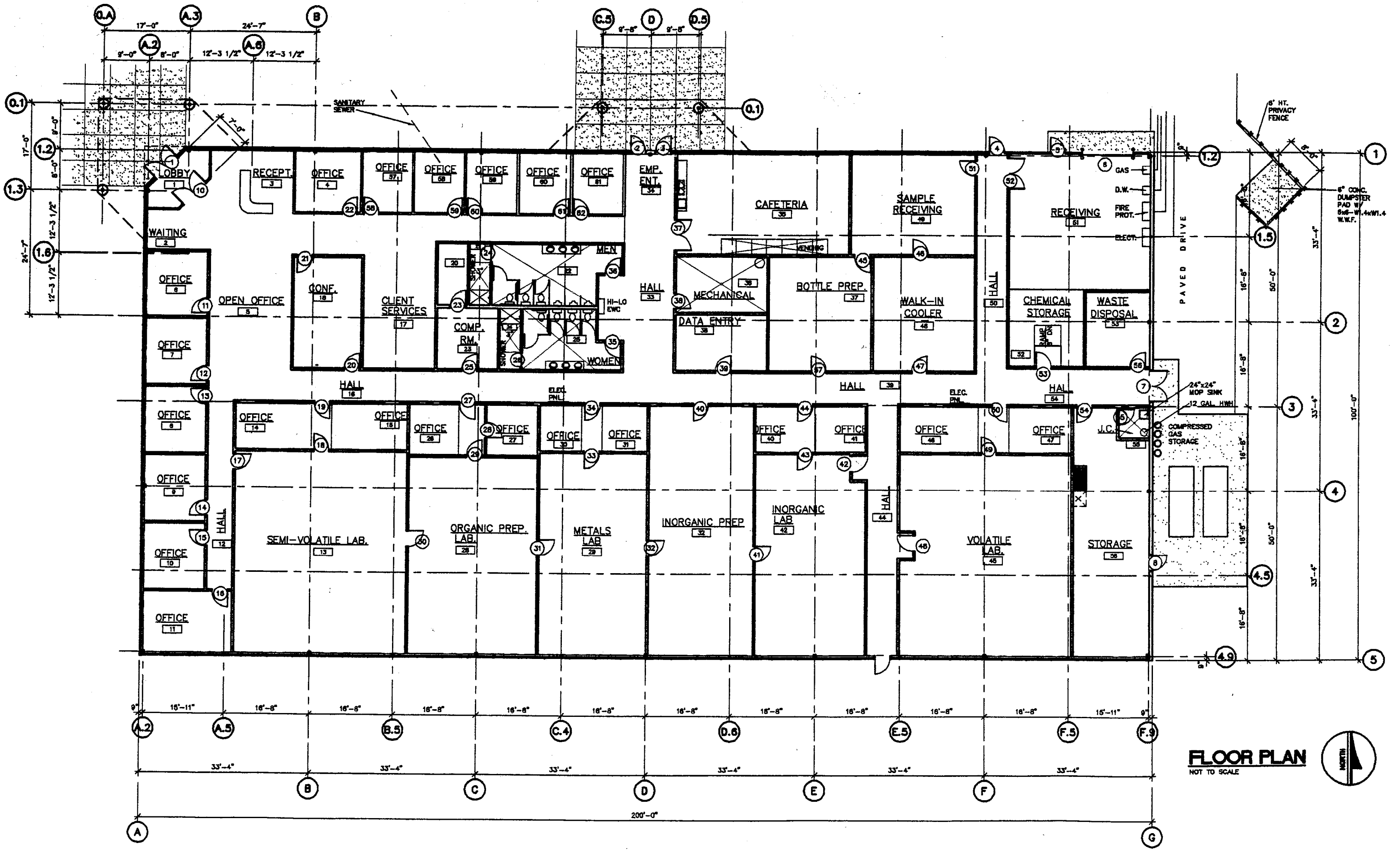
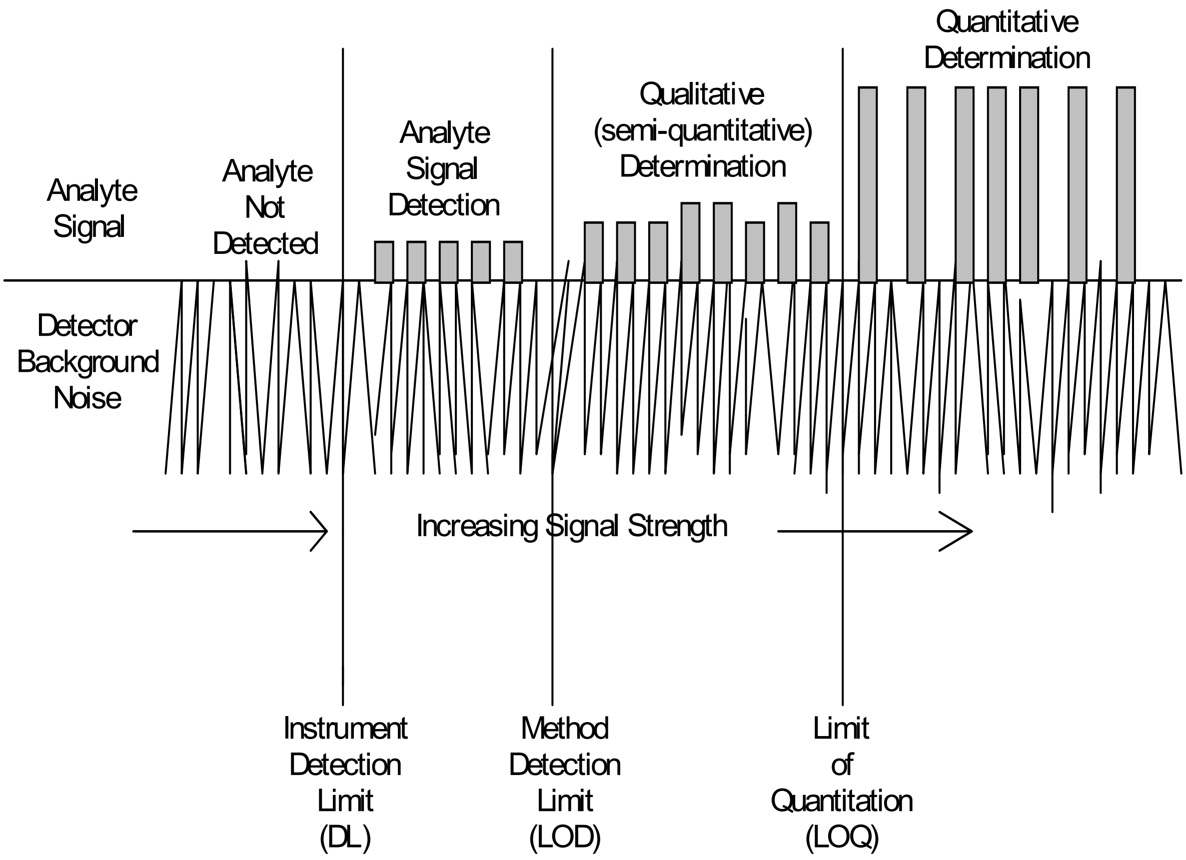


Figure 3-7

Regions of Analyte Signal



4.0 QUALITY CONTROL

4.1 CONTROL AND MAINTENANCE OF LABORATORY DOCUMENTS AND RECORDS

4.1.1 Procedures for the Control and Maintenance of Documentation and Records

Documents utilized and records kept as part of the quality system are subject to strict control regarding their creation, approval, distribution and access, use, revision, and archival. This applies to documents generated both internally and those received from outside sources. Obsolete documents that are retained in circulation for legal or knowledge preservation purposes are marked as “obsolete”. The structure of documentation used in the TriMatrix quality system is presented in Figure 4-1.

4.1.1.1 Internal Documentation

Examples of controlled documents include Standard Operating Procedures, the Quality Assurance Manual, blank forms and logbooks. All documents must be reviewed and approved by one or more senior staff prior to their use. All logbooks will also be reviewed quarterly, and upon completion. All documents will print with both the file name and revision number. Where possible, the document will contain the TriMatrix logo. All logbooks must be bound and paginated.

Document revisions may be made by any qualified, laboratory employee. Minor document revisions, such as those required in a Standard Operating Procedure, may be made by hand. All hand amendments must be legible, dated and initialed, and recorded in ink. All hand amendments must be approved by, and distributed through, the Quality Assurance Department. Hand amendments will be incorporated into the next revision of the document. Extensive revisions require a formal document update. Some documents, such as the QAM and SOPs, require annual reviews.

4.1.1.2 External Documentation

Examples of external documentation include regulations, analytical methods, QAPPs, and client required standards. These documents are maintained by the quality assurance department. When possible, the documents are stored electronically on the Library drive. Instrument manuals are controlled by the individual laboratory areas.

4.1.1.3 Laboratory Records

Scanned copies of all completed laboratory records, such as logbooks, forms, internal and external audits, and PT results, are also stored on the Library drive. Once scanned the resulting file is available to all staff.

All completed logbooks are issued document control numbers, inventoried, scanned and archived in accordance with section 4.1.1.4.

4.1.1.4 Document Storage and Traceability

Archiving information at TriMatrix has been designed to meet both short-term and long-term storage needs. Archives are maintained for a wide variety of data and documentation. These archives can be categorized into two main groups, a) document archives (physical documents) and b) electronic archives (data files). Table 1 illustrates the current TriMatrix archival systems, their location, and duration.

All approved documents are stored on the laboratory intranet read only drive designated as “Library.” Document control is maintained through use of the laboratory computer network. By maintaining only the current version of an approved document on the Library drive, document control and security are maintained. This procedure provides immediate access to the latest revision of all documents.

Documentation records or logs are maintained for all archival systems to aid in the quick retrieval of information. Extended archival periods or special procedures are also in place for some projects and clients.

The Library drive is a “read only” drive to the laboratory staff. Because it isn’t possible for documents to be edited and resaved to the Library drive, an Access Log is not required.

4.1.2 Traceability of Measurements/Documentation Requirements

A properly designed and implemented documentation protocol will assure that all information presented in an analytical report can be traced back to its point of origin. The documentation protocol must also provide traceability for all non-reported supporting information. These items include but are not limited to: stock standard records, test calibration records, data reduction and validation activities, sample custody, facilities monitoring, and final data reporting.

4.1.3 Paperwork/Information Flow

As displayed in Figure 4-2, document flow remains constant regardless of the quality control requirements of the sample. The records trace can provide for the following:

- Answers to questions of analytical integrity
- Assistance in finding and solving random and systematic problems
- Assistance in preventing long term degradation of the analytical process
- Assistance in ensuring continuity of analytical effort despite personnel and mechanical changes

The following subsections identify and describe the procedures followed, and the corresponding documents generated, from project initiation through completion.

4.1.3.1 Worklists/Benchsheets

The worklists and benchsheets produced by the LIMS system are designed to provide the analyst with essential project information.

This information not only includes client/project specifications, but also provides an avenue for communication of test specifications and parameter expiration dates and times. This up-front information enables the analyst to make informed decisions in their analytical scheme, and helps minimize problems after samples are analyzed.

Examples of laboratory area work orders are presented in Appendix V.

4.1.3.2 Management Reports

Several reports are provided within the TriMatrix laboratory system to help monitor operational conditions of the laboratory. These reports include workload reports, on-time reports, and aging logs.

The flow of information from these various reports is geared to a variety of personnel within the management structure of the laboratory, and to specific persons outside the laboratory. Examples of management reports are presented in Appendix W.

4.1.3.3 Quality Assurance Reports

Quality assurance reports play a vital role in the management of the quality system. Quality systems must be closely scrutinized in order to monitor, maintain, adjust, and add, procedures or systems to meet existing and new QA objectives of the laboratory.

Several quality assurance reports are created in this effort. These reports serve different functions and are designed to inform the ultimate user. In the case of a client/invoice report the quality assurance data is presented to facilitate the objectives of the project requirements from data assessment through full 3rd party data validation.

Quality control reports are also used extensively within TriMatrix to assess the analytical process. All QC reports are created through the LIMS system. Examples of efforts available for this monitoring process are presented in Appendix X.

4.1.3.4 Project Files

The project file is the comprehensive record of every analytical project completed at TriMatrix. Physical project files are stored in secure filing cabinets. Electronic project files are stored in the Project folder on the secure laboratory network. Items typically retained in a project file include:

- Initial project report/analysis plan/proposal
- All correspondence or documents mailed or received with the samples
- Written record of client phone conversations
- All sample receiving/log-in forms
- Chain-of-custody forms
- Laboratory worksheets
- Invoice copy

To save paper and file space, electronic, rather than paper, copies of final reports are typically retained in the physical project file. Reports can be regenerated on demand.

By default, project files are stored on-site for 1 year, followed by off-site storage at a secured limited access facility for an additional 6 years. Length of storage requirements are determined on a client/project specific basis. If the ownership of the laboratory changes, record storage will become the responsibility of the new owner, who will take into consideration client instructions on records disposition. In the event the laboratory was to go out of business, each client will be contacted for instructions on record disposition. Client records will be transferred or destroyed as instructed. Access to archived information is documented with an access log (Appendix Y)

4.1.3.5 Quality Control Records

A) Instrument Logbooks

Two different instrument logbooks are maintained, an Instrument Run-Log and an Instrument Maintenance Log. Each log plays an important role in the documentation of daily instrument activities.

The Instrument Run Logbook is used to document all analytical determinations of a designated instrument. These determinations include not only sample analyses, but also recordings of all calibration and calibration runs, quality control analyses, and where applicable, instrument tuning activities.

The Instrument Run Logbook provides a chronology of each day’s analyses. This chronology plays an important role in the data validation process. When possible, electronic instrument software generated run logs are utilized over a bound paper logbook.

The Instrument Maintenance Log is used to document instrument maintenance procedures, repairs, or modifications. All activities are documented by recording what was done, by whom, and why.

B) Controlled Temperature Units (CTU)

Temperatures for all ovens and incubators used for sample processing, and all cold sample and standard storage devices, are monitored and recorded on a daily basis through the use of a certified thermometer. Additionally, each CTU used for sample storage, and incubators used for BOD and bacteriological incubation have their weekend temperature monitored via electronic data loggers. The calibration of liquid and digital thermometers is verified annually.

All temperature readings and thermometer calibrations are recorded in a CTU Logbook (Appendix Z). This logbook contains a page for each unit with detailed information on unit identification, serial number, laboratory location, and designated operating temperature.

C) Balance Monitoring

Each analytical and top loading balance used at TriMatrix is monitored for accuracy. All daily checks are recorded in the TriMatrix Balance Log (Appendix AA).

D) Standard and Reagent Preparation Records

When possible, all standards and calibration solutions used at TriMatrix are prepared from reagents or solutions traceable to national standards. Whether a stock, an intermediate, or a working concentration, each reagent and standard solution is traceable to its origin. This is accomplished within the laboratory's LIMS system (Appendix AB).

Information available on each standard includes:

- The analyte or analytes contained in the standard
- The concentration
- The solvent used to prepare the standard
- The preservative (i.e., nitric acid)
- The date of preparation
- Initials of the preparer
- The expiration date
- The unique identification number

E) Pipet Logs

All autopipetors utilized for the delivery of standard solutions, diluents, and reagents, are periodically checked for delivery accuracy. Because these pipetors contain mechanical parts they are subject to inaccuracies if not properly maintained and calibrated.

Daily calibrations (for pipets used to prepare standards), and weekly calibrations (for pipets used to prepare quality control samples) are recorded in the Pipet Calibration Logbook (Appendix AC).

4.1.4 Confidentiality and Proprietary Rights

Since significant amounts of information regarding the details of a client's operations are received in the laboratory it is essential that strict confidentiality be maintained in the handling of all client information. Client data is protected in locked filing cabinets and in limited access computer files. Under no circumstances is the name of a client, or any information regarding that client, revealed to another client or to a regulatory agency without the client's written permission, under penalty of employment termination.

Any details of a client's operations that have necessarily been revealed to the laboratory for testing purposes are considered as proprietary and protected by patents, copyrights, infringement laws, or other legal constraints against disclosure.

4.1.5 Standard Operating Procedures (SOPs)

Many of the methods published today by various agencies provide only general guidance in performing an analytical determination. A significant part of the variability observed in analytical data is in large part due to minor variations in the analytical process. A Standard Operating Procedure is a guide that clearly defines the exact steps to be followed while performing a procedure. The delineation of these exact steps in an SOP will improve the analytical conditions, which in turn will help the overall reproduction of analytical data.

4.1.5.1 SOP Categories

SOPs are written for nearly all laboratory activities. The categories utilized in the organization of SOPs are presented in Table 2.

4.1.5.2 SOP Development, Formatting, and Approval

All TriMatrix SOPs are formatted and written to specific guidelines. These guidelines are outlined in one of three SOPs specific to the activity the SOP is instructing on – analytical, pre-analytical, or a non-analytical. The guidelines were developed from both USEPA and TNI protocols for the creation of standard operating procedures.

All SOPs are assigned a unique procedure identifier. Other information included in every SOP is the effective date, revision number, information on the author, total number of pages, and identification of any individual page revisions. New SOPs will be assigned a revision number of 0.0.

New SOPs, must be reviewed and approved by the appropriate area manager, the quality assurance department, and the laboratory president, all of whom must designate their approval by signing the SOP cover page (Appendix AD).

4.1.5.3 SOP Control and Review

Signed copies of approved SOPs are scanned and stored on the Library drive. The SOPs are accessible to all TriMatrix personnel. Access to the electronic copy of the text file is controlled by the Quality Assurance Department.

SOPs are reviewed on an annual basis. If the SOP does not require a modification the cover sheet is signed and dated by the reviewer. The signed cover page will be scanned and inserted in the existing file on the library drive, replacing the previous cover sheet.

If modifications are required, the laboratory area will be provided with an electronic copy of the controlled text file by placing it in the “In Process” folder located in the laboratory area’s network folder. After editing, the file will be removed and returned to controlled access. Depending on the extent of the modifications, training may or may not be required. Minor modifications typically will not require re-training. In the case of minor modifications, the revision number of the SOP will increase by 0.1.

Minor SOP modifications required during the course of the year can be made by hand editing the SOP. These modifications must be made through the Quality Assurance Department. All minor modifications will be incorporated into the next revision of the SOP.

Major modifications will require re-training and formal documentation of the training. When major modifications are performed on the SOP the revision number will increase to the next whole number. In both cases a signed copy of the new revision of the SOP will replace the old version on the Library drive.

All original, signed cover sheets are retained in files controlled by the Quality Assurance Department.

4.1.6 LIMS

TriMatrix utilizes the Element LIMS system developed by Promium Corporation. This system controls all aspects of laboratory operations. The main functions of the LIMS system are:

- Project Management
- Sample Management
- Work Scheduling and Management
- Data Entry, Verification, and Approval
- Report Generation
- Invoicing

4.2 SAMPLE CONTROL, FLOW, AND STORAGE

Presented in the following section is a description of the policies and procedures that were developed to identify, monitor, and document the flow of samples through the laboratory. A flow chart depicting this process is presented in Figure 4-3.

4.2.1 Project Initiation

The process starts with the award of a contract or proposal, a client request, or a pre-scheduled sampling event. The basic steps and supporting documentation involved in the project initiation process begins with the gathering of project information, communications with all affected laboratory areas, and the input of required project related data into the LIMS system. All requests for analytical work are reviewed by the project chemist, and when necessary, applicable management staff. Items reviewed include methodology/instrument capabilities, detection limit capabilities, turnaround capabilities, and conformation with any required analyte, method, and matrix accreditations. Any potential conflicts or deficiencies, including the lack of any required accreditation, will be communicated with the client.

TriMatrix uses test methods that meet the needs of the client and are appropriate for the tests undertaken. Methods published in international, regional, or national standards are used. TriMatrix uses the latest valid edition of a method unless it is not appropriate or possible to do so. Laboratory developed methods (or methods adopted by the laboratory) are also used when appropriate for the intended use, and have been validated following the various initial demonstration of capability procedures. When specified by the client, TriMatrix will inform the client if the requested method is considered inappropriate, or out of date. All analytical procedures are documented in SOPs supplemented with additional details to ensure consistent application.

Any differences between the request or tender and the contract shall be resolved before work commences. Each contract shall be acceptable both to the laboratory and the client. A contract may be any written or oral agreement to provide a client with environmental testing services; however, records of reviews, including any significant changes, will be maintained by the project chemist. Records will also be maintained of pertinent client discussions.

Requests for changes to in-progress projects must be made with the appropriate project chemist. The same contract review process will be repeated and any changes communicated to all affected personnel and laboratory areas. Any changes in a relevant accreditation status will be communicated to the client. All approved changes will be formally made via the LIMS system, thus continuing the normal paperwork flow.

Loss of any project required accreditation must be immediately communicated with the client.

4.2.1.1 Sample Subcontracting

Occasionally, a portion of a project may involve an analytical methodology not currently possible at TriMatrix. When requested by the client, samples for analyses outside the analytical scope of TriMatrix can be subcontracted to another laboratory. It is preferred that the client specify the subcontract laboratory. When the subcontract lab is not specified by the client, TriMatrix will only subcontract to laboratories that are NELAP accredited, or ISO-17025 certified, for the specific method of interest. Client specific program requirements will take precedence over this rule. For example, Department of Defense work must only be subcontracted (with prior client project specific approval), to a DoD accredited laboratory. All subcontract laboratories specified by TriMatrix will be evaluated prior to use through the use of a qualification form (Appendix AE). An annual resubmission of the form is required. When specified by TriMatrix, TriMatrix will be responsible for the subcontractor’s work.

A registry of subcontract laboratories used by TriMatrix will be maintained, documenting their NELAP accreditation or ISO-17025 certification. A separate registry will be maintained to document DoD accredited laboratories.

4.2.2 Sample Containers and Materials Procurement

The development of a project within the laboratory also involves the preparation and shipment of sample collection materials and containers. TriMatrix utilizes only virgin bottle ware for all sample collection kits. All containers are purchased pre-cleaned and come with a Certificate of Analyses.

Specific projects or programs may require the laboratory to verify the cleanliness of the containers. When this is required specific lots will be sequestered from the container vendor. Each lot will be tested to verify the containers meet the project or program requirements. Only containers whose cleanliness has been verified will be used for the project.

4.2.2.1 Preparation of Containers

All sample containers utilized for the collection and preservation of environmental samples are prepared by the bottle prep group. The staff members of this group focus their activities exclusively in the area of sample container procurement, preparation, and shipping. Project sample container kits are requested using the Container Packing List, presented in Appendix O.

4.2.2.2 Sample Container Shipment

When all containers have been assembled as requested, the bottles are packaged and placed into one or more shipping coolers. 40 mL glass vials are packed in small bubble wrap bags. When possible, containers are grouped together by sample point to help minimize time spent in the field. When possible this is accomplished by packing bottles together by sample point. When complete, each shipping container will be inspected by a project chemist to verify its accuracy. Documentation of this inspection is made on the bottle packing list. A copy of the bottle packing list is placed in each cooler.

Also provided in each cooler is a set of instructions or comments about the containers, material safety data sheets for the chemical preservatives present, a return address label, an external COC form, and if required, TriMatrix sample bottle custody seals. All materials are packaged in a waterproof zip-lock bag. Examples of these additional materials are presented in Appendix AF.

Packing is now added to the cooler and the shipping container is sealed. When requested, signed TriMatrix custody seals can also be applied to the outgoing cooler.

4.2.3 Sample Receipt

All samples or sample groups entering the analytical process must be accompanied by the appropriate documentation. This documentation is necessary to define the analytical goals and project objectives. Information concerning analytes, reporting limits, and reporting formats must be provided.

Samples received at TriMatrix are required to be accompanied by a TriMatrix Laboratory Chain-of-Custody (COC) form (Appendix AG). For samples received without this form, the log-in technician will initiate the COC process. Should a submittal or delivery group be identified as an internal COC project, the log-in technician will initiate the procedures outlined in section 4.2.8 B.

The receipt of all sample shipping coolers (empty or full) will be documented in the Sample Receipt Record logbook (Appendix P). This logbook documents the delivery method, date and time received, number of coolers received, client, and the name of the TriMatrix employee who received the cooler. This information is entered into the logbook immediately after drop-off.

4.2.4 Sample Examination

As soon as possible after the shipping cooler is received and all available information entered into the Sample Receipt Record, cooler inspection and sample temperature determination occurs. Observations on the receipt of each sample delivery group, including sample temperatures, are documented on the “Sample Receiving/Log-in Checklist” (Appendix Q). This form was designed in a step-by-step format to walk the log-in technician through all the steps required when receiving and logging-in samples. A supplemental “Sample Receiving/Log-in Checklist Additional Cooler Information” form is available when receiving projects consisting of more than four coolers (Appendix R).

IMPORTANT: When initiating any form, make sure the Receipt Log Page/Line number from the Sample Receipt Record logbook is recorded at the top of each Checklist. This ties the receipt of the sample coolers in with the samples themselves.

Record the cooler number of the first cooler and the current time. Observe and record the type of coolant used. Provided sufficient containers are received, measure and record the temperature of three random samples from locations representative of the coolant present in the cooler. If a temperature blank was received, measure and record this temperature as well.

Temperatures are recorded using a calibrated infrared thermometer. Because this type of thermometer is actually measuring the temperature of the container, it is critical that the temperature is taken as the sample is removed from the cooler. The container warms up quickly and any other method will result in an incorrect reading. Do not dry the container prior to measuring the temperature. Containers wet from melt water are preferred to dry containers. Record the temperature values on the Checklist. Report all temperatures to the nearest 0.1° C. If a correction factor is necessary, record the correction factor and the corrected temperature on the Checklist. Average the three sample results and also report the average. If any temperature exceeds 6° C it must be noted on the Checklist and documented in a non-conformance report.

NOTE: Samples hand delivered to the laboratory on the same day they were collected whose temperature exceeds 6° C will be considered acceptable if the samples are received well packed in ice. A non-conformance report will not be necessary, however, documentation must be provided to validate the delivery method, the collection date and time, and that the samples were received well packed on ice.

The remainder of page 1 of the Checklist is now filled in. Observations are made on the accuracy of the COC and the condition of the sample containers. Many of the aqueous samples received have been subjected to some form of chemical preservation. Verification of the preservation is required; however, depending on the analysis this verification may not occur during the log-in process. The “Sample Preservation Verification Form” (Appendix S) specifies what container types will have their preservation checked during log-in. Container types that are not checked include aldehydes, bacteriologicals, oil and grease, semi-volatile and diesel range organics, total organic carbon, total petroleum hydrocarbons, and volatile organics. The form also specifies what container types can have an incorrect preservation adjusted. Preservation verification is performed using calibrated pH strips. Determine the correct reading against the color chart on the pH strip container. Document the pH found on the Sample Preservation Verification Form. Use only the pH strips located in the log-in area whose calibration has been verified and recorded in the pH Strip Calibration Logbook (Appendix AH).

Should a) the result of any preservation check indicate that the sample has not been properly preserved in the field (or the buffering capacity of the sample has resulted in an unacceptable sample pH at receipt) or b) there is insufficient evidence indicating that other needed preservation reagents (e.g., Zinc Acetate for Sulfides) have been added, then a Sample Receiving Non-Conformance Report (Appendix T) must be initiated and the project chemist contacted as soon as possible. In some instances, the holding time of such samples may be shortened. No preservation adjustment may be made without approval from a project chemist.

IMPORTANT: Shaded boxes on the Checklist indicate an out-of-control situation. The selection of any shaded box during the completion of this form also requires the initiation of the Sample Receiving Non-Conformance Report.

Collect all paperwork and deliver to the appropriate project chemist for review. Any issues that require contact with the client for resolution will be made in a timely manner by the project chemist. The project chemist will create a project and schedule in the LIMS system and return the paperwork to sample receiving.

4.2.5 Sample Log-In

Once the project chemist returns the paperwork, page 2 of the Log-In Checklist will be completed and the samples will be logged into the LIMS system. All samples received by TriMatrix are logged into the LIMS system. The log-in procedure assigns a unique TriMatrix sample number to each sample container, allowing samples to be tracked, data stored, and quality control associated for any sequence of events during a particular analytical period.

During log-in, a series of computer entry functions are performed in an effort to document and validate the log-in process. The remainder of the Checklist is also used to record the completion of the various steps that must be followed when logging samples into the LIMS system. Once complete, container labels are produced and a Work Order generated for the project chemist (Appendix U).

The log-in technician will create a folder for each work order received. This folder is labeled with the LIMS generated work order and will contain all documents associated with the log-in process. These documents will include: all external chain-of-custody forms, sample preservation records, shipping records, any client correspondence, and a copy of the actual log for each submittal. Upon completion of the analytical process the file becomes part of the project's permanent record.

4.2.6 Sample Splitting

In the event that TriMatrix is unable to provide sample bottles, or circumstances prevent the splitting of samples in the field, the log-in technician can provide sample splitting services; however, sample splitting will typically be performed by a laboratory area chemist. These services include taking the sample as received and sub-sampling it into the appropriate bottle with the preservative requirements as set forward in Appendix AI – Sample Collection Guidelines Bottle and Preservative Requirements. Sample splitting will only be performed with client approval.

A) Sample Splitting-Water Samples

Laboratory area managers will be consulted in order to insure that sufficient volume will be available to all areas of the lab after splitting. In the event that sufficient volume does not exist, the Project Chemist will be immediately notified for resolution.

When a bulk sample arrives for both organic and inorganic analysis, and sufficient sample exists, the organic aliquots will be removed first. The remainder of the sample will be transferred to properly preserved containers for each inorganic analyses.

B) Sample Splitting-Solid Samples

When solid samples, such as sediment or soil, are to be received at TriMatrix, every attempt will be made by the Project Chemist and field sampling personnel to insure that two samples are provided as replicates for the appropriate tests. One of these samples will be assigned to the organic area and the other to the inorganic area. If only one sample is received and organic analyses are required, the organic aliquots will be removed first. Prior to sub-sampling, solid samples will be made homogeneous by either one or all of the following manners:

- Stirring
- Grinding
- Particle separation (sieving)

The laboratory area manager is responsible for deciding how a solid sample will be split. Problems or concerns that may arise on splitting a solid sample will be addressed by the Project Chemist and Laboratory Area Manager. After the organic portions have been removed or split, the remaining sample will be provided to the inorganic facilities.

4.2.7 Sample Distribution

All samples received at TriMatrix are labeled by the log-in technician. These labels include both the necessary information for proper identification, and information on any potential for flammability, reactivity, contact, or health based risks.

After completing the log-in process the log-in technician will store the samples in the correct Controlled Temperature Unit (CTU).

- Routine Water and Solid Samples: Samples that require refrigeration will be stored in the CTU designated for all routine water and soil samples.

- Routine Volatile Water and Solid Samples: All volatile samples are stored in designated VOA CTUs. Volatile water and soil samples are segregated and stored separately. No other sample types are stored in the VOA CTUs.

All CTUs used for VOA sample storage will also contain a storage blank. The storage blank is a preserved 40 mL VOA vial filled with deionized/distilled water. The storage blank is replaced and analyzed on a weekly basis. The storage blank is analyzed for an extensive list of volatile analytes using mass spectrometry. A TIC scan is also performed. A separate storage blank is also analyzed for alcohols when applicable Department of Defense samples have been received. If positive results are observed for any target analyte above the laboratory's minimum reporting limit, all samples stored concurrently in the CTU must be evaluated for possible contamination. All sample results within 5 times the level quantitated in the storage blank must be qualified as estimated.

- Odoriferous and Hazardous Samples: Stored separately in a special vented facility. If volatile analyses are to be performed, samples are stored under refrigeration. Samples are identified to the laboratory by means of a narrative within the LIMS System.

4.2.8 Chain-of-Custody (COC)

All samples received by the laboratory require some form of chain-of-custody (COC). TriMatrix practices two levels of COC, external and internal. The degree of custody tracking and documentation is driven by the final deposition of the laboratory data. Generally, if samples and their analytical results are subject to involvement as physical evidence or in a legal procedure, both external and internal custody procedures will be followed. If samples or results are not subject to legal procedures, only external COC procedures will be followed.

A) External COC

Samples requiring external COC will have their custody tracked from sample collection to delivery at the laboratory. This process involves the completion of a TriMatrix external COC form, as presented in Appendix AG. This form accompanies the sample containers prepared by TriMatrix to the sample collection site. Any sample or submittal received at the laboratory without a TriMatrix external COC form will initiate a process where the log-in technician will complete the necessary external COC forms for carrier sign-off.

For document control purposes, all external COC forms have a unique identification number.

B) Internal COC

Samples requiring strict COC will initiate the process by which all events or periods of sample handling will require a traceable document protocol.

The internal COC process involves the completion of a TriMatrix internal COC form for all phases of the analytical process. This includes sample extractions, distillations, digestions, analyses, and disposal. An example of the TriMatrix internal COC form is presented in Appendix AJ.

C) Sample Security

All samples, regardless of the COC protocol, are maintained in a limited access secured area. This level of security is applied to all phases of the analytical process from sample log-in to final sample disposal.

D) Sample Disposal

All samples received are subject to disposal as waste. Discarded samples fall into three general categories:

1. Returned to the client (if highly contaminated).
2. Too contaminated for municipal disposal and must be disposed of as waste through a hazardous waste facility.
3. Inert, uncontaminated, and nontoxic samples are disposed in accordance with municipal waste regulations.

4.2.9 General Laboratory Security

Access to the laboratory is handled in a secure fashion, with access restricted to authorized personnel only. In addition to the laboratory areas, sample storage, sample container preparation, sample preparation, sample disposal, analytical documents, and data files, are restricted access areas. Non-authorized personnel may enter these areas only when escorted by a laboratory staff member.

It is the responsibility of all laboratory staff members to insure that the rules of restricted access are followed and maintained at all times.

4.3 CALIBRATION AND CALIBRATION VERIFICATION

Calibration of the instruments and equipment is performed prior to each use or on a scheduled periodic basis. Calibration of laboratory instruments and equipment is performed to verify that the analysis portion of the testing process is functioning properly and at the required sensitivity. A calibration section included in each analytical SOP covers the frequency, stability, and specific calibration steps, based on analytical method requirements and instrument or equipment manufacturer's recommendations.

Initial calibration is performed using standards of certified value to establish the linear range of the analysis for the analytes of interest. Each calibration curve is verified using a Second Source Calibration Verification Standard (SCV) prepared from a source dissimilar to that used in the preparation of the calibration standards. The calibration is also verified at the beginning and during the analytical sequence, using a standard prepared from the same source as that used in the initial calibration.

4.3.1 Field Equipment Calibration

Perform daily calibration checks on field equipment prior to the commencement of any field analyses. Follow the written calibration procedure for each individual piece of field equipment. The equipment is held out of service until repairs and successful recalibration occurs. A summary table of all calibration procedures and frequencies is included (Table 3).

4.3.2 Laboratory Instrumentation Calibration

Calibration of laboratory instruments is based on approved SOPs. A summary table of method calibration procedures and frequencies is included (Table 4); however, program requirements may differ. Any instrument that does not pass daily quality requirements must be removed from service until repairs or successful recalibration occurs. Instruments removed from service must be flagged as such (Appendix AK).

4.3.2.1 Inorganic/Classical Chemistries

The inorganic laboratory utilizes a wide variety of wet-chemical procedures and instruments. Calibration steps vary depending on the specific analytical method being utilized. However, certain general principles of calibration apply to all inorganics testing. Every analytical method requires calibration or calibration verification prior to sample analysis. Using a group of certified standards, the linear range is defined. The calibration is checked on a continuing basis to be certain that the method is within the required test parameters. All inorganic calibrations must meet the specific requirements described below unless required otherwise by the method or manufacturer.

The instrumentation is calibrated using standards prepared by dilution of stock solutions. One standard is prepared at the reporting limit of the analyte of interest while the other standards bracket the concentration range. The high or the low standard may be omitted from the calibration curve; however, the minimum number of calibration standards required by the method must be maintained. Additionally, the minimum reporting limit must be elevated, or the linear range reduced, if the corresponding standard is eliminated from the calibration curve.

An SCV originating from a stock solution dissimilar to that used for preparation of the calibration standards is prepared and analyzed. Continuing Calibration Verification blanks and standards (same source as that used in the initial calibration curve) are run at the beginning, and periodically, throughout the analytical sequence, typically after every 10 analyses. The value of the continuing calibration standard concentration must agree within the method specified criteria; generally ±15 percent of the initial value or appropriate corrective action is taken. Corrective action may include recalibrating the instrument and must include reanalyzing the previous 10 samples.

4.3.2.2 ICP-ICP/MS Emission Systems

The inductively coupled plasma emission spectrophotometer (ICP), and inductively coupled plasma mass spectrometer (ICP/MS) instruments are calibrated by the use of a minimum of three calibration standards (6 for ICP/MS) prepared by dilution of certified stock solutions. One standard is prepared at the reporting limit of the analyte of interest while the other standards bracket the concentration range. The high or the low standard may be omitted from the calibration curve; however, the minimum number of calibration standards required by the method must be maintained. Additionally, the minimum reporting limit must be elevated, or the linear range reduced, if the corresponding standard is eliminated from the calibration curve. Calibration standards contain acids at the same concentration as the digestates. A continuing calibration standard is analyzed after every 10 samples. The value of the continuing calibration standard concentration must agree within method specified criteria, generally ±10 percent of the initial value or appropriate corrective action is taken. Corrective action may include recalibrating the instrument and must include reanalyzing the previous ten samples.

4.3.2.3 Gas/Liquid Chromatography

Analysis performed by gas chromatography follows USEPA protocols. The instrument is calibrated using three or five point calibration curves (depending on method requirements) for both volatile and semi-volatile compounds. One standard is prepared at the reporting limit of the analyte of interest while the other standards bracket the concentration range. The high or the low standard may be omitted from the calibration curve; however, the minimum number of calibration standards required by the method must be maintained. Additionally, the minimum reporting limit must be elevated, or the linear range reduced, if the corresponding standard is eliminated from the calibration curve. Continuing calibrations are performed after every ten samples. The value of the continuing calibration standard must agree within ±15 or 20 percent (depending on method requirements) of the initial value or the appropriate corrective action is taken, which may include recalibrating the instrument and must include reanalyzing the previous ten samples.

4.3.2.4 Gas Chromatography/Mass Spectrometry (GC/MS)

Prior to calibration, the instruments used for GC/MS analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenylphosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria for these reference compounds are met, the instrument is initially calibrated using a three or five point calibration curve (depending on method requirements). One standard is prepared at the reporting limit of the analyte of interest while the other standards bracket the concentration range. The high or the low standard may be omitted from the calibration curve; however, the minimum number of calibration standards required by the method must still be maintained. Additionally, the minimum reporting limit must be elevated, or the linear range reduced, if the corresponding standard is eliminated from the calibration curve. The instrument tune will be verified each 12 or 24 hours of operation (depending on method requirements). Continuing calibration is verified as specified in the method. The calibration standards are commercially available certified standards containing the target analytes, surrogate spikes, and internal standards.

4.3.3 Laboratory Equipment Calibration

Personnel performing calibration should also be alert for any condition that renders a piece of equipment inoperable or unfit for use; for example, inspect thermometers to ensure that mercury or alcohol columns are not separated. If an equipment malfunction is noted the equipment must be removed from service until repairs or successful recalibration occurs. Instruments removed from service must be flagged as such (Appendix AK). Record all malfunctions, repairs, and re-calibrations in the appropriate logbook.

Maintain records for each piece of equipment requiring calibration, showing equipment description and identification number, calibration frequency and acceptable tolerances, personnel performance calibration, date, reference material used, calibration results including acceptance or failure, removal from service, repairs, and date and authorization for return to service.

4.3.3.1 Balances

An annual third party maintenance and calibration is performed on all balances. Daily calibration is performed by TriMatrix on all balances using class S or higher NIST traceable weights. Re-certification or replacement of the weights is required every five years.

4.3.3.2 Thermometers

Thermometer calibration is performed annually, using NIST certified thermometers. The NIST thermometer must be re-certified or purchased new every five years. Written records are maintained of all annual calibrations.

4.4 DATA REDUCTION, VALIDATION, AND REPORTING

Data reduction is the process by which raw analytical data is tabulated and calculated. Data validation is the review of the data generation and reduction process. Data reporting is the compilation of all sample results for distribution to the client. All analytical data generated by TriMatrix Laboratories is subjected to the reduction, validation, and reporting process as described below.

4.4.1 Laboratory Data

4.4.1.1 Data Reduction

Initial results for most analyses are calculated using a computer directly interfaced to the instument. Data reduction is accomplished using software that has been validated for its intended purpose. The initial result is exported to the LIMS system. Data such as initial volume, final volume, and percent solids, are used by the LIMS system to calculate a final result. When manual data reduction is required it is performed according to the written standard operating procedure for that analysis.

4.4.1.2 Manual Integrations

Manual integration is defined as any post acquisition adjustment to the automated software peak integration. Manual integrations are often times legitimately required to correct for baseline drift, noisy baselines, poorly resolved peaks, closely eluting or missed peaks, peak tailing, or peak splitting. Manual integration may never be used for the sole purpose of correcting failing quality control parameters (i.e. shaving or enhancing peak areas or heights to make failed calibrations, surrogates, or internal standards pass), or as a substitute for poor or ineffective sample cleanup. Manual integration must be used cautiously due to the increased scrutiny inherent with adjusted data. Particular attention will be paid to manual integrations performed on standards and blanks since these samples are typically free of interferences.

Before and after documentation must be provided with all manual integrations. This documentation must clearly show the original integration “before”, and the manual integration “after” baseline. Clear identification of manual integrations must be included in the case narrative for all samples analyzed under Federal Facilities work requirements. All quantitation reports must clearly identify manual integrations by flagging the peak with a designator that cannot be removed by the analyst. Additional documentation requirements include:

- Date of the manual integration
- Reason for the manual integration
- The integration area or height before manual integration
- The integration area or height after manual integration

- Initials/date by both the analyst and the reviewer.

All manual integrations must be narrated. Two LIMS qualifiers have been written. Qualifier number DoD21 is used for reports that include copies of the raw data. It reads “Manual integration was performed on this sample for the analyte(s) listed below in accordance with the TriMatrix Manual Integration SOP. All necessary documentation, including the signed review, is included in the raw data section of the data package."

Qualifier number GN042 was written for reports that do not include copies of the raw data and reads, “Manual integration was required on the analytes listed below. All manual integrations were performed and reviewed in accordance with TriMatrix laboratory policy.”

The qualifiers must be used on all manual integrations. In addition to providing a narration, use of the qualifier also summarizes and identifies in the report all samples and analytes for which manual integration was necessary.

Any questions concerning manual integration must be resolved with the area manager or the quality assurance officer before final results are approved and released to the Project Chemist. The complete laboratory manual integration requirements are detailed in the TriMatrix manual integration SOP GR-10-115.

4.4.1.3 Data Validation

Data validation begins with the analyst. It is the basic responsibility of the analyst to produce data that is complete, correct, and conforms to all applicable methods and standard operating procedures. If results are not acceptable, it is the duty of the analyst to perform the appropriate corrective action and to thoroughly document that action. The analyst will verify the following before updating the analysis status to “Analyzed”:

- Applicable standard operating procedures were followed
- Proper analytical sequence was followed
- Sample preparation information was correct
- Calibration has been performed properly
- Analytical results are complete
- Holding times have been met
- Method criteria were met
- Any special sample preparation or analytical requirements have been achieved
- All analytical abnormalities have been noted
- Corrective actions are thoroughly described
- Good record keeping practices have been followed
- Any problems are communicated to area manager
- Data was correctly transferred to Element
- Calculations were performed properly
- Quality control samples are within established limits
- Documentation is complete
- Raw data, including chromatograms and instrument printouts are complete
- Case narrative or qualifier pages are complete

Second Level Review

A laboratory area peer or designated validator, in essence, performs the same validation steps performed by the analyst. Particular attention should be paid to:

- Dilution factors were entered correctly and detection limits elevated accordingly
- Analysis dates are correct
- Quality control and analytical batch information is correct
- Quality control results and spike amounts are correct and in control
- Project specific limits are correct

- Run a draft copy of the report, specific to the laboratory area, to verify all results have been adjusted correctly
- Any required qualifiers or narratives have been entered

Any problems must be resolved with the analyst, and when appropriate the quality assurance manager, prior to updating the status to “Reviewed.”

Third Level Review

Once all analyses associated with a work order have been entered into the LIMS system and approved, the project chemist will perform the Third Level Review. This review will verify that:

- The requirements of the client have been met
- All required narratives and qualifiers have been included
- All quality control parameters required are in the report
- Results of complimentary tests make sense
- The data is accurately presented
- Holding times have been met
- Calibration checks are sufficient
- Documentation is complete

Once this review is complete the project chemist will approve the data and generate a final report. It is during this time that any data package deliverables are collected and reviewed. When printed the work order status updates to “Reported.”

Fourth Level Review

The project chemist will perform a final review of the data package hard copy to ensure that:

- All required data package components are complete and accounted for
- Quantitative results are correct

- The overall presentation of data to the client is in an understandable format

In addition to the formal data validation guidelines listed above for the analyst, area manager, and project chemist, there are many practical questions that all of these persons need to keep in mind when reviewing data and finished client reports. Among these "common-sense" evaluations of laboratory data are the following important considerations:

- Data makes good, sound, practical sense
- Multiple runs of the same samples relate, match, or are within acceptable range
- Data from complimentary analyses compares, i.e. COD>BOD>CBOD
- Total cyanide ≥ amenable and free cyanide
- Total solids ≥ suspended and dissolved solids
- TKN ≥ organic N + ammonia N
- Inorganic N = ammonia N + nitrate N + nitrite N
- TOC < BOD or COD
- Total phosphorus ≥ ortho phosphorus
- Calculated total dissolved solids/conductivity = 0.55 – 0.7
- Analytical run looks good; proper decisions were made
- Peaks from chromatogram or instrument printout look normal
- Computer identifications are correct
- Are qualitative/quantitative results real, especially low level
- Know and be sensitive to common laboratory contaminants
- Know area/analytical method pitfalls-be extra cautious
- All practices are sound and are supported by documentation-no appearance of random decisions

When complete the report will be signed. Data packages with deliverables will be scanned and archived. Work order status will be updated to "Completed".

4.4.2 Field Data

All data reduction, validation, and reporting for field activities must meet the same requirements as those required in the laboratory. Many of the field instruments, such as those measuring pH, dissolved oxygen, turbidity, temperature, and specific conductance, require a manual data printout from a computer interface. The analyst is responsible for immediate tabulation and calculation of raw data in the field. The field section manager must perform a prompt, on-site validation of field data before the opportunity is lost to perform any necessary field re-tests.

4.4.3 Subcontracted Data

Analytical results from subcontracted samples will be reported as an attachment to the TriMatrix data package. The attachment will contain the entire subcontracted data package as received by TriMatrix. To eliminate the impression that the subcontracted analyses were performed by TriMatrix, subcontracted results will always be appended to, never incorporated within, the TriMatrix LIMS generated report.

4.5 VERIFICATION PRACTICES - EXTERNAL/INTERNAL QUALITY CONTROL

4.5.1 Standard Reference Materials

A crucial step in the generation of quality data is the purity and traceability of reference materials used in the analyses. Reference materials may be physical standards (such as certified thermometers and weights used to calibrate laboratory thermometers and balances) or chemical standards (used to establish and check operational calibration of analytical methods). Physical standards should be traceable to the National Institute of Standards and Technology (NIST). Physical standards must be recalibrated (by an external vendor certified to perform the calibration), or purchased new every five years. Chemical reference materials of high quality can usually be obtained from reliable commercial vendors. For a given analysis, standard reference materials must be kept on hand from more than one vendor source. During the testing operation, standard reference materials from different vendor sources are crosschecked with each other.

4.5.2 Internal Quality Control Programs

TriMatrix routinely adds samples to the sample stream to demonstrate the total testing process is operating within prescribed limits for accuracy and precision. With the exception of blanks, the concentration of these quality control samples is known prior to analysis. Types of Quality Control Samples are presented in Table 5. Duplicates and spiked duplicates are selected at random, and when not specified are rotated among clients.

4.5.3 External Quality Control Samples-Proficiency Testing

TriMatrix Laboratories receive Performance Testing (PT) samples on a scheduled basis from state and federal regulatory agencies as well as certain client organizations. A summary of these PT samples is given below:

PT Program	Sample Type	Source	Frequency
WS	Drinking Water	Phenova	Semi-Annual
WP	Waste/Ground Water	Phenova	Semi-Annual
HW	Soil / Hazardous Waste	Phenova	Semi-Annual
Varies	Environmental	State/Federal Programs	Varies
Varies	Environmental	Client	Varies

TriMatrix receives written reports from sponsoring agencies grading performance and providing a comparison to other laboratories participating in the study. This provides feedback to laboratory personnel regarding the satisfactory use of analytical methods and equipment. Additionally, results from all single and double blind PT samples are used as part of the laboratory's fraud prevention and detection program.

NOTE: PT samples must be handled (i.e., managed, analyzed, and reported) in the same manner as real environmental samples.

NOTE: Non-conformances associated with failing PT samples are required by certain state, federal, and other applicable regulatory agencies.

They must be distributed to those agencies within the time frame they have established.

4.6 DATA ASSESSMENT PROCEDURES

4.6.1 Precision

Precision of laboratory analyses will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analyses, and laboratory duplicates or MSDs for inorganic analyses. The relative percent difference (RPD) will be calculated for each pair of duplicate analyses using the following equation:

$$\%RPD = \left(\frac{S - D}{\frac{S + D}{2}} \right) \times 100$$

where:

S = first sample value (original of MS value)
D = second sample value (duplicate or MSD value)

4.6.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of various types of blanks, matrix spike/matrix spike duplicates, and blank spikes. The percent recovery (%R) of matrix spikes will be calculated using the equation below:

$$\%R = \left(\frac{A - B}{C} \right) \times 100$$

where:

A = the analyte concentration determined experimentally from the spiked sample
B = the background level determined by a separate analysis of the un-spiked sample
C = the amount of the spike added

4.6.3 Control Limits

Unless specified by the client or the analytical method, all quality control acceptance limits in use at TriMatrix are derived from historical data, for each method, matrix, and QC type combination. Precision and accuracy control limits are calculated at a 99% confidence level (+/- three standard deviations); warning limits are calculated at a 95% confidence level, (+/- two standard deviations). Accuracy windows are calculated using the mean of the percent recoveries. Precision windows are calculated using the relative percent difference of the amounts found, not the percent recoveries.

4.6.4 Uncertainty

In addition to the precision and accuracy of a result, a value relating to confidence is available in the form of a measurement uncertainty estimate. The measurement uncertainty value is estimated using the QC-based nested approach and is calculated at the 95% confidence level. Uncertainty estimates are reported as "percent relative uncertainty."

4.6.5 Completeness

Completeness will be assessed for compliance with the amount of data required for decision making. Completeness is calculated as follows:

$$\text{Completeness} = \left(\frac{\text{valid data obtained}}{\text{total data planned}} \right) \times 100$$

4.7 PROCEDURES FOR CORRECTIVE ACTION

When a non-conforming event or process deviation has occurred, corrective action is required. A written standard operating procedure provides the steps for dealing with an out-of-control testing situation. The assessment of whether the process is out-of-control is based on predetermined limits for laboratory operations. Non-conformances based on statistical analysis or quality control samples are readily apparent and easy to identify. A process deviation, which does not have a directly observable impact on data quality, is more difficult to discern. Examples of the latter, subtler types of non-conformances include volatile samples not properly stored; oily layers in certain types of samples that may interfere with analysis; or a water-soaked sample label whose information is barely legible. Discovery of a non-conforming event or process deviation can result from the observations of a staff member, a review of laboratory data at any level, the result of an audit, or a client complaint. A corrective action investigation will be initiated within one week of the discovery of any non-conformance. The time frame required to resolve a specific deficiency and implement the corrective action is dependant on the magnitude of the problem and the defensibility and use of the data. Most non-conformances should be resolved within 60 days from the initiation date. Non-conformances that specifically impact sample results should be resolved within 14 days.

NOTE: The client must be contacted within 48 hours (2 business days) upon the discovery of any event that may cast doubt on the validity of a sample result.

NOTE: Where the results of a non-conformance investigation casts doubt on the laboratory's compliance with its own policies and procedures or a specific Standard, an internal audit of appropriate areas of activity are required as soon as possible. Based on the results of the non-conformance and/or the related audit, the Quality Assurance Manager has the authority to stop work.

The overall scheme of a corrective action plan can be outlined as follows:

1. Define the problem and evaluate the significance of the non-conformance;
2. Assign responsibility for evaluating the problem and determine if the client should be notified and/or work recalled;
3. Determine thorough investigation of all the pertinent facts what the probable cause of the problem is;
4. Select and implement the action(s) most likely to eliminate the problem and prevent recurrence;
5. Assign responsibility for carrying out the corrective steps and implement the action;
6. Follow-up to ensure that the problem has been eliminated and when necessary authorize the resumption of work.

Specific responsibility for implementing corrective action is as follows:

It is the responsibility of the analyst or other employee who observes a non-conforming event to:

- Identify and define the problem.

- Report the problem promptly to the area manager.
- Fill out a Non-Conformance Investigation Report (refer to Appendix AL).
- When applicable, investigate and attempt to determine the cause of the problem.
- When applicable, accept responsibility for implementing the corrective action approved by the area manager.
- When applicable, evaluate the effectiveness of the corrective action.
- When applicable, verify that the corrective action has eliminated the problem.

It is the responsibility of the laboratory area manager to:

- Review the problem and the proposed corrective action.
- If the reporting person does not have a remedy, work together with the person to determine a satisfactory solution.
- Assign the final corrective action steps to be performed.

It is the responsibility of the QA Department to:

- Follow-up to ensure that the problem has been eliminated and when necessary authorize the resumption of work.
- Review, sign, and categorize every Non-Conformance Investigation Report.
- Randomly review corrective action documentation in laboratory through internal audits to ensure that adequate records are being kept.

The ultimate goal of every non-conformance investigation is to resolve the error through identification of the error’s root cause. Ideally, once the source of error is found, change can be implemented to prevent reoccurrence of the same error thereby providing a system of continuous quality improvement.

Non-conformances can originate from anyone in the laboratory. Provide the QA department with a copy of the initial report at the time of its distribution, followed by a copy of the completed report. The final report will be distributed to all necessary personnel. Initiation of non-conformance reports associated with out-of-control PT samples will commence with the QA department.

NOTE: Non-conformances associated with PT samples must be completed and distributed to state, federal, and other applicable regulatory agencies within the time frame established by that agency.

Returned non-conformance reports will be typed and the final report may include copies of raw data, information concerning traceability, graphs charting historical data, graphs charting trends in analysis, calibration graphs, or any other information relevant to the investigation.

When investigating a failing PT sample, a questionable analytical result, or a client complaint, the following systematic approach for error analysis should be followed until the primary source of error is located and resolved. Progress through them in the order they are presented below (easy to determine transcription error through difficult to determine analytical/procedural failure).

1. Consolidate all necessary raw information, run data and associated calibration and quality control data for both the reported and any non-reported analyses of that sample.
2. Confirm that the intended result was the reported result (transcription error).
3. Verify that the sample was prepped correctly.
4. Verify the correct analytical and pre-treatment method was used.
5. Double check all manual calculations, looking for incorrectly calculated results, missing dilution factor, wrong initial and final volumes, etc. Where possible manually calculate the result and compare with the reported result.
6. Compare the age of the calibration to the PT analysis date.
7. Review data associated with all quality control samples for biases. Also evaluate all QC solutions with respect to age, source, storage, and handling.
8. Determine the reasonableness of the data. Verify that all QC parameters were in control. Compare results to established limits to the data quality objectives of the study (i.e. tighter QC required for WS studies).
9. Review standard laboratory techniques used on the sample and all associated QC analyses. Were measurements used in quantitation made volumetrically? Were pipets and volumetric flasks used, or were less stringent techniques employed? Were serial dilutions made during the preparation of the curve?

10. Review analytical conditions, integration, background corrections, analyte resolution, and any confirmation runs.
11. Review calibration ranges. Are they too large for the analysis? An over extended calibration range will appear S-shaped. Check the population of curve points in the area of the analyte concentration.
12. Review calibration type (linear, average, response factor, polynomial non-linear, etc.). Reprocess multi-level curve data through a best fit program and if linear, perform a residuals analysis to identify outlier calibration points. If the result was quantitated using an average response factor, compare with the best-fit information and confirm justification for use of the average response factor quantitation.

In general, there are four major areas where corrective action is required. These categories are described below.

4.7.1 Quality Control Failures

These are usually handled within the laboratory by the analyst.

Indications of Non-Conformance

- Blanks, laboratory control, or spiked samples contain contamination greater than acceptable levels.
- Suspicious trends in spike recoveries or relative percent differences (RPD) between duplicates.
- Initial instrument blank, initial calibration standards, QC check standards, continuing calibration standard spikes, or method blanks are outside acceptance criteria.
- The method blank or instrument blank analysis exceeds the detection limit for the analyte.

Recommended Corrective Action

- Prepare another instrument blank. If the response is still greater than the reporting limit, look for sources of contamination in reagents, the laboratory working environment, and the instrument.
- Reanalyze standard. If results are still unacceptable, prepare new standards. If necessary obtain new primary standards.

- Reanalyze continuing calibration standard. If necessary, recalibrate and reanalyze samples since last successful continuing calibration.
- Evaluate preparation of spikes, spiking techniques, spiking equipment and materials.

4.7.2 Procedural Failures

These are usually handled by the laboratory area manager and the quality assurance department.

Indications of Non-Conformance

- There are unusual changes in detection limits.
- Statistical quality control data is demonstrating unacceptable trends or is outside the warning or acceptance limits.
- Deficiencies are evidenced on performance evaluation samples or internal or external audits.
- Clients express concern about the quality of their data.

Recommended Corrective Action

- Review the method with the analyst.
- Reanalyze the samples and evaluate the results.
- Recalibrate the instrument or analysis method with freshly prepared standards and reanalyze the samples.
- Re-extract and reanalyze the samples per the method.
- Evaluate the data and sample behavior and investigate any possible chemical interferences.
- Re-run the samples using the method of standard additions.
- Check the instrument for possible maintenance deficiencies.
- Seek additional help from other analysts or provide additional training for personnel involved.
- Perform a system audit to evaluate corrective action measures.

4.7.3 Test Specification Failures

These are usually handled by the analyst, laboratory area manager, and the quality assurance department.

Indications of Non-Conformance

- Quality control check standard data is outside the acceptance limits defined for that analyte.

Recommended Corrective Action

- Review the method with the analyst.
- Reanalyze the check standard and evaluate the results.
- Prepare fresh check standard or new primary standard.
- Recalibrate the instrument or analysis method.
- Switch to a different standard vendor.
- Investigate possible chemical interferences.
- Check the instrument for possible maintenance deficiencies.
- Retrain the analyst.

4.7.4 Customer Complaints

The Quality Assurance Department coordinates with the client services staff to receive quality feedback from clients. It is the responsibility of the QA department to communicate any customer complaints to the laboratory operating areas and to follow-up on corrective action taken to prevent a recurrence.

4.8 PROCEDURES FOR PREVENTIVE ACTION

Changes and enhancements to existing policies and procedures are not always made based on the result of failing analytical performance or other non-conformances. Borderline performance, equipment changes/modernization, or outdated internal procedures are all areas that may require modification or enhancement. Employees are encouraged to analyze internal procedures of all kinds, and offer suggestions for improvement. A Preventive Action Investigation form exists for this purpose (Appendix AM). The form is used to record a description of the existing procedure and a proposed solution, an action plan and systematic implementation schedule, and a follow-up section to monitor the effectiveness of any resulting changes.

All Preventive Action Investigations are stored in the same database with non-conformances.

4.9 DEPARTURE FROM DOCUMENTED PROCEDURES

4.9.1 Management Policies

Any departure from a laboratory written standard operating procedure not directly involving sample analysis or processing must be approved by the area manager. The area manager must file a Non-Conformance Investigation Report. The Non-Conformance Investigation Report must be included as part of the data package.

Any departure from a SOP involving sample processing or sample analysis must be justified in writing by the analyst and laboratory area manager. The prior written approval of the laboratory president must be received before performing the analysis. The laboratory president must also file a Non-Conformance Investigation Report. This Non-Conformance Investigation Report must be included as part of the data package.

4.9.2 Method Modification and Variances

Unauthorized modification of, and variances in, analytical methods, except for the deviations justified in writing and approved per section 4.9.1 are strictly prohibited. Modifications to approved procedures must go through the formal approval and documentation process. Posting unauthorized hand edits to approved methods or procedures, or posting other forms of unauthorized procedural instructions in the work area is not acceptable. All such postings must have prior managerial approval. Modifications must be incorporated into the next version of the SOP.

4.10 PERFORMANCE AND SYSTEM AUDITS

4.10.1 Internal Audits

It is the responsibility of the quality assurance department to plan and organize internal audits as required by the schedule and requested by management. Over the course of a calendar year the internal audits should encompass all areas of the laboratory's operations.

4.10.2 External Audits

Audits of the laboratory conducted by regulatory agencies and client representatives are to be perceived by the laboratory staff as learning experiences and opportunities to hear suggestions from knowledgeable persons on how operations might be improved. Consequently, the laboratory staff is to be open and cooperative with external auditors.

4.10.3 Client Notification

If during the course of an audit, problems were uncovered that may have impacted the laboratory's ability to generate quality data, written notification will be provided to all impacted clients. Impacted clients include those clients who received results from samples analyzed during the time frame the problem existed. Revised data reports will be issued as necessary.

NOTE: The client must be contacted within 48 hours (2 business days) upon the discovery of any event that may cast doubt on the validity of a sample result.

Figure 4-1

Documentation System Structure

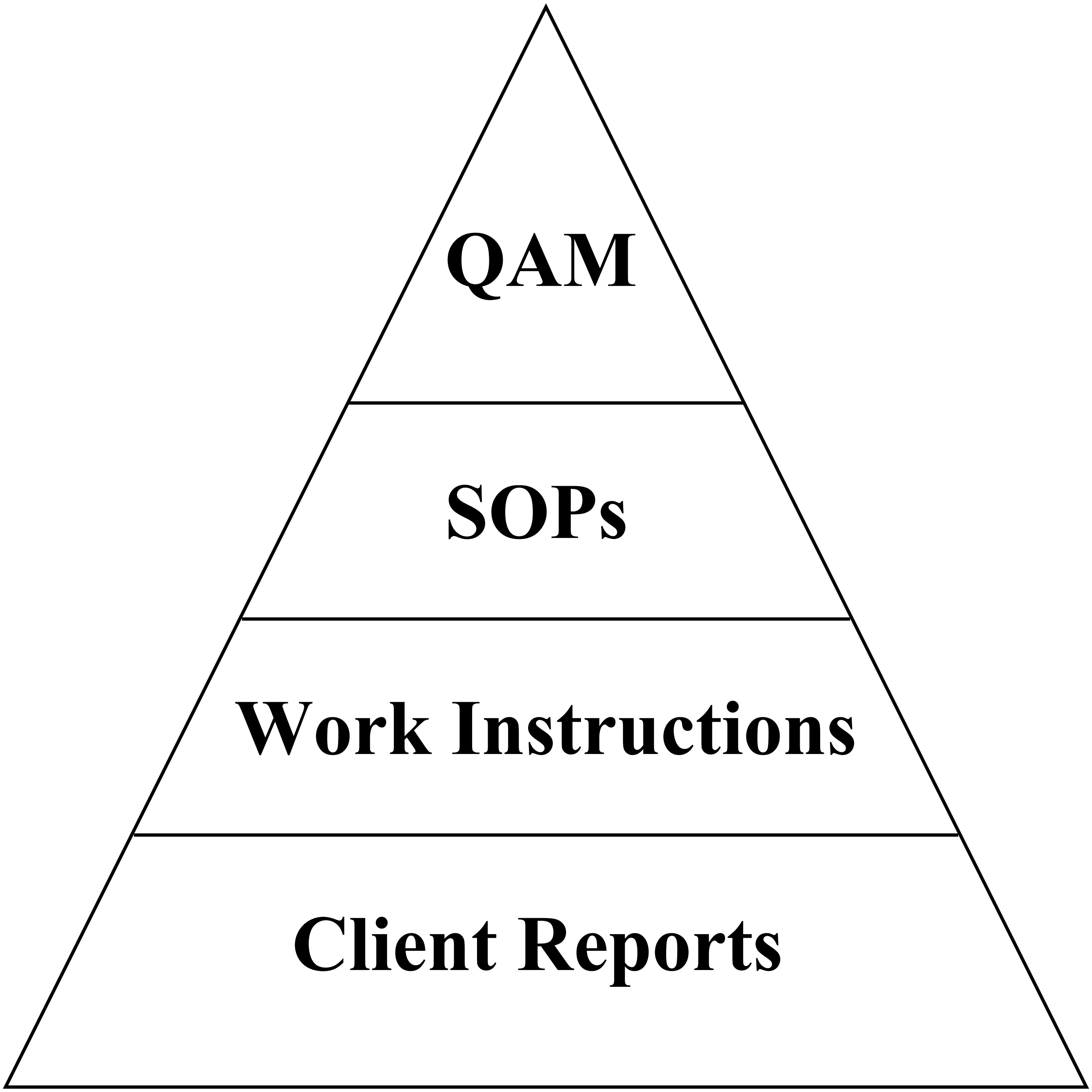


Figure 4-2

Benchsheet/Client Report

Flow Diagram

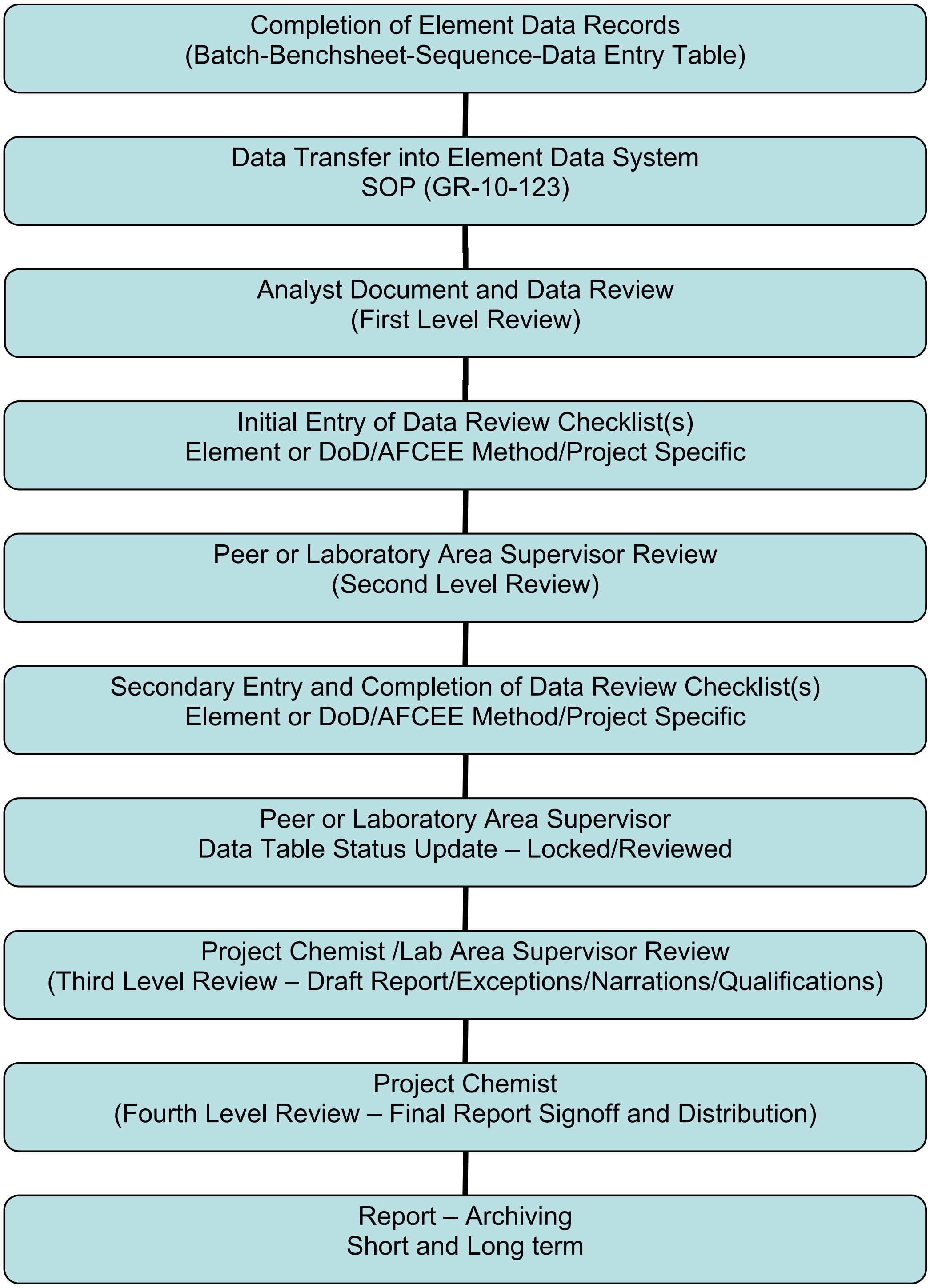
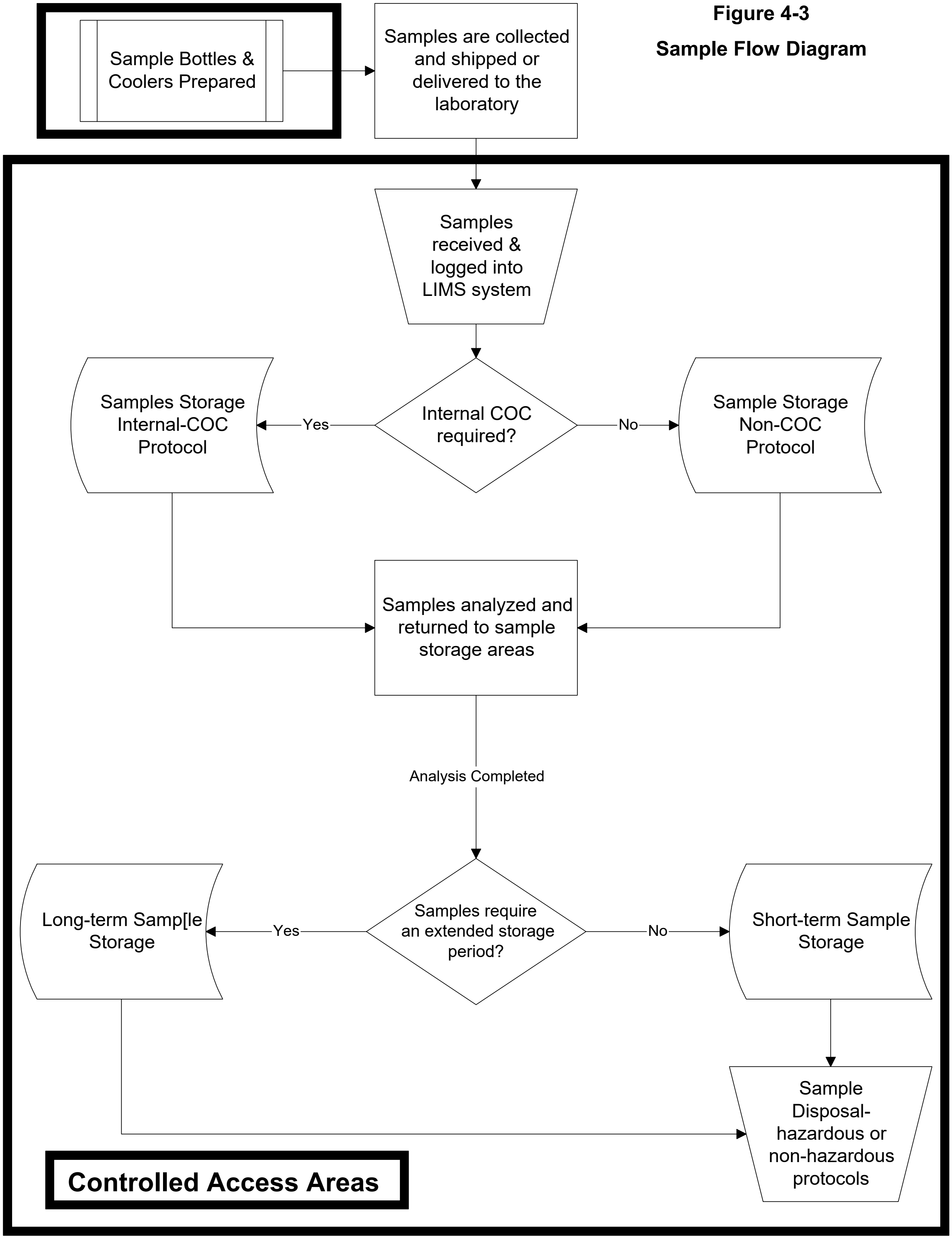


Figure 4-3

Sample Flow Diagram



5.0 REFERENCES

- Methods for Chemical Analysis of Water and Wastes; EPA-600/4-79-020 most current revision.
- Standard Methods for the Evaluation of Water and Wastewater; Current Edition, APHA, AWWA, WPCF.
- Handbook for Analytical Quality Assurance in Water and Wastewater Laboratories; EPA 600/4-79-019, most current revision.
- Physical and Chemical Methods for the Evaluation of Solid Waste; EPA-SW-846, most current revision.
- Guidelines Establishing Text Procedures for the Analysis of Pollutants; 40 CFR; Parts 100 to 149, Current Edition.
- Good Automated Laboratory Practices; USEPA Office of Administration and Resource Management, most current revision.

TABLE 1
Default Data Archiving Systems

Document Archives

Document Description	Storage Location	Storage Duration
Laboratory benchsheets	on-site	1 year
Laboratory benchsheets	off-site	6 years
Instrument Print-Outs (raw data)	on-site	1 year
Instrument Print-Outs (raw data)	off-site	6 years
Laboratory Logs (run, maintenance, analyst)	on-site	1 year
Laboratory Logs (run, maintenance, analyst)	off-site	6 years
Client Files (reports, correspondence, invoices)	on-site	1 year
Client Files (reports, correspondence, invoices)	off-site	6 years
Proposal Files	on-site	5 years
Purchase Agreements	on-site	5 years
SOPs	on-site	5 years

Electronic Archives

File Description	Storage Location	Storage Duration	Storage Media
Instrument Data Files-GC/MS	on-site	1 year	Compact Disk
Instrument Data Files-GC/MS (copy)	off-site	10 years	Compact Disk
Instrument Data files-GC (Turbochrom)	on-site	1 year	Compact Disk
Instrument Data files-GC (Turbochrom) (copy)	off-site	10 years	Compact Disk
Instrument Data files-AA, ICP, ICP/MS	on-site	1 year	Compact Disk
Instrument Data files-AA, ICP, ICP/MS (copy)	off-site	10 years	Compact Disk
Instrument Data files-Auto Analyzer	on-site	1 year	Compact Disk
Instrument Data files-Auto Analyzer (copy)	off-site	10 years	Compact Disk
LIMS daily backup	on-site fire-safe	30 day rotation	DAT-Tape
SOPs	on-site	indefinitely	Compact Disk

TABLE 2
Laboratory SOP Categories

- Trace Metals
- Gas Chromatograph
- Spectrophotometric Procedures
- Gravimetric Procedures
- Extractions-Organic
- Sales and Customer Service
- Laboratory Computer Operations
- Sample Receiving, Storage, & Disposal
- Bottle Prep
- Microbiology
- Waste Characterization
- Instrumental-General
- Gas Chromatography/Mass Spectroscopy
- Titrimetric Procedures
- Electrochemical/Potentiometric Procedures
- Quality Assurance
- Business and Accounting
- Laboratory Safety and Security
- Miscellaneous
- Inorganic-General

TABLE 3
Field Equipment Calibration

Equipment	Method Reference	Minimum # Standards Initial Calibration	Type of Curve	Frequency of Calibration	Acceptance/ Rejection Criteria Initial Calibration	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Conductivity Meter	SW-846 Method 9050	2	---	Initial	± 5% of Value	Daily	---
Dissolved Oxygen Meter	Standard Method 4500-O G.	---	---	Initial	± 5% of Value	Daily	---
Temperature Probes	Standard Method 2550 B.	---	---	Initial	± 5% of Value	Daily	---
pH Meter	SW-846 Method 9040	3	Linearity	Initial	Adjust slope to within ±0.05 pH units accuracy	Daily	---

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Mercury Cold Vapor AA	SW-846 7470/7471	5	Correlation coefficient must be ≥0.995	Daily, at the beginning of every analytical batch, and when CCV fails acceptance criteria	Every calibration	90-110% recovery	Every 10 samples	90-110% recovery
	EPA 245.1					95-105% recovery		90-110% recovery
ICP	SW-846 6010 EPA 200.7	3	same as above	same as above	same as above	95-105% recovery	same as above	90-110% recovery
ICP/MS	SW-846 6020 EPA 200.8	5	same as above	same as above	same as above	90-110% recovery	same as above	90-110% recovery
Ion Chromatograph	SW-846 9056 EPA 300.1	6	Correlation coefficient must be ≥0.995	Every month or when CCV fails	Every calibration	90-110% recovery	Every 10 samples	90-110% recovery
Sulfate	ASTM D516-90, 9038	6 Low range 8 High range	same as above	Daily	same as above	85-115% recovery	Every 10 samples (sulfate every 4 samples)	85-115% recovery
Chloride	4500-Cl E, 9251					90-110% recovery		
Phenolics (Total)	SW-846 9065 EPA 420.4	7-8	same as above	Daily	same as above	90-110% recovery	Every 10 samples	90-110% recovery

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Cyanide Total Cyanide Amenable	SW-846 9014, 4500-CN E 4500-CN G	7	same as above	Daily	1 High / 1 Low every calibration	90-110% recovery	Every 10 samples	90-110% recovery
TOC	5310 C, 9060	6 Low range 7 High range	same as above	Every 6 months or until SCV failure	Daily	90-110% recovery	Every 10 samples	85-115% recovery
COD	5220 D	5 High 5 Low 4 Ultra Low	same as above	Every 6 months or until SCV failure or with every new lot of vials	As needed, with analysis of each curve	95-105% recovery	Every 10 samples	95-105% recovery
GC-PID/ ELCD	SW-846 8021	5 for linear 6 for quadratic	≤20% RSD use average RF or regression, >20% must use regression	As needed, when CCV >20% expected response or concentration	As needed, with analysis of each curve	75-125% recovery	Before and after every 10 samples and at end of each analytical batch	±20% expected response or concentration; ±20% for compounds that boil below 30° C (Bromomethane, chloroethane, chloromethane, dichlorodifluoromethane, trichlorofluoromethane, and vinyl chloride
	EPA 601/602	3	<10% RSD use average RF or regression, ≥10% must use regression	As needed when CCV fails method Table 2 criteria				Method Table 2 criteria

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC-FID	SW-846 8015	5 for linear 6 for quadratic	≤20% RSD use average CF or regression, >20% must use regression	As needed, when CCV >20% expected response or concentration	As needed, with analysis of each curve	75-125% recovery	Before and after every 10 samples and at end of each analytical batch	±20% expected response or concentration
GC-ECD	SW-846 8081 SW-846 8151 SW-846 8082 SW-846 8121 EPA 608 EPA 612	5 for linear 6 for quadratic 3	≤20% RSD use average CF or regression, >20% must use regression <10% RSD use average CF or regression, ≥10% must use regression	As needed, when CCV > 20% 20% 15% 15% 15% 15% expected response or concentration	As needed, with analysis of each curve	75-125% recovery	Before and after every 10 samples and at end of each analytical batch	Amount found ± 20% 20% 15% 15% 15% 15% expected response or concentration
GC-HPLC	SW-846 8310	5 for linear 6 for quadratic	≤20% RSD use average CF or regression, >20% must use regression	As needed, when CCV >15% expected response or concentration	As needed, with analysis of each curve	80-120% recovery	Before and after every 10 samples and at end of each analytical batch	±15% expected response or concentration

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC/MS-Volatiles	SW-846 8260	5 for linear 6 for quadratic	CCCs – %RSD ≤30% 1,1-dichloroethene, chloroform, 1,2-dichloropropane, toluene ethyl benzene, vinyl chloride, all other target analytes ≤15% use average RF for quantitation, otherwise regression SPCCs – average RF ≥ 0.10 for chloromethane, 1,1-dichloroethane and bromoform; ≥ 0.30 for 1,1,2,2-tetrachloroethene and Chlorobenzene	As needed, when CCV fails	As needed, with analysis of each curve	75-125% recovery	12 hours	8260: CCCs – % Difference or drift ≤20%, all other target analytes within 20% expected value, high recovery acceptable when analyte not present in sample; SPCCs same criteria as initial calibration
	EPA 624	3	<35% RSD for all compounds use average RF, otherwise use regression				24 hours	Recovery of all analytes must meet recoveries specified in method

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
	EPA 524.2	3 (more based on calibration range)	≤20% RSD for all compounds use average RF, otherwise limear or second order regression	As needed, when CCV fails	As needed, with analysis of each curve	70-130% recovery	12 hours	Internal standard and surrogate quant ion area ≤30% from most recent continuing calibration check, or ≤50% from most recent initial calibration. RF for each analyte and surrogate ±30% of the initial cal mean RF. If a linear or second order regression was used, the CCV quantitated value must be within ±30% of the true value.

TABLE 4
Instrument Calibration

Instrument	Method Reference	Minimum Number Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Second Source Calibration Verification	Acceptance/ Rejection Criteria Second Source Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC/MS-Semi-volatiles	SW-846-8270	5 for linear 6 for quadratic	CCCs – %RSD ≤30% acenaphthene, 1,4-dichlorobenzene, hexachlorobutadiene, N-nitroso-diphenylamine, di-n-octylphthalate, fluoranthene, benzo(a)pyrene, 4-chloro-3-methylphenol, 2,4-dichlorophenol, 2-nitrophenol, phenol, pentachlorophenol, 2,4,6-trichlorophenol, all other target analytes ≤15% use average RF for quantitation, otherwise regression SPCCs – average RF ≥0.05 N-nitrosodi-n-propylamine, hexachlorocyclopentadiene, 2,4-dinitrophenol, 4-nitrophenol	As needed, when CCV fails	As needed, with analysis of each curve	75-125% recovery	12 hours	8270: CCCs ≤20% difference or drift; 60-140% for: Benzidine 3,3—Dichlorobenzidine 2,4-Dinitrophenol 4-Nitrophenol All other target analytes within 25% expected value. High recovery acceptable when analyte not present in sample. SPCCs same criteria as initial calibration
	EPA 625	3	<35% RSD for all compounds to use average RF, otherwise regression				24 hours	80-120% recovery

TABLE 5
Quality Control Sample Types

Blank Type	Abbreviation	Description	Frequency of Use
Method Preparation Blank	MPB	This blank has been carried through the entire analytical process including any pretreatment procedures. The MPB will monitor any contaminants that may affect the sample results. General acceptance limits for the MPB are less than the test reporting Limit. If contamination is detected in the MPB above the reporting limit, all samples with analyte concentrations within 10x that found in the MPB must be flagged for re-extraction or digestion. If it is not possible to re-prep the samples then all analyses for that batch must be qualified.	One per analytical batch

TABLE 5
Quality Control Sample Types

Blank Type	Abbreviation	Description	Frequency of Use
Continuing Calibration Blank	CCB	The continuing calibration blank is a reagent blank that is analyzed as a sample, generally after 10 samples have been tested. The CCB must be run prior to re-zeroing an instrument, unless this practice was performed for each previous sample. The CCB will verify whether significant instrument drift has occurred during the analytical run near the test method detection limit. General acceptance limits are ± the test reporting limit. If the CCB falls outside the acceptance limits, the instrument must be recalibrated and the previous 10 samples reanalyzed. For automated tests where run data is generated after all analyses are completed, 10 samples before and after the unacceptable CCB must be reanalyzed, i.e., all sample results must be encased in acceptable CCB. The reanalysis must also include the ICB and ICV QC samples.	Every ten samples/or as specified in the analytical method.

TABLE 5
Quality Control Sample Types

Blank Type	Abbreviation	Description	Frequency of Use
Field Trip Blank	FTB	These are used with VOA vials where there is the possibility that organic contaminants may diffuse through the PTFE-faced silicone rubber septum of the sample vial. A field trip blank vial filled with organic-free water accompanies the sample containers to and from a client location, at the discretion of the client, may be analyzed along with the samples.	One per sample shipping container
Storage Blank	STB	Reagent-grade water (40 mL aliquot) is stored with samples in a client set. Per the discretion of the client, it may be analyzed after all samples in that set are analyzed. The purpose is to determine the level of contamination acquired during storage.	One per sample storage refrigerator or client sample set (if required)

TABLE 5
Quality Control Sample Types

Control Type	Abbreviation	Description	Frequency of Use
Laboratory Fortified Blank or Blank Spike	LFB or BS	This is a fortified method preparation blank in which an aliquot of de-ionized water has been spiked with a known amount of a stock reference standard or spiking solution. A blank spike is required for each digestion or distillation batch. The purpose of the blank spike is to verify the analyst's spiking procedure and assure that any matrix interference shown by the spike and spike duplicate is really matrix induced.	One per analytical batch or as specified in the analytical method

TABLE 5
Quality Control Sample Types

Control Type	Abbreviation	Description	Frequency of Use
Second-Source Calibration Verification	SCV	The SCV is identical to the CCV with the exception it must be made from a source dissimilar to that used to prepare the initial calibration curve. The purpose of the SCV is to validate the accuracy both the calibration standards, and the initial calibration curve. Unless otherwise specified by the method, recovery limits for this QC type are typically 80-120%. Sample analysis may not begin prior to the analysis of a successful SCV.	One with every initial calibration

TABLE 5
Quality Control Sample Types

Control Type	Abbreviation	Description	Frequency of Use
Continuing Calibration Verification	CCV	The continuing calibration verification standard is generally the standard used as the midpoint of the initial calibration curve. The standard is analyzed and quantitated in the in the same manner as a sample. The CCV will reveal any significant instrument drift. Acceptance limits for this QC type are ± 10%, or as stated in the method. If the CCV falls outside the acceptance window, the instrument must be recalibrated and the previous 10 samples reanalyzed. For automated tests where run data is generated after all analysis is complete, all samples run after the last acceptable CCV must be reanalyzed, i.e. all samples must be bracketed by an acceptable CCV.	Every 10 samples or as specified in the analytical method

TABLE 5
Quality Control Sample Types

Control Type	Abbreviation	Description	Frequency of Use
Detection Limit	CRDL	A standard which contains the minimum level of detection acceptable under a contract Statement of Work must be analyzed for particular contract sample sets to demonstrate that detection limit can be met.	One per analytical batch for certain contract sample sets and methods only.
Sample Duplicate	DUP	The sample duplicate is a replicate analysis of a particular sample that has been analyzed previously during the sample analytical batch. The purpose of the duplicate is to monitor precision within the analytical process.	Every 10 samples for each matrix type

TABLE 5
Quality Control Sample Types

Control Type	Abbreviation	Description	Frequency of Use
Sample Matrix Spike	SPK	The sample matrix spike is an aliquot of a sample that has been spiked with a known amount of a stock reference standard or spiking solution. A the purpose of the SPK is to monitor sample matrix effects on the test. Acceptance limits for this QC type are based on the 95% confidence limits established for a test and matrix.	Every 10 samples for each matrix type, or as specified in the analytical method

TABLE 5
Quality Control Sample Types

Matrix QC Type	Abbreviation	Description	Frequency of Use
Matrix Spike Duplicate	MSD	A matrix spike duplicate is an aliquot of the same sample used for the matrix spike (SPK). A spike duplicate is required for each matrix type within a digestion or distillation batch. A spike duplicate analysis may be required on a non-distilled or non-digested sample if the spike has indicated a matrix interference. The purpose of this duplicate spike is to confirm any matrix effects on the test. Acceptance limits for this QC type are based on the 95% confidence limits established for a test and matrix.	Every 10 samples for each matrix type or as specified in the analytical method

TABLE 5
Quality Control Sample Types

Matrix QC Type	Abbreviation	Description	Frequency of Use
Field Duplicate	FDUP	This may be required to evaluate the uniformity of samples and sampling techniques at a field location. Acceptance limits for this QC type are based on established confidence limits, with generally two levels or ranges. The first range extends from the test reporting limit to 10x the test reporting limit. The second range encompasses any values higher than 10x the MDL.	As required on a project basis
Post-Digestion Spike	PDS	The post-digestion spike may be required, on a project basis, when a matrix precludes the use of pre-digestion spike.	One per analytical batch when required by project

TABLE 5
Quality Control Sample Types

Matrix QC Type	Abbreviation	Description	Frequency of Use
Surrogate Spike	SUR	For almost all organic analyses, the analytical method requires surrogate compounds to be added to every blank, sample, matrix spike, matrix spike duplicate, and standard. Surrogate compounds are used to measure analytical efficiency by measuring percent recovery from the known value. They are generally brominated, fluorinated, or isotopically labeled compounds not typically detected in environmental samples.	Every QC and per batch for semi-volatile, volatile, pesticide, PCB analysis
Internal Standard	IST	These are compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), at a known concentration, prior to analysis. Internal standards are used as the basis of quantitation of the target compounds.	Every QC and client sample per batch for volatiles and semi-volatiles

Appendix A

CHEMIST I

General Description

Under direct supervision of the area manager and group leader, conducts analyses on samples to determine their chemical and/or physical properties.

Educational/Background Requirements

- Associates degree and 3 or more years of experience in an environmental or related laboratory setting; or
- BS degree in Chemistry or a related field of science.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Chemist I.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine maintenance of instruments and equipment.
- Become completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Perform all other activities deemed necessary to management.

TRIMATRIX
LABORATORIES

CHEMIST II

General Description

Under ***general*** supervision of the area manager and group leader, conducts analyses on samples to determine their chemical and/or physical properties.

Educational/Background Requirements

- Associates degree and ***5*** or more years of experience in an ***applicable discipline***; or
- BS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline***; or
- ***MS degree in Chemistry or a related field of science***.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Chemist II.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine maintenance of instruments and equipment.
- ***Remain*** completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- ***Assist other chemists and technicians with their professional development***.
- ***Act as company advocate by setting a positive example in work habits and attitude to other staff members***.
- ***Demonstrate ability to work independently with minimal errors***.
- ***Capable of conducting peer review on routine data packages***.

- ***Possess the minimum level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements***.

- Perform all other activities deemed necessary to management.

CHEMIST III

General Description

Under ***minimal*** supervision of the area manager and group leader, conducts analyses on samples to determine their chemical and/or physical properties. ***Eligible for consideration of group leader status.***

Educational/Background Requirements

- Associates degree and ***7 or more years of experience in an applicable discipline***; or
- BS degree in Chemistry or a related field of science and ***4*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Chemist III.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine/***non-routine*** maintenance ***and troubleshooting*** of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other chemists and technicians with their professional development.
- Act as company advocate by setting a positive example in work habits and attitude to other staff members.
- Demonstrate ***increased*** ability to work independently with minimal errors.

- Capable of conducting peer review on routine ***and non-routine*** data packages. ***Has demonstrated knowledge to perform final data review and approval on LIMS.***

- Possess ***an above average*** level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.

- ***Assist in the development and maintenance of laboratory SOPs.***

- Perform all other activities deemed necessary to management.

CHEMIST IV

General Description

Under minimal supervision of the area manager and***/or the technical director***, conducts ***complex*** analyses on samples to determine their chemical and/or physical properties. Eligible for consideration of group leader status.

Educational/Background Requirements

- Associates degree and ***10*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***7*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science and ***4*** or more years of experience in an applicable discipline; or
- ***Ph.D. in Chemistry or a related field of science and experience in an environmental or related laboratory setting***.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Chemist IV.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation ***of, and assisting other chemists in***, routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other chemists and technicians with their professional development ***and in the integration of new methods and technologies***.

- Act as company advocate by setting a positive example in work habits and attitude to other staff members, ***prospective employees, existing and perspective clientele, and the general public***.
- Demonstrate ***superior*** ability to work independently with minimal errors.
- Capable of conducting peer review on routine and non-routine data packages. Has demonstrated knowledge to perform final data review and approval on LIMS.
- Possess ***a superior*** level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.
- ***Demonstrate ability to improve productivity as shown by an increase in sample throughput, addition of new methods of analysis, and/or operation of additional instruments.***
- ***When appropriate, work with the technical director to develop new methods and technologies***.
- ***Develop, review, and update laboratory SOPs as necessary***.
- Perform all other activities deemed necessary to management.

CHEMIST V

General Description

Under minimal supervision of the area manager and/or the technical director, conducts complex analyses on samples to determine their chemical and/or physical properties. Eligible for consideration of group leader status. ***May work directly with the technical director to develop new methods and technologies for the laboratory***.

Educational/Background Requirements

- Associates degree and ***13*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***10*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science and ***6*** or more years of experience in an applicable discipline; or
- Ph.D. in Chemistry or a related field of science and ***2 or more years of*** experience in an environmental or related laboratory setting.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Chemist V.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation of, assisting other chemists in, ***and serving as the primary reference for***, routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other chemists and technicians with their professional development and in the integration of new methods and technologies.

- Act as company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and perspective clientele, and the general public.
- Demonstrate superior ability to work independently with minimal errors.
- Capable of conducting peer review on routine and non-routine data packages. Has demonstrated knowledge to perform final data review and approval on LIMS.
- Possess a superior level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.
- Demonstrate ability to improve productivity as shown by an increase in sample throughput, addition of new methods of analysis, and/or operation of additional instruments.
- ***Responsible for the study and implementation of*** new methods and technologies.
- Develop, review, and update existing laboratory SOPs as necessary, ***write new SOPs as required to reflect advancements in methods and technologies***.
- ***Work with management team to plan for future equipment acquisitions***.
- ***Provide input to area manager/technical director/laboratory president on personnel issues including performance reviews and staff additions/reductions***.
- Perform all other activities deemed necessary to management.

SENIOR CHEMIST

General Description

Working independently or under minimal supervision of, ***an*** area manager, technical director, ***or the laboratory president***, conducts ***or supervises analysis of complex non-routine projects*** to determine their chemical and/or physical properties. Eligible for consideration of group leader status.

Educational/Background Requirements

- BS degree in Chemistry or a related field of science and ***15*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science and ***10*** or more years of experience in an applicable discipline; or
- Ph.D. in Chemistry or a related field of science and ***7*** or more years of experience in an environmental or related laboratory setting.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Senior Chemist.

- Perform analyses in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation of, assisting other chemists in, and serving as the primary reference for, routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent methods following the guidelines established in the test method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to analyses, including but not limited to, standard preparation logbooks, instrument run logbooks, personal notebooks, and instrument maintenance logbooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other chemists and technicians with their professional development and in the integration of new methods and technologies.
- Act as company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and perspective clientele, and the general public.

- Demonstrate superior ability to work independently with minimal errors.
- Capable of conducting peer review on routine and non-routine data packages. Has demonstrated knowledge to perform final data review and approval on LIMS.
- Possess a superior level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.
- Demonstrate ability to improve productivity as shown by an increase in sample throughput, addition of new methods of analysis, and/or operation of additional instruments.
- Responsible for the study and implementation of new methods and technologies.
- Develop, review, and update existing laboratory SOPs as necessary, write new SOPs as required to reflect advancements in methods and technologies.
- Work with management team to plan for future equipment acquisitions.
- Provide input to area manager/technical director/laboratory president on personnel issues including performance reviews and staff additions/reductions.
- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

PROJECT CHEMIST I

General Description

Under direct supervision of the client services manager and project chemist group leader, acts as the primary interface with the client to assure laboratory services are meeting client needs.

Educational/Background Requirements

- Associates degree and 3 or more years of experience in an environmental or related laboratory setting; or

- BS degree in Chemistry or a related field of science.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Project Chemist I.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).

- Prepare incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.

- Become completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.

- Review all final reports for accuracy and completeness.

- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".

- Follow all laboratory safety procedures.

- Prepare proposal outlines for existing clients.

- Perform all other activities deemed necessary to management.

PROJECT CHEMIST II

General Description

Under ***general*** supervision of the client services manager and project chemist group leader, acts as the primary interface with the client to assure laboratory services are meeting client needs.

Educational/Background Requirements

- Associates degree and ***5*** or more years of experience in an ***applicable discipline;*** or
- BS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline;*** or
- ***MS degree in Chemistry or a related field of science.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Project Chemist II.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Prepare incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.
- ***Remain*** completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Review all final reports for accuracy and completeness.
- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".
- Follow all laboratory safety procedures.
- Prepare proposal outlines for existing ***and new*** clients.
- ***Assist other project chemists and technicians with their professional development.***
- ***Act as a company advocate by setting a positive example in work habits and attitude to other staff members.***
- ***Demonstrate ability to work independently with minimal errors.***

- ***Posses the minimum level of competence in computer skills (Excel, Word, LIMS, etc.) required to carry out job requirements.***

- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

PROJECT CHEMIST III

General Description

Under ***minimal*** supervision of the client services manager and project chemist group leader, acts as the primary interface with the client to assure laboratory services are meeting client needs. ***Eligible for consideration of group leader status.***

Educational/Background Requirements

- Associates degree and ***7*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***4*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Project Chemist III.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Prepare incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Review all final reports for accuracy and completeness. ***Assist with the preparation, archiving, and delivery of a CLP or "CLP Like" deliverables package.***
- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".
- Follow all laboratory safety procedures.
- ***Prepare and/or coordinate the preparation of proposals for existing and new clients under direct supervision of the client services manager, sales manager, or laboratory president.***
- Assist other project chemists and technicians with their professional development.
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members.

- Demonstrate ***increased*** ability to work independently with minimal errors.
- Posses ***an above average*** level of competence in computer skills (Excel, Word, LIMS, etc.) required to carry out job requirements.
- ***Demonstrate ability to improve productivity as shown by an increase in project workload and throughput.***
- ***Provide data interpretation services to clients.***
- ***Assist in the development and maintenance of laboratory SOPs.***
- Perform all other activities deemed necessary to management.

TRIMATRIX
LABORATORIES

PROJECT CHEMIST IV

General Description

Under minimal supervision of the client services manager and/***or the sales manager,*** acts as the primary interface with the client to assure laboratory services are meeting client needs. ***May work directly with the sales manager to develop increased business from existing clients.*** Eligible for consideration of group leader status.

Educational/Background Requirements

- Associates degree and ***10*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***7*** or more years of experience in an applicable discipline; or
- MS degree in chemistry or a related field of science and ***4*** or more years of experience in an applicable discipline; or
- ***Ph.D. in Chemistry or a related field of science and experience in an environmental or related laboratory setting.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Project Chemist IV.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Prepare, ***and assist other project chemists with,*** incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Review all final reports for accuracy and completeness. ***Coordinate*** the preparation, archiving, and delivery of CLP or “CLP Like” deliverables packages.
- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".
- Follow all laboratory safety procedures.
- Prepare and/or coordinate the preparation of proposals for existing and new clients under ***minimum*** supervision of the client services manager, sales manager, or laboratory president.

- Assist other project chemists and technicians with their professional development ***and in the integration of new methods and technologies.***

- Act as a company advocate by setting a positive example in work habits and attitude to other staff members***, prospective employees, existing and perspective clientele, and the general public.***

- Demonstrate ***superior*** ability to work independently with minimal errors.

- Posses ***a superior*** level of competence in computer skills (Excel, Word, LIMS, etc.) required to carry out job requirements.

- Demonstrate ability to improve productivity as shown by an increase in project workload and throughput ***as well as an increased in the complexity of projects and data packages. This includes, but is not limited to, managing projects requiring a CLP or "CLP Like" deliverables package and/or managing projects to specifications outlines in QAPPs.***

- Provide data interpretation services to clients.

- ***Develop, review, and update laboratory SOPs as necessary.***

- ***When appropriate, work with sales manager to develop additional business from existing clients.***

- Perform all other activities deemed necessary to management.

TRIMATRIX
LABORATORIES

PROJECT CHEMIST V

General Description

Under minimal supervision of the client services manager and/or the sales manager, acts as the primary interface with the client to assure laboratory services are meeting client needs. ***Works*** directly with the sales manager to ***establish relationships with new clients as well as increase*** business from existing clients. Eligible for consideration of group leader status.

Educational/Background Requirements

- Associates degree and ***13*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***10*** or more years of experience in an applicable discipline; or
- MS degree in chemistry or a related field of science and ***6*** or more years of experience in an applicable discipline; or
- Ph.D. in Chemistry or a related field of science and ***2 or more years of*** experience in an environmental or related laboratory setting.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Project Chemist V.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Prepare, and assist other project chemists with, incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Review all final reports for accuracy and completeness. Coordinate the preparation, archiving, and delivery of CLP or “CLP Like” deliverables packages.
- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".
- Follow all laboratory safety procedures.
- Prepare and/or coordinate the preparation of proposals for existing and new clients under minimum supervision of the client services manager, sales manager, or laboratory president. ***Take an active***

and substantial role on the marketing team in the development and coordination of large technical and cost proposals, qualifications packages, and marketing literature.

- Assist other project chemists and technicians with their professional development and ***serve as the primary reference for*** the integration of new methods and technologies.
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and perspective clientele, and the general public.
- Demonstrate superior ability to work independently with minimal errors.
- Posses a superior level of competence in computer skills (Excel, Word, LIMS, etc.) required to carry out job requirements.
- Demonstrate ability to improve productivity as shown by an increase in project workload and throughput as well as an increased in the complexity of projects and data packages. This includes, but is not limited to, managing projects requiring a CLP or “CLP Like” deliverables package and/or managing projects to specifications outlines in QAPPs. ***Improve the productivity of others through training, assistance and the development and implementation of new, more efficient procedures.***
- Provide data interpretation services to clients. ***Assist clients in developing work plans or QAPPs by providing technical and administrative laboratory documentation and/or writing the laboratory portion of QAPPs.***
- Develop, review, and update laboratory SOPs as necessary. ***Write new SOPs as required to reflect advancements in procedures or technologies.***
- ***Routinely*** work with sales manager to develop additional business from existing clients ***and new clients.***
- ***Responsible for the study and implementation of new procedures and technologies.***
- ***Work with management team to plan for future equipment and software acquisitions.***
- ***Provide input to client services manager, sales manager, and/or laboratory president on personnel issues including performance reviews and staff additions / reductions.***
- Perform all other activities deemed necessary to management.

SENIOR PROJECT CHEMIST

General Description

Working independently or under minimal supervision of the client services manager and/or the sales manager***, or laboratory president,*** acts as the primary interface with the client to assure laboratory services are meeting client needs. Works directly with the sales manager to establish relationships with new clients as well as increase business from existing clients. ***Works directly with the laboratory president to develop the laboratory portion of QAPPs, work plans, and other technical documents.*** Eligible for consideration of group leader status.

Educational/Background Requirements

- BS degree in Chemistry or a related field of science and ***15*** or more years of experience in an applicable discipline; or
- MS degree in chemistry or a related field of science and ***10*** or more years of experience in an applicable discipline; or
- Ph.D. in Chemistry or a related field of science and ***7*** or more years of experience in an environmental or related laboratory setting.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Senior Project Chemist.

- Perform duties in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Prepare, and assist other project chemists with, incoming projects for laboratory testing. Required tasks include, but are not limited to, timely submittal of properly completed bottle request forms to bottle prep, verification of the accuracy, completeness, and punctuality of filled bottle requests prior to their shipment, and timely problem solving and creation of submittals for sample delivery groups which are received to the lab.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Review all final reports for accuracy and completeness. Coordinate the preparation, archiving, and delivery of CLP or “CLP Like” deliverables packages.
- Maintain files of all applicable documentation pertinent to projects, including but not limited to, quotations, completed bottle request forms, copies of contracts / purchase orders, and all other documentation listed on the "Project File Outline".
- Follow all laboratory safety procedures.
- Prepare and/or coordinate the preparation of proposals for existing and new clients under minimum supervision of the client services manager, sales manager, or laboratory president. Take an active

and substantial role on the marketing team in the development and coordination of large technical and cost proposals, qualifications packages, and marketing literature.

- Assist other project chemists and technicians with their professional development and serve as the primary reference for the integration of new methods and technologies.
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and perspective clientele, and the general public.
- Demonstrate superior ability to work independently with minimal errors.
- Posses a superior level of competence in computer skills (Excel, Word, LIMS, etc.) required to carry out job requirements.
- Demonstrate ability to improve productivity as shown by an increase in project workload and throughput as well as an increased in the complexity of projects and data packages. This includes, but is not limited to, managing projects requiring a CLP or “CLP Like” deliverables package and/or managing projects to specifications outlines in QAPPs. Improve the productivity of others through training, assistance and the development and implementation of new, more efficient procedures.
- Provide data interpretation services to clients. Assist clients in developing work plans or QAPPs by providing technical and administrative laboratory documentation and/or writing the laboratory portion of QAPPs.
- Develop, review, and update laboratory SOPs as necessary. Write new SOPs as required to reflect advancements in procedures or technologies.
- Routinely work with sales manager to develop additional business from existing clients and new clients.
- Responsible for the study and implementation of new procedures and technologies.
- Work with management team to plan for future equipment and software acquisitions.
- Provide input to client services manager, sales manager, and/or laboratory president on personnel issues including performance reviews and staff additions / reductions.
- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

TECHNICIAN I

General Description

Under direct supervision of the area manager and group leader, performs tasks necessary for efficient operation of the laboratory.

Educational/Background Requirements

- High school diploma or equivalent.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Technician I.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine maintenance of instruments and equipment.
- Become completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Perform all other activities deemed necessary to management.

TECHNICIAN II

General Description

Under ***general*** supervision of the area manager and group leader, performs tasks necessary for efficient operation of the laboratory.

Educational/Background Requirements

- High school diploma or equivalent ***and 2 or more years of experience in an applicable discipline;*** or
- ***Associates degree and 1 or more years of experience in an applicable discipline;*** or
- ***BS degree in Chemistry or a related field of science***.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Technician II.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine maintenance of instruments and equipment.
- ***Remain*** completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- ***Assist other technicians with their professional development.***
- ***Act as a company advocate by setting a positive example in work habits and attitude to other staff members.***
- ***Demonstrate ability to work independently with minimal errors.***
- ***Possess the minimum level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.***
- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

TECHNICIAN III

General Description

Under ***minimal*** supervision of the area manager and group leader, performs tasks necessary for efficient operation of the laboratory. ***Eligible for consideration of group leader status.***

Educational/Background Requirements

- High school diploma or equivalent and ***4*** or more years of experience in an applicable discipline; or
- Associates degree and ***3*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline.***
- ***MS degree in Chemistry or a related field of science.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Technician III.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation and routine/***non-routine*** maintenance ***and troubleshooting*** of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other technicians with their professional development.
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members.
- Demonstrate ***increased*** ability to work independently with minimal errors.

- Possess ***an above average*** level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.

- ***Demonstrate ability to improve productivity as shown by an increase in process/data/sample throughput.***

- ***Assist in the development and maintenance of laboratory SOPs.***

- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

TECHNICIAN IV

General Description

Under minimal supervision of the area manager and***/or the technical director***, performs ***complex*** tasks necessary for efficient operation of the laboratory. Eligible for consideration of group leader status.

Educational/Background Requirements

- High school diploma or equivalent and ***7*** or more years of experience in an applicable discipline; or
- Associates degree and ***5*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***4*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or a related field of science ***and 2 or more years of experience in an applicable discipline.***

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Technician IV.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation ***of, and assisting other technicians in,*** routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other technicians with their professional development ***and in the integration of new procedures and technologies.***
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members, ***prospective employees, existing and prospective clientele, and the general public***.

- Demonstrate ***superior*** ability to work independently with minimal errors.
- Possess ***a superior*** level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.
- Demonstrate ability to improve productivity as shown by an increase in process/data/sample throughput***, addition of new procedures/technologies and/or operation of additional equipment/instruments.***
- ***When appropriate, work with the technical director, laboratory president, or sales manager to develop new procedures and technologies.***
- ***Develop, review, and update laboratory SOPs as necessary.***
- Perform all other activities deemed necessary to management.

TECHNICIAN V

General Description

Under minimal supervision of the area manager and/or the technical director, performs complex tasks necessary for efficient operation of the laboratory. Eligible for consideration of group leader status. ***May work directly with the technical director, laboratory president, or sales manager to develop methods, procedures, and technologies for the laboratory.***

Educational/Background Requirements

- High school diploma or equivalent and ***10*** or more years of experience in an applicable discipline; or
- Associates degree and ***8*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***6*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or related field of science and ***4*** or more years of experience in an applicable discipline.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Technician V.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation of, and assisting other technicians in, ***and serving as the primary reference for,*** routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other technicians with their professional development and in the integration of new procedures and technologies.

- Act as a company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and prospective clientele, and the general public.

- Demonstrate superior ability to work independently with minimal errors.

- Possess a superior level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.

- Demonstrate ability to improve productivity as shown by an increase in process/data/sample throughput, addition of new procedures/technologies and/or operation of additional equipment/instruments.

- ***Responsible for the study and implementation of*** new procedures and technologies.

- Develop, review, and update laboratory SOPs as necessary***, write new SOPs as required to reflect advancement in procedures and technologies.***

- ***Work with management team to plan for future equipment acquisitions.***

- ***Provide input to area manager/technical director/laboratory president on personnel issues including performance reviews and staff additions/reductions.***

- Perform all other activities deemed necessary to management.

TRIMATRIX
LABORATORIES

SENIOR TECHNICIAN

General Description

Working independently or under minimal supervision of***, an*** area manager, technical director, ***or the laboratory president,*** performs ***or supervises tasks related to complex non-routine projects*** necessary for efficient operation of the laboratory. Eligible for consideration of group leader status.

Educational/Background Requirements

- High school diploma or equivalent and ***15*** or more years of experience in an applicable discipline; or
- Associates degree and ***13*** or more years of experience in an applicable discipline; or
- BS degree in Chemistry or a related field of science and ***10*** or more years of experience in an applicable discipline; or
- MS degree in Chemistry or related field of science and ***7*** or more years of experience in an applicable discipline.

Minimum Required Skills and Responsibilities

The following are the minimum skills and responsibilities required of a Senior Technician.

- Perform tasks in an ethical and acceptable manner, as outlined in the TriMatrix Laboratory Code of Ethics, and each applicable Standard Operating Procedure (SOP).
- Responsible for the daily operation of, and assisting other technicians in, and serving as the primary reference for, routine/non-routine maintenance and troubleshooting of instruments and equipment.
- Remain completely familiar with all aspects of the laboratory Quality Assurance Manual. Perform all QA/QC procedures outlined in the laboratory Quality Assurance Manual and the laboratory specific SOPs.
- Perform Demonstration of Capabilities (DOC) for all pertinent procedures following the guidelines established in the method or Quality Assurance Manual.
- Maintain all applicable documentation pertinent to procedures, including but not limited to, procedural and maintenance logbooks and personal notebooks.
- Follow all laboratory safety procedures.
- Maintain adequate supply of all spare parts and consumable supplies to ensure efficient, uninterrupted operation of the laboratory area.
- Assist other technicians with their professional development and in the integration of new procedures and technologies.
- Act as a company advocate by setting a positive example in work habits and attitude to other staff members, prospective employees, existing and prospective clientele, and the general public.

- Demonstrate superior ability to work independently with minimal errors.

- Possess a superior level of competence in computer skills (Excel, Word, instrument software, LIMS, etc.) required to carry out job requirements.

- Demonstrate ability to improve productivity as shown by an increase in process/data/sample throughput, addition of new procedures/technologies and/or operation of additional equipment/instruments.

- Responsible for the study and implementation of new procedures and technologies.

- Develop, review, and update laboratory SOPs as necessary, write new SOPs as required to reflect advancement in procedures and technologies.

- Work with management team to plan for future equipment acquisitions.

- Provide input to area manager/technical director/laboratory president on personnel issues including performance reviews and staff additions/reductions.

- Perform all other activities deemed necessary to management.

TRIMATRIX LABORATORIES

GROUP LEADER

General Description

In addition to the duties associated with the current chemist level, a group leader also takes on administrative responsibilities involved with the operation of the laboratory area.

Educational/Background Requirements

- Minimum of those specified with a Chemist III.

Minimum Required Skills and Responsibilities

Consistent with current Chemist Level, with additional or increased emphasis on the following requirements.

- Act as the area manager when the area manager is absent, filling such duties as supervision of employees and review and approval of data.
- Act as an additional source of information for management and others regarding laboratory area analysis capabilities.
- Responsible for the scheduling of work and the monitoring of workload for such items as hold times and due dates.
- Provide leadership, guidance, and training to other laboratory personnel on methods, equipment, and quality control.
- Develop, review and update laboratory SOPs as necessary.
- Assure that new methods, policies, and procedures are integrated into the laboratory area.
- Assume a primary responsibility for verifying that sample analyses are adhering to all method and laboratory specified quality assurance parameters.

Appendix B

Inorganic Analyses

Description	Method
Bromide	ASTM D1246-05
Specific Gravit	ASTM D1429-79
Oxidation-Reduction Potential	ASTM D1498-76
Moisture	ASTM D2216-98
Fractional Organic Carbon	ASTM D2974-87
Cyanide, Free	ASTM D-4282-02 (2010)
Bulk Density	ASTM D5057-90
Specific Gravity	ASTM D5057-90
Sulfate	ASTM D516-90 (07)
Acid Volatile Sulfide	EPA-821-R-91-100
Color, True	NCASI 71.01
Cyanide, Available	OIA-1677-09
Cyanide, Free	OIA-1677-09
Color	SM 2120 B-2011
Turbidity	SM 2130 B-2011
Odor	SM 2150 B
Acidity	SM 2310 B-2011
Alkalinity, Bicarbonate	SM 2320 B-2011
Alkalinity, Carbonate	SM 2320 B-2011
Alkalinity, Hydroxide	SM 2320 B-2011
Alkalinity, Total	SM 2320 B-2011
Hardness	SM 2340 C-2011
Conductivity	SM 2510 B-2011
Salinity	SM 2520 B
HEM: Floatable Oil & Grease	SM 2530 C (modified)
Moisture (%)	SM 2540 B-2011
Solids, Total	SM 2540 B-2011
Solids, Total Dissolved	SM 2540 C-2011
Solids, Total Suspended	SM 2540 D-2011
Solids, Total Volatile	SM 2540 E-2011
Solids, Settleable	SM 2540 F-2011
Solids, Total Volatile (%)	SM 2540 G
Specific Gravity	SM 2710 F
Hexavalent Chromium, Dissolved	SM 3500-Cr B-2011
Hexavalent Chromium, Total	SM 3500-Cr B-2011
Iron, Ferrous	SM 3500-Fe B-2011
Chloride	SM 4500-Cl E-2011
Cyanide, Total	SM 4500-CN E-2011
Cyanide, Amenable	SM 4500-CN G-2011
Thiocyanate	SM 4500-CN M
Carbon Dioxide	SM 4500-CO2 C
Fluoride	SM 4500-F C-2011
pH	SM 4500-H B-2011
Inorganic Nitrogen, Ammonia	SM 4500-NH3 G-2011
Nitrogen, Ammonia	SM 4500-NH3 G-2011
Nitrogen, Ammonia (Un-ionized)	SM 4500-NH3 G-2011
Nitrogen, Nitrite	SM 4500-NO2 B-2011
Inorganic Nitrogen, Nitrate + Nitrite	SM 4500-NO3 F-2011
Nitrogen, Nitrate	SM 4500-NO3 F-2011

Inorganic Analyses

Description	Method
Nitrogen, Nitrate + Nitrite	SM 4500-NO3 F-2011
Nitrogen, Total Kjeldahl	SM 4500-Norg D/NH3
Oxygen, Dissolved	SM 4500-O C
Phosphate, Ortho	SM 4500-P E-2011
Phosphorus, Dissolved	SM 4500-P E-2011
Phosphorus, Total	SM 4500-P E-2011
Phosphorus, Total Soluble	SM 4500-P E-2011
Sulfide, Dissolved	SM 4500-S2 D-2011
Sulfide, Total	SM 4500-S2 D-2011
Sulfide, Total	SM 4500-S2 F-2011
Hydrogen Sulfide	SM 4500-S2 H
Silica, Dissolved	SM 4500-SiO2 D-2011
Sulfite	SM 4500-SO3 B-2011
Sulfate	SM 4500-SO4 E-2011
Biochemical Oxygen Demand, 5-Day	SM 5210 B-2011
Biochemical Oxygen Demand, 5-Day Carb	SM 5210 B-2011
UBOD, Carbonaceous	SM 5210 C
Chemical Oxygen Demand	SM 5220 D-2011
Carbon, Dissolved Organic	SM 5310 C-2011
Inorganic Carbon, Total	SM 5310 C-2011
Organic Carbon, Total	SM 5310 C-2011
Phenolics	SM 5530 D-2005
MBAS Surfactants	SM 5540 C-2011
Ultraviolet Absorption	SM 5910 B
Heterotrophic Plate Count	SM 9215 B
Coliform, Membrane Filtration	SM 9222 D-1997
Coliform, Enzyme Substrate (MPN)	SM 9223 B-1997
Coliform, Enzyme Substrate (P/A)	SM 9223 B-2004
Organic Carbon, Total (Lloyd Kahn)	USEPA - Lloyd Kahn
Coliform, Membrane Filtration	USEPA - March, 1993
Particulate-phase Organic Carbon (POC)	USEPA LG206/207 (Modified)
FlashPoint	USEPA-1020B
Solids, Ash	USEPA-160.4
Solids, Total Volatile	USEPA-160.4
Solids, Total Volatile Dissolved	USEPA-160.4
Solids, Total Volatile Suspended	USEPA-160.4
Oil & Grease, HEM	USEPA-1664B
Total Petroleum Hydrocarbons, HEM-SGT	USEPA-1664B
Bromide	USEPA-300.0
Chloride	USEPA-300.0
Fluoride	USEPA-300.0
Nitrogen, Nitrate	USEPA-300.0
Nitrogen, Nitrite	USEPA-300.0
Sulfate	USEPA-300.0
Nitrogen, Total Kjeldahl	USEPA-351.2 Rev. 2.0
Moisture	USEPA-3550C
Solids, Total (%)	USEPA-3550C
Phenolics	USEPA-420.4
Reactive Cyanide	USEPA-7.3.3.2
Reactive Sulfide	USEPA-7.3.4.2
Hexavalent Chromium, Dissolved	USEPA-7196A
Hexavalent Chromium, Total	USEPA-7196A
Cyanide, Amenable	USEPA-9014
Cyanide, Total	USEPA-9014

Inorganic Analyses

Description	Method
Reactive Cyanide	USEPA-9014
Cyanide, Free	USEPA-9016
Organic Halides, Total	USEPA-9020B
Extractable Organic Halides	USEPA-9023
Sulfide	USEPA-9034
Sulfate	USEPA-9038
pH	USEPA-9040C
pH	USEPA-9041A
pH	USEPA-9045D
Conductivity	USEPA-9050A
Bromide	USEPA-9056A
Chloride	USEPA-9056A
Chloride	USEPA-9056A
Fluoride	USEPA-9056A
Nitrogen, Nitrate	USEPA-9056A
Nitrogen, Nitrite	USEPA-9056A
Sulfate	USEPA-9056A
Organic Carbon, Total	USEPA-9060A
Phenolics	USEPA-9065
Oil & Grease, HEM	USEPA-9070A
Total Petroleum Hydrocarbons, HEM-SGT	USEPA-9070A
Oil & Grease, HEM	USEPA-9071B
Total Petroleum Hydrocarbons, HEM-SGT	USEPA-9071B
Paint Filter Liquids Test	USEPA-9095B
Chloride	USEPA-9251
Organic Carbon, Total	Walkley-Black

Metals Analyses

Description	Method
Grain Size (Sieve)	ASTM D422-63(07)
Grain Size (Sieve+Hydrometer)	ASTM D422-63(07)
Magnesium as Calcium Carbonate	SM 2340 B-2011
Magnesium as Calcium Carbonate	SM 2340 B-2011
Mercury	USEPA-1631E
Aluminum	USEPA-200.7 Rev. 4.4
Antimony	USEPA-200.7 Rev. 4.4
Arsenic	USEPA-200.7 Rev. 4.4
Barium	USEPA-200.7 Rev. 4.4
Beryllium	USEPA-200.7 Rev. 4.4
Boron	USEPA-200.7 Rev. 4.4
Cadmium	USEPA-200.7 Rev. 4.4
Calcium	USEPA-200.7 Rev. 4.4
Chromium	USEPA-200.7 Rev. 4.4
Cobalt	USEPA-200.7 Rev. 4.4
Copper	USEPA-200.7 Rev. 4.4
Gallium	USEPA-200.7 Rev. 4.4
Germanium	USEPA-200.7 Rev. 4.4
Gold	USEPA-200.7 Rev. 4.4
Indium	USEPA-200.7 Rev. 4.4
Iron	USEPA-200.7 Rev. 4.4
Lead	USEPA-200.7 Rev. 4.4
Lithium	USEPA-200.7 Rev. 4.4
Magnesium	USEPA-200.7 Rev. 4.4
Manganese	USEPA-200.7 Rev. 4.4
Molybdenum	USEPA-200.7 Rev. 4.4
Nickel	USEPA-200.7 Rev. 4.4
Potassium	USEPA-200.7 Rev. 4.4
Selenium	USEPA-200.7 Rev. 4.4
Silver	USEPA-200.7 Rev. 4.4
Sodium	USEPA-200.7 Rev. 4.4
Strontium	USEPA-200.7 Rev. 4.4
Thallium	USEPA-200.7 Rev. 4.4
Tin	USEPA-200.7 Rev. 4.4
Titanium	USEPA-200.7 Rev. 4.4
Vanadium	USEPA-200.7 Rev. 4.4
Zinc	USEPA-200.7 Rev. 4.4
Zirconium	USEPA-200.7 Rev. 4.4
Aluminum	USEPA-200.8 Rev. 5.4
Antimony	USEPA-200.8 Rev. 5.4
Arsenic	USEPA-200.8 Rev. 5.4
Barium	USEPA-200.8 Rev. 5.4
Beryllium	USEPA-200.8 Rev. 5.4
Boron	USEPA-200.8 Rev. 5.4
Cadmium	USEPA-200.8 Rev. 5.4
Chromium	USEPA-200.8 Rev. 5.4
Cobalt	USEPA-200.8 Rev. 5.4
Copper	USEPA-200.8 Rev. 5.4
Gold	USEPA-200.8 Rev. 5.4

Metals Analyses

Description	Method
Lead	USEPA-200.8 Rev. 5.4
Manganese	USEPA-200.8 Rev. 5.4
Molybdenum	USEPA-200.8 Rev. 5.4
Nickel	USEPA-200.8 Rev. 5.4
Platinum	USEPA-200.8 Rev. 5.4
Rubidium	USEPA-200.8 Rev. 5.4
Selenium	USEPA-200.8 Rev. 5.4
Silver	USEPA-200.8 Rev. 5.4
Strontium	USEPA-200.8 Rev. 5.4
Thallium	USEPA-200.8 Rev. 5.4
Tin	USEPA-200.8 Rev. 5.4
Uranium	USEPA-200.8 Rev. 5.4
Vanadium	USEPA-200.8 Rev. 5.4
Zinc	USEPA-200.8 Rev. 5.4
Mercury	USEPA-245.1 Rev. 3.0
Aluminum	USEPA-6010C
Antimony	USEPA-6010C
Arsenic	USEPA-6010C
Barium	USEPA-6010C
Beryllium	USEPA-6010C
Boron	USEPA-6010C
Cadmium	USEPA-6010C
Calcium	USEPA-6010C
Chromium	USEPA-6010C
Cobalt	USEPA-6010C
Copper	USEPA-6010C
Gallium	USEPA-6010C
Germanium	USEPA-6010C
Gold	USEPA-6010C
Indium	USEPA-6010C
Iron	USEPA-6010C
Lead	USEPA-6010C
Lithium	USEPA-6010C
Magnesium	USEPA-6010C
Manganese	USEPA-6010C
Molybdenum	USEPA-6010C
Nickel	USEPA-6010C
Potassium	USEPA-6010C
Scandium	USEPA-6010C
Selenium	USEPA-6010C
Silver	USEPA-6010C
Sodium	USEPA-6010C
Strontium	USEPA-6010C
Sulfur	USEPA-6010C
Thallium	USEPA-6010C
Tin	USEPA-6010C
Titanium	USEPA-6010C
Vanadium	USEPA-6010C
Zinc	USEPA-6010C
Zirconium	USEPA-6010C
Aluminum	USEPA-6020A
Antimony	USEPA-6020A
Arsenic	USEPA-6020A
Barium	USEPA-6020A

Metals Analyses

Description	Method
Beryllium	USEPA-6020A
Boron	USEPA-6020A
Cadmium	USEPA-6020A
Chromium	USEPA-6020A
Cobalt	USEPA-6020A
Copper	USEPA-6020A
Gold	USEPA-6020A
Lead	USEPA-6020A
Lead, Total (Calc)	USEPA-6020A
Lead, Total (Coarse)	USEPA-6020A
Lead, Total (Fine)	USEPA-6020A
Manganese	USEPA-6020A
Molybdenum	USEPA-6020A
Nickel	USEPA-6020A
Palladium	USEPA-6020A
Phosphorus	USEPA-6020A
Platinum	USEPA-6020A
Rubidium	USEPA-6020A
Selenium	USEPA-6020A
Silver	USEPA-6020A
Strontium	USEPA-6020A
Thallium	USEPA-6020A
Tin	USEPA-6020A
Uranium	USEPA-6020A
Vanadium	USEPA-6020A
Zinc	USEPA-6020A
Zirconium	USEPA-6020A
Mercury	USEPA-7470A
Mercury	USEPA-7471B

Semivolatile Analyses

Description	Method
Volatile Organics in Air GC(Charcoal)	40CFR Method 18
Volatile Organics in Air GC(Tedlar Bag)	40CFR Method 18
Diesel Range Organics Wisconsin Method	DNR PUBL-SW-141
Dissolved Gases	RSK-175
Ethane	RSK-175
Ethylene	RSK-175
Methane	RSK-175
Organochlorine Pesticides	USEPA-608
Polychlorinated Biphenyls	USEPA-608
Methoxychlor	USEPA-608.2
Chlorinated Hydrocarbons	USEPA-612
Semivolatiles	USEPA-625
EDB/DBCP	USEPA-8011
Alcohols	USEPA-8015C
Diesel Range Organics	USEPA-8015C
Glycol Ethers	USEPA-8015C
Oil Range Organics	USEPA-8015C
Organochlorine Pesticides	USEPA-8081B
Polychlorinated Biphenyls	USEPA-8082A
Chlorinated Hydrocarbons	USEPA-8121
Chlorinated Herbicides	USEPA-8151A
Semivolatiles	USEPA-8270C
Semivolatiles	USEPA-8270C (SIM)
Semivolatiles	USEPA-8270D
Semivolatiles	USEPA-8270D (SIM)
Carbonyl Compounds	USEPA-8315A
Formaldehyde	USEPA-8315A
Acrylamide	USEPA-8316
Explosives	USEPA-8330A
Explosives	USEPA-8330B
Nitroglycerin	USEPA-8332
Nitroglycerin + PETN	USEPA-8332

Volatile Analyses

Description	Method
Gasoline Range Organics Wisconsin Method	DNR PUBL-SW-140
Volatiles	USEPA-524.2
Volatile Halocarbons	USEPA-601
Volatile Aromatics	USEPA-602
Volatiles	USEPA-624
Gasoline Range Organics	USEPA-8015C
Volatiles	USEPA-8021B
Volatiles	USEPA-8260B
Volatiles	USEPA-8260B (SIM)
Volatiles	USEPA-8260C

Appendix C

TRIMATRIX
LABORATORIES

Monthly Ordering Sheet

Budget

Amt Spent

For the Month of: ________________________________

Date Requested	**Approved By**	**Date Ordered**	**Initials**	**Quantity**	**Package Type**	**Qty of Pkg**	**Item**	**Catalog #**	**Contact**	**Vendor**	**PO Number**	**Backorder Date**	**Price for Each Unit**	**Date Received**

Appendix D

TRIMATRIX
LABORATORIES

Vendor Approval Record

Date Approved	Approved By	Vendor Name	Why Approved

Appendix E

TRIMATRIX
LABORATORIES

Inst. #	Department	Item	Manufacturer	Model
177	Administration	Analytical Balance	Mettler	AE200
204	Administration	Toploading Balance	Mettler	BB2440
207	Administration	Analytical Balance	Denver	A-250
209	Administration	Toploading Balance	Mettler	PC4400
210	Administration	Analytical Balance	Mettler	AE163
211	Administration	Toploading Balance	Mettler	PB1502
215	Administration	Toploading Balance	Denver	P-4002
327	Administration	Toploading Balance	Mettler	MS3002S/03
343	Administration	Toploading Balance	Mettler	MS3002S/03
356	Administration	Analytical Balance	Mettler	XS204DR
100	Inorganic	pH/ISE Meter	Orion	8102
165	Inorganic	Expandable Ion Analyzer	Orion	EA920
167	Inorganic	Spectrophotometer	Shimadzu	1201
185	Inorganic	pH Meter	Fisher	Accumet AB15
186	Inorganic	Flashpoint Tester	Koehler	RT-1
188	Inorganic	Conductivity Meter	YSI	3200
196	Inorganic	Ion Chromatograph	Lachat	IC-8000
298	Inorganic	Automated Ultraviolet Spectrophotometer	Konelab	Aqua 20
303	Inorganic	Automated Ultraviolet Spectrophotometer	Konelab	20
305	Inorganic	Dissolved Oxygen Meter	Orion	1113000
306	Inorganic	Ion Chromatograph	Dionex	ICS-2000
309	Inorganic	pH Meter	Fisher	AB15
310	Inorganic	Autoclave	Market Forge	STM-E
312	Inorganic	Portable Multi-meter (pH/Cond/Sal/TDS/LDO)	HACH	HQ40d
313	Inorganic	Turbidimeter	HACH	2100N
324	Inorganic	TOC Analyzer	OI Analytical	Aurora 1030
326	Inorganic	Automated Chemistry Analyzer	OI Analytical	Flow Solution 3100
330	Inorganic	Spectrophotometer	Shimadzu	UV-1800
334	Inorganic	Carbon Analyzer	LECO	C632 (620-200-100)
336	Inorganic	Digestion Unit	Fisher	BD40
337	Inorganic	Heating Block	HACH	COD Reactor
338	Inorganic	Heating Block	HACH	COD Reactor
347	Inorganic	Automated Chemistry Analyzer	OI Analytical	Flow Solution FS-3100
349	Inorganic	pH Meter	Fisher	AB150
355	Inorganic	pH Meter	Fisher	AB150
305a	Inorganic	DO Probe	Orion	081010MD
201	Metals	ICP/MS	Perkin Elmer	ELAN 6100 ICP/MS
216	Metals	Cold Vapor AA Mercury Analyzer	PS Analytical	PSA Millenium System
217	Metals	Hotblock Digestor	Environmental Express	CS154
218	Metals	Hotblock Digestor	Environmental Express	CS154
219	Metals	Hotblock Digestor	Environmental Express	CS154
220	Metals	Hotblock Digestor	Environmental Express	CS154
311	Metals	ICP	Perkin Elmer	5300DV
335	Metals	ICP/MS	Perkin Elmer	NexION 300 Series

Inst. #	Department	Item	Manufacturer	Model
346	Metals	Low Level Mercury Analyzer	PS Analytical	PSA Millenium System
348	Metals	Hotblock Digestor	Environmental Express	SC154
354	Metals	ICP	Perkin Elmer	Optima 8300 ICP-OES
191	Organic Prep	Sonicator	Fisher	500
192	Organic Prep	Sonicator	Fisher	500
225	Organic Prep	Accelerated Solvent Extractor	Dionex	ASE 300
329	Organic Prep	Accelerated Solvent Extractor	Dionex	ASE-350
341	Organic Prep	Sonicator	Fisher	FB-505
342	Organic Prep	Ultrasonic Bath	Fisher	FS140
345	Organic Prep	GPC Cleanup	J2 Scientific	AccuPrep MPS
144	Semivolatiles GC	Gas Chromatograph - ECD	Hewlett Packard	5890A
158	Semivolatiles GC	Gas Chromatograph - ECD	Hewlett Packard	5890A
199	Semivolatiles GC	Gas Chromatograph - ECD	Hewlett Packard	6890
222	Semivolatiles GC	Gas Chromatograph - ECD	Agilent	6890
333	Semivolatiles GC	Gas Chromatograph - FID	Agilent	7890A
340	Semivolatiles GC	HPLC	Perkin Elmer	Flexar
344	Semivolatiles GC	Gas Chromatograph - ECD	Agilent	7890A
352	Semivolatiles GC	Gas Chromatograph - FID	Agilent	7890BDF
195	Semivolatiles MS	Gas Chromatograph/Mass Spectrometer	Hewlett Packard	5973
308	Semivolatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	5975B
339	Semivolatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	7890A
117	Volatiles GC	Gas Chromatograph - PID/ELCD	Agilent	6890
140	Volatiles GC	Gas Chromatograph -	Hewlett Packard	5890 Series II
142	Volatiles GC	Gas Chromatograph -	Hewlett Packard	5890 Series II
332	Volatiles GC	Gas Chromatograph - FID	Agilent	7890A
224	Volatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	5973 MSD
323	Volatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	6890/5973 Inert
328	Volatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	7890A/5975C
350	Volatiles MS	Gas Chromatograph/Mass Spectrometer	Agilent	7890B/5977A

Appendix F

TRIMATRIX
LABORATORIES

New Employee Orientation Checklist

Name: ________________________________ **Employee #:** ______________ **Date of Hire:** ____/____/____

I. Personnel Information Review (Human Resources Manager)

Reviewed (☑)	Item
	Employee Information Sheet Completed
	I-9 Employment Eligibility Verification Form Completed
	W-4 Forms Completed
	Employee Benefits Reviewed
	Direct Deposit Forms Initiated
	Details of Compensation Reviewed
	Key Fob to the Facility Provided (Number __________________)
	Employee Handbook Distributed
	Code of Ethics / Data Integrity Policy Agreement Form Signed and Collected. Violation of Ethics Policy Explained.

Signatures below attest that all the information or items described above have been discussed/provided:

____/____/____ ______________________________
Human Resources Manager Signature

____/____/____ ______________________________
Employee Signature

New Employee Orientation Checklist

II. Quality Assurance Training (Quality Assurance Officer)

Reviewed (☑)	**Item**
	Initial and Continuing Demonstration of Capability Requirements Reviewed
	Corrective Action (Non-Conformance) Investigation Procedure Reviewed
	Code of Ethics/Data Integrity Policies Explained
	Initials Added to the Initials Logbook

Training Forms Initiated for the Following Documents

Initiated (☑)	**All Employees**
	Quality Assurance Manual
	GR-10-109 Employee Training Protocols
	GR-10-122 Preventive Action
	GR-10-124 Code of Ethics for Data Integrity
	GR-10-127 Error Correction Policies and Practices

YES	**NA**	**Job Specific**
		USDA Soil Permit
		GR-10-103 Guidelines for Data Generation, Validation, Approval, and Reporting
		GR-10-104 Chain-of-Custody (COC)
		GR-10-107 Documentation and Procedures for Instrument Maintenance Activities
		GR-10-115 Manual Integrations
		GR-10-118 Data Confidentiality
		GR-10-125 Method Detection Limit (MDL)
		GR-10-106 Inorganic and Metals Laboratories Corrective Actions
		GR-03-101 Semi-Volatiles Laboratory Quality Control Corrective Actions
		GR-03-124 Volatile Organic Laboratory Corrective Actions

Signatures below attest that all the information or items described above have been discussed/provided:

____/____/____ ______________________________ Quality Assurance Officer Signature

____/____/____ ______________________________ Employee Signature

New Employee Orientation Checklist

III. Safety Training (Health and Safety Officer)

Reviewed (☑)	**Item**
	MSDS Location Discussed
	Safety Walk/Safety Equipment Review, First-Aid Cabinet Locations Identified
	Safety Exam Explained-First two of thirteen videos completed (others to be completed on own during normal working hours)

Training Forms Initiated for the Following Documents

Initiated (☑)	**<u>All Employees</u>**
	Chemical Hygiene Plan
	Safety Manual
	Emergency Action Plan

YES	**NA**	**The Following Safety Items were Ordered or Distributed**
		Safety Glasses
		Lab Coat

Signatures below attest that all the information or items described above have been discussed/provided:

____/____/____ ________________________________ ____/____/____ ________________________________

Safety Officer Signature Employee Signature

New Employee Orientation Checklist

IV. General Laboratory Area Overview (Area Supervisor)

Reviewed (☑)	**Item**
	Primary Job Responsibilities Reviewed
	Job Levels and Requirements for Advancement Reviewed
	Introduction to Apparatus and Materials Completed
	Specific Laboratory Area Safety Issues Reviewed
	Method/SOP – Laboratory Intranet Library Directories Shown
	Instrument Manual Storage Location Shown
	Instrument Maintenance Logbook Requirements Reviewed
	Instrument Run Logbook Requirements Reviewed
	Method Detection Limit Study Requirements Reviewed
	Overview of Laboratory Area LIMS Requirements and Procedures Reviewed
	General Paperwork Flow and Benchsheet Procedures Reviewed
	QC Types / Control Windows / Qualifier Procedures Reviewed
	Data Review and Documentation Procedures Reviewed

Signatures below attest that all the information or items described above have been discussed/provided:

____/____/____ ________________________________ ____/____/____ ________________________________

Area Supervisor Signature Employee Signature

Appendix G

TRIMATRIX
LABORATORIES

CODE OF ETHICS / DATA INTEGRITY AGREEMENT

All full time, part time and contracted employees working for TriMatrix Laboratories, Inc. are required to make every effort to conduct quality work with data integrity, ethical practices and professionalism. To ensure strength in the individual, in the laboratory organization and in client relationships, each employee must be aware of the following company policies:

I. Each TriMatrix employee is responsible for the propriety and consequences of his or her actions when representing the laboratory through sample analysis, data review, adherence to policies and procedures, client /vender relationships, other employees and/or visitors.

II. All aspects of company business must be conducted in an ethical, legal and professional manner, and in compliance with all applicable federal, state and local laws and regulations.

III. Under no circumstances must client confidentiality be compromised or any information regarding the client be revealed to another agency without the client's prior written permission.

IV. Gratuities, gifts and/or rewards provided by clients or vendors are laboratory property and may not be kept for personal use without written approval.

V. Reporting of data integrity issues is encouraged. Reporting shall be kept confidential when anonymity is requested and/or required.

Additionally, violations of the data integrity/code of ethics policy may result in immediate termination of employment with TriMatrix Laboratories, Inc. Such violations include the following:

A. Intentionally misrepresenting laboratory data in any manner.

B. Intentionally misapplying any date and/or time.

C. Intentional representation of another employee without written approval.

D. Intentional omission of any information, fact or datum.

E. Intentional deviation from or shortcut through a procedure without written approval.

A highly ethical approach to laboratory analysis/reporting is a key component of the TriMatrix laboratory objective. This approach is backed by management in providing the facilities, equipment and time necessary minimize undue pressures to make compromises, whether such pressures be internal or external.

AGREEMENT STATEMENT

I have read and understood the Code of Ethics/Data Integrity Agreement, and agree to abide by all policies stated. I understand that violation of these policies may result in severe consequences up to and including termination of my employment with TriMatrix Laboratories, Inc.

Employee (print name)	Signature	Date

Appendix H

TRIMATRIX LABORATORIES

******************** LABORATORY

DEMONSTRATION OF CAPABILITY FOR ********************************

Parameter	Date Analyzed	Method	Inst. #	Units	Amount Apiked	Cert. #1 Amount Found	Cert. #2 Amount Found	Cert. #3 Amount Found	Cert. #4 Amount Found	Average Percent Recovery	Percent Recovery Window	Pass/Fail Percent Recovery	Percent RSD	Percent RSD Window	Percent RSD Pass/Fail	Overall Pass/Fail

Appendix I

TRIMATRIX LABORATORIES

INORGANIC LABORATORY
DEMONSTRATION OF CAPABILITY

Parameter: Percent Solids

Trainer: John Doe

Method: SW-846 3550B/GR-07-115

Trainee: John Smith

Analyst	Date	Run #1	Run #2	Run #3	Run #4	Units	Inst. #	Standard Deviation	Average	Degrees of Freedom D	Experimental Student's t Value	Tabular Student's t Value	Are the Two Sets of Results Statistically the Same AND RSDs<20?
John Doe	12/31/02	48.3	55.6	44.2	47.5	%	117	4.81	48.9	5.48	0.227	3.365	YES(PASS)
John Smith	12/31/02	45.9	50.2	52.1	44.7	%	117	3.50	48.2				

Appendix J

TRIMATRIX
LABORATORIES

New Instrument Information and Initial Demonstration of Capability

Item: ____________________ **Serial Number:** ____________________
Manufacturer: ____________________ **Date Received:** ____________________
Model: ____________________ **Location:** ____________________

Initial Demonstration of Capability Passed: ____________________

Date Initial Demonstration of Capability Completed: ____________________

Initial Demonstration of Capability Data Attached: ____________________

Adequate Sensitivity Achieved (LFB or MDL Completed): Yes / No / N/A

LFB or MDL Documentation Attached: Yes / No / N/A

Date LFB or MDL Completed: ____________________

Linear Range Developed and Demonstrated: Yes / No / N/A

Linear Range Development Information Attached: Yes / No / N/A

Software Verification Completed (QA Use Only): Yes / No / N/A

Date Software Verification Completed (QA Use Only): ____________________

Notes: ____________________

Approvals and Assigned Instrument Number

____________________ ____________________
Quality Assurance Officer **Area Supervisor**

TriMatrix Instrument Number: ____________________ **Date In Service:** ____________________

Appendix K

TRIMATRIX
L A B O R A T O R I E S

NELAC Demonstration of Capability Certification Statement

Employee Name: [redacted] **Date:** 05/11/12

Method Name(s), Number(s), and Revision(s):

[5210 B 20th ed/online] Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Part 5210 B, "5-Day BOD Test"; Standard Methods for the Examination of Water and Wastewater, online Edition, 2001, Part 5210 B, "5-Day BOD Test" (Note: All dissolved oxygen readings are taken with a luminescence probe instead of the membrane probe described in the method) Title: Biochemical Oxygen Demand (5-day BOD/CBOD)

Matrix: not applicable **Analyte(s) or Parameter:** procedure revision

SOP Number: GR-18-103 **Revision Number:** REV 2.6

We, the undersigned, CERTIFY that:

YES / NA

☐ ☒ 1. The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.

☐ ☒ 2. The test method(s) was performed by the analyst identified on this certification.

☒ ☐ 3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.

☐ ☒ 4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory.

> With *true* meaning consistent with supporting data; *accurate* meaning based on good laboratory practices consistent with sound scientific principles/practices; *complete* meaning includes the results of all supporting performance testing; and *self-explanatory* meaning data properly labeled and stored so that the results are clear and require no additional explanation.

☐ ☒ 5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

This certification form must be completed each time an Initial Demonstration of Capability study is performed, or when a Continuing Demonstration of Capability study is performed in conjunction with a revised SOP.

[redacted] ______________________ Area Supervisor ______________ Date

[redacted] ______________________ Quality Assurance Officer ______________ Date

Appendix L

TRIMATRIX
LABORATORIES

LABORATORY TRAINING CHECKLIST

Trainee Name:	[redacted]
Trainer Name:	[redacted]
Method Number(s) and Revision(s):	[5210 B 20th ed/online] Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Part 5210 B, “5-Day BOD Test”; Standard Methods for the Examination of Water and Wastewater, online Edition, 2001, Part 5210 B, “5-Day BOD Test” (Note: All dissolved oxygen readings are taken with a luminescence probe instead of the membrane probe described in the method) Title: Biochemical Oxygen Demand (5-day BOD/CBOD)
SOP Name, Number, and Revision:	Biochemical Oxygen Demand (5-Day BOD/CBOD), GR-18-103, REV 2.6
Applicable Matrices:	wastewaters, effluents and polluted waters

NA	**Trainer/Trainee Initials**		**Item**
☐			1) The trainee has read the Standard Operating Procedure, and when referenced, the associated method.
☐			2) The trainer has reviewed the Standard Operating Procedure, and when referenced, the associated method, with the trainee.
☐			3) The trainer has demonstrated the procedure for the trainee.
☐			4) The trainee has correctly performed the procedure under direct supervision of the trainer.
☐			5) The trainee has been instructed in all QA/QC requirements of the procedure.
☐			6) The trainee has been instructed in all paperwork, logbook and benchsheet requirements relevant to the procedure.
☐			7) The trainee has successfully and exclusively completed an Initial Demonstration of Capability (IDC).
☐			8) The DoC spreadsheet has been completed. The spreadsheet and all supporting analytical data have been attached.

The required Items have been successfully completed. In my opinion, initial training is now complete, and the trainee is capable of correctly performing the procedure.

Trainer:____ **Date:** __________________________

I have read and understand the SOP, understand what is required, and agree to follow it as written. I understand that I may not deviate from the SOP without prior approval from management.

Trainee:____ **Date:** __________________________

Appendix M

TRIMATRIX
LABORATORIES

INORGANIC/METALS/SEMI-VOLATILE/VOLATILE LABORATORY
2012 WATER/SOIL
METHOD DETECTION LIMIT STUDY

Parameter / Compound	Instrument Number	Reference Citation	Date Analyzed	Amount Spiked	Units	Rep. #1 Amount Found	Rep. #2 Amount Found	Rep. #3 Amount Found	Rep. #4 Amount Found	Rep. #5 Amount Found	Rep. #6 Amount Found	Rep. #7 Amount Found	Average Amount Found	Average % Recovery	Standard Deviation	MDL

TRIMATRIX
LABORATORIES

INORGANIC/METALS/SEMI-VOLATILE/VOLATILE LABORATORY
2012 WATER/SOIL
METHOD DETECTION LIMIT STUDY

Parameter / Compound	Average Amount Found	Average % Recovery	Standard Deviation	MDL	Amount Spiked	MDL Window	Pass / Fail	Average % Recovery Check	Minimum Report Limit (Amount Spiked)	Difference Between Minimum Reporting Limit and
							Missing Parameter / Compound			
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TRIMATRIX
LABORATORIES

INORGANIC/METALS/SEMI-VOLATILE/VOLATILE LABORATORY
2012 WATER/SOIL
LIMIT OF DETECTION (LOD) VERIFICATION STUDY (INITIAL)

Parameter / Compound	Instrument Number	Reference Citation	MDL Result	Units	Date	Analyst	LOD Verification Concentration	MDL/LOD Verification Concentration Difference	MPB Result	LOD Verification Result	MPB/LOD Verification Response Increase	LOD Verification Acceptable (≥3x MPB Response)?

Appendix N

TRIMATRIX
LABORATORIES

CONTINUING DEMONSTRATION OF CAPABILITY CHECKLIST

Employee Name:	[redacted]
Method Number(s) and Revision(s):	[5210 B 20th ed/online] Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Part 5210 B, “5-Day BOD Test”; Standard Methods for the Examination of Water and Wastewater, online Edition, 2001, Part 5210 B, “5-Day BOD Test” (Note: All dissolved oxygen readings are taken with a luminescence probe instead of the membrane probe described in the method) Title: Biochemical Oxygen Demand (5-day BOD/CBOD)
Specific Analyte(s):	BOD analysis
Date of Analysis:	05/09/12
SOP Number:	GR-18-103
Revision:	REV 2.6
Applicable Matrices:	wastewaters, effluents and polluted waters
Specific matrix:	water
Area Supervisor:	hlb

CDC Completed via

☒	Preparing or analyzing four BSs or SCVs as a repeat of the initial demonstration study.
☐	Calculating a CDC from four existing consecutive BSs or SCVs (if done exclusively by the analyst).
☐	Statistical comparison of four same-sample aliquots against another analyst's identical data.
☐	Calculating a CDC from the last four runs of an MDL study (if done exclusively by the analyst).
☐	The successful completion of a blind PT study sample (if done exclusively by the analyst). Study Name:

N/A	Yes	DOC Supporting Data
☐	☒	The DOC spreadsheet has been completed. The spreadsheet and all supporting analytical data have been attached.
☒	☐	Documentation that shows only the last four runs from an MDL study, or that four consecutive BSs or SCVs were used is attached.
☐	☒	NELAC Demonstration of Capability Certification Statement attached.

Analyst Signature: ________________________________ Date: ______________

Area Supervisor Signature: ________________________________ Date: ______________

Quality Assurance Officer Signature: ________________________________ Date: ______________

TRIMATRIX LABORATORIES

SOP MINOR REVISION
LABORATORY TRAINING CHECKLIST

Employee Name:	[redacted]
Method Number(s) and Revision(s):	[5210 B 20th ed/online] Standard Methods for the Examination of Water and Wastewater, 20th Edition, 1998, Part 5210 B, “5-Day BOD Test”; Standard Methods for the Examination of Water and Wastewater, online Edition, 2001, Part 5210 B, “5-Day BOD Test” (Note: All dissolved oxygen readings are taken with a luminescence probe instead of the membrane probe described in the method) Title: Biochemical Oxygen Demand (5-day BOD/CBOD)
SOP Name, Number, and Revision:	Biochemical Oxygen Demand (5-Day BOD/CBOD), GR-18-103, REV 2.6
Applicable Matrices:	wastewaters, effluents and polluted waters

NA	Employee Initials		Item
☐	☐	1)	I have read and understood the updated method and/or the revised Standard Operating Procedure.
☐	☐	2)	I have read and understood any new QA/QC requirements of this procedure.
☐	☐	3)	NELAC Demonstration of Capability Certification Statement is attached.

I have read and understand the revised SOP, understand what is required, and agree to follow it as instructed. I understand that I may not deviate from the SOP without prior approval from management.

Date:___________________ **Employee Signature:**____

The SOP revision has been successfully implemented.

Date:___________________ **QA/QC Signature:**____

Appendix O

TRIMATRIX
LABORATORIES

WORK ORDER 1204360

Printed: 5/4/2012, 10:56:38AM

Inorganic - Wet Chemistry Sample Receipt Notice

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Client Due Date:	**May-17-12 23:00 (19 day TAT)**	Report Level:	**3MD**
W.O. Comments:	*QC is 3MD; full list spike*		

Lab Number	**Sample Name** Analysis	**Matrix**	**Sampled Date** TAT	Expire Date	**Sample Comments** Lab Due Date	Comments
1204360-01	**1: Minerals**	**Water**	**Apr-20-12 00:00 Eastern**			
	Alkalinity, Total 2320 B		28	May-04-12 00:00	May-17-12 13:40	ERA WP Minerals
	Chloride 9056A		28	May-18-12 00:00	May-17-12 13:40	ERA WP Minerals
	Chloride 9251		28	May-18-12 00:00	May-17-12 13:40	
	Conductivity 9050A		28	May-18-12 00:00	May-17-12 13:40	ERA WP Minerals
	Fluoride 4500-F C		28	May-18-12 00:00	May-17-12 13:40	Delete Fluoride sample and ADD to Minerals
	Fluoride 9056A		28	May-18-12 00:00	May-17-12 13:40	Delete Fluoride sample and ADD to Minerals
	Solids, TDS 2540 C		28	Apr-27-12 00:00	May-17-12 13:40	Remove from WP Solids but leave in WP Minerals
	Solids, Total 2540 B		28	Apr-27-12 00:00	May-17-12 13:40	Remove from WP Solids and add to WP Minerals
	Sulfate 9038		28	May-18-12 00:00	May-17-12 13:40	ERA WP Minerals
	Sulfate 9056A		28	May-18-12 00:00	May-17-12 13:40	ERA WP Minerals
1204360-02	**2: Hardness**	**Water**	**Apr-20-12 00:00 Eastern**			
	Hardness 2340 C (Custom Equation)		19	Oct-17-12 00:00	May-16-12 17:00	
	Solids, TSS 2540 D		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Solids
1204360-03	**3: pH**	**Water**	**Apr-20-12 00:00 Eastern**			
	pH 9040B		28	Apr-20-12 00:00	May-17-12 13:40	GOOD WP pH
1204360-04	**4: Settleable Solids**	**Water**	**Apr-20-12 00:00 Eastern**			
	Solids, Settleable 2540 F		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Settleable Solids
1204360-05	**5: Volatile Solids**	**Water**	**Apr-20-12 00:00 Eastern**			
	Solids, TVS 160.4 (mg/L)		28	Apr-27-12 00:00	May-17-12 13:40	
1204360-06	**6: Simple Nutrients**	**Water**	**Apr-20-12 00:00 Eastern**			
	Nitrogen, Ammonia 4500-NH3 G		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Nutrients
	Nitrogen, NO3 4500-NO3 F		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nutrients
	Nitrogen, NO3 9056A		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nutrients
	Nitrogen, NO3+NO2 4500-NO3 F		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Nitrate-Nitrite as N
	Phosphate, Ortho 4500-P E		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nutrients
1204360-07	**7: Complex Nutrients**	**Water**	**Apr-20-12 00:00 Eastern**			
	Nitrogen, TKN 351.2		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Nutrients
	Phosphorus, Total 4500-P E		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Nutrients
1204360-08	**8: Nitrite as N**	**Water**	**Apr-20-12 00:00 Eastern**			
	Nitrogen, Nitrite SM 4500-NO3 F		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nitrite as N
	Nitrogen, NO2 4500-NO2 B		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nitrite as N
	Nitrogen, NO2 9056A		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Nitrite as N

Inorganic - Wet Chemistry Sample Receipt Notice

Lab Number	Sample Name Analysis	Matrix	Sampled Date TAT	Expire Date	Sample Comments Lab Due Date	Comments
1204360-09	**9: Demand**	**Water**	**Apr-20-12 00:00 Eastern**			
	BOD 5-Day 5210B		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Demand
	BOD 5-Day Carb 5210 B		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Demand
	COD 5220 D		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Demand
	TOC 9060		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Demand
1204360-10	**10: Oil & Grease**	**Water**	**Apr-20-12 00:00 Eastern**			
	HEM: O&G 1664A		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Oil & Grease
1204360-13	**13: Hexavalent Chromium**	**Water**	**Apr-20-12 00:00 Eastern**			
	Cr6 Diss 7196A		28	Apr-21-12 00:00	May-17-12 13:40	GOOD WP Hexavalent Chromium
1204360-15	**15: Color**	**Water**	**Apr-20-12 00:00 Eastern**			
	Color 2120B		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Color
1204360-16	**16: Turbidity**	**Water**	**Apr-20-12 00:00 Eastern**			
	Turbidity 2130 B		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP Turbidity
1204360-17	**17: Total Cyanide**	**Water**	**Apr-20-12 00:00 Eastern**			
	Cyanide, Total 9014		28	May-04-12 00:00	May-17-12 13:40	GOOD WP Total Cyanide
1204360-18	**18: Total Phenolics**	**Water**	**Apr-20-12 00:00 Eastern**			
	Phenolics 9065		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Total Phenolics
1204360-19	**19: Sulfide**	**Water**	**Apr-20-12 00:00 Eastern**			
	Sulfide 9034		28	Apr-27-12 00:00	May-17-12 13:40	GOOD Sulfide
	Sulfide, Total 4500-S2 D		28	Apr-27-12 00:00	May-17-12 13:40	GOOD Sulfide
1204360-20	**20: MBAS**	**Water**	**Apr-20-12 00:00 Eastern**			
	MBAS 5540 C		28	Apr-22-12 00:00	May-17-12 13:40	GOOD WP MBAS
1204360-21	**21: Acidity as CaCO3**	**Water**	**Apr-20-12 00:00 Eastern**			
	Acidity 2310 B		28	May-04-12 00:00	May-17-12 13:40	GOOD WP Acidity as CaCO3
1204360-22	**22: Bromide**	**Water**	**Apr-20-12 00:00 Eastern**			
	Bromide 9056A		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Bromide
	Bromide D 1246-88		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Bromide
1204360-35	**35: Total Organic Halides (TO**	**Water**	**Apr-20-12 00:00 Eastern**			
	TOX 9020B		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Total Organic Halides (TOX)
1204360-38	**38: Total Petroleum Hydrocar**	**Water**	**Apr-20-12 00:00 Eastern**			
	HEM-SGT: TPH 1664A		28	May-18-12 00:00	May-17-12 13:40	GOOD WP Total Petroleum Hydrocarbons
1204360-42	**42: Silica as SiO2**	**Water**	**Apr-20-12 00:00 Eastern**			
	Silica, Diss 4500-SiO2 D(low level)		28	May-18-12 00:00	May-17-12 13:40	Silica

Inorganic - Wet Chemistry Analysis Detail

* indicates custom

Matrix	Analysis	Unit	MDL	RL
Water	Bromide D 1246-88	mg/L	0.152	0.5
Water	Color 2120B	A.C.U.	5	5
Water	Turbidity 2130 B	NTU	0.2	1
Water	Acidity 2310 B	mg/L	4.02	10
Water	Alkalinity, Total 2320 B	mg/L	0.495	20
Water	Hardness 2340 C (Custom Equation)	mg/L	1.02	2
Water	Solids, Total 2540 B	mg/L	50	50
Water	Solids, TDS 2540 C	mg/L	50	50
Water	Solids, TSS 2540 D	mg/L	3.3	3.3
Water	Solids, Settleable 2540 F	mL/L	0.1	0.1
Water	Fluoride 4500-F C	mg/L	0.0378	0.1
Water	Nitrogen, Ammonia 4500-NH3 G	mg/L	0.0049	0.05
Water	Nitrogen, NO2 4500-NO2 B	mg/L	0.0007	0.01
Water	Nitrogen, Nitrite SM 4500-NO3 F	mg/L	0.0073	0.05
Water	Nitrogen, NO3 4500-NO3 F	mg/L	0.0036	0.05
Water	Nitrogen, NO3+NO2 4500-NO3 F	mg/L	0.0097	0.05
Water	Phosphate, Ortho 4500-P E	mg/L	0.0007	0.01
Water	Phosphorus, Total 4500-P E	mg/L	0.003	0.01
Water	Sulfide, Total 4500-S2 D	mg/L	0.0052	0.02
Water	Silica, Diss 4500-SiO2 D(low level)	mg SiO2/L	0.0211	0.1
Water	BOD 5-Day 5210B	mg/L	1	2
Water	BOD 5-Day Carb 5210 B	mg/L	1	2
Water	COD 5220 D	mg/L	2.35	5
Water	MBAS 5540 C	mg/L	0.0209	0.025
Water	Solids, TVS 160.4 (mg/L)	mg/L	3.3	3.3
Water	HEM: O&G 1664A	mg/L	1.22	5
Water	HEM-SGT: TPH 1664A	mg/L	0.665	10
Water	Nitrogen, TKN 351.2	mg/L	0.0729	0.5
Water	Cr6 Diss 7196A	ug/L	0.0003	0.001
Water	Cyanide, Total 9014	mg/L	0.0029	0.005
Water	TOX 9020B	ug/L as Cl	3.65	10
Water	Sulfide 9034	mg/L	1	1
Water	Sulfate 9038	mg/L	0.282	5
Water	pH 9040B	pH Units		0.1
Water	Conductivity 9050A	umhos/cm	5	5
Water	Bromide 9056A	mg/L	0.0215	0.1
Water	Chloride 9056A	mg/L	0.0568	1
Water	Fluoride 9056A	mg/L	0.0401	0.1
Water	Nitrogen, NO2 9056A	mg/L	0.0268	0.1
Water	Nitrogen, NO3 9056A	mg/L	0.0154	0.1
Water	Sulfate 9056A	mg/L	0.223	2
Water	TOC 9060	mg/L	0.104	0.5
Water	Phenolics 9065	mg/L	0.0025	0.05
Water	Chloride 9251	mg/L	0.502	1

Metals Sample Receipt Notice

Client: [redacted]

Project: **WP PT Samples Spring**

Client Due Date: **May-17-12 23:00 (19 day TAT)**

W.O. Comments: *QC is 3MD; full list spike*

Project Manager: [redacted]

Project Number: **35508**

Report Level: **3MD**

Lab Number	Sample Name Analysis	Matrix	Sampled Date TAT	Expire Date	Sample Comments Lab Due Date	Comments
1204360-01	**1: Minerals**	**Water**	**Apr-20-12 00:00 Eastern**			
	K Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	ERA WP Minerals
	Na Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	ERA WP Minerals
1204360-02	**2: Hardness**	**Water**	**Apr-20-12 00:00 Eastern**			
	Ca Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	REMOVE from Minerals
	Ca Total 6010B		10	Oct-17-12 00:00	May-17-12 13:40	
	Mg Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	REMOVE from Minerals
	Mg Total 6010B		10	Oct-17-12 00:00	May-17-12 13:40	
1204360-11	**11: Trace Metals**	**Water**	**Apr-20-12 00:00 Eastern**			
	Ag Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Ag Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Al Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Al Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	
	As Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	As Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	B Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	B Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Ba Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Ba Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Be Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Be Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cd Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cd Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Co Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Co Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cr Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cr Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cu Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Cu Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Fe Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Mn Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Mn Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Mo Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Mo Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Ni Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals

Metals Sample Receipt Notice

Lab Number	**Sample Name** Analysis	**Matrix**	**Sampled Date** TAT	Expire Date	**Sample Comments** Lab Due Date	Comments
	Ni Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Pb Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Pb Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Sb Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Se Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Se Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Sr Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Sr Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Tl Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Tl Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	V Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	V Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Zn Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Zn Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
1204360-12	**12: Mercury**	**Water**	**Apr-20-12 00:00 Eastern**			
	Hg Diss 7470A		28	May-18-12 00:00	May-17-12 13:40	WP Trace Metals
1204360-14	**14: Tin and Titanium**	**Water**	**Apr-20-12 00:00 Eastern**			
	Sn Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Sn Diss 6020		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
	Ti Diss 6010B		28	Oct-17-12 00:00	May-17-12 13:40	WP Trace Metals
1204360-41	**41: Low Level Mercury**	**Water**	**Apr-20-12 00:00 Eastern**			
	Hg Total 1631E		28	May-18-12 00:00	May-17-12 13:40	Low Level Mercury

Metals Analysis Detail

* indicates custom

	Analysis	Unit	MDL	RL
Water	**USEPA-1631E**			
	Hg Total 1631E	ng/L	0.298	0.5
Water	**USEPA-6010C**			
	Ag Diss 6010B	ug/L	4.08	10
	Al Diss 6010B	ug/L	13.1	50
	As Diss 6010B	ug/L	35	100
	B Diss 6010B	ug/L	15.7	100
	Ba Diss 6010B	ug/L	2.71	10
	Be Diss 6010B	ug/L	0.235	1
	Ca Diss 6010B	mg/L	0.23	0.5
	Ca Total 6010B	mg/L	0.23	0.5
	Cd Diss 6010B	ug/L	2.03	10
	Co Diss 6010B	ug/L	3.56	10
	Cr Diss 6010B	ug/L	4.62	50
	Cu Diss 6010B	ug/L	3.85	10
	Fe Diss 6010B	ug/L	6.53	10
	K Diss 6010B	mg/L	0.0329	0.1
	Mg Diss 6010B	mg/L	0.143	0.5
	Mg Total 6010B	mg/L	0.143	0.5
	Mn Diss 6010B	ug/L	2.78	10
	Mo Diss 6010B	ug/L	22.1	100
	Na Diss 6010B	mg/L	0.127	0.5
	Ni Diss 6010B	ug/L	3.81	10
	Pb Diss 6010B	ug/L	14.6	50
	Se Diss 6010B	ug/L	32.6	100
	Sn Diss 6010B	ug/L	30.8	200
	Sr Diss 6010B	ug/L	13	50
	Ti Diss 6010B	ug/L	21.6	100
	Tl Diss 6010B	ug/L	28.7	100
	V Diss 6010B	ug/L	3.01	10
	Zn Diss 6010B	ug/L	4.89	20
Water	**USEPA-6020A**			
	Ag Diss 6020	ug/L	0.0367	0.2
	Al Diss 6020	ug/L	1.76	10
	As Diss 6020	ug/L	0.177	1
	B Diss 6020	ug/L	1.22	10
	Ba Diss 6020	ug/L	0.136	1
	Be Diss 6020	ug/L	0.111	1
	Cd Diss 6020	ug/L	0.0385	0.2
	Co Diss 6020	ug/L	0.0501	1
	Cr Diss 6020	ug/L	0.195	1
	Cu Diss 6020	ug/L	0.127	1
	Mn Diss 6020	ug/L	0.141	1
	Mo Diss 6020	ug/L	0.0753	1
	Ni Diss 6020	ug/L	0.171	1
	Pb Diss 6020	ug/L	0.152	1
	Sb Diss 6020	ug/L	0.148	1
	Se Diss 6020	ug/L	0.31	1
	Sn Diss 6020	ug/L	0.142	10
	Sr Diss 6020	ug/L	0.104	1

Metals Analysis Detail

	Analysis	Unit	* indicates custom MDL	RL
	Tl Diss 6020	ug/L	0.0268	1
	V Diss 6020	ug/L	0.0657	1
	Zn Diss 6020	ug/L	1.5	10
Water	**USEPA-7470A**			
	Hg Diss 7470A	ug/L	0.0551	0.2

Semivolatiles GC Sample Receipt Notice

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Client Due Date:	**May-17-12 23:00 (19 day TAT)**	Report Level:	**3MD**
W.O. Comments:	*QC is 3MD; full list spike*		

Lab Number	**Sample Name** Analysis	**Matrix**	**Sampled Date** TAT	Expire Date	**Sample Comments** Lab Due Date	Comments
1204360-25	**25: Herbicides**	**Water**	**Apr-20-12 00:00 Eastern**			
	8151A Herbicides (master list)		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Herbicides
1204360-26	**26: PCBs in Water**	**Water**	**Apr-20-12 00:00 Eastern**			
	8082 PCBs (std 7 aroclors)		28	Apr-20-13 00:00	May-17-12 13:40	GOOD WP PCBs in Water, WP PCBs in Oil
1204360-27	**27: PCBs in Oil**	**Waste**	**Apr-20-12 00:00 Eastern**			
	8082 PCBs (std 7 aroclors)		28	Apr-20-13 00:00	May-17-12 13:40	GOOD WP PCBs in Water, WP PCBs in Oil
1204360-30	**30: Nitroaromatics/Nitroamine**	**Water**	**Apr-20-12 00:00 Eastern**			
	8330 Explosives DoD		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Nitroaromatics/Nitramines
1204360-32	**32: Organochlorine Pesticides**	**Water**	**Apr-20-12 00:00 Eastern**			
	8081A PESTs (master list)		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Pesticides, NELAC Pesticides
1204360-33	**33: Total Chlordane**	**Water**	**Apr-20-12 00:00 Eastern**			
	8081A APP IX Pests		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Total Chlordane
1204360-34	**34: WP Toxaphene**	**Water**	**Apr-20-12 00:00 Eastern**			
	8081A MDEQ Pests		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Toxaphene
1204360-37	**37: DRO 8015**	**Water**	**Apr-20-12 00:00 Eastern**			
	DRO EPA 8015B		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP DRO
1204360-40	**40: Wisconsin DRO**	**Water**	**Apr-20-12 00:00 Eastern**			
	DRO - Wisconsin Method		28	Apr-27-12 00:00	May-17-12 13:40	
1204360-44	**8121 Chlorinated Hydrocarbo**	**Water**	**Apr-20-12 00:00 Eastern**			
	8121 Chl. Hydrocarbns (master)		28	Apr-27-12 00:00	May-17-12 13:40	8121 Chlorinated Hydrocarbons

Semivolatiles GC Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
Waste	**8082 PCBs (std 7 aroclors)**			**mg/kg**	
	PCB-1016	Y	Y	0.0123	0.5
	PCB-1221	Y	Y	0.0115	0.5
	PCB-1232	Y	Y	0.0027	0.5
	PCB-1242	Y	Y	0.0106	0.5
	PCB-1248	Y	Y	0.0028	0.5
	PCB-1254	Y	Y	0.0034	0.5
	PCB-1260	Y	Y	0.0049	0.5
Water	**DRO - Wisconsin Method**			**ug/L**	
	DRO (Wisconsin Method)	Y	Y	30	100
Water	**DRO EPA 8015B**			**ug/L**	
	Diesel Range Organics - 8015 (C10-C28)	Y	Y	48.8	200
Water	**8081A APP IX Pests**			**ug/L**	
	Technical Chlordane	Y	Y	0.0082	0.025
Water	**8081A MDEQ Pests**			**ug/L**	
	Toxaphene	Y	Y	0.0067	1
Water	**8081A PESTs (master list)**			**ug/L**	
	alpha-BHC	Y	Y	0.00042	0.01
	beta-BHC	Y	Y	0.00204	0.01
	gamma-BHC (Lindane)	Y	Y	0.00047	0.01
	delta-BHC	Y	Y	0.00057	0.01
	alpha-Chlordane	Y	Y	0.00017	0.01
	gamma-Chlordane	Y	Y	0.0003	0.01
	4,4'-DDD	Y	Y	0.00019	0.01
	4,4'-DDE	Y	Y	0.00017	0.01
	4,4'-DDT	Y	Y	0.00017	0.01
	Aldrin	Y	Y	0.00058	0.01
	Dieldrin	Y	Y	0.00046	0.01
	Endosulfan I	Y	Y	0.00028	0.01
	Endosulfan II	Y	Y	0.00028	0.01
	Endosulfan Sulfate	Y	Y	0.00033	0.01
	Endrin	Y	Y	0.00039	0.01
	Endrin Aldehyde	Y	Y	0.00234	0.01
	Endrin Ketone	Y	Y	0.00275	0.02
	Heptachlor	Y	Y	0.00055	0.01
	Heptachlor Epoxide	Y	Y	0.00028	0.01
	Methoxychlor	Y	Y	0.00068	0.01
Water	**8082 PCBs (std 7 aroclors)**			**ug/L**	
	PCB-1016	Y	Y	0.0537	0.2
	PCB-1221	Y	Y	0.0454	0.2
	PCB-1232	Y	Y	0.0409	0.2
	PCB-1242	Y	Y	0.0619	0.2
	PCB-1248	Y	Y	0.0544	0.2
	PCB-1254	Y	Y	0.0532	0.2
	PCB-1260	Y	Y	0.0291	0.2
Water	**8121 Chl. Hydrocarbns (master)**			**ug/L**	
	1,3-Dichlorobenzene	Y	Y	0.0346	1
	1,4-Dichlorobenzene	Y	Y	0.025	1

Semivolatiles GC Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
	1,2-Dichlorobenzene	Y	Y	0.0463	1
	Hexachloroethane	Y	Y	0.0045	1
	1,2,4-Trichlorobenzene	Y	Y	0.0017	2
	Hexachlorobutadiene	Y	Y	0.0036	0.01
	1,2,4,5-Tetrachlorobenzene	Y	Y	0.0017	0.02
	Hexachlorocyclopentadiene	Y	Y	0.0034	0.01
	2-Chloronaphthalene	Y	Y	0.25	2
	Pentachlorobenzene	Y	Y	0.001	0.01
	Hexachlorobenzene	Y	Y	0.0021	0.01
Water	**8151A Herbicides (master list)**			**ug/L**	
	2,4-D	Y	Y	0.194	5
	2,4,5-T	Y	Y	0.038	5
	2,4,5-TP (Silvex)	Y	Y	0.0095	5
	2,4-DB	Y	Y	0.276	2
	Dalapon	Y	Y	0.523	2
	Dicamba	Y	Y	0.025	0.5
	Dichloroprop	Y	Y	0.016	0.5
	Dinoseb	Y	Y	0.182	0.5
	MCPA	Y	Y	14.3	75
	MCPP	Y	Y	12.2	75
Water	**8330 Explosives DoD**			**ug/L**	
	1,3,5-Trinitrobenzene	Y	Y	0.469	5
	1,3-Dinitrobenzene	Y	Y	0.144	5
	2,4,6-Trinitrotoluene	Y	Y	0.16	5
	2,4-Dinitrotoluene	Y	Y	0.52	5
	2,6-Dinitrotoluene	Y	Y	0.256	5
	2-Amino-4,6-dinitrotoluene	Y	Y	1.04	5
	2-Nitrotoluene	Y	Y	0.271	5
	3-Nitrotoluene	Y	Y	0.133	5
	4-Amino-2,6-dinitrotoluene	Y	Y	0.231	5
	4-Nitrotoluene	Y	Y	0.52	5
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Y	Y	0.489	5
	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	Y	Y	0.194	5
	Nitrobenzene	Y	Y	0.161	5
	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Y	Y	0.131	5

WORK ORDER 1204360

Printed: 5/4/2012, 10:56:38AM

Semivolatiles MS Sample Receipt Notice

Client: [redacted]
Project Manager: [redacted]
Project: **WP PT Samples Spring**
Project Number: **35508**
Client Due Date: **May-17-12 23:00 (19 day TAT)**
Report Level: **3MD**
W.O. Comments: *QC is 3MD; full list spike*

Lab Number	Sample Name Analysis	Matrix	Sampled Date TAT	Expire Date	Sample Comments Lab Due Date	Comments
1204360-28	**28: Base Neutral Extractables**	**Water**	**Apr-20-12 00:00 Eastern**			
	zz8270C SVOCs (master list)		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Base Neutrals
1204360-29	**29: Acid Extractables**	**Water**	**Apr-20-12 00:00 Eastern**			
	8270C SVOCs (FO19)		28	Apr-27-12 00:00	May-17-12 13:40	GOOD WP Acids
1204360-31	**31: Low Level PAHs SIM**	**Water**	**Apr-20-12 00:00 Eastern**			
	8270C PNAs - SIM		28	Apr-27-12 00:00	May-17-12 13:40	
1204360-43	**OPP Pesticides**	**Water**	**Apr-20-12 00:00 Eastern**			
	8270C APP IX PEST		28	Apr-27-12 00:00	May-17-12 13:40	OPP Pesticides
1204360-45	**Extra 8270 App IX**	**Water**	**Apr-20-12 00:00 Eastern**			
	8270C APP IX BNA		28	Apr-27-12 00:00	May-17-12 13:40	Extra 8270 BNA

Semivolatiles MS Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
Water	**8270C APP IX BNA**			**ug/L**	
	1,3-Dinitrobenzene	Y	Y	0.0788	2
	1,3,5-Trinitrobenzene	Y	Y	0.5	2
Water	**8270C APP IX PEST**			**ug/L**	
	Disulfoton	Y	Y	0.25	2
	Methyl Parathion	Y	Y	0.199	2
	Parathion	Y	Y	0.173	2
	Phorate	Y	Y	0.25	2
Water	**8270C SVOCs (FO19)**			**ug/L**	
	Benzoic Acid	Y	Y	0.211	1
	4-Chloro-3-methylphenol	Y	Y	0.166	0.5
	2-Chlorophenol	Y	Y	0.0703	0.5
	2,4-Dichlorophenol	Y	Y	0.232	0.5
	2,6-Dichlorophenol	Y	Y	0.195	0.5
	2,4-Dimethylphenol	Y	Y	0.309	1
	4,6-Dinitro-2-methylphenol	Y	Y	0.145	0.5
	2,4-Dinitrophenol	Y	Y	1.8	5
	2-Methylphenol	Y	Y	0.126	0.5
	3+4-Methylphenol	Y	Y	0.113	5
	4-Nitrophenol	Y	Y	0.71	5
	2-Nitrophenol	Y	Y	0.0677	0.5
	Pentachlorophenol	Y	Y	0.094	0.5
	Phenol	Y	Y	0.146	0.5
	2,3,4,6-Tetrachlorophenol	Y	Y	0.289	5
	2,4,5-Trichlorophenol	Y	Y	0.0298	0.5
	2,4,6-Trichlorophenol	Y	Y	0.0646	0.5
Water	**zz8270C SVOCs (master list)**			**ug/L**	
	Acenaphthene	Y	Y	0.0299	0.5
	Acenaphthylene	Y	Y	0.0204	0.5
	Aniline	Y	Y	0.0434	0.5
	Anthracene	Y	Y	0.0363	0.5
	Benzidine	Y	Y	1.42	10
	Benzo(a)anthracene	Y	Y	0.0222	0.5
	Benzo(a)pyrene	Y	Y	0.0418	0.5
	Benzo(b)fluoranthene	Y	Y	0.114	0.5
	Benzo(k)fluoranthene	Y	Y	0.124	0.5
	Benzo(g,h,i)perylene	Y	Y	0.0984	0.5
	Benzyl Alcohol	Y	Y	0.166	0.5
	4-Bromophenyl Phenyl Ether	Y	Y	0.0356	0.5
	Butyl Benzyl Phthalate	Y	Y	0.0575	1
	Carbazole	Y	Y	0.047	0.5
	4-Chloroaniline	Y	Y	0.15	1
	Bis(2-chloroethoxy)methane	Y	Y	0.035	0.5
	Bis(2-chloroethyl) Ether	Y	Y	0.035	0.5
	Bis(2-chloroisopropyl) Ether	Y	Y	0.0594	0.5
	2-Chloronaphthalene	Y	Y	0.029	0.5
	4-Chlorophenyl Phenyl Ether	Y	Y	0.0314	0.5
	Chrysene	Y	Y	0.0356	0.5
	Dibenz(a,h)anthracene	Y	Y	0.0699	0.5
	Dibenzofuran	Y	Y	0.039	0.5

Semivolatiles MS Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
	Di-n-butyl Phthalate	Y	Y	0.267	1
	1,2-Dichlorobenzene	Y	Y	0.0675	0.5
	1,3-Dichlorobenzene	Y	Y	0.0299	0.5
	1,4-Dichlorobenzene	Y	Y	0.024	0.5
	3,3´-Dichlorobenzidine	Y	Y	0.641	5
	Diethyl Phthalate	Y	Y	0.0434	5
	Dimethyl Phthalate	Y	Y	0.0446	0.5
	2,4-Dinitrotoluene	Y	Y	0.096	0.5
	2,6-Dinitrotoluene	Y	Y	0.134	0.5
	Di-n-octyl Phthalate	Y	Y	0.0642	1
	Bis(2-ethylhexyl) Phthalate	Y	Y	0.242	1
	Fluoranthene	Y	Y	0.0299	0.5
	Fluorene	Y	Y	0.0314	0.5
	Hexachlorobenzene	Y	Y	0.0621	0.5
	Hexachlorobutadiene	Y	Y	0.0321	0.5
	Hexachlorocyclopentadiene	Y	Y	0.0566	0.5
	Hexachloroethane	Y	Y	0.035	0.5
	Indeno(1,2,3-cd)pyrene	Y	Y	0.0378	0.5
	Isophorone	Y	Y	0.0557	0.5
	2-Methylnaphthalene	Y	Y	0.0238	0.5
	1-Methylnaphthalene	Y	Y	0.0283	0.5
	Naphthalene	Y	Y	0.0238	0.5
	2-Nitroaniline	Y	Y	0.155	1
	3-Nitroaniline	Y	Y	0.0495	1
	4-Nitroaniline	Y	Y	0.0699	1
	Nitrobenzene	Y	Y	0.0764	0.5
	N-Nitroso-diethylamine	Y	Y	0.5	2
	N-Nitroso-dimethylamine	Y	Y	0.341	0.5
	N-Nitroso-diphenylamine	Y	Y	0.042	0.5
	N-Nitroso-di-n-propylamine	Y	Y	0.0444	0.5
	Pentachlorobenzene	Y	Y	0.256	2
	Phenanthrene	Y	Y	0.0308	0.5
	Pyrene	Y	Y	0.0217	0.5
	Pyridine	Y	Y	0.217	0.5
	1,2,4,5-Tetrachlorobenzene	Y	Y	0.0181	2
	o-Toluidine	Y	Y	0.142	2
	1,2,4-Trichlorobenzene	Y	Y	0.0247	0.5
Water	**8270C PNAs - SIM**			**ug/L**	
	Acenaphthene	Y	Y	0.02	0.06
	Acenaphthylene	Y	Y	0.02	0.06
	Anthracene	Y	Y	0.01	0.05
	Benzo(a)anthracene	Y	Y	0.0109	0.05
	Benzo(a)pyrene	Y	Y	0.0087	0.05
	Benzo(b)fluoranthene	Y	Y	0.0125	0.05
	Benzo(g,h,i)perylene	Y	Y	0.0111	0.05
	Benzo(k)fluoranthene	Y	Y	0.0108	0.05
	Chrysene	Y	Y	0.0136	0.05
	Dibenz(a,h)anthracene	Y	Y	0.0111	0.05
	Fluoranthene	Y	Y	0.006	0.05
	Fluorene	Y	Y	0.0076	0.05
	Indeno(1,2,3-cd)pyrene	Y	Y	0.0112	0.05

Semivolatiles MS Analysis Detail

Analyte	CLrept?	QCrept?	* indicates custom MDL	RL
Naphthalene	Y	Y	0.02	0.06
Phenanthrene	Y	Y	0.02	0.06
Pyrene	Y	Y	0.012	0.05

TRIMATRIX LABORATORIES

WORK ORDER 1204360

Printed: 5/4/2012, 10:56:38AM

Volatiles GC Sample Receipt Notice

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Client Due Date:	**May-17-12 23:00 (19 day TAT)**	Report Level:	**3MD**
W.O. Comments:	*QC is 3MD; full list spike*		

Lab Number	**Sample Name** Analysis	**Matrix**	**Sampled Date** TAT	Expire Date	**Sample Comments** Lab Due Date	Comments
1204360-24	**24: Volatiles**	**Water**	**Apr-20-12 00:00 Eastern**			
	8021B VOAs (master list)		28	May-04-12 00:00	May-17-12 13:40	GOOD WP Volatiles
1204360-36	**36: GRO 8015**	**Water**	**Apr-20-12 00:00 Eastern**			
	8021B VOAs (BETX)		28	May-04-12 00:00	May-17-12 13:40	
	GRO EPA 8015B		28	May-04-12 00:00	May-17-12 13:40	GOOD WP GRO
1204360-39	**39 Wisconsin GRO**	**Water**	**Apr-20-12 00:00 Eastern**			
	8021B VOAs (custom2)		28	May-04-12 00:00	May-17-12 13:40	Wisconsin GRO/PVOC
	GRO - Wisconsin Method		28	May-04-12 00:00	May-17-12 13:40	

Volatiles GC Analysis Detail

	Analyte	CLrept?	QCrept?	* indicates custom MDL	RL
Water	**GRO - Wisconsin Method**			**ug/L**	
	Gasoline Range Organics (Wisconsin Method)	Y	Y	12.5	100
Water	**GRO EPA 8015B**			**ug/L**	
	GRO - 8015 (C6-C10)	Y	Y	24	100
Water	**8021B VOAs (BETX)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Ethylbenzene	Y	Y	0.304	1
	Toluene	Y	Y	0.27	1
	Xylene (Total)	Y	Y	0.906	3
Water	**8021B VOAs (custom2)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Ethylbenzene	Y	Y	0.304	1
	Methyl tert-Butyl Ether	Y	Y	0.2	5
	Naphthalene	Y	Y	0.182	1
	Toluene	Y	Y	0.27	1
	1,3,5-Trimethylbenzene	Y	Y	0.285	1
	1,2,4-Trimethylbenzene	Y	Y	0.299	1
	Xylene (Total)	Y	Y	0.906	3
	Xylene, Meta + Para	Y	Y	0.602	2
	Xylene, Ortho	Y	Y	0.304	1
Water	**8021B VOAs (master list)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Bromodichloromethane	Y	Y	0.264	1
	Bromoform	Y	Y	0.216	1
	Bromomethane	Y	Y	0.271	1
	Carbon Tetrachloride	Y	Y	0.258	1
	Chlorobenzene	Y	Y	0.254	1
	Chloroethane	Y	Y	0.231	1
	2-Chloroethyl Vinyl Ether	Y	Y	0.145	10
	Chloroform	Y	Y	0.285	1
	Chloromethane	Y	Y	0.415	1
	1,2-Dibromo-3-chloropropane	Y	Y	0.173	1
	Dibromochloromethane	Y	Y	0.289	1
	1,2-Dibromoethane	Y	Y	0.228	1
	Dibromomethane	Y	Y	0.223	1
	1,3-Dichlorobenzene	Y	Y	2	2
	1,2-Dichlorobenzene	Y	Y	2	2
	1,4-Dichlorobenzene	Y	Y	0.223	1
	Dichlorodifluoromethane	Y	Y	0.255	1
	1,1-Dichloroethane	Y	Y	0.328	1
	1,2-Dichloroethane	Y	Y	0.25	1
	cis-1,2-Dichloroethene	Y	Y	0.294	1
	trans-1,2-Dichloroethene	Y	Y	0.255	1
	1,1-Dichloroethene	Y	Y	0.232	1
	1,2-Dichloropropane	Y	Y	0.226	1
	trans-1,3-Dichloropropene	Y	Y	1	1
	cis-1,3-Dichloropropene	Y	Y	0.216	1
	Ethylbenzene	Y	Y	0.304	1
	Hexachlorobutadiene	Y	Y	0.185	1

Volatiles GC Analysis Detail

* indicates custom

Analyte	CLrept?	QCrept?	MDL	RL
Methylene Chloride	Y	Y	5	5
Methyl tert-Butyl Ether	Y	Y	0.2	5
Naphthalene	Y	Y	0.182	1
Styrene	Y	Y	0.306	1
1,1,2,2-Tetrachloroethane	Y	Y	0.291	1
1,1,1,2-Tetrachloroethane	Y	Y	0.304	1
Tetrachloroethene	Y	Y	0.284	1
Toluene	Y	Y	0.27	1
1,2,4-Trichlorobenzene	Y	Y	0.258	1
1,1,2-Trichloroethane	Y	Y	0.254	1
1,1,1-Trichloroethane	Y	Y	0.293	1
Trichloroethene	Y	Y	0.238	1
Trichlorofluoromethane	Y	Y	0.233	1
1,2,3-Trichloropropane	Y	Y	0.196	1
Vinyl Chloride	Y	Y	0.216	1
Xylene (Total)	Y	Y	0.906	3
Xylene, Meta + Para	Y	Y	0.602	2
Xylene, Ortho	Y	Y	0.304	1

TRIMATRIX LABORATORIES

WORK ORDER 1204360

Printed: 5/4/2012, 10:56:38AM

Volatiles MS Sample Receipt Notice

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Client Due Date:	**May-17-12 23:00 (19 day TAT)**	Report Level:	**3MD**
W.O. Comments:	*QC is 3MD; full list spike*		

Lab Number	**Sample Name** Analysis	**Matrix**	**Sampled Date** TAT	 Expire Date	**Sample Comments** Lab Due Date	 Comments
1204360-24	**24: Volatiles**	**Water**	**Apr-20-12 00:00 Eastern**			
	zz8260B VOAs (master list)		28	May-04-12 00:00	May-17-12 13:40	GOOD WP Volatiles

Volatiles MS Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
Water	**zz8260B VOAs (master list)**			**ug/L**	
	Acetone	Y	Y	1.09	5
	Acetonitrile	Y	Y	2.45	5
	Acrolein	Y	Y	0.788	5
	Acrylonitrile	Y	Y	0.188	1
	Benzene	Y	Y	0.114	1
	Bromodichloromethane	Y	Y	0.128	1
	Bromoform	Y	Y	0.257	1
	Bromomethane	Y	Y	0.214	1
	Carbon Disulfide	Y	Y	0.231	5
	Carbon Tetrachloride	Y	Y	0.265	1
	Chlorobenzene	Y	Y	0.167	1
	Chloroethane	Y	Y	0.143	1
	2-Chloroethyl Vinyl Ether	Y	Y	0.32	5
	Chloroform	Y	Y	0.0975	1
	Chloromethane	Y	Y	0.289	1
	1,2-Dibromo-3-chloropropane	Y	Y	0.128	1
	Dibromochloromethane	Y	Y	0.152	1
	1,2-Dibromoethane	Y	Y	0.152	1
	Dibromomethane	Y	Y	0.257	1
	1,2-Dichlorobenzene	Y	Y	0.236	1
	1,3-Dichlorobenzene	Y	Y	0.238	1
	1,4-Dichlorobenzene	Y	Y	0.25	1
	Dichlorodifluoromethane	Y	Y	0.214	1
	1,1-Dichloroethane	Y	Y	0.185	1
	1,2-Dichloroethane	Y	Y	0.213	1
	1,1-Dichloroethene	Y	Y	0.21	1
	cis-1,2-Dichloroethene	Y	Y	0.121	1
	trans-1,2-Dichloroethene	Y	Y	0.202	1
	1,2-Dichloropropane	Y	Y	0.276	1
	cis-1,3-Dichloropropene	Y	Y	0.19	1
	trans-1,3-Dichloropropene	Y	Y	0.187	1
	Ethylbenzene	Y	Y	0.206	1
	Hexachlorobutadiene	Y	Y	0.241	1
	2-Hexanone	Y	Y	0.493	5
	Methyl tert-Butyl Ether	Y	Y	0.19	1
	Methylene Chloride	Y	Y	0.245	1
	2-Butanone (MEK)	Y	Y	0.63	5
	4-Methyl-2-pentanone (MIBK)	Y	Y	0.395	5
	Naphthalene	Y	Y	0.282	5
	Styrene	Y	Y	0.205	1
	1,1,1,2-Tetrachloroethane	Y	Y	0.136	1
	1,1,2,2-Tetrachloroethane	Y	Y	0.255	1
	Tetrachloroethene	Y	Y	0.226	1
	Toluene	Y	Y	0.185	1
	1,2,4-Trichlorobenzene	Y	Y	0.126	1
	1,1,1-Trichloroethane	Y	Y	0.138	1
	1,1,2-Trichloroethane	Y	Y	0.203	1
	Trichloroethene	Y	Y	0.212	1
	Trichlorofluoromethane	Y	Y	0.266	1
	1,2,3-Trichloropropane	Y	Y	0.279	1

Volatiles MS Analysis Detail

* indicates custom

Analyte	CLrept?	QCrept?	MDL	RL
Vinyl Acetate	Y	Y	0.414	5
Vinyl Chloride	Y	Y	0.209	1
Xylene, Meta + Para	Y	Y	0.283	2
Xylene, Ortho	Y	Y	0.11	1
Xylene (Total)	Y	Y	0.393	3

Appendix P

TriMatrix Laboratories, Inc. - Department

Work Orders Received Sep-01-11 to Sep-30-11 - Printed May-04-12 13:13 by TCB

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Department	Samples	Analyses	Price	Surcharge	Total
Inorganic - Wet Chemistry	1646	4889	$75,257.16	$280.25	$75,537.41
Metals	1586	13064	$116,546.70	$17.00	$116,563.70
Semivolatiles GC	463	483	$36,195.00	$180.00	$36,375.00
Semivolatiles MS	527	549	$59,170.00	$0.00	$59,170.00
Volatiles GC	85	85	$2,945.00	$0.00	$2,945.00
Volatiles MS	1264	1329	$108,462.10	$162.00	$108,624.10
****TOTALS****	**5571**	**20399**	**$398,575.96**	**$639.25**	**$399,215.21**

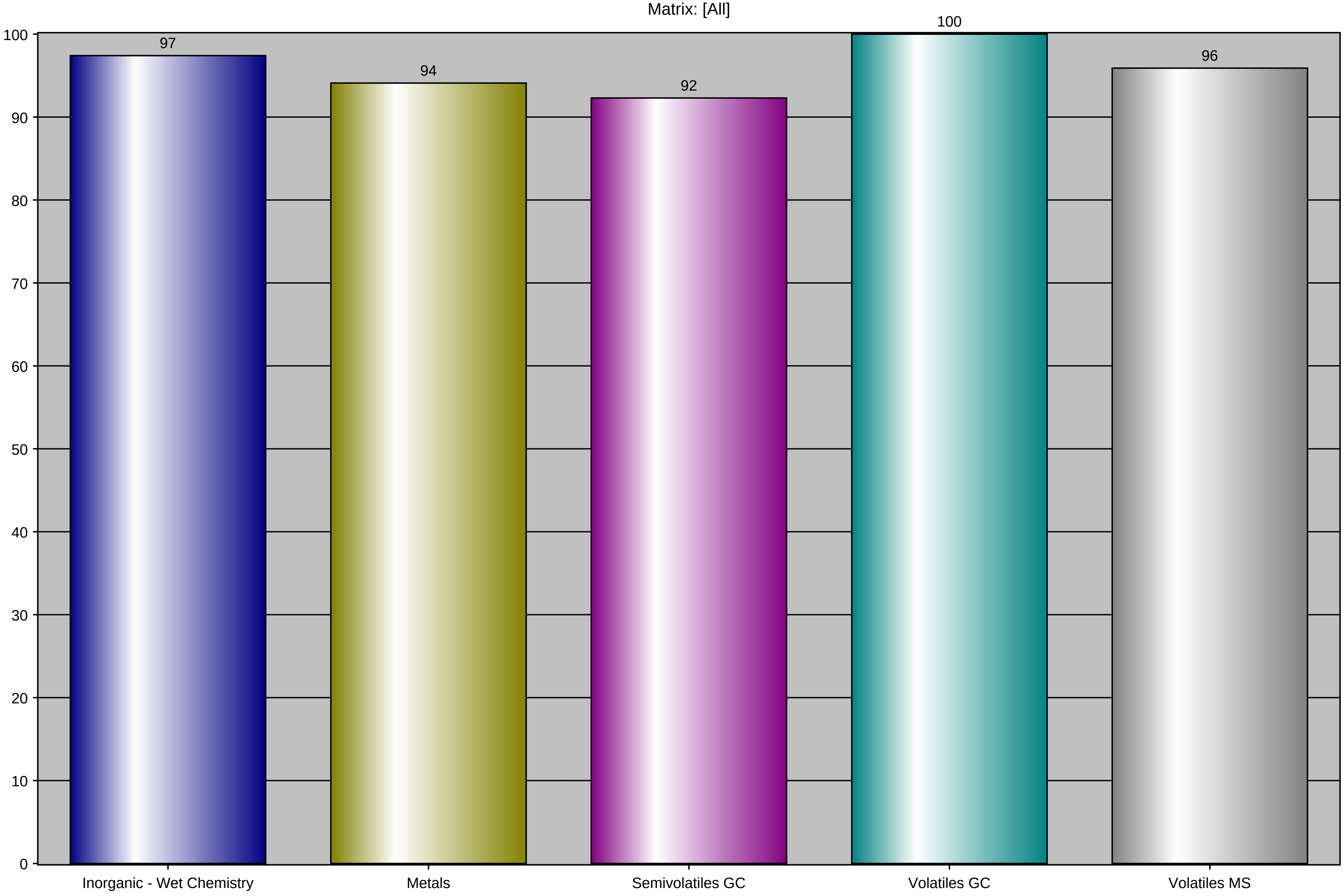
TriMatrix Laboratories, Inc. - % On-Time by Department [Apr-01-11 to Apr-28-11]

Printed May-04-12 15:01 by RDW
Department: Inorganic - Wet Chemistry, Metals, Semivolatiles GC, Volatiles GC, Volatiles MS
Analysis: [All]
Matrix: [All]

Department	On-Time	Total	%
Inorganic - Wet Chemistry	4458	4576	97.4
Metals	13676	14533	94.1
Semivolatiles GC	262	284	92.3
Volatiles GC	27	27	100
Volatiles MS	1494	1558	95.9

TriMatrix Laboratories, Inc. - % On-Time by Department [Apr-01-11 to Apr-28-11]

Printed May-04-12 15:00 by RDW
Department: Inorganic - Wet Chemistry, Metals, Semivolatiles GC, Volatiles GC, Volatiles MS
Analysis: [All]
Matrix: [All]



TriMatrix Laboratories, Inc.

WORK ORDER STATUS REPORT

Printed: 5/4/2012 11:38:37AM

Lab PM ([redacted]) Jan-01-11 - Dec-31-11

Available,Cancelled,Completed,Invoiced,Preliminary,Received,Reported

Work Order	Done	RptLvl	Pending	Status	Client	Project Name (Number)	PMgr	TAT	Received	Due
1101323	118/118	3MD		Completed	[redacted]	Semi-Annual Solid PE Study (35338)	RDW	19	Jan-31-11	Feb-25-11
1102035	1/1	3MD		Completed	[redacted]	ERA WS PT Samples (35005)	RDW	11	Feb-03-11	Feb-18-11
1102146	59/59	3MD		Completed	[redacted]	ERA WS PT Samples (35005)	RDW	20	Feb-14-11	Mar-14-11
1102182	170/170	3MD		Completed	[redacted]	Department of Health PT Samples (36229)	RDW	10	Feb-17-11	Mar-03-11
1102307	75/75	3MD		Completed	[redacted]	pH Strip Testing (36236)	RDW	10	Feb-28-11	Mar-14-11
1103267	3/3	3MD		Completed	[redacted]	pH Strip Testing (36236)	RDW	10	Mar-21-11	Apr-04-11
1104034	82/82	3MD		Completed	[redacted]	DMRQA Testing (36330)	RDW	30	Apr-04-11	May-16-11
1104286	117/117	3MD		Completed	[redacted]	WP PT Samples Spring (35508)	RDW	20	Apr-18-11	May-16-11
1105086	48/48	2RL		Completed	[redacted]	Stericup Filter Certification ([none])	RDW	10	May-04-11	May-18-11
1105247	15/15	3MD		Completed	[redacted]	ERA WS PT Samples (35005)	RDW	11	May-12-11	May-27-11
1105248	5/5	3MD		Completed	[redacted]	RTC PT SAMPLES ([none])	RDW	11	May-12-11	May-27-11
1107092	60/60	3MD		Completed	[redacted]	ERA WS PT Samples (35005)	RDW	17	Jul-11-11	Aug-03-11
1107234	4/4	3MD		Completed	[redacted]	WP PT Samples Spring (35508)	RDW	10	Jul-18-11	Aug-01-11
1107251	169/169	3MD		Completed	[redacted]	Department of Health PT Samples (36229)	RDW	17	Jul-19-11	Aug-11-11
1107279	120/120	3MD		Completed	[redacted]	Semi-Annual Solid PE Study (35338)	RDW	18	Jul-20-11	Aug-15-11
1108243	46/46	3MD		Completed	[redacted]	pH Strip Testing (36236)	RDW	10	Aug-16-11	Aug-30-11
1108311	48/48	1RL		Completed	[redacted]	Stericup Filter Certification ([none])	RDW	10	Aug-18-11	Sep-01-11
1109257	15/15	3MD		Completed	[redacted]	ERA WS PT Samples (35005)	RDW	21	Sep-19-11	Oct-18-11
1109409	2/2	3MD		Completed	[redacted]	Semi-Annual Solid PE Study (35338)	RDW	10	Sep-28-11	Oct-12-11
1110362	2/2	3MD		Completed	[redacted]	Semi-Annual Solid PE Study (35338)	RDW	10	Oct-19-11	Nov-02-11
1110364	9/9	3MD		Completed	[redacted]	RTC UST and TCLP SOIL ([none])	RDW	23	Oct-19-11	Nov-21-11
1110420	118/118	3MD		Completed	[redacted]	WP PT Samples Fall (35508)	RDW	15	Oct-21-11	Nov-11-11

TriMatrix Laboratories, Inc.

ANALYSIS STATUS REPORT

Printed: 5/4/2012 11:44:00AM

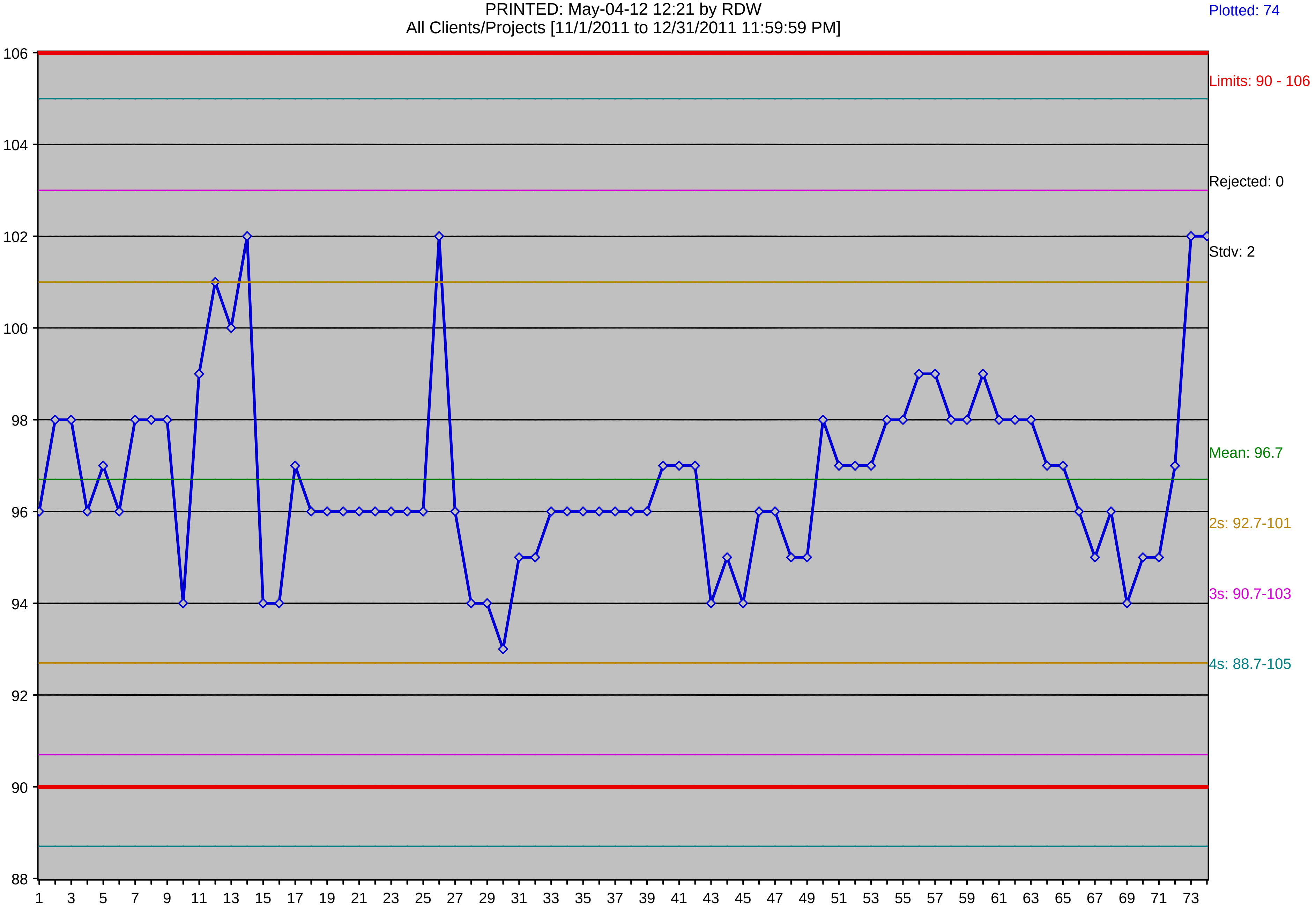
Lab PM [redacted] Jan-01-11 - Dec-31-11

yzed,Available,Batched,Cancelled,Entered,Hold,Invoiced,Leached,Prepared,Received,Reported,Reviewed,Subcontr

Lab Number	Analysis	Matrix	RptLev	RTAT	Due	Expires	Status	Client	Project	Sample [Analysis] Comments
1101323-01	Ag Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Ag Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Al Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	As Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	As Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	B Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	B Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Ba Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Ba Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Be Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Be Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Ca Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cd Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cd Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Co Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Co Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cr Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cr Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cu Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Cu Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Fe Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Hg Total 7471A	Soil	3MD	18	Feb-24-11	Feb-27-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	K Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Mg Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Mn Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Mn Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Mo Total 6010B	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]
1101323-01	Mo Total 6020	Soil	3MD	18	Feb-24-11	Jul-29-11	Reported	Environmental Resource Assoc	Semi-Annual Solid PE Study	[metals]

Appendix Q

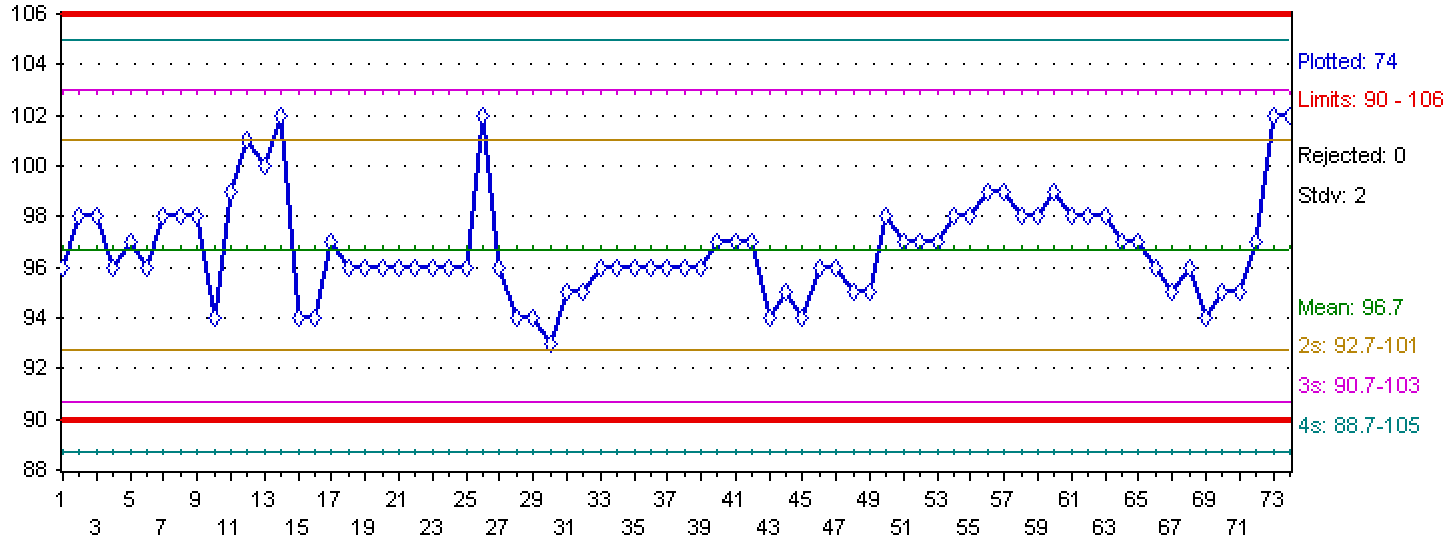
LAB: TriMatrix Laboratories, Inc.
CHART: LCS %R
ANALYTE: CHLORIDE
ANALYSES: Chloride 4500-Cl E
MATRICES: Soil, Waste Water, Water
PRINTED: May-04-12 12:21 by RDW
All Clients/Projects [11/1/2011 to 12/31/2011 11:59:59 PM]



Printed: May-04-12 11:59
Client: All Clients
Project: All Projects
Analyses: Chloride 4500-Cl E

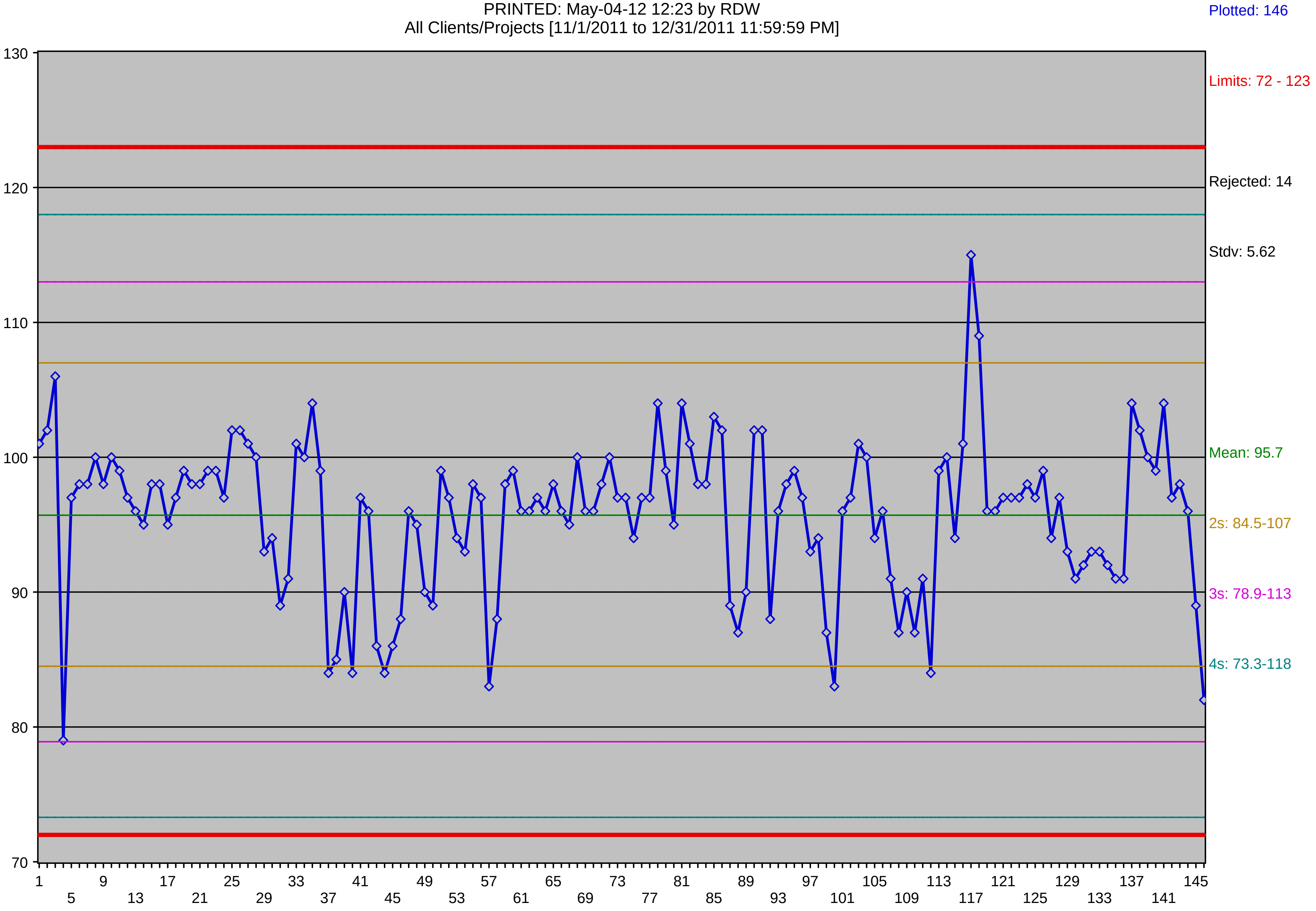
Matrices: All Matrices
Instruments: All Instruments
Prepared By: All Extractionists
Analyzed By: All Analysts
Extractions: All Extractions

Chloride ***LCS %R***



Rjct	Sample ID	Prepared	Analyzed	Spike Level	Result	%R	Limits	Qualifiers
	1112157-BS1	11/1/11	11/1/11	50	47.9	96	90-106	
	1112158-BS1	11/1/11	11/1/11	50	48.8	98	90-106	
	1112159-BS1	11/1/11	11/1/11	50	48.9	98	90-106	
	1112162-BS1	11/1/11	11/1/11	50	48.1	96	90-106	
	1112160-BS1	11/1/11	11/1/11	50	48.4	97	90-106	
	1112161-BS1	11/1/11	11/1/11	50	48	96	90-106	
	1112247-BS1	11/2/11	11/2/11	50	49.2	98	90-106	
	1112249-BS1	11/2/11	11/2/11	50	49.2	98	90-106	
	1112248-BS1	11/2/11	11/2/11	50	49	98	90-106	
	1112400-BS1	11/4/11	11/4/11	50	46.9	94	90-106	
	1112424-BS1	11/5/11	11/5/11	50	49.6	99	90-106	
	1112425-BS1	11/5/11	11/5/11	50	50.3	101	90-106	
	1112431-BS1	11/5/11	11/5/11	50	50.1	100	90-106	
	1112430-BS1	11/5/11	11/5/11	50	51	102	90-106	
	1112483-BS1	11/7/11	11/7/11	50	47.1	94	90-106	
	1112486-BS1	11/7/11	11/7/11	50	47.1	94	90-106	
	1112485-BS1	11/7/11	11/7/11	50	48.7	97	90-106	
	1112668-BS1	11/9/11	11/9/11	50	48.2	96	90-106	
	1112676-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112669-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112674-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112670-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112673-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112672-BS1	11/9/11	11/9/11	50	48	96	90-106	
	1112675-BS1	11/9/11	11/9/11	50	47.9	96	90-106	
	1112733-BS1	11/9/11	11/9/11	50	51.1	102	90-106	
	1112847-BS1	11/12/11	11/12/11	50	47.8	96	90-106	

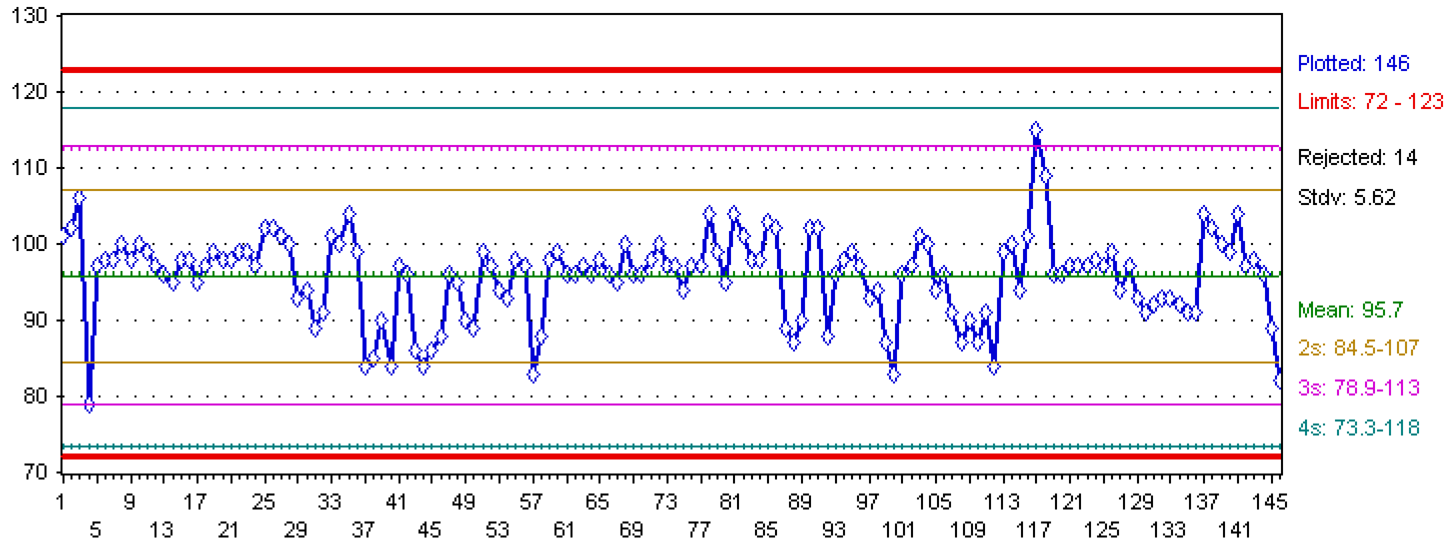
LAB: TriMatrix Laboratories, Inc.
CHART: MS %R
ANALYTE: CHLORIDE
ANALYSES: Chloride 4500-Cl E
MATRICES: Soil, Waste Water, Water
PRINTED: May-04-12 12:23 by RDW
All Clients/Projects [11/1/2011 to 12/31/2011 11:59:59 PM]



Printed: May-04-12 12:24
Client: All Clients
Project: All Projects
Analyses: Chloride 4500-Cl E

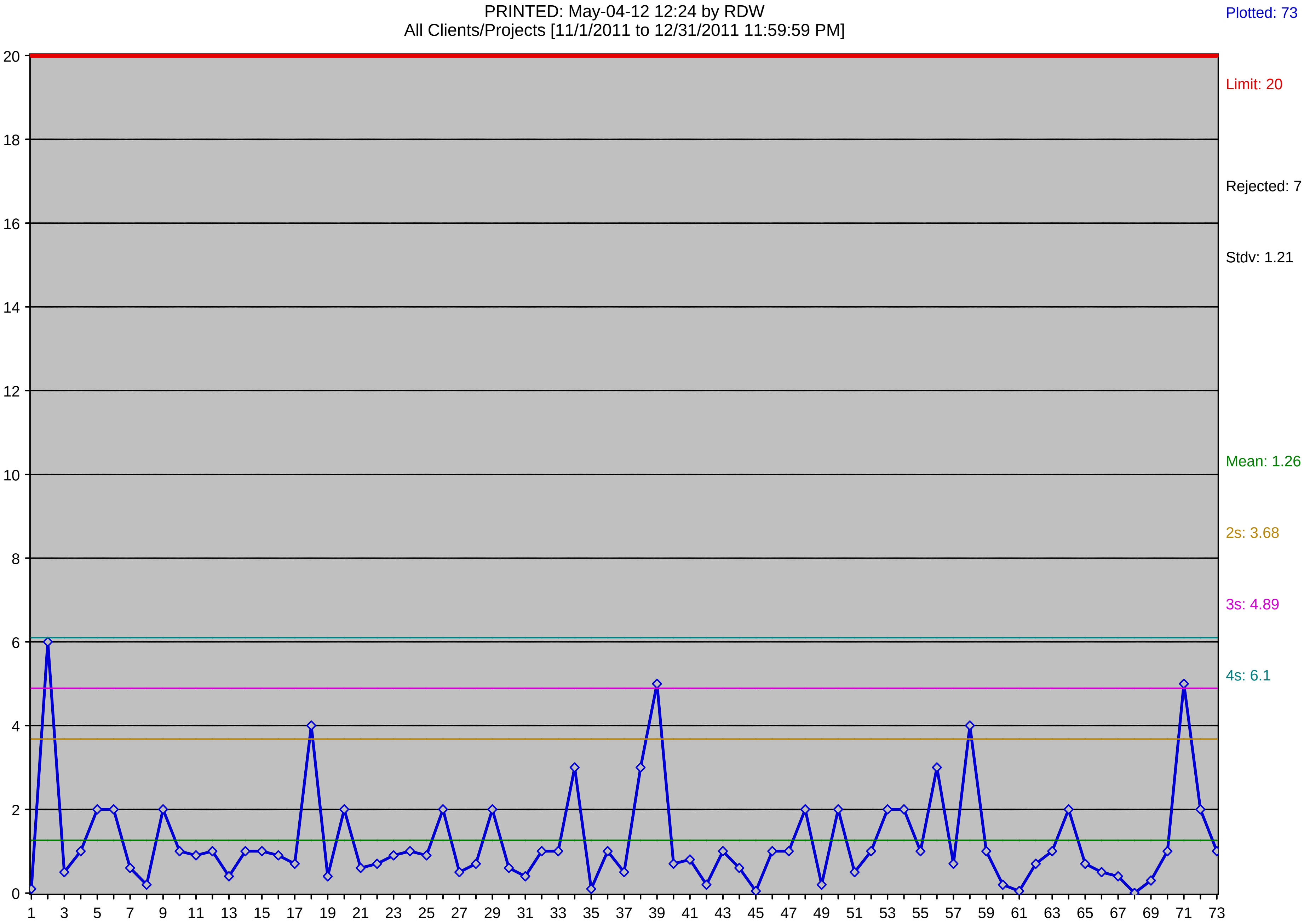
Matrices: All Matrices
Instruments: All Instruments
Prepared By: All Extractionists
Analyzed By: All Analysts
Extractions: All Extractions

Chloride ***MS %R***



Rjct	Sample ID	Prepared	Analyzed	Spike Level	Result	%R	Source	Limits	Qualifiers
	1112158-MS1	11/1/11	11/1/11	50	56.2	101	1110408-01 (5.52)	72-123	
	1112158-MSD1	11/1/11	11/1/11	50	56.3	102	1110408-01 (5.52)	72-123	
	1112158-MS2	11/1/11	11/1/11	50	215	106	1110409-01 (162)	72-123	
	1112158-MSD2	11/1/11	11/1/11	50	201	79	1110409-01 (162)	72-123	
	1112159-MS1	11/1/11	11/1/11	50	86.1	97	1110415-04 (37.6)	72-123	
	1112159-MSD1	11/1/11	11/1/11	50	86.5	98	1110415-04 (37.6)	72-123	
	1112159-MS2	11/1/11	11/1/11	50	81.4	98	1110415-09 (32.2)	72-123	
	1112159-MSD2	11/1/11	11/1/11	50	82.2	100	1110415-09 (32.2)	72-123	
	1112160-MS1	11/1/11	11/1/11	50	66	98	1110418-12 (17.1)	72-123	
	1112160-MSD1	11/1/11	11/1/11	50	67.2	100	1110418-12 (17.1)	72-123	
X	1112162-MS1	11/1/11	11/1/11	50	543	64	1110459-01 (511)	72-123	
X	1112162-MSD1	11/1/11	11/1/11	50	536	50	1110459-01 (511)	72-123	
	1112161-MS1	11/1/11	11/1/11	50	58.9	99	1110454-01 (9.18)	72-123	
	1112161-MSD1	11/1/11	11/1/11	50	57.8	97	1110454-01 (9.18)	72-123	
	1112157-MS1	11/1/11	11/1/11	50	48.9	96	1110471-01 (1)	72-123	
	1112157-MSD1	11/1/11	11/1/11	50	48.6	95	1110471-01 (1)	72-123	
	1112247-MS1	11/2/11	11/2/11	50	85.4	98	1110434-02 (36.5)	72-123	
	1112247-MSD1	11/2/11	11/2/11	50	85.2	98	1110434-02 (36.5)	72-123	
	1112249-MS1	11/2/11	11/2/11	50	48.8	95	1111011-01 (1.04)	72-123	
	1112249-MSD1	11/2/11	11/2/11	50	49.6	97	1111011-01 (1.04)	72-123	
	1112247-MS2	11/2/11	11/2/11	50	65	99	1110455-03 (15.3)	72-123	
	1112247-MSD2	11/2/11	11/2/11	50	64.2	98	1110455-03 (15.3)	72-123	
	1112248-MS1	11/2/11	11/2/11	50	50	98	1110478-05 (1.16)	72-123	
	1112248-MSD1	11/2/11	11/2/11	50	50.5	99	1110478-05 (1.16)	72-123	
	1112400-MS1	11/4/11	11/4/11	50	82	99	1110492-01 (32.7)	72-123	
	1112400-MSD1	11/4/11	11/4/11	50	81.1	97	1110492-01 (32.7)	72-123	
	1112425-MS1	11/5/11	11/5/11	50	52.9	102	1110506-31 (1.62)	72-123	
	1112425-MSD1	11/5/11	11/5/11	50	52.7	102	1110506-31 (1.62)	72-123	
	1112424-MS1	11/5/11	11/5/11	50	52.1	101	1110506-32 (1.5)	72-123	

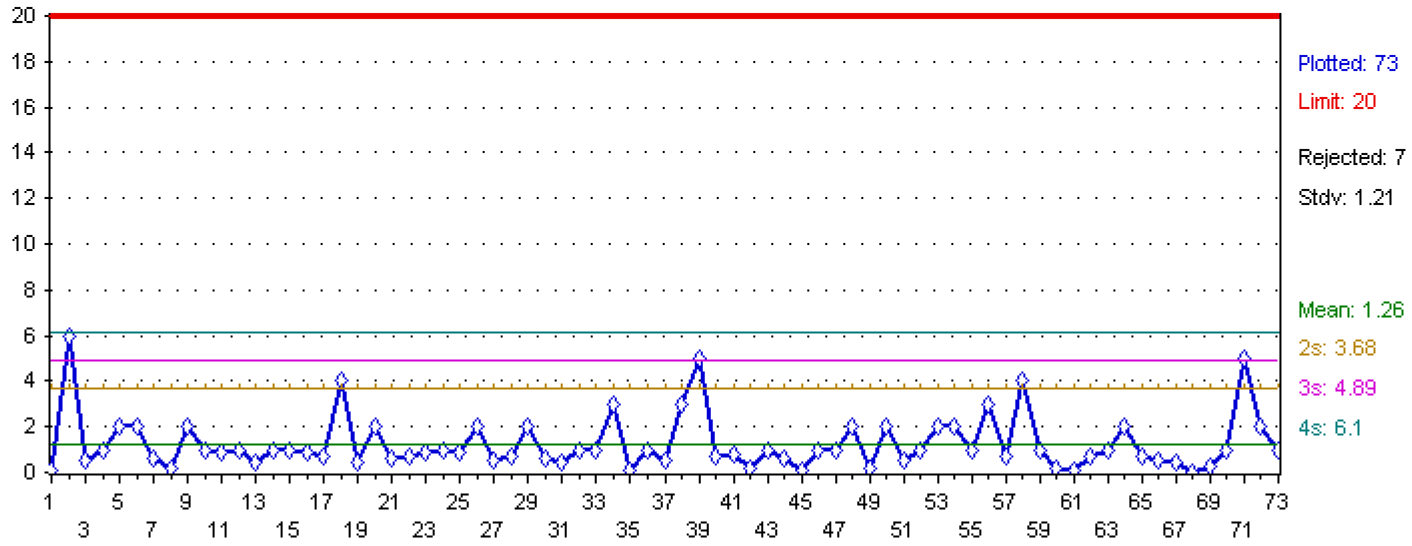
LAB: TriMatrix Laboratories, Inc.
CHART: MS/MSD RPD
ANALYTE: CHLORIDE
ANALYSES: Chloride 4500-Cl E
MATRICES: Soil, Waste Water, Water
PRINTED: May-04-12 12:24 by RDW
All Clients/Projects [11/1/2011 to 12/31/2011 11:59:59 PM]



Printed: May-04-12 12:25
Client: All Clients
Project: All Projects
Analyses: Chloride 4500-Cl E

Matrices: All Matrices
Instruments: All Instruments
Prepared By: All Extractionists
Analyzed By: All Analysts
Extractions: All Extractions

Chloride ***MS/MSD RPD***



Rjct	Sample ID	Prepared	Analyzed	Spike Level	Result	%R	Dup	Dup %R	Source	RPD	Limit	Qualifiers
	1112158-MSD1	11/1/11	11/1/11	50	56.3	102	56.2	101	1110408-01 (5.52)	0.1	20	
	1112158-MSD2	11/1/11	11/1/11	50	201	79	215	106	1110409-01 (162)	6	20	
	1112159-MSD1	11/1/11	11/1/11	50	86.5	98	86.1	97	1110415-04 (37.6)	0.5	20	
	1112159-MSD2	11/1/11	11/1/11	50	82.2	100	81.4	98	1110415-09 (32.2)	1	20	
	1112160-MSD1	11/1/11	11/1/11	50	67.2	100	66	98	1110418-12 (17.1)	2	20	
X	1112162-MSD1	11/1/11	11/1/11	50	536	50	543	64	1110459-01 (511)	1	20	
	1112161-MSD1	11/1/11	11/1/11	50	57.8	97	58.9	99	1110454-01 (9.18)	2	20	
	1112157-MSD1	11/1/11	11/1/11	50	48.6	95	48.9	96	1110471-01 (1)	0.6	20	
	1112247-MSD1	11/2/11	11/2/11	50	85.2	98	85.4	98	1110434-02 (36.5)	0.2	20	
	1112249-MSD1	11/2/11	11/2/11	50	49.6	97	48.8	95	1111011-01 (1.04)	2	20	
	1112247-MSD2	11/2/11	11/2/11	50	64.2	98	65	99	1110455-03 (15.3)	1	20	
	1112248-MSD1	11/2/11	11/2/11	50	50.5	99	50	98	1110478-05 (1.16)	0.9	20	
	1112400-MSD1	11/4/11	11/4/11	50	81.1	97	82	99	1110492-01 (32.7)	1	20	
	1112425-MSD1	11/5/11	11/5/11	50	52.7	102	52.9	102	1110506-31 (1.62)	0.4	20	
	1112424-MSD1	11/5/11	11/5/11	50	51.5	100	52.1	101	1110506-32 (1.5)	1	20	
	1112431-MSD1	11/5/11	11/5/11	50	63.3	94	62.5	93	1110511-02 (16.1)	1	20	
	1112430-MSD1	11/5/11	11/5/11	50	95.2	91	94.3	89	1110465-02 (49.6)	0.9	20	
	1112485-MSD1	11/7/11	11/7/11	50	72.9	100	73.4	101	1110575-01 (23.1)	0.7	20	
	1112485-MSD2	11/7/11	11/7/11	50	63.1	99	65.5	104	1110575-03 (13.4)	4	20	
	1112485-MSD3	11/7/11	11/7/11	50	117	85	117	84	1110577-02 (74.6)	0.4	20	
	1112486-MSD1	11/7/11	11/7/11	50	135	84	138	90	1111005-02 (92.6)	2	20	
X	1112483-MSD1	11/7/11	11/7/11	50	541	113	544	118	1110538-04 (485)	0.4	20	
	1112669-MSD1	11/9/11	11/9/11	50	70.1	96	70.6	97	1110553-05 (22.2)	0.6	20	
	1112668-MSD1	11/9/11	11/9/11	50	155	84	156	86	1110535-08 (113)	0.7	20	
	1112670-MSD1	11/9/11	11/9/11	50	145	88	144	86	1110587-11 (101)	0.9	20	
	1112676-MSD1	11/9/11	11/9/11	50	48.3	95	48.8	96	1111034-01 (0.692)	1	20	
	1112670-MSD2	11/9/11	11/9/11	50	87.5	89	88.3	90	1111030-22 (43.2)	0.9	20	
	1112670-MSD3	11/9/11	11/9/11	50	52.5	97	53.3	99	1111031-01 (3.8)	2	20	
	1112672-MSD1	11/9/11	11/9/11	50	78.6	93	79	94	1111032-01 (31.9)	0.5	20	
	1112675-MSD1	11/9/11	11/9/11	50	49.6	97	49.9	98	1111035-07 (0.905)	0.7	20	
X	1112674-MSD1	11/9/11	11/9/11	50	342	93	340	91	1111026-01 (295)	0.3	20	

Appendix R

TRIMATRIX
LABORATORIES

Archived Information Access Log

Date Removed	Name	File	Location	Date Returned

Appendix S

TRIMATRIX LABORATORIES

Controlled Temperature Unit #55
Daily Log Sheet

Description: Fisher Isotemp Freezer
Model Number: 13-986-148
Serial #: 2017080504449
Location: Volatile Organic Laboratory

Purpose: Volatile Low-Level Soil Samples
Control Windows: Low: ≥ -20° C High: ≤ -7° C
Thermometer #: 184
Thermometer Serial #: 1353

Date	Initials	Time of First Reading	First Reading (°C)	Time of Second Reading	Second Reading (°C)	Weekend Minimum (°C)	Weekend Maximum (°C)	Adjustments/Observations/Comments

Appendix T

TRIMATRIX
LABORATORIES

Daily Balance Calibration Logbook

Balance ID: 204
Manufacturer: Mettler
Balance Type: Top Loading
Model Number: BB2440
Readability: 0.00
Serial Number: J58563
Area: Volatiles Laboratory
Calibration Source: External
Location: South Bench Top
Calibration Mass (g): 1000

Date	**Analyst**	**Low Calibration Mass:**	0.50	**High Calibration Mass:**	100.50
		Acceptance Window:	0.48-0.52	**Acceptance Window:**	98.49-102.51
		Mass Observed	**Pass / Fail**	**Mass Observed**	**Pass / Fail**

Appendix U

Analytical Standard Record

TriMatrix Laboratories, Inc.

1110526

Description:	100ppm bna	Expires:	Oct-17-12
Standard Type:	Calibration Standard	Prepared:	Nov-10-11
Solvent:	mecl2 k08s00	Prepared By:	[redacted]
Final Volume (mls):	10	Department:	Semivolatiles MS
Vials:	1	Last Edit:	Nov-11-11 09:38 by JLB

Analyte	CAS Number	Concentration	Units
4-Bromophenyl Phenyl Ether	101-55-3	100	ug/mL
2-Chlorophenol	95-57-8	100	ug/mL
2-Ethoxyethanol	110-80-5	100	ug/mL
2-Methylnaphthalene	91-57-6	100	ug/mL
2-Methylphenol	95-48-7	100	ug/mL
2-Nitroaniline	88-74-4	100	ug/mL
2-Nitrophenol	88-75-5	100	ug/mL
3+4-Methylphenol	108-39-4	100	ug/mL
3-Methylphenol	108-39-4	100	ug/mL
Aniline	62-53-3	100	ug/mL
4,6-Dinitro-2-methylphenol	534-52-1	100	ug/mL
2,6-Dinitrotoluene	606-20-2	100	ug/mL
4-Chloro-3-methylphenol	59-50-7	100	ug/mL
4-Chloroaniline	106-47-8	100	ug/mL
4-Chlorophenyl Phenyl Ether	7005-72-3	100	ug/mL
4-Methylphenol	106-44-5	100	ug/mL
4-Nitroaniline	100-01-6	100	ug/mL
4-Nitrophenol	100-02-7	100	ug/mL
Acenaphthene	83-32-9	100	ug/mL
Acenaphthylene	208-96-8	100	ug/mL
1,1'-Biphenyl	92-52-4	100	ug/mL
3-Nitroaniline	99-09-2	100	ug/mL
2,3,4,6-Tetrachlorophenol	58-90-2	100	ug/mL
1,2,4,5-Tetrachlorobenzene	95-94-3	100	ug/mL
1,2,4-Trichlorobenzene	120-82-1	100	ug/mL
1,2-Bis(2-chloroethoxy)ethane	112-26-5	100	ug/mL
1,2-Dichlorobenzene	95-50-1	100	ug/mL
1,2-Dinitrobenzene	528-29-0	100	ug/mL
1,2-Diphenylhydrazine	122-66-7	100	ug/mL
1,3-Dichlorobenzene	541-73-1	100	ug/mL

Reviewed By Date

1,3-Dinitrobenzene	99-65-0	100	ug/mL
1,4-Dichlorobenzene	106-46-7	100	ug/mL
2-Chloronaphthalene	91-58-7	100	ug/mL
1-Methylnaphthalene	90-12-0	100	ug/mL
2-Chloroaniline	95-51-2	100	ug/mL
2,3,5,6-Tetrachlorophenol	935-95-5	100	ug/mL
2,4,5-Trichlorophenol	95-95-4	100	ug/mL
2,4,6-Trichlorophenol	88-06-2	100	ug/mL
2,4-Dichlorophenol	120-83-2	100	ug/mL
2,4-Dimethylphenol	105-67-9	100	ug/mL
2,4-Dinitrophenol	51-28-5	100	ug/mL
2,4-Dinitrotoluene	121-14-2	100	ug/mL
2,6-Dichlorophenol	87-65-0	100	ug/mL
Anthracene	120-12-7	100	ug/mL
1,4-Dinitrobenzene	100-25-4	100	ug/mL
Isophorone	78-59-1	100	ug/mL
Diethyl Phthalate	84-66-2	100	ug/mL
Dimethyl Phthalate	131-11-3	100	ug/mL
Diphenylamine	122-39-4	100	ug/mL
Fluoranthene	206-44-0	100	ug/mL
Fluorene	86-73-7	100	ug/mL
Hexachlorobenzene	118-74-1	100	ug/mL
Hexachlorobutadiene	87-68-3	100	ug/mL
Hexachlorocyclopentadiene	77-47-4	100	ug/mL
Acetophenone	98-86-2	100	ug/mL
Indeno(1,2,3-cd)pyrene	193-39-5	100	ug/mL
Dibenz(a,h)anthracene	53-70-3	100	ug/mL
N-Nitroso-di-n-propylamine	621-64-7	100	ug/mL
N-Nitroso-dimethylamine	62-75-9	100	ug/mL
N-Nitroso-diphenylamine	86-30-6	100	ug/mL
Naphthalene	91-20-3	100	ug/mL
Nitrobenzene	98-95-3	100	ug/mL
Pentachlorophenol	87-86-5	100	ug/mL
Phenanthrene	85-01-8	100	ug/mL
Phenol	108-95-2	100	ug/mL
Pyrene	129-00-0	100	ug/mL
Hexachloroethane	67-72-1	100	ug/mL
Bis(2-chloroethyl) Ether	111-44-4	100	ug/mL
Atrazine	1912-24-9	100	ug/mL

Reviewed By Date

Analytical Standard Record

TriMatrix Laboratories, Inc.

1110526

Benzaldehyde	100-52-7	100	ug/mL
Benzo(a)anthracene	56-55-3	100	ug/mL
Benzo(a)pyrene	50-32-8	100	ug/mL
Benzo(b)fluoranthene	205-99-2	100	ug/mL
Benzo(g,h,i)perylene	191-24-2	100	ug/mL
Benzo(k)fluoranthene	207-08-9	100	ug/mL
Benzoic Acid	65-85-0	200	ug/mL
Benzyl Alcohol	100-51-6	100	ug/mL
Dicyclohexyl phthalate	84-61-7	100	ug/mL
Bis(2-chloroethoxy)methane	111-91-1	100	ug/mL
Dibenzofuran	132-64-9	100	ug/mL
Bis(2-chloroisopropyl) Ether	108-60-1	100	ug/mL
Bis(2-ethylhexyl) Phthalate	117-81-7	100	ug/mL
Butyl Benzyl Phthalate	85-68-7	100	ug/mL
Caprolactam	105-60-2	100	ug/mL
Carbazole	86-74-8	100	ug/mL
Chrysene	218-01-9	100	ug/mL
Di-n-butyl Phthalate	84-74-2	100	ug/mL
Di-n-octyl Phthalate	117-84-0	100	ug/mL
Pyridine	110-86-1	100	ug/mL
Bis(2-chloroethoxy)ethane	112-26-5	100	ug/mL

Parent Standards used in this standard:

Standard	Description	Prepared	Prepared By	Expires	Last Edit	(mls)
1100928	Benzoic Acid, SVMS	Oct-20-11	** Vendor **	Apr-30-15	Oct-20-11 08:10 by RGJ	1
1100929	8270 mega mix	Oct-20-11	** Vendor **	Mar-31-13	Oct-20-11 08:12 by RGJ	1
1101009	2-Ethoxyethanol	Oct-21-11	** Vendor **	Oct-17-14	Oct-21-11 14:01 by RGJ	1
1101010	1,2-bis(2-Chloroethoxy)ethane	Oct-21-11	** Vendor **	Oct-17-14	Oct-21-11 14:02 by RGJ	1
1101011	1,2,4,5-Tetrachlorobenzene	Oct-21-11	** Vendor **	Oct-17-14	Oct-21-11 14:03 by RGJ	1
1101012	2,6-Dichlorophenol	Oct-21-11	** Vendor **	Oct-17-14	Oct-21-11 14:04 by RGJ	1
1101014	SV-041 5 Compounds	Oct-21-11	** Vendor **	Oct-17-13	Oct-21-11 14:06 by RGJ	0.5
1101018	Dicyclohexyl phthalate	Oct-21-11	** Vendor **	Oct-17-12	Oct-21-11 14:08 by RGJ	1
1101023	2-Chloroaniline solution	Oct-21-11	** Vendor **	Oct-17-14	Oct-21-11 14:09 by RGJ	1

Reviewed By　　　　Date

Appendix V

Metals Laboratory Spiking Pipet Calibration Logbook

Pipet ID	Calibration Volume	Acceptance Window (g)	Date: Initials:		Date: Initials:		Date: Initials:		Date: Initials:		Date: Initials:	
			g Found	Pass/Fail	g Found	Pass/Fail	g Found	Pass/Fail	g Found	Pass/Fail	g Found	Pass/Fail
SPK-5	10 uL	0.0096 - 0.0104										
	25 uL	0.0245 - 0.0255										
	50 uL	0.0485 - 0.0515										
	100 uL	0.0982 - 0.1018										
B-8	20 uL	0.0192 - 0.0208										
	50 uL	0.0495 - 0.0505										
	100 uL	0.0981 - 0.1019										
SPK-16	100 uL	0.0953 - 0.1047										
	200 uL	0.1944 - 0.2056										
	250 uL	0.2457 - 0.2543										
	300 uL	0.2918 - 0.3082										
	500 uL	0.4922 - 0.5078										
	1000 uL	0.9641 - 1.0359										
SPK-17	200 uL	0.1905 - 0.2095										
	500 uL	0.4911 - 0.5089										
	1000 uL	0.9863 - 1.0137										
SPK-18	100 uL	0.0930 - 0.1070										
	200 uL	0.1912 - 0.2088										
	250 uL	0.2408 - 0.2592										
	300 uL	0.2885 - 0.3115										
	500 uL	0.4853 - 0.5147										
	1000 uL	0.9659 - 1.0341										

Appendix W

TRIMATRIX
LABORATORIES

STANDARD OPERATING PROCEDURE

Block Digestion of Aqueous Samples and Extracts for Total/Dissolved Metals by ICPMS

SW-846 Method 3020A

APPROVALS:

Area Supervisor: Marge a Scott Date: 10-03-11
Marge A. Scott

QA Officer: Date: 10-3-11
Tom C. Boocher

President: Date: 10-3-11
Douglas E. Kriscunas

Procedure Number: GR-01-148
Revision Number: 0.4

Date Initiated: 12/3/01
Effective Date: 10/20/11

Date Revised: 10/3/11
Pages Revised: All

By: Marge A. Scott

Total Number of Pages: 13

If signed below, the last annual review required no procedural revision.

Date Reviewed	Reviewed by	Review Expires

Appendix X

TRIMATRIX LABORATORIES

Subcontractor Qualification Form

Company Information

Laboratory Name:____

Address:____

City, State, Zip:____

Main Phone:____________________Fax:______________Website:____________________________

QA Manager:____________________Title:______________Phone:____________email:______________

Project Contact :_________________Title:______________Phone:____________email:______________

Laboratory Quality Systems

Does the laboratory have a company wide quality assurance manual (QAM)? Yes ☐ No ☐

Do all staff members have training documents (demonstration of capability) for the QAM? Yes ☐ No ☐

Laboratory Certifications

Please check all that apply. Listings for other certifications (federal, state) may be provided as an attachment.

NELAC ☐ DoD ELAP ☐ ISO 17025 ☐ Other: ______________________________

Does the laboratory perform analytical laboratory services in compliance with the Department of Defense Quality Systems Manual (QSM)? Yes No Compliant Version(s):______________________________

Please list information related to your most recent audit (past two years):

Auditing Agency:______________________________Date:______________Program:________________

Auditing Agency:______________________________Date:______________Program:________________

Auditing Agency:______________________________Date:______________Program:________________

Auditing Agency:______________________________Date:______________Program:________________

Requested Documentation (PDF)

Copies of all referenced laboratory certifications.

Quality Systems Manual (if not certified under NELAC, ISO17025 or DoD ELAP).

Certification

I certify that the information provided on this form is accurate.

Name:________________________________Title:___________________________Date:______________

Signature:____

This section for TriMatrix use only

Subcontractor Approved By:____________________________Title:____________________________

Date:____________________________Subcontractor Reference ID:____________________________

Appendix Y

TRIMATRIX LABORATORIES

Container Packing List

For any questions regarding these containers,
contact a Project Chemist at (616) 975-4500.

Client: ______________ Project: ______________ Page 1 of 1

#	Sets	Sample Locations	Sample Container Types and Quantities Requested																										
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1																													
2																													
3																													
4																													
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													
13																													
14																													
15																													
16																													
17																													
18																													
19																													
20																													
		Total Containers																											

This container type requires field-filtering ⬏

MATRIX	#	TEST	SIZE (mL) / TYPE CONTAINER	OPTIONS	PRESERVATIVE	TAG COLOR
WATER	0	Unpreserved Purgeable Organics	40 mL Clear Glass Vial	40	Cool to 4° C	Yellow & Black Stripe
	1	Preserved Purgeable Organics	40 mL Clear Glass Vial (pre-preserved)	40	HCl; Cool to 4° C	Yellow
	2	Non-Purgeable Organics	1000 mL Amber Glass	1000	Cool to 4° C	Salmon
	3	General ☐ Short Hold	Plastic	125, 250, 500, 1000	Cool to 4° C	Green
	4	Nutrients	Plastic	125, 250, 500, 1000	pH <2 w/ H_2SO_4	Dark Blue
	5	Cyanides	500 mL Amber Plastic	500	pH >12 w/ NaOH	Light Blue
	6	Total Metals	Plastic	125, 250, 500, 1000	pH <2 w/ HNO_3	Red
	7	Oil & Grease/TPH	Clear Glass	1000WM, 1000NM	pH <2 w/ H_2SO_4	Dark Blue
	8	Bacteria	125 mL Plastic (pre-preserved)	125	$Na_2S_2O_3$; Cool to 4° C	Pre-Labeled (White)
	9	Sulfide:	500 mL Amber Glass	500	Choose Total or Dissolved	Light Green
	10	TOX	250 mL Amber Glass **w/ Septa Lid**	250	pH <2 w/ H_2SO_4	Lilac
	11	TOC	40 mL Amber Vial	40	pH <2 w/ H_2SO_4	Pink
	12	DRO	1000 mL Amber Glass	1000	pH <2 w/ HCl	Gray
	13	Phenols	500 mL Amber Glass	500	pH <2 w/ H_2SO_4	Brown
	14	Formaldehyde	250 mL Amber Glass	250	Cool to 4° C	Orange
	15	Dissolved Metals	Plastic	125, 250, 500, 1000	pH <2 w/ HNO_3	Red & White Stripe
SOIL	16	Inorganics/Metals	WM Plastic	125, 250, 500, 1000	Cool to 4° C	White
	17	Non Purgeable Organics	WM Clear Glass	125, 250, 500, 1000	Cool to 4° C	Manila
	18	Purgeable Organics - Bulk	60 mL WM Clear Glass	60	Cool to 4° C	Light Yellow
	19	TCLP Volatiles	125 mL Clear Glass Vial	125	Cool to 4° C	Yellow & Black Stripe
	20	% Solids	125 mL WM Plastic	125	Cool to 4° C	Yellow & White Stripe
	21	Purgeable Organics	Encore Sampler	5g, 25g	Cool to 4° C	Label on Bag
	22	Purgeable Organics - PrePres.	40 mL Pre-Tared Clear Glass Vial + 10 mL MeOH ampule	40	MeOH in field; Cool to 4° C	Pre-Labeled (Light Yellow added at Lab)
MISC	23					
	24					
	25					
	26					

Notes:

DI Water for Equipment Blanks	Container Type and Size	Quantity
VOC Free		
Millipore		
ASTM Metals Free		

TRIMATRIX LABORATORIES

Project Chemist Initials	Added to Calendar & Folders (initials/date)	Revision	Revised By/Date

Client: ______________________ Project Manager: ______________________

Project: ______________________ Contact: ______________________

TriMatrix Project No: ______________________ Date of Request: ______________________

Type of Order: ○ One-Time ⇨ Due to Client: ______________ ○ AM ● PM

or

● Calendar ⇨ Frequency: ○ Weekly ○ Semi-Annually

○ Monthly ○ Annually

Prepare Containers For: ○ Quarterly ● Daily

Months	☐ Jan	☐ Feb	☐ Mar	☐ Apr	☐ May	☐ Jun
	☐ Jul	☐ Aug	☐ Sep	☐ Oct	☐ Nov	☐ Dec
Weeks	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	
Days	☐ M	☐ T	☐ W	☐ TH	☐ F	

Containers will be ● Picked Up or ○ Shipped via: ○ First Overnight ● Standard Overnight

Pick up/Ship Date: ______________________ ○ Priority Overnight ○ Express Saver

Ship Containers to: ○ 2-Day ○ Ground

○ Saturday Delivery ○ TriMatrix Courier

○ Other: ______________________

☐ Shipment to be billed to FedEx Account No.:

Telephone No: ______________________

Shipment to include: ☐ COCs (Qty) ______ ☐ Custody Seals ☐ Temperature Blanks

☐ MSDS Sheets for all preservatives used ☐ WB TM#? ○ Y ● N

Comments: ☐ Cooler Banding Required

Assembled by/Date:		Checked by/Date:	Shipped by/Date:
Cooler Number(s) Used:	Coolers Sealed With Tape Banding Strap	Tracking Number Label(s):	
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		
	☐ ☐		

Appendix Z

TRIMATRIX
LABORATORIES

Sample Collection, Packing and Return

All supplied containers are pre-cleaned and certified to EPA standards; no additional cleaning is required. Because some containers contain preservatives do not rinse or overfill. Removal of some or all of the preservative may result in qualified data. Most of the chemicals used as preservatives are hazardous so please use caution when handling. Do not breathe or come in physical contact with these chemicals.

When conducting soil sampling please clean off any residual soil from the outside of the containers. This will help prevent cross contamination of other samples in the cooler.

Please fill out all sample identification tags as completely as possible.

Please fill out the enclosed Chain-of-Custody (COC) form for adequate sample tracking.

The temperature requirement for the receipt of most environmental samples is above freezing to ≤6° C. Temperatures that exceed this range are subject to qualification and data rejection by regulatory agencies. Following the instructions below provides the best chance of achieving and maintaining this temperature and avoiding qualified data.

- Samples should be collected and placed on ice as soon as possible. It is much more difficult to cool down warm samples. Please provide additional ice if your samples are warm.

- When possible, sample containers should be sealed in zip-lock containers or the plastic bags provided. This separation will aid in preventing cross contamination and protects the sample labels from moisture that could render them illegible.

- <u>Do not overfill the cooler with samples.</u> Overfilling the cooler limits the space available for ice.

- Surround the sides and the tops of the sample containers with loose, crushed, or cubed, ice. Surrounding the samples with ice is the most efficient way of cooling. <u>Do not use Blue Ice.</u> <u>Do not use small individual bags of ice.</u> <u>Do not simply lay a bag of ice on top of the samples.</u>

- Place the temperature blank in a representative location in the cooler (the middle of a bag of ice is not representative).

- Secure all paperwork in a zip-lock bag and place in the cooler. Seal the cooler closed.

- When shipping the coolers back to TriMatrix, complete the appropriate carrier paperwork and attach it to the cooler. Samples shipped during the week for standard overnight delivery typically arrive the next day between 9:00 and 10:00 a.m. Saturday deliveries must be approved by your project chemist. When shipping samples for a Saturday delivery, we recommend using FedEx Priority Overnight service. When doing so, you must select the “Saturday Delivery” option on the FedEx Airbill.

Please call your TriMatrix project chemist at 1-616-975-4500 if you require any further instructions, or to notify them of the pending arrival of any non-scheduled samples.

Thank You,
TriMatrix Laboratories, Inc.

TRIMATRIX
LABORATORIES

IMPORTANT INFORMATION REGARDING THE COLLECTION OF NON-CHLORINATED DRINKING WATER SAMPLES FOR VOLATILE ORGANICS

Remove the aerator from the faucet. Turn the cold water on and allow the system to flush until the water temperature has stabilized (usually about 3-5 minutes). Reduce the water flow enough so that air bubbles do not pass through the sample as the vial is being filled, or become trapped when the vial is sealed. Slowly fill the sample vials to just overflowing. Each 40 mL vial has been pre-preserved with 0.5 mL of 18% HCl acid preservative. Take care not to flush out the acid. Carefully collect a set of duplicate samples.

CAUTION: The 1:1 HCl is very acidic. Handle with care.

NOTE: If the sample foams vigorously when collected it must be discarded and recollected without the HCl preservative. These samples must be flagged as “not acidified” on the chain of custody.

Seal the vials and mix by inverting repeatedly for 1 minute. Verify that the sealed and mixed vials are bubble and headspace free. Sample data generated from vials received with headspace will require qualification.

Package the samples surrounded by crushed or cubed ice. Blue Ice is not recommended. Samples received by the laboratory the same day they were collected may not have time to reach ≤ 6° C. Provided they were packaged correctly using crushed or cubed ice no qualifications will be required. All other samples must be received by the laboratory at ≤ 6° C or the data will be qualified accordingly.

Please call 1-616-975-4500 and speak to your project chemist if you have any questions. Thank you.

TRIMATRIX
LABORATORIES

IMPORTANT INFORMATION REGARDING THE COLLECTION OF CHLORINATED DRINKING WATER SAMPLES FOR VOLATILE ORGANICS

Remove the aerator from the faucet. Turn the cold water on and allow the system to flush until the water temperature has stabilized (usually about 3-5 minutes). Reduce the water flow enough so that air bubbles do not pass through the sample as the vial is being filled, or become trapped when the vial is sealed. Slowly fill the sample vials to just overflowing. Each 40 mL vial has been pre-preserved with 25 mg of ascorbic acid preservative. Take care not to flush out the acid. Carefully collect three vials for every sample.

Seal the vial labeled “Do NOT Add HCl”.

Using the supplied eyedropper and vial of HCl, carefully add 4 drops of HCl to each of the remaining two vials.

CAUTION: The 1:1 HCl is very acidic. Handle with care.

NOTE: It is important that the 4 drops of HCl are added only to the appropriate two vials, and that it is added after sample collection.

NOTE: If the sample foams vigorously when the HCl is added it must be discarded and recollected without the HCl preservative (all three samples will now only contain ascorbic acid). These samples must be flagged as “No HCl Preservative” on the chain of custody.

Seal the remaining two vials and mix all three by inverting repeatedly for 1 minute. Verify that the sealed and mixed vials are bubble and headspace free. Sample data generated from vials received with headspace will require qualification.

Package the samples surrounded by crushed or cubed ice. Blue Ice is not recommended. Samples received by the laboratory the same day they were collected may not have time to reach ≤ 6° C. Provided they were packaged correctly using crushed or cubed ice no qualifications will be required. All other samples must be received by the laboratory at ≤ 6° C or the data will be qualified accordingly.

Please call 1-616-975-4500 and speak to your project chemist if you have any questions. Thank you.

TRIMATRIX
LABORATORIES

Dissolved Sulfide Sample Collection and Preservation

To measure dissolved sulfide, insoluble matter in the sample must first be removed. This is accomplished by producing an aluminum hydroxide floc. The flocculent is allowed to settle and the supernatant decanted off and preserved with zinc acetate and sodium hydroxide.

Supplies

Quantity	*Item*
1 per sample	250 mL amber bottle containing 0.5 mL (10 drops) 6N sodium hydroxide
2 per sample	40 mL vials, each containing 0.1 mL (2 drops) 2N zinc acetate and 0.1 mL (2 drops) 6N sodium hydroxide
2	eye droppers
1	Container of aluminum chloride. Enough has been sent to allow for the addition of 10 drops (0.5 mL) to each 250 mL sample.

Procedure

1.0 Collect the sample in the 250 mL amber bottle containing the sodium hydroxide. Completely fill the bottle (must be enough sample so when capped it is headspace free).

2.0 Immediately add 10 drops of the aluminum chloride solution, cap, and mix by holding the bottle in an upright position and rotating your wrist back and forth for 1 minute.

3.0 Allow the sample to settle for 5 to 15 minutes (long enough to allow the flocculent to settle to the bottom of the bottle but not longer than 15 minutes). Wait only as long as necessary to collect 80 mL of supernatant.

4.0 Carefully decant the supernatant into the (2) 40 mL vials containing the zinc acetate and sodium hydroxide. Completely fill the vials with sample so they are headspace free.

5.0 The sample remaining in the 250 mL amber bottle is caustic. Please return the partially filled bottle to TriMatrix for disposal.

If you have any questions on the treatment procedures described below, please contact your project chemist at 1-616-975-4500.

TRIMATRIX
LABORATORIES

IMPORTANT INFORMATION FOR
AVAILABLE CYANIDE SAMPLE COLLECTION

Two sample containers must be collected at each sample point. One container will be treated with both lead carbonate and sodium hydroxide, and the second with only sodium hydroxide. A form titled "Available Cyanide Sample Treatment Record" has been provided to document all field pre-treatment activities. Please complete it as you collect and treat each sample.

IMPORTANT: To avoid analyte loss it is **required** that all sample treatments occur within 15 minutes of sample collection.

CAUTION: All containers labeled as Sodium Hydroxide and Lead Carbonate/Sodium Hydroxide contain 1.3 mL of 10N sodium hydroxide. This solution is very caustic. Avoid skin contact. Handle with care.

CAUTION: All containers labeled as Lead Carbonate contain 0.25 g of solid lead carbonate. Avoid inhalation and skin contact.

1.0 Sample Collection Equipment

Per Sample

- One disposable vacuum filtration apparatus
- One plastic powder funnel
- One sheet of filter paper
- One bottle labeled Lead Carbonate
- One bottle labeled Lead Carbonate/Sodium Hydroxide
- One bottle labeled Sodium Hydroxide

A hand pump (not provided) is also required to perform this procedure

2.0 Collecting a Lead Carbonate/Sodium Hydroxide Pre-Treated Sample

If the sample contains particulates, begin with section 2.1. If the sample is particulate free, begin with section 2.2.

2.1 Sample Contains Particulate Matter

To avoid the loss of cyanides that may have bonded to the particulate matter, the sample must be filtered prior to the lead carbonate pre-treatment. Using a powder funnel and a sheet of filter paper filter the well mixed sample into the bottle labeled Lead Carbonate. Filter enough sample to fill the bottle up to its neck. Place the used filter paper into the bottle labeled Lead Carbonate/Sodium Hydroxide. Cap the Lead Carbonate bottle and gently swirl to mix the sample and the lead carbonate. The sulfide will react with the lead carbonate and precipitate out as lead sulfide. To prevent the loss of any cyanide through reaction with the precipitated lead sulfide the precipitate must be removed. Filter the solution using the vacuum filtration apparatus. Transfer the filtrate into the Lead Carbonate/Sodium Hydroxide bottle containing the used filter paper. Do not pre-rinse the container or fill to overflowing, as a loss of the particulate matter and sodium hydroxide will result. Proceed to section 3.0.

2.2 Sample Particulate Free

With a minimum of aeration, fill the 250 mL bottle labeled Lead Carbonate up to the neck with sample. Cap and gently swirl to mix the sample and the lead carbonate. The sulfide will react with the lead carbonate and precipitate out as lead sulfide. To prevent the loss of any cyanide through reaction with the precipitated lead sulfide the precipitate must be removed. Filter the solution using the vacuum filtration apparatus. Transfer the filtrate into the <u>Lead Carbonate/Sodium Hydroxide</u> bottle. Do not pre-rinse the container or fill to overflowing, as a loss of sodium hydroxide will result. Proceed to section 3.0.

3.0 Collecting a Sodium Hydroxide Pre-Treated Sample

With a minimum of aeration fill the 250 mL bottle labeled <u>Sodium Hydroxide</u> with sample. Do not pre-rinse the container or fill to overflowing, as a loss of sodium hydroxide will result.

4.0 Collect all Paperwork and Return the Samples to TriMatrix

Place all samples in the cooler. Surround the samples with crushed or cubed ice. Do not use chemical refrigerants such as Blue Ice.

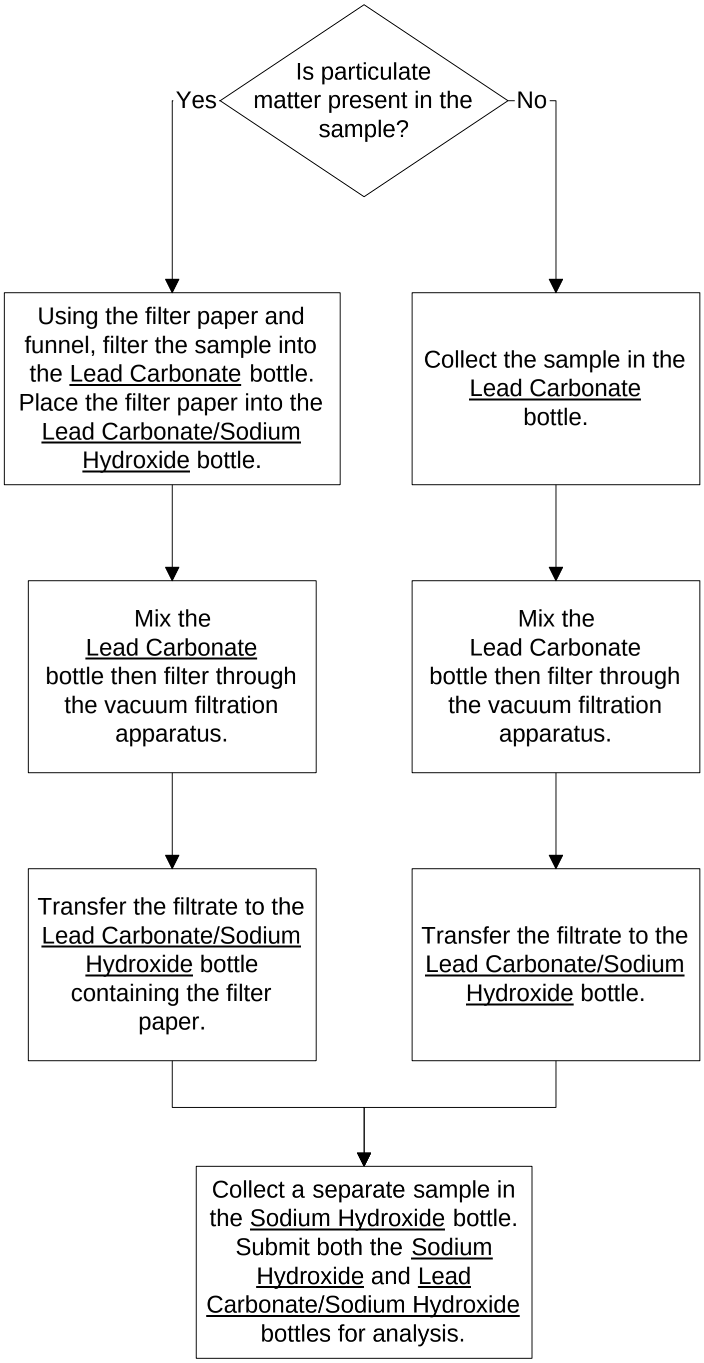
IMPORTANT: Samples received by the laboratory the same day they were collected may not have time to reach ≤ 6° C. Provided they were packaged correctly using crushed or cubed ice no qualifications will be required. All other samples must be received by the laboratory at ≤ 6° C or the data will be qualified accordingly.

Seal all paperwork in the re-sealable bag and place the sealed bag in the cooler. Place all plastic powder funnels and <u>unopened</u> vacuum filters in the cooler. Seal the cooler and return it to TriMatrix.

If you have any questions, please call TriMatrix at 1-616-975-4500 and speak with your project chemist.

TRIMATRIX
LABORATORIES

Available Cyanide Sample Collection Flowchart



TRIMATRIX
LABORATORIES

Available Cyanide Sample Treatment Record

Sampled By: ______________________________ **Company:** ________________________ **Date:** ____________

Sample ID		Time Collected	Did Sample Contain Particulate Matter and Require Filtration?	Sample Combined with Lead Carbonate	Filtrate Combined with Sodium Hydroxide	Time Treatment Completed	Treatment Completed within 15 minutes of Collection?	Preserved Sample Collected
1)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
2)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
3)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
4)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
5)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
6)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
7)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
8)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
9)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
10)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
11)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
12)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
13)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
14)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
15)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
16)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
17)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
18)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No
19)			Yes / No	Yes / No	Yes / No		Yes / No	Yes / No

Appendix AA

TRIMATRIX
LABORATORIES

5560 Corporate Exchange Court SE   Grand Rapids, MI 49512
Phone (616) 975-4500   Fax (616) 942-7463
www.trimatrixlabs.com

Chain of Custody Record

COC # ______________

Page ____ of ____

For Lab Use Only

Cart	
VOA Rack/Tray	
Receipt Log No.	
Project Chemist	
Work Order #	

Client Name	Project Name
Address	Client Project # / P.O. #
	Invoice To ☐ Client ☐ Other (comments)
Phone Fax	Contact/Report To

Analyses Requested

PRESERVATIVES

A NONE pH 6-8
B HNO_3 pH<2
C H_2SO_4 pH<2
D 1+1 HCl pH<2
E NaOH pH>12
F ZnAc/NaOH pH>9
G MeOH
H Other (note below)

Container Type (corresponds to Container Packing List)

Test Group	Matrix Code	Laboratory Sample Number		Sample ID	Cooler ID	Sample Date	Sample Time	COMP	GRAB	Matrix	Number of Containers Submitted										Total	Sample Comments
			1																			
			2																			
			3																			
			4																			
			5																			
			6																			
			7																			
			8																			
			9																			
			10																			

Sampled By (print)	How Shipped? Hand Carrier____________________	Comments
Sampler's Signature	Tracking No.	

Company	1. Relinquished By	Date	Time	2. Relinquished By	Date	Time	3. Relinquished By	Date	Time
	1. Received By	Date	Time	2. Received By	Date	Time	3. Received For Lab By	Date	Time

WHITE COPY - REPORT   YELLOW COPY - LABORATORY   PINK COPY - FIELD

revision 2.0

Appendix AB

Sample Receipt Record

TRIMATRIX LABORATORIES

Date: ____________

Delivery Method A: ____________ **No. of Sample Boxes:** ______ **Number of Coolers:** ______ **Signed for By:** ______ **Time:** ______
Delivery Method B: ____________ **No. of Sample Boxes:** ______ **Number of Coolers:** ______ **Signed for By:** ______ **Time:** ______
Delivery Method C: ____________ **No. of Sample Boxes:** ______ **Number of Coolers:** ______ **Signed for By:** ______ **Time:** ______
Delivery Method D: ____________ **No. of Sample Boxes:** ______ **Number of Coolers:** ______ **Signed for By:** ______ **Time:** ______
TriMatrix Courier (TC): ____________ **No. of Sample Boxes:** ______ **Number of Coolers:** ______ **Signed for By:** ______ **Time:** ______

Page/ Line Number	Client	Quantity of Coolers OR TriMatrix Cooler Number	Arrived in Laboratory					Work Order Number	Folder Prepared (✓)
			Time	AM	PM	Received By	Delivery Method Letter		
49-1									
49-2									
49-3									
49-4									
49-5									
49-6									
49-7									
49-8									
49-9									
49-10									
49-11									
49-12									
49-13									
49-14									
49-15									
49-16									
49-17									
49-18									
49-19									
49-20									

Appendix AC

SAMPLE RECEIVING / LOG-IN CHECKLIST

TRIMATRIX LABORATORIES

Client	Work Order #: New / Add To	
Receipt Record Page/Line #	Project Chemist	Sample #s

Recorded by (initials/date)

☐ Cooler
☐ Box
☐ Other____________

Qty Received

Thermometer Used
☐ IR Gun (#202)
☐ Digital Thermometer (#54)
☐ Other (#_______)

☐ See Additional Cooler Information Form

Cooler # | Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact

Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None

Coolant Location:
Dispersed / Top / Middle / Bottom

Temp Blank Present: ☐ Yes ☐ No

If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________

☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler # | Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact

Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None

Coolant Location:
Dispersed / Top / Middle / Bottom

Temp Blank Present: ☐ Yes ☐ No

If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________

☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler # | Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact

Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None

Coolant Location:
Dispersed / Top / Middle / Bottom

Temp Blank Present: ☐ Yes ☐ No

If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________

☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler # | Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact

Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None

Coolant Location:
Dispersed / Top / Middle / Bottom

Temp Blank Present: ☐ Yes ☐ No

If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________

☐ Cooler ID on COC?
☐ VOC Trip Blank received?

If any shaded areas checked, complete Sample Receiving Non-Conformance and/or Inventory Form

Paperwork Received

Yes	No	
☐	☐	Chain of Custody record(s)? If No, Initiated By ________________
☐		Received for Lab Signed/Date/Time?
☐	☐	Shipping document?
☐	☐	Other ____

COC Information

☐ TriMatrix COC ☐ Other____

COC ID Numbers:

Check Sample Preservation

N/A	Yes	No	
	☐	☐	Temperature Blank **OR** average sample temperature, ≥6° C?
☐	☐	☐	If either is ≥6° C, was thermal preservation required?
☐	☐		If "Yes", Project Chemist Approval Initials:_____________
☐	☐		If "Yes" Completed Non Con Cooler - Cont Inventory Form?
☐	☐		Completed Sample Preservation Verification Form?
☐	☐	☐	Samples chemically preserved correctly?
☐	☐		If "No", added orange tag?
	☐	☐	Received pre-preserved VOC soils?

☐ MeOH ☐ Na_2SO_4

Check COC for Accuracy

Yes	No	
☐	☐	Analysis Requested?
☐	☐	Sample ID matches COC?
☐	☐	Sample Date and Time matches COC?
☐		Container type completed on COC?
☐	☐	All container types indicated are received?

Check for Short Hold-Time Prep/Analyses

☐ Bacteriological
☐ Air Bags
☐ EnCores / Methanol Pre-Preserved
☐ Formaldehyde/Aldehyde
☐ Green-tagged containers
☐ Yellow/White-tagged 1 L ambers (SV Prep-Lab)

AFTER HOURS ONLY:
COPIES OF COC TO LAB AREA(S)
☐ NONE RECEIVED
☐ RECEIVED, COCs TO LAB(S)

Sample Condition Summary

N/A	Yes	No	
	☐	☐	Broken containers/lids?
	☐	☐	Missing or incomplete labels?
	☐	☐	Illegible information on labels?
	☐	☐	Low volume received?
	☐	☐	Inappropriate or non-TriMatrix containers received?
☐	☐	☐	VOC vials / TOX containers have headspace?
☐	☐	☐	Extra sample locations / containers not listed on COC?

Notes

☐ Trip Blank received ☐ Trip Blank not listed on COC

Cooler Received (Date/Time)	Paperwork Delivered (Date/Time)	≤1 Hour Goal Met?
		Yes / No

SAMPLE RECEIVING / LOG-IN CHECKLIST - page 2

TRIMATRIX LABORATORIES

Project Chemist Use

Notify Laboratory Personnel of Short Hold-Times and/or Rush Work

☐ **NONE**

(Lab personnel notified/Date)

☐ Inorganics ____________________
☐ Microbiology (Bacteria) ____________________
☐ Metals Prep ____________________
☐ Metals ____________________
☐ GC-Volatiles ____________________
☐ MS-Volatiles ____________________
☐ Semi-Vol. Prep ____________________
☐ GC-Semi-Volatiles ____________________
☐ MS-Semi-Volatiles ____________________

Log-In Priority ☐ RUSH ☐ Standard

Project Chemist Notes to Log-In Personnel

Trip Blank: ☐ Log-In ☐ Do Not log-in

☐ Prep Storage Blank for client (VOCs)

☐ Sub-Contracting required ☐ Coolant required

☐ Non-TriMatrix or non-standard container type(s) received
Check pH of container type ________________________
Expected pH:____________ ☐ Adjust if needed

☐ Adjust pH of orange-tagged containers

☐ Lab-filter samples and document on Preservation Form

Sample narratives to be added at Log-In

____
____
____
____

Log-In Use

Log Samples into LIMS

Sample #s

N/A	Yes	
	☐	Receive samples in LIMS
	☐	Date/Time received entered in LIMS match COC
	☐	Read Work Order narratives
☐	☐	Enter VOC rack/tray number into Work Order narrative
	☐	Enter sample information into LIMS
☐	☐	Add any sample narratives
☐	☐	If non-conformance issues, add sample qualifiers
	☐	Print sample number labels

Log-in Analyst (initials/date/time)

Label Sample Containers

N/A	Yes	No	
	☐	☐	LIMS label matches tag?
☐	☐		**DISCREPANCIES CORRECTED IN LIMS**
			Initials/Date: __________________
☐	☐		Applicable stickers applied to labels?
			☐ MS/MSD sample
			☐ Composite before analysis
☐	☐		Applicable stickers applied to containers?
			☐ Waste sample
			☐ PT sample
			☐ USDA regulated
	☐	☐	Orange-tagged containers present?
☐	☐	☐	Adjust pH per project chemist?
☐	☐		Initials and Date/Time adjusted on orange tag?
☐	☐		Initials and Date/Time adjusted on Preservation Form?

Verify Label Accuracy

N/A	Yes	
	☐	Second analyst checked labels for accuracy?
☐	☐	Verify that orange-tagged containers adjusted/initialed?

Labeled by (initials/date)	Verified by (initials/date)

Sample Storage

Check all that apply:

Bacteria……………………	☐	Bacteria refrigerator
Non-Volatiles………………	☐	Walk-In cooler
Volatiles……………………	☐	Volatile Lab refrigerator
Waste………………………	☐	Waste Cabinet
Waste VOCs.....................	☐	Log-In hood refrigerator
Low-Level Hg ………………	☐	Metals Lab - DO NOT STORE IN WALK-IN

Paperwork

N/A	Yes	
	☐	Original COC (White)
	☐	Copy of COC (Yellow)
	☐	Receiving/Log-In Checklist
☐	☐	Additional Cooler Information Form
☐	☐	Sample Preservation Verification
☐	☐	Sample Receiving Non-Conformance Form
☐	☐	Shipping Documents
☐	☐	Custody Seals
	☐	Arrival Log
☐	☐	Other (Note)

Appendix AD

TRIMATRIX
LABORATORIES

SAMPLE RECEIVING / LOG-IN CHECKLIST
ADDITIONAL COOLER INFORMATION

Recorded by (initials/date)	Client		Work Order #
	Receipt Log #	Sample #s	Project Chemist

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Cooler #	Time

Custody Seals:
☐ None
☐ Present / Intact
☐ Present / Not Intact
Coolant Type:
☐ Loose Ice
☐ Bagged Ice
☐ Blue Ice
☐ None
Coolant Location:
Dispersed / Top / Middle / Bottom
Temp Blank Present: ☐ Yes ☐ No
If Present, Temperature Blank Location is:
☐ Representative ☐ Not Representative

	Observed °C	Correction Factor °C	Actual °C
Temp Blank:			
Sample 1:			
Sample 2:			
Sample 3:			

3 Sample Average °C: ____________
☐ Cooler ID on COC?
☐ VOC Trip Blank received?

Comments

Appendix AE

TRIMATRIX
LABORATORIES

SAMPLE PRESERVATION VERIFICATION FORM

page ____ of ____

Client		Work Order #
Receipt Log #	Completed By (initials/date)	Project Chemist

pH Strip Reagent #

☐ **5120353**

☐ ____________

COC ID #			Adjusted by:______________ Date:__________________		DO NOT ADJUST pH FOR THESE CONTAINER TYPES			
Container Type	5 / 23	4	13		6	15		
Tag Color	Lt. Blue	Blue	Brown		Red	Red Stripe		
Preservative	NaOH	H_2SO_4	H_2SO_4		HNO_3	HNO_3		
Expected pH	**>12**	**<2**	**<2**		**<2**	**<2**		
COC Line #1								
COC Line #2								
COC Line #3								
COC Line #4								
COC Line #5								
COC Line #6								
COC Line #7								
COC Line #8								
COC Line #9								
COC Line #10								

Comments

Aqueous Samples: For each sample and container type, check the box if pH is acceptable. If pH is not acceptable for any sample container, record pH in box, and note on Sample Receiving Checklist and on Sample Receiving Non-Conformance Form. If approved by Project Chemist, add acid or base to the sample to achieve the correct pH. Add up to, but do not exceed 2x the volume initially added at container prep (see table below for initial volumes used). Add orange pH tag to sample container and record information requested. Record adjusted pH on this form. Do not adjust pH for container types 6 and 15.

COC ID #			Adjusted by:______________ Date:__________________		DO NOT ADJUST pH FOR THESE CONTAINER TYPES			
Container Type	5 / 23	4	13		6	15		
Tag Color	Lt. Blue	Blue	Brown		Red	Red Stripe		
Preservative	NaOH	H_2SO_4	H_2SO_4		HNO_3	HNO_3		
Expected pH	**>12**	**<2**	**<2**		**<2**	**<2**		
COC Line #1								
COC Line #2								
COC Line #3								
COC Line #4								
COC Line #5								
COC Line #6								
COC Line #7								
COC Line #8								
COC Line #9								
COC Line #10								

Comments

Container Size (mL)	**Original Vol. of Preservative (mL)**
Container Type 5	NaOH
500	2.5
1000	5.0
Container Type 4	H_2SO_4
125	0.5
250	1.0
500	2.0
1000	4.0
Container Type 13	H_2SO_4
500	2.5

Appendix AF

TRIMATRIX
LABORATORIES

pH Strip Verification Logbook

Date	Analyst	Lot #	pH 2	pH 4	pH 7	pH 10	Use

pH STRIP CALIBRATION VERIFICATION INSTRUCTIONS AND CRITERIA

1. To be considered acceptable the strip must read the exact pH of the buffer. Use the following table to determine what buffers to use:

Range	Use	pH			
0 - 14	General Laboratory	2	4	7	10
0 - 14	Log-In	2	4	7	10
5 - 10	BOD			7	10
0 - 2.5	Hexavalent Chromium	2			

2. If the pH strip does NOT read correctly at all pH levels then the lot of strips must NOT be used. Return them to purchasing and request another lot be ordered.

Appendix AG

TRIMATRIX
LABORATORIES

SAMPLE RECEIVING NON-CONFORMANCE REPORT

Client		Work Order #
Receipt Log #	Completed By (initials/date)	Project Chemist

List non-conformance issues associated with this work order in the chart below/left. Identify discrepancies between the COC and sample tags in the chart below/right. Add comments as needed.

COC ID #	Line #	Type of Problem										COC					Sample Tag					Line Item Comments
		Discrepancy	Missing Container	Broken Container	Label Missing / Incomplete	Label Illegible	Low Volume	Inappropriate Container	Headspace	Not Listed on COC	Preservation	Sample Field ID	Date Sampled	Time Sampled	Container Type	Qty	Sample Field ID	Date Sampled	Time Sampled	Container Type	Qty	

General Comments:

Project Chemist (initials/date)

Appendix AH

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Report To:
Environmental Resource Associates
[redacted]

Invoice To:
[redacted]
To Whom it May Concern
[redacted]

Package Due Date:	**n.a.**		
W.O. Due Date:	**May-17-12 23:00 (19 day TAT)**	Report Level:	**3MD**
Date Received:	Apr-20-12 00:00	Received By:	[redacted]
Date Logged In:	Apr-20-12 13:38	Logged In By:	[redacted]
W.O. Comments:	*QC is 3MD; full list spike*		

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-23 DON'T USE Total Residual Chlorine [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
1204360-01 1: Minerals [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Alkalinity, Total 2320 B	May-17-12 13:40	28	May-04-12 00:00	ERA WP Minerals
Chloride 9056A	May-17-12 13:40	28	May-18-12 00:00	ERA WP Minerals
Chloride 9251	May-17-12 13:40	28	May-18-12 00:00	
Conductivity 9050A	May-17-12 13:40	28	May-18-12 00:00	ERA WP Minerals
Fluoride 4500-F C	May-17-12 13:40	28	May-18-12 00:00	Delete Fluoride sample and ADD to Minerals
Fluoride 9056A	May-17-12 13:40	28	May-18-12 00:00	Delete Fluoride sample and ADD to Minerals
K Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	ERA WP Minerals
Na Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	ERA WP Minerals
Solids, TDS 2540 C	May-17-12 13:40	28	Apr-27-12 00:00	Remove from WP Solids but leave in WP Minerals
Solids, Total 2540 B	May-17-12 13:40	28	Apr-27-12 00:00	Remove from WP Solids and add to WP Minerals
Sulfate 9038	May-17-12 13:40	28	May-18-12 00:00	ERA WP Minerals
Sulfate 9056A	May-17-12 13:40	28	May-18-12 00:00	ERA WP Minerals
1204360-02 2: Hardness [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Ca Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	REMOVE from Minerals
Calcium Hardness as CaCO3 6010B [Calc]	May-17-12 13:40	28	Apr-30-12 00:00	REMOVE from Minerals
Hardness 2340 C (Custom Equation)	May-16-12 17:00	19	Oct-17-12 00:00	
Hardness 6010B (Calc)	May-17-12 13:40	28	Oct-17-12 00:00	REMOVE from Minerals
Mg Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	REMOVE from Minerals
Solids, TSS 2540 D	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Solids

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-03 3: pH [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
pH 9040B	May-17-12 13:40	28	Apr-20-12 00:00	GOOD WP pH
1204360-04 4: Settleable Solids [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Solids, Settleable 2540 F	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Settleable Solids
1204360-05 5: Volatile Solids [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Solids, TVS 160.4 (mg/L)	May-17-12 13:40	28	Apr-27-12 00:00	
1204360-06 6: Simple Nutrients [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Nitrogen, Ammonia 4500-NH3 G	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Nutrients
Nitrogen, NO3 4500-NO3 F	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nutrients
Nitrogen, NO3 9056A	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nutrients
Nitrogen, NO3+NO2 4500-NO3 F	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Nitrate-Nitrite as N
Phosphate, Ortho 4500-P E	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nutrients
1204360-07 7: Complex Nutrients [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Nitrogen, TKN 351.2	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Nutrients
Phosphorus, Total 4500-P E	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Nutrients
1204360-08 8: Nitrite as N [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Nitrogen, Nitrite SM 4500-NO3 F	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nitrite as N
Nitrogen, NO2 4500-NO2 B	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nitrite as N
Nitrogen, NO2 9056A	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Nitrite as N
1204360-09 9: Demand [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
BOD 5-Day 5210B	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Demand
BOD 5-Day Carb 5210 B	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Demand
COD 5220 D	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Demand
TOC 9060	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Demand
1204360-10 10: Oil & Grease [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
HEM: O&G 1664A	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Oil & Grease
1204360-11 11: Trace Metals [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Ag Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-11 11: Trace Metals [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Ag Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Al Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Al Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	
As Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
As Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
B Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
B Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Ba Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Ba Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Be Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Be Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cd Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cd Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Co Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Co Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cr Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cr Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cu Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Cu Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Fe Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Mn Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Mn Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Mo Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Mo Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Ni Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Ni Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Pb Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Pb Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Sb Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Se Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Se Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Sr Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Sr Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Tl Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Tl Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
V Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
V Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-11 11: Trace Metals [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Zn Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Zn Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
1204360-12 12: Mercury [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Hg Diss 7470A	May-17-12 13:40	28	May-18-12 00:00	WP Trace Metals
1204360-13 13: Hexavalent Chromium [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Cr6 Diss 7196A	May-17-12 13:40	28	Apr-21-12 00:00	GOOD WP Hexavalent Chromium
1204360-14 14: Tin and Titanium [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Sn Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Sn Diss 6020	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
Ti Diss 6010B	May-17-12 13:40	28	Oct-17-12 00:00	WP Trace Metals
1204360-15 15: Color [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Color 2120B	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Color
1204360-16 16: Turbidity [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Turbidity 2130 B	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP Turbidity
1204360-17 17: Total Cyanide [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Cyanide, Total 9014	May-17-12 13:40	28	May-04-12 00:00	GOOD WP Total Cyanide
1204360-18 18: Total Phenolics [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Phenolics 9065	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Total Phenolics
1204360-19 19: Sulfide [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Sulfide 9034	May-17-12 13:40	28	Apr-27-12 00:00	GOOD Sulfide
Sulfide, Total 4500-S2 D	May-17-12 13:40	28	Apr-27-12 00:00	GOOD Sulfide
1204360-20 20: MBAS [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
MBAS 5540 C	May-17-12 13:40	28	Apr-22-12 00:00	GOOD WP MBAS
1204360-21 21: Acidity as CaCO3 [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Acidity 2310 B	May-17-12 13:40	28	May-04-12 00:00	GOOD WP Acidity as CaCO3

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-22 22: Bromide [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Bromide 9056A	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Bromide
Bromide D 1246-88	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Bromide
1204360-24 24: Volatiles [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8021B VOAs (master list)	May-17-12 13:40	28	May-04-12 00:00	GOOD WP Volatiles
zz8260B VOAs (master list)	May-17-12 13:40	28	May-04-12 00:00	GOOD WP Volatiles
1204360-25 25: Herbicides [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8151A Herbicides (master list)	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Herbicides
1204360-26 26: PCBs in Water [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8082 PCBs (std 7 aroclors)	May-17-12 13:40	28	Apr-20-13 00:00	GOOD WP PCBs in Water, WP PCBs in Oil
1204360-27 27: PCBs in Oil [Waste] ***Sampled Apr-20-12 00:00 Eastern by***				
8082 PCBs (std 7 aroclors)	May-17-12 13:40	28	Apr-20-13 00:00	GOOD WP PCBs in Water, WP PCBs in Oil
1204360-28 28: Base Neutral Extractables [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
zz8270C SVOCs (master list)	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Base Neutrals
1204360-29 29: Acid Extractables [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8270C SVOCs (FO19)	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Acids
1204360-30 30: Nitroaromatics/Nitroamines [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8330 Explosives DoD	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Nitroaromatics/Nitramines
1204360-31 31: Low Level PAHs SIM [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8270C PNAs - SIM	May-17-12 13:40	28	Apr-27-12 00:00	
1204360-32 32: Organochlorine Pesticides [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8081A PESTs (master list)	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Pesticides, NELAC Pesticides
1204360-33 33: Total Chlordane [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8081A APP IX Pests	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Total Chlordane
1204360-34 34: WP Toxaphene [Water] ***Sampled Apr-20-12 00:00 Eastern by***				

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	Lab Due Date	TAT	Expires	Analysis Comments
1204360-34 34: WP Toxaphene [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8081A MDEQ Pests	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP Toxaphene
1204360-35 35: Total Organic Halides (TOX) [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
TOX 9020B	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Total Organic Halides (TOX)
1204360-36 36: GRO 8015 [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8021B VOAs (BETX)	May-17-12 13:40	28	May-04-12 00:00	
GRO EPA 8015B	May-17-12 13:40	28	May-04-12 00:00	GOOD WP GRO
1204360-37 37: DRO 8015 [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
DRO EPA 8015B	May-17-12 13:40	28	Apr-27-12 00:00	GOOD WP DRO
1204360-38 38: Total Petroleum Hydrocarbons [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
HEM-SGT: TPH 1664A	May-17-12 13:40	28	May-18-12 00:00	GOOD WP Total Petroleum Hydrocarbons
1204360-39 39 Wisconsin GRO [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8021B VOAs (custom2)	May-17-12 13:40	28	May-04-12 00:00	Wisconsin GRO/PVOC
GRO - Wisconsin Method	May-17-12 13:40	28	May-04-12 00:00	
1204360-40 40: Wisconsin DRO [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
DRO - Wisconsin Method	May-17-12 13:40	28	Apr-27-12 00:00	
1204360-41 41: Low Level Mercury [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Hg Total 1631E	May-17-12 13:40	28	May-18-12 00:00	Low Level Mercury
1204360-42 42: Silica as SiO2 [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
Silica, Diss 4500-SiO2 D(low level)	May-17-12 13:40	28	May-18-12 00:00	Silica
1204360-43 OPP Pesticides [Water] ***Sampled Apr-20-12 00:00 Eastern by ERA***				
8270C APP IX PEST	May-17-12 13:40	28	Apr-27-12 00:00	OPP Pesticides
1204360-44 8121 Chlorinated Hydrocarbons [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8121 Chl. Hydrocarbns (master)	May-17-12 13:40	28	Apr-27-12 00:00	8121 Chlorinated Hydrocarbons
1204360-45 Extra 8270 App IX [Water] ***Sampled Apr-20-12 00:00 Eastern by***				

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Analysis	**Lab Due Date**	**TAT**	**Expires**	**Analysis Comments**
1204360-45 Extra 8270 App IX [Water] ***Sampled Apr-20-12 00:00 Eastern by***				
8270C APP IX BNA	May-17-12 13:40	28	Apr-27-12 00:00	Extra 8270 BNA

Analysis groups included in this work order

Hardness 6010B (Calc)

Mg Total 6010B

Ca Total 6010B

Reviewed By

Date

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Inorganic - Wet Chemistry Analysis Detail

* indicates custom

Matrix	Analysis	Unit	MDL	RL
Water	Bromide D 1246-88	mg/L	0.152	0.5
Water	Color 2120B	A.C.U.	5	5
Water	Turbidity 2130 B	NTU	0.2	1
Water	Acidity 2310 B	mg/L	4.02	10
Water	Alkalinity, Total 2320 B	mg/L	0.495	20
Water	Hardness 2340 C (Custom Equation)	mg/L	1.02	2
Water	Solids, Total 2540 B	mg/L	50	50
Water	Solids, TDS 2540 C	mg/L	50	50
Water	Solids, TSS 2540 D	mg/L	3.3	3.3
Water	Solids, Settleable 2540 F	mL/L	0.1	0.1
Water	Fluoride 4500-F C	mg/L	0.0378	0.1
Water	Nitrogen, Ammonia 4500-NH3 G	mg/L	0.0049	0.05
Water	Nitrogen, NO2 4500-NO2 B	mg/L	0.0007	0.01
Water	Nitrogen, Nitrite SM 4500-NO3 F	mg/L	0.0073	0.05
Water	Nitrogen, NO3 4500-NO3 F	mg/L	0.0036	0.05
Water	Nitrogen, NO3+NO2 4500-NO3 F	mg/L	0.0097	0.05
Water	Phosphate, Ortho 4500-P E	mg/L	0.0007	0.01
Water	Phosphorus, Total 4500-P E	mg/L	0.003	0.01
Water	Sulfide, Total 4500-S2 D	mg/L	0.0052	0.02
Water	Silica, Diss 4500-SiO2 D(low level)	mg SiO2/L	0.0211	0.1
Water	BOD 5-Day 5210B	mg/L	1	2
Water	BOD 5-Day Carb 5210 B	mg/L	1	2
Water	COD 5220 D	mg/L	2.35	5
Water	MBAS 5540 C	mg/L	0.0209	0.025
Water	Solids, TVS 160.4 (mg/L)	mg/L	3.3	3.3
Water	HEM: O&G 1664A	mg/L	1.22	5
Water	HEM-SGT: TPH 1664A	mg/L	0.665	10
Water	Nitrogen, TKN 351.2	mg/L	0.0729	0.5
Water	Cr6 Diss 7196A	ug/L	0.0003	0.001
Water	Cyanide, Total 9014	mg/L	0.0029	0.005
Water	TOX 9020B	ug/L as Cl	3.65	10
Water	Sulfide 9034	mg/L	1	1
Water	Sulfate 9038	mg/L	0.282	5
Water	pH 9040B	pH Units		0.1
Water	Conductivity 9050A	umhos/cm	5	5
Water	Bromide 9056A	mg/L	0.0215	0.1
Water	Chloride 9056A	mg/L	0.0568	1
Water	Fluoride 9056A	mg/L	0.0401	0.1
Water	Nitrogen, NO2 9056A	mg/L	0.0268	0.1
Water	Nitrogen, NO3 9056A	mg/L	0.0154	0.1
Water	Sulfate 9056A	mg/L	0.223	2
Water	TOC 9060	mg/L	0.104	0.5
Water	Phenolics 9065	mg/L	0.0025	0.05
Water	Chloride 9251	mg/L	0.502	1

Metals Analysis Detail

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

* indicates custom

	Analysis	Unit	MDL	RL
Water	**USEPA-1631E**			
	Hg Total 1631E	ng/L	0.298	0.5
Water	**USEPA-6010C**			
	Ag Diss 6010B	ug/L	4.08	10
	Al Diss 6010B	ug/L	13.1	50
	As Diss 6010B	ug/L	35	100
	B Diss 6010B	ug/L	15.7	100
	Ba Diss 6010B	ug/L	2.71	10
	Be Diss 6010B	ug/L	0.235	1
	Ca Diss 6010B	mg/L	0.23	0.5
	Ca Total 6010B	mg/L	0.23	0.5
	Cd Diss 6010B	ug/L	2.03	10
	Co Diss 6010B	ug/L	3.56	10
	Cr Diss 6010B	ug/L	4.62	50
	Cu Diss 6010B	ug/L	3.85	10
	Fe Diss 6010B	ug/L	6.53	10
	K Diss 6010B	mg/L	0.0329	0.1
	Mg Diss 6010B	mg/L	0.143	0.5
	Mg Total 6010B	mg/L	0.143	0.5
	Mn Diss 6010B	ug/L	2.78	10
	Mo Diss 6010B	ug/L	22.1	100
	Na Diss 6010B	mg/L	0.127	0.5
	Ni Diss 6010B	ug/L	3.81	10
	Pb Diss 6010B	ug/L	14.6	50
	Se Diss 6010B	ug/L	32.6	100
	Sn Diss 6010B	ug/L	30.8	200
	Sr Diss 6010B	ug/L	13	50
	Ti Diss 6010B	ug/L	21.6	100
	Tl Diss 6010B	ug/L	28.7	100
	V Diss 6010B	ug/L	3.01	10
	Zn Diss 6010B	ug/L	4.89	20
Water	**USEPA-6020A**			
	Ag Diss 6020	ug/L	0.0367	0.2
	Al Diss 6020	ug/L	1.76	10
	As Diss 6020	ug/L	0.177	1
	B Diss 6020	ug/L	1.22	10
	Ba Diss 6020	ug/L	0.136	1
	Be Diss 6020	ug/L	0.111	1
	Cd Diss 6020	ug/L	0.0385	0.2
	Co Diss 6020	ug/L	0.0501	1
	Cr Diss 6020	ug/L	0.195	1
	Cu Diss 6020	ug/L	0.127	1
	Mn Diss 6020	ug/L	0.141	1
	Mo Diss 6020	ug/L	0.0753	1
	Ni Diss 6020	ug/L	0.171	1
	Pb Diss 6020	ug/L	0.152	1
	Sb Diss 6020	ug/L	0.148	1

	Se Diss 6020	ug/L	0.31	1
	Sn Diss 6020	ug/L	0.142	10
	Sr Diss 6020	ug/L	0.104	1
	Tl Diss 6020	ug/L	0.0268	1
	V Diss 6020	ug/L	0.0657	1
	Zn Diss 6020	ug/L	1.5	10
Water	**USEPA-7470A**			
	Hg Diss 7470A	ug/L	0.0551	0.2

Semivolatiles GC Analysis Detail

	Analyte	CLrept?	QCrept?	* indicates custom MDL	RL
Waste	**8082 PCBs (std 7 aroclors)**			**mg/kg**	
	PCB-1016	Y	Y	0.0123	0.5
	PCB-1221	Y	Y	0.0115	0.5
	PCB-1232	Y	Y	0.0027	0.5
	PCB-1242	Y	Y	0.0106	0.5
	PCB-1248	Y	Y	0.0028	0.5
	PCB-1254	Y	Y	0.0034	0.5
	PCB-1260	Y	Y	0.0049	0.5
Water	**DRO - Wisconsin Method**			**ug/L**	
	DRO (Wisconsin Method)	Y	Y	30	100
Water	**DRO EPA 8015B**			**ug/L**	
	Diesel Range Organics - 8015 (C10-C28)	Y	Y	48.8	200
Water	**8081A APP IX Pests**			**ug/L**	
	Technical Chlordane	Y	Y	0.0082	0.025
Water	**8081A MDEQ Pests**			**ug/L**	
	Toxaphene	Y	Y	0.0067	1
Water	**8081A PESTs (master list)**			**ug/L**	
	alpha-BHC	Y	Y	0.00042	0.01
	beta-BHC	Y	Y	0.00204	0.01
	gamma-BHC (Lindane)	Y	Y	0.00047	0.01
	delta-BHC	Y	Y	0.00057	0.01
	alpha-Chlordane	Y	Y	0.00017	0.01
	gamma-Chlordane	Y	Y	0.0003	0.01
	4,4'-DDD	Y	Y	0.00019	0.01
	4,4'-DDE	Y	Y	0.00017	0.01
	4,4'-DDT	Y	Y	0.00017	0.01
	Aldrin	Y	Y	0.00058	0.01
	Dieldrin	Y	Y	0.00046	0.01
	Endosulfan I	Y	Y	0.00028	0.01
	Endosulfan II	Y	Y	0.00028	0.01
	Endosulfan Sulfate	Y	Y	0.00033	0.01
	Endrin	Y	Y	0.00039	0.01
	Endrin Aldehyde	Y	Y	0.00234	0.01
	Endrin Ketone	Y	Y	0.00275	0.02
	Heptachlor	Y	Y	0.00055	0.01
	Heptachlor Epoxide	Y	Y	0.00028	0.01
	Methoxychlor	Y	Y	0.00068	0.01
Water	**8082 PCBs (std 7 aroclors)**			**ug/L**	

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

	PCB-1016	Y	Y	0.0537	0.2
	PCB-1221	Y	Y	0.0454	0.2
	PCB-1232	Y	Y	0.0409	0.2
	PCB-1242	Y	Y	0.0619	0.2
	PCB-1248	Y	Y	0.0544	0.2
	PCB-1254	Y	Y	0.0532	0.2
	PCB-1260	Y	Y	0.0291	0.2
Water	**8121 Chl. Hydrocarbns (master)**			**ug/L**	
	1,3-Dichlorobenzene	Y	Y	0.0346	1
	1,4-Dichlorobenzene	Y	Y	0.025	1
	1,2-Dichlorobenzene	Y	Y	0.0463	1
	Hexachloroethane	Y	Y	0.0045	1
	1,2,4-Trichlorobenzene	Y	Y	0.0017	2
	Hexachlorobutadiene	Y	Y	0.0036	0.01
	1,2,4,5-Tetrachlorobenzene	Y	Y	0.0017	0.02
	Hexachlorocyclopentadiene	Y	Y	0.0034	0.01
	2-Chloronaphthalene	Y	Y	0.25	2
	Pentachlorobenzene	Y	Y	0.001	0.01
	Hexachlorobenzene	Y	Y	0.0021	0.01
Water	**8151A Herbicides (master list)**			**ug/L**	
	2,4-D	Y	Y	0.194	5
	2,4,5-T	Y	Y	0.038	5
	2,4,5-TP (Silvex)	Y	Y	0.0095	5
	2,4-DB	Y	Y	0.276	2
	Dalapon	Y	Y	0.523	2
	Dicamba	Y	Y	0.025	0.5
	Dichloroprop	Y	Y	0.016	0.5
	Dinoseb	Y	Y	0.182	0.5
	MCPA	Y	Y	14.3	75
	MCPP	Y	Y	12.2	75
Water	**8330 Explosives DoD**			**ug/L**	
	1,3,5-Trinitrobenzene	Y	Y	0.469	5
	1,3-Dinitrobenzene	Y	Y	0.144	5
	2,4,6-Trinitrotoluene	Y	Y	0.16	5
	2,4-Dinitrotoluene	Y	Y	0.52	5
	2,6-Dinitrotoluene	Y	Y	0.256	5
	2-Amino-4,6-dinitrotoluene	Y	Y	1.04	5
	2-Nitrotoluene	Y	Y	0.271	5
	3-Nitrotoluene	Y	Y	0.133	5
	4-Amino-2,6-dinitrotoluene	Y	Y	0.231	5
	4-Nitrotoluene	Y	Y	0.52	5
	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	Y	Y	0.489	5
	Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	Y	Y	0.194	5
	Nitrobenzene	Y	Y	0.161	5
	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Y	Y	0.131	5

Semivolatiles MS Analysis Detail

* indicates custom

	Analyte	CLrept?	QCrept?	MDL	RL
Water	**8270C APP IX BNA**			**ug/L**	
	1,3-Dinitrobenzene	Y	Y	0.0788	2
	1,3,5-Trinitrobenzene	Y	Y	0.5	2

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Water	**8270C APP IX PEST**			**ug/L**	
	Disulfoton	Y	Y	0.25	2
	Methyl Parathion	Y	Y	0.199	2
	Parathion	Y	Y	0.173	2
	Phorate	Y	Y	0.25	2
Water	**8270C SVOCs (FO19)**			**ug/L**	
	Benzoic Acid	Y	Y	0.211	1
	4-Chloro-3-methylphenol	Y	Y	0.166	0.5
	2-Chlorophenol	Y	Y	0.0703	0.5
	2,4-Dichlorophenol	Y	Y	0.232	0.5
	2,6-Dichlorophenol	Y	Y	0.195	0.5
	2,4-Dimethylphenol	Y	Y	0.309	1
	4,6-Dinitro-2-methylphenol	Y	Y	0.145	0.5
	2,4-Dinitrophenol	Y	Y	1.8	5
	2-Methylphenol	Y	Y	0.126	0.5
	3+4-Methylphenol	Y	Y	0.113	5
	4-Nitrophenol	Y	Y	0.71	5
	2-Nitrophenol	Y	Y	0.0677	0.5
	Pentachlorophenol	Y	Y	0.094	0.5
	Phenol	Y	Y	0.146	0.5
	2,3,4,6-Tetrachlorophenol	Y	Y	0.289	5
	2,4,5-Trichlorophenol	Y	Y	0.0298	0.5
	2,4,6-Trichlorophenol	Y	Y	0.0646	0.5
Water	**zz8270C SVOCs (master list)**			**ug/L**	
	Acenaphthene	Y	Y	0.0299	0.5
	Acenaphthylene	Y	Y	0.0204	0.5
	Aniline	Y	Y	0.0434	0.5
	Anthracene	Y	Y	0.0363	0.5
	Benzidine	Y	Y	1.42	10
	Benzo(a)anthracene	Y	Y	0.0222	0.5
	Benzo(a)pyrene	Y	Y	0.0418	0.5
	Benzo(b)fluoranthene	Y	Y	0.114	0.5
	Benzo(k)fluoranthene	Y	Y	0.124	0.5
	Benzo(g,h,i)perylene	Y	Y	0.0984	0.5
	Benzyl Alcohol	Y	Y	0.166	0.5
	4-Bromophenyl Phenyl Ether	Y	Y	0.0356	0.5
	Butyl Benzyl Phthalate	Y	Y	0.0575	1
	Carbazole	Y	Y	0.047	0.5
	4-Chloroaniline	Y	Y	0.15	1
	Bis(2-chloroethoxy)methane	Y	Y	0.035	0.5
	Bis(2-chloroethyl) Ether	Y	Y	0.035	0.5
	Bis(2-chloroisopropyl) Ether	Y	Y	0.0594	0.5
	2-Chloronaphthalene	Y	Y	0.029	0.5
	4-Chlorophenyl Phenyl Ether	Y	Y	0.0314	0.5
	Chrysene	Y	Y	0.0356	0.5
	Dibenz(a,h)anthracene	Y	Y	0.0699	0.5
	Dibenzofuran	Y	Y	0.039	0.5
	Di-n-butyl Phthalate	Y	Y	0.267	1
	1,2-Dichlorobenzene	Y	Y	0.0675	0.5
	1,3-Dichlorobenzene	Y	Y	0.0299	0.5
	1,4-Dichlorobenzene	Y	Y	0.024	0.5
	3,3´-Dichlorobenzidine	Y	Y	0.641	5
	Diethyl Phthalate	Y	Y	0.0434	5

	Dimethyl Phthalate	Y	Y	0.0446	0.5
	2,4-Dinitrotoluene	Y	Y	0.096	0.5
	2,6-Dinitrotoluene	Y	Y	0.134	0.5
	Di-n-octyl Phthalate	Y	Y	0.0642	1
	Bis(2-ethylhexyl) Phthalate	Y	Y	0.242	1
	Fluoranthene	Y	Y	0.0299	0.5
	Fluorene	Y	Y	0.0314	0.5
	Hexachlorobenzene	Y	Y	0.0621	0.5
	Hexachlorobutadiene	Y	Y	0.0321	0.5
	Hexachlorocyclopentadiene	Y	Y	0.0566	0.5
	Hexachloroethane	Y	Y	0.035	0.5
	Indeno(1,2,3-cd)pyrene	Y	Y	0.0378	0.5
	Isophorone	Y	Y	0.0557	0.5
	2-Methylnaphthalene	Y	Y	0.0238	0.5
	1-Methylnaphthalene	Y	Y	0.0283	0.5
	Naphthalene	Y	Y	0.0238	0.5
	2-Nitroaniline	Y	Y	0.155	1
	3-Nitroaniline	Y	Y	0.0495	1
	4-Nitroaniline	Y	Y	0.0699	1
	Nitrobenzene	Y	Y	0.0764	0.5
	N-Nitroso-diethylamine	Y	Y	0.5	2
	N-Nitroso-dimethylamine	Y	Y	0.341	0.5
	N-Nitroso-diphenylamine	Y	Y	0.042	0.5
	N-Nitroso-di-n-propylamine	Y	Y	0.0444	0.5
	Pentachlorobenzene	Y	Y	0.256	2
	Phenanthrene	Y	Y	0.0308	0.5
	Pyrene	Y	Y	0.0217	0.5
	Pyridine	Y	Y	0.217	0.5
	1,2,4,5-Tetrachlorobenzene	Y	Y	0.0181	2
	o-Toluidine	Y	Y	0.142	2
	1,2,4-Trichlorobenzene	Y	Y	0.0247	0.5
Water	**8270C PNAs - SIM**			**ug/L**	
	Acenaphthene	Y	Y	0.02	0.06
	Acenaphthylene	Y	Y	0.02	0.06
	Anthracene	Y	Y	0.01	0.05
	Benzo(a)anthracene	Y	Y	0.0109	0.05
	Benzo(a)pyrene	Y	Y	0.0087	0.05
	Benzo(b)fluoranthene	Y	Y	0.0125	0.05
	Benzo(g,h,i)perylene	Y	Y	0.0111	0.05
	Benzo(k)fluoranthene	Y	Y	0.0108	0.05
	Chrysene	Y	Y	0.0136	0.05
	Dibenz(a,h)anthracene	Y	Y	0.0111	0.05
	Fluoranthene	Y	Y	0.006	0.05
	Fluorene	Y	Y	0.0076	0.05
	Indeno(1,2,3-cd)pyrene	Y	Y	0.0112	0.05
	Naphthalene	Y	Y	0.02	0.06
	Phenanthrene	Y	Y	0.02	0.06
	Pyrene	Y	Y	0.012	0.05

Volatiles GC Analysis Detail

* indicates custom

Analyte	CLrept?	QCrept?	MDL	RL

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

Water	**GRO - Wisconsin Method**			**ug/L**	
	Gasoline Range Organics (Wisconsin Method)	Y	Y	12.5	100
Water	**GRO EPA 8015B**			**ug/L**	
	GRO - 8015 (C6-C10)	Y	Y	24	100
Water	**8021B VOAs (BETX)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Ethylbenzene	Y	Y	0.304	1
	Toluene	Y	Y	0.27	1
	Xylene (Total)	Y	Y	0.906	3
Water	**8021B VOAs (custom2)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Ethylbenzene	Y	Y	0.304	1
	Methyl tert-Butyl Ether	Y	Y	0.2	5
	Naphthalene	Y	Y	0.182	1
	Toluene	Y	Y	0.27	1
	1,3,5-Trimethylbenzene	Y	Y	0.285	1
	1,2,4-Trimethylbenzene	Y	Y	0.299	1
	Xylene (Total)	Y	Y	0.906	3
	Xylene, Meta + Para	Y	Y	0.602	2
	Xylene, Ortho	Y	Y	0.304	1
Water	**8021B VOAs (master list)**			**ug/L**	
	Benzene	Y	Y	0.3	1
	Bromodichloromethane	Y	Y	0.264	1
	Bromoform	Y	Y	0.216	1
	Bromomethane	Y	Y	0.271	1
	Carbon Tetrachloride	Y	Y	0.258	1
	Chlorobenzene	Y	Y	0.254	1
	Chloroethane	Y	Y	0.231	1
	2-Chloroethyl Vinyl Ether	Y	Y	0.145	10
	Chloroform	Y	Y	0.285	1
	Chloromethane	Y	Y	0.415	1
	1,2-Dibromo-3-chloropropane	Y	Y	0.173	1
	Dibromochloromethane	Y	Y	0.289	1
	1,2-Dibromoethane	Y	Y	0.228	1
	Dibromomethane	Y	Y	0.223	1
	1,3-Dichlorobenzene	Y	Y	2	2
	1,2-Dichlorobenzene	Y	Y	2	2
	1,4-Dichlorobenzene	Y	Y	0.223	1
	Dichlorodifluoromethane	Y	Y	0.255	1
	1,1-Dichloroethane	Y	Y	0.328	1
	1,2-Dichloroethane	Y	Y	0.25	1
	cis-1,2-Dichloroethene	Y	Y	0.294	1
	trans-1,2-Dichloroethene	Y	Y	0.255	1
	1,1-Dichloroethene	Y	Y	0.232	1
	1,2-Dichloropropane	Y	Y	0.226	1
	trans-1,3-Dichloropropene	Y	Y	1	1
	cis-1,3-Dichloropropene	Y	Y	0.216	1
	Ethylbenzene	Y	Y	0.304	1
	Hexachlorobutadiene	Y	Y	0.185	1
	Methylene Chloride	Y	Y	5	5
	Methyl tert-Butyl Ether	Y	Y	0.2	5
	Naphthalene	Y	Y	0.182	1

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

	Analyte	CLrept?	QCrept?	MDL	RL
	Styrene	Y	Y	0.306	1
	1,1,2,2-Tetrachloroethane	Y	Y	0.291	1
	1,1,1,2-Tetrachloroethane	Y	Y	0.304	1
	Tetrachloroethene	Y	Y	0.284	1
	Toluene	Y	Y	0.27	1
	1,2,4-Trichlorobenzene	Y	Y	0.258	1
	1,1,2-Trichloroethane	Y	Y	0.254	1
	1,1,1-Trichloroethane	Y	Y	0.293	1
	Trichloroethene	Y	Y	0.238	1
	Trichlorofluoromethane	Y	Y	0.233	1
	1,2,3-Trichloropropane	Y	Y	0.196	1
	Vinyl Chloride	Y	Y	0.216	1
	Xylene (Total)	Y	Y	0.906	3
	Xylene, Meta + Para	Y	Y	0.602	2
	Xylene, Ortho	Y	Y	0.304	1

Volatiles MS Analysis Detail

	Analyte	CLrept?	QCrept?	* indicates custom MDL	RL
Water	**zz8260B VOAs (master list)**			**ug/L**	
	Acetone	Y	Y	1.09	5
	Acetonitrile	Y	Y	2.45	5
	Acrolein	Y	Y	0.788	5
	Acrylonitrile	Y	Y	0.188	1
	Benzene	Y	Y	0.114	1
	Bromodichloromethane	Y	Y	0.128	1
	Bromoform	Y	Y	0.257	1
	Bromomethane	Y	Y	0.214	1
	Carbon Disulfide	Y	Y	0.231	5
	Carbon Tetrachloride	Y	Y	0.265	1
	Chlorobenzene	Y	Y	0.167	1
	Chloroethane	Y	Y	0.143	1
	2-Chloroethyl Vinyl Ether	Y	Y	0.32	5
	Chloroform	Y	Y	0.0975	1
	Chloromethane	Y	Y	0.289	1
	1,2-Dibromo-3-chloropropane	Y	Y	0.128	1
	Dibromochloromethane	Y	Y	0.152	1
	1,2-Dibromoethane	Y	Y	0.152	1
	Dibromomethane	Y	Y	0.257	1
	1,2-Dichlorobenzene	Y	Y	0.236	1
	1,3-Dichlorobenzene	Y	Y	0.238	1
	1,4-Dichlorobenzene	Y	Y	0.25	1
	Dichlorodifluoromethane	Y	Y	0.214	1
	1,1-Dichloroethane	Y	Y	0.185	1
	1,2-Dichloroethane	Y	Y	0.213	1
	1,1-Dichloroethene	Y	Y	0.21	1
	cis-1,2-Dichloroethene	Y	Y	0.121	1
	trans-1,2-Dichloroethene	Y	Y	0.202	1
	1,2-Dichloropropane	Y	Y	0.276	1
	cis-1,3-Dichloropropene	Y	Y	0.19	1
	trans-1,3-Dichloropropene	Y	Y	0.187	1
	Ethylbenzene	Y	Y	0.206	1
	Hexachlorobutadiene	Y	Y	0.241	1

Reviewed By

Date

Client:	[redacted]	Project Manager:	[redacted]
Project:	**WP PT Samples Spring**	Project Number:	**35508**
Work Order:	**Laboratory Services**	SDG:	

2-Hexanone	Y	Y	0.493	5
Methyl tert-Butyl Ether	Y	Y	0.19	1
Methylene Chloride	Y	Y	0.245	1
2-Butanone (MEK)	Y	Y	0.63	5
4-Methyl-2-pentanone (MIBK)	Y	Y	0.395	5
Naphthalene	Y	Y	0.282	5
Styrene	Y	Y	0.205	1
1,1,1,2-Tetrachloroethane	Y	Y	0.136	1
1,1,2,2-Tetrachloroethane	Y	Y	0.255	1
Tetrachloroethene	Y	Y	0.226	1
Toluene	Y	Y	0.185	1
1,2,4-Trichlorobenzene	Y	Y	0.126	1
1,1,1-Trichloroethane	Y	Y	0.138	1
1,1,2-Trichloroethane	Y	Y	0.203	1
Trichloroethene	Y	Y	0.212	1
Trichlorofluoromethane	Y	Y	0.266	1
1,2,3-Trichloropropane	Y	Y	0.279	1
Vinyl Acetate	Y	Y	0.414	5
Vinyl Chloride	Y	Y	0.209	1
Xylene, Meta + Para	Y	Y	0.283	2
Xylene, Ortho	Y	Y	0.11	1
Xylene (Total)	Y	Y	0.393	3

Reviewed By ____________________ Date ____________

Appendix AI

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

The collection of the sample is the starting point for the generation of quality data. It is the responsibility of TriMatrix to provide the client who collects the sample with sample collection instructions, which ensure sample integrity. Also, where applicable TriMatrix also supplies the client with appropriate clean sample containers and preservative chemicals; these glass containers are purchased new and certified as clean and vendors such as QEC and I-Chem Research.

Sampling and Preservation Requirements for certain common environmental analyses are listed in the following table: (NOTE: Holding times are based on EPA guidelines for CLP, NPDES, and RCRA).

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
ORGANICS							
Volatile Halocarbons*	Water	7 days	4° C	2-40 mL VOA vials	40 mL each	8015, 8021, 8260	Yellow/Black
	Water	14 days	4° C	2-40 mL VOA vials	40 mL each	601	Yellow/Black
	Water	14 days	4° C/HCl to pH <2	2-40 mL VOA vials	40 mL each	601, 8015, 8021, 8260	Yellow
	Soil/Waste (High Level Bulk)	14 days	4° C	60 mL glass jar	fill the jar	8015, 8021, 8260	Light Yellow
	Soil (Low Level Bisulfate)	14 days	4° C/5 mL sodium bisulfate	2-pre-tared 40 mL VOA vials each containing 5 mL of 20% sodium bisulfate and a stir bar	5 g each	8015, 8021, 8260	Light Yellow
	Soil (Encore)	48 hours/14 days	4° C	10 or 25 g Encore	10 or 25 g	8015, 8021, 8260	Label on Bag
	Soil (MeOH Preserved)	14 days	4° C	Pre-tared 40 mL VOA vial and 10 mL ampule of methanol	10 g	8015, 8021, 8260	Light Yellow
Volatile Aromatics*	Water	7 days	4° C	2-40 mL VOA vials	40 mL each	602	Yellow/Black
	Water	14 days	4° C/HCl to pH <2.0	2-40 mL VOA vials	40 mL each	602, 8021, 8260	Yellow
	Soil/Waste (High Level Bulk)	14 days	4° C	60 mL glass jar or	fill the jar	8021, 8260	Light Yellow
	Soil (Low Level Bisulfate)	14 days	4° C/5 mL sodium bisulfate	2-pre-tared 40 mL VOA vials each containing 5 mL of 20% sodium bisulfate and a stir bar	5 g each	8021, 8260	Light Yellow
	Soil (Encore)	48 hours/14 days	4° C	10 or 25 g Encore	10 or 25 g	8021, 8260	Label on Bag
	Soil (MeOH Preserved)	14 days	4° C	Pre-tared 40 mL VOA vial and 10 mL ampule of methanol	10 g	8021, 8260	Light Yellow
Acrolein*	Water	3 days	4° C	2-40 mL VOA vials	40 mL each	624	Yellow/Black
	Water	14 days	4° C/HCl to pH 4-5	2-40 mL VOA vials	40 mL each	624	Yellow
Acrylonitrile*	Water	14 days	4° C	2-40 mL VOA vials	40 mL each	624	Yellow/Black
	Water	14 days	4°C/HCl to pH 4-5	2-40 mL VOA vials	40 mL each	624	Yellow
TPH-GRO	Water	7 days	4° C	2-40 mL VOA vials	40 mL each	8015	Yellow/Black
	Water	14 days	4° C/HCl to pH <2.0	2-40 mL VOA vials	40 mL each	8015	Yellow
TPH-GRO/PVOC	Water	14 days	4° C/HCl to pH <2.0	2-40 mL VOA vials	40 mL each	Wisconsin PUBL-SW-140	Yellow
TPH-GRO	Soil/Waste (High Level Bulk)	14 days	4° C	60 mL glass jar or	fill the jar	8015	Light Yellow
	Soil (Low Level Bisulfate)	14 days	4° C/5 mL sodium bisulfate	2-pre-tared 40 mL VOA vials each containing 5 mL of 20% sodium bisulfate and a stir bar	5 g each	8015	Light Yellow
	Soil (Encore)	48 hours/14 days	4° C	10 or 25 g Encore	10 or 25 g	8015	Label on Bag
	Soil (MeOH Preserved)	14 days	4° C	Pre-tared 40 mL VOA vial and 10 mL ampule of methanol	10 g	8015	Light Yellow
TPH-GRO/PVOC	Soil (Encore)	48 hours/21 days	4° C	10 or 25 g Encore	See Table 1 in Method	Wisconsin PUBL-SW-140	Label on Bag
	Soil (MeOH Preserved)	14 days	4° C	Pre-tared 40 mL VOA vial and 10 mL ampule of methanol	10 g	Wisconsin PUBL-SW-140	Light Yellow
Petroleum Hydrocarbons (DRO)	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	8015	Salmon
	Water	7 days/47 days	4° C/HCl to pH <2.0	1000 mL amber glass bottle	1000 mL	Wisconsin PUBL-SW-141	Gray
	Soil/Waste (High Level Bulk)	14 days/54 days	4° C	60 mL glass jar or	fill the jar	8015	Manila
	Soil/Waste	10 days/47 days	4° C	Tared VOC vial	See Table 1 in Method	Wisconsin PUBL-SW-141	Gray

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
Pesticides	Water	7 days/47 days	4° C/pH 5-9	1000 mL amber glass bottle	1000 mL	608	Yellow/White
PCBs	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	608, 8082	Salmon
Methoxychlor	Water	7 days/47 days	4° C/pH 6-8	1000 mL amber glass bottle	1000 mL	608.2	Yellow/White
Pesticides	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8081	Manila
PCBs	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8082	Manila
PCB Oils	Oil	N/A	None	40 mL VOA vial	20 mL	8082	Manila
Organo-phosphorous Pesticides	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	8141	Salmon
	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8141	Manila
Phenoxy Acid Herbicides	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	8151	Salmon
	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8151	Manila
Polynuclear aromatic Hydrocarbons*	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	610, 8100	Salmon
	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8310, 8270	Manila
Acid Extractables	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	8041, 8270	Salmon
	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8041, 8270	Manila
Base/Neutral Extractables	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	8270	Salmon
	Soil/Waste	14 days/54 days	4° C	60 mL glass jar	fill the jar	8270	Manila
TCLP-							
Volatiles	Soil/Waste	14 days/28 days	4° C	60 mL glass jar	100 g	1311	Yellow/Black
Semi-Volatiles	Soil/Waste	14 days/21 days/61 days	4° C	125 mL glass jar	250 g	1311	Manila
Metals	Soil/Waste	180 days/360 days (Hg-28 days/56 days)	None	125 mL glass jar	250 g	1311	Manila
Pesticide/Herbicide	Soil/Waste	14 days/21 days/61 days	4° C	125 mL glass jar	250 g	1311	Manila
Dioxins/ Furans	Water	7 days/47 days	4° C	1000 mL amber glass bottle	1000 mL	Screen-625	Salmon
	Soil/Waste	None Required	4° C	60 mL glass jar	fill the jar	Screen-625	Manila

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
METALS							
Metals, Total (including phosphorus)	Water	6 months	HNO_3 to pH <2.0	500 mL plastic bottle	500 mL	6010/6020/200.7/200.8	Red
Metals, Dissolved (including phosphorus)	Water	6 months	HNO_3 to pH <2.0	500 mL plastic bottle	500 mL	6010/6020/200.7/200.8	Red/White Stripe
	Soil/Waste	6 months	None	250 mL plastic bottle	50 g	6010/6020	White
Mercury Cold Vapor	Water	28 days	HNO_3 to pH <2.0	500 mL plastic bottle	500 mL	245.1, 7470	Red
	Soil/Waste	28 days	4° C	250 mL plastic bottle	50 g	7471	White
Low-Level	Water	28 days	None	500 mL borosilicate glass bottle**	500 mL	1631	Label on Bag

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
INORGANICS							
Color (Apparent)	Water	48 hours	4° C	125 mL plastic bottle	100 mL	110.2	Green
Color (True)	Water	48 hours	4° C	125 mL plastic bottle	100 mL	110.2	Green
Oil & Grease (HEM and SGT)	Water	28 days	4° C/H_2SO_4 to pH <2.0	1000 mL glass bottle	1000 mL	9070/1664	Dark Blue
	Soil/Waste	28 days	None	60 mL glass jar	50 g	9071	Manila
Specific Conductance	Water	28 days	4° C	125 mL plastic bottle	100 mL	2510 B./120.1/9050	Green
Acidity	Water	14 days	4° C	125 mL plastic bottle	100 mL	2310 B.	Green
pH	Water	24 hours	4° C	125 mL plastic bottle	100 mL	150.1/9041/4500-H B.	Green
	Soil/Waste	24 hours	4° C	60 mL glass jar	50 g	9040/9041/9045	
Alkalinity	Water	14 days	4° C	125 mL plastic bottle	100 mL	310.1/2320 B.	Green
Hardness	Water	6 months	HNO_3 to pH <2.0	125 mL plastic bottle	100 mL	130.2/2340 C.	Red
Biochemical Oxygen Demand (BOD)	Water	48 hours	4° C	1000 mL plastic bottle	1000 mL	5210 B.	Green
Chemical Oxygen Demand (COD)	Water	28 days	4° C/H_2SO_4 to pH <2.0	125 mL plastic bottle	100 mL	410.4/5220 D.	Dark Blue
Chromium (Hexavalent)	Water	24 hours	4° C	500 mL plastic bottle	500 mL	7196A, 3500-Cr B.	Green
	Soil/Waste	30 days/24 hours	4° C	60 mL glass jar	50 g	7196A	Manila
Organic Carbon (TOC)	Water	28 days	4° C/H_2SO_4 to pH <2.0	3-40 mL VOA vials	40 mL	415.1/5310 D./9060	Salmon
	Soil/Waste	28 days	4° C	60 mL glass jar	10 g	MSA 29-3.5.2/415.1/9060	Manila
Ortho-Phosphate	Water	48 hours	4° C	125 mL plastic bottle	100 mL	365.1/4500-P E.	Green
Total Phosphorus	Water	28 days	H_2SO_4 to pH <2.0	125 mL plastic bottle	100 mL	365.1/4500-P F.	Dark Blue
	Soil/Waste	28 days	4° C	60 mL glass jar	50 g	365.1/4500-P F.	Manila

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
Total Kjeldahl Nitrogen (TKN)	Water	28 days	4° C/H_2SO_4 to pH <2.0	125 mL plastic bottle	100 mL	351.2	Dark Blue
	Soil/Waste	28 days	4° C	60 mL glass jar	50 g	351.2	Manila
Ammonia	Water	28 days	4° C/H_2SO_4 to pH <2.0	125 mL plastic bottle (500 mL for wastewater)	100 mL (200 mL for wastewater)	350.1/4500-NH_3 G.	Dark Blue
	Soil/Waste	28 days	4° C	60 mL glass jar	50 g	350.1/4500-NH_3 G.	Manila
Nitrite	Water	48 hours	4° C	125 mL plastic bottle	100 mL	300.0/9056/353.2/354.1/ 4500 NO_2-B/4500 NO_2-F	Green
	Soil/Waste	28 days/48 hours	4° C	60 mL glass jar	50 g	353.2/9056	Manila
Nitrate	Water	48 hours	4° C	125 mL plastic bottle	100 mL	300.0/9056/353.2/4500 NO_3-F	Green
	Soil/Waste	28 days/48 hours	4° C	60 mL glass jar	50 g	9056/353.2/4500 NO_3-F	Manila
Nitrite plus Nitrate	Water	28 days	4° C/H_2SO_4 to pH <2.0	125 mL plastic bottle	100 mL	353.2/4500 NO_3-F	Dark Blue
	Soil/Waste	28 days	4° C	60 mL glass jar	50 g	353.2/4500 NO_3-F	Manila
(No distinction between NO_2 and NO_3)							
Total Volatile Solids	Water	7 days	4° C	125 mL plastic bottle	100 mL	160.4	Green
	Soil/Waste	7 days	4° C	60 mL glass jar	50 g	2540-G	Manila
Turbidity	Water	48 hours	4° C	125 mL plastic bottle	100 mL	180.1/2130 B.	Green
Sulfate	Water	28 days	4° C	125 mL plastic bottle	100 mL	300.0/9056/375.4/9038	Green
	Soil/Waste	28 days	4° C	60 mL glass jar	50 g	9056/375.2/9038/4500 SO_4-F	Manila
Sulfite	Water	48 hours	4° C/3 mL 1% EDTA	125 mL plastic bottle	100 mL	377.1	Manila
Sulfide, Total	Water	7 days	4° C/Pre-Preserved with Zinc Acetate; NaOH Added in field to pH ≥9	125 mL plastic bottle	100 mL	9034/376.1/376.2/4500 S_2-D 4500 S_2-F	Light Green
	Soil/Waste	7 days	4° C	60 mL glass jar	50 g	9034	Manila
Cyanide*	Water	14 days	4° C/NaOH to pH >12	1000 mL plastic bottle	1000 mL	335.2/335.4/9012/9014	Light Blue
	Soil/Waste	14 days	4° C	60 mL glass jar	50 g	9012/9014	Manila
Cyanide, Available	Water	14 days	1 Lead Carbonate bottle 1 Lead Carbnate/NaOH bottle 1 NaOH bottle	125 mL amber glass bottles	125 mL	OIA-1677	Light Blue

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
Coliform Fecal and Total	Water	24 hours	4° C/$Na_2S_2O_3$	Sterile plastic bottle or Whirl-Pak	100 mL	9222-D/9223-B	White
Bromide	Water	28 days	4° C	125 mL plastic bottle	100 mL	9056/ASTM D1246-88	Green
Chloride	Water	28 days	4° C	125 mL plastic bottle	100 mL	300.0/9056/325.2/4500-Cl E.	Green
	Soil	28 days	4° C	60 mL glass jar	50 g	9056/325.2/4500-Cl E.	Manila
Chlorine Residual	Water	Analyze Immediately	4° C	125 mL plastic bottle	100 mL	HACH-8167	Green
Total Solids (% Moisture)	Water	7 days	4° C	125 mL plastic bottle	100 mL	160.3/2540 B.	Green
	Soil/Waste	7 days	4° C	60 mL glass jar	50 g	3550	Manila
Total Dissolved Solids (TDS)	Water	7 days	4° C	1000 mL plastic bottle	1000 mL	160.1/2540 C.	Green
Total Suspended Solids (TSS)	Water	7 days	4° C	1000 mL plastic bottle	1000 mL	160.2/2540 D.	Green
Fluoride	Water	28 days	4° C	125 mL plastic bottle	100 mL	300.0/9056/4500-F C.	Green
	Soil	28 days	4° C	60 mL glass jar	50 g	9056	Manila
Organic Halogen (TOX)	Water	28 days	4° C/H_2SO_4 to pH <2.0	500 mL amber glass bottle	500 mL	9020	Lilac
	Soil	28 days	4° C	60 mL glass jar	50 g	9023	Manila
Phenolics	Water	28 days	4° C/H_2SO_4 to pH <2.0	500 mL amber glass bottle	100 mL	420.2/420.4/9066	Brown
	Soil	28 days	4° C	60 mL glass jar	50 g	9066	Manila
Surfactants (MBAS)	Water	48 hours	4° C	1000 mL plastic bottle	400 mL	425.1/5540 C.	Green
Flash Point	Solid/Liquid/Waste	N/A	None	Clear glass wide mouth jar. 60 mL unless otherwisespecified.	100 g	1010/1020	White
	Waste	N/A	None		100 g	1010/1020	White
Corrosivity (pH and Method 1110)	Waste	N/A	None	(Appropriate to Sample) 500 mL glass or plastic bottle	500 mL	9040/9041/1110	White
Paint Filter (Free Liquids)	Soil/Waste	N/A	None	(Appropriate to Sample) 250 mL glass jar or	100 g	9095	White

SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (from Date Sampled)	Preservation	Container	Minimum Sample Size	Method Reference	Container Tag Color
				125 mL plastic bottle			
Radiologicals (Alpha + Beta, Alpha, Beta, Ra 226, Ra 228	Water	6 months	HNO_3 to pH <2.0	1000 mL plastic bottles or 1000 mL glass bottle	1000 mL		White
Reactivity (Releasable CN and S)	Waste	14 days CN, 7 days S	4° C	(Appropriate to Sample 125 mL plastic bottle or 60 mL glass jar	10 g	SW- 846 Chapter 7	White

*Sample must also be preserved with Sodium Thiosulfate or Ascorbic Acid if chlorinated

**All low-level mercury bottles are stored filled with 5 mL of concentrated HCl and Millipore water

NOTE: For Organics parameters, container lid should be Teflon.

NOTE: For Inorganic parameters, container lid should be plastic or Teflon lined.

NOTE: When testing for several like parameters (ICP metals, Ion Chromatograph anions), one container per sample is sufficient. For example, a sample to be tested for the 13 priority pollutant metals needs one 500 mL container.

Appendix AJ

Internal Chain of Custody

SDGID: **Work Order #: 1204360**

Client: [redacted]
Project: **WP PT Samples Spring**
Project Manager: [redacted]
Date Received: **Apr-20-12 00:00**

Department: **Inorganic - Wet Chemistry** Analysis: ____________________

Lab Number / Sample Name	*Container*	*Removed by (Signature)*	*Date & Time Removed*	*Date & Time Returned*	*Consumed?*	*Extract Container*
1204360-01 1: Minerals						
1204360-02 2: Hardness						
1204360-03 3: pH						
1204360-04 4: Settleable Solids						
1204360-05 5: Volatile Solids						
1204360-06 6: Simple Nutrients						
1204360-07 7: Complex Nutrients						
1204360-08 8: Nitrite as N						
1204360-09 9: Demand						
1204360-10 10: Oil & Grease						
1204360-13 13: Hexavalent Chromium						
1204360-15 15: Color						
1204360-16 16: Turbidity						
1204360-17 17: Total Cyanide						

Appendix AK

NOTICE

This Piece of Equipment is

<u>OUT</u> <u>OF</u> <u>SERVICE</u>

This piece of equipment has been removed from service for safety or performance reasons. Under NO CIRCUMSTANCES is this equipment to be used while it is flagged as Out of Service. If you have any questions, please ask the party specified below. Thank You.

Removed From Service On:____

By:____

Appendix AL

TRIMATRIX
LABORATORIES

Non-Conformance Investigation Report

Client:______________________________ **Work Order Number:**______________

Sample Number(s):______________ **Date Initiated:**______________ **Date Due:**______________

Investigation Resulting From: ☐ Internal Observation ☐ Client Complaint ☑ **Audit** ☐ Failing PT Sample

I. Area of Non-Conformance:

☐ Sample Receiving / Storage ☐ Bottle Prep ☑ **Client Services** / Reporting ☐ Other______________

☐ Inorganic (Wet Chemistry / Metals / **Prep**) Laboratory ☐ Organic (Volatile / Semi-Volatile / Extraction) Laboratory

II. Description of Non-Conformance:

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______________________________ Initiated By:______________

III. Investigation into Non-Conformance:

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______________________________ Initials:__________

IV. Corrective Action:

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______________________________ Initials:__________

V. Follow-Up (if required):

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______________________________ Initials:__________

VI. Reviewed By:

Managerial Approval:______________________ **Area Supervisor:**______________________

Date Completed:______________

Appendix AM

TRIMATRIX LABORATORIES

Preventive Action Investigation

Initiated By:_______________________________________ **Document Control Number:**________________________

Date Initiated:_____________________________________ **Date Due:**______________________________________

Investigation Resulting From: ☑ Internal Observation ☐ Client Complaint ☐ Audit ☐ Failing PT Sample

I. Area of Preventive Action:

☐ Sample Receiving / Storage ☐ Bottle Prep ☐ Client Services / Reporting ☐ Other_____________________

☐ Inorganic (Wet Chemistry / Metals) Laboratory ☐ Organic (Volatile / Semi-Volatile / Extraction) Laboratory

II. Description and Proposed Solutions:

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III. Action Plan and Implementation Schedule:

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____Initials: ________ Date: __________

IV. Follow-Up to Monitor Effectiveness:

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____Initials: ________ Date: __________

V. Reviewed By:

QA Officer: ____________________________________ **Area Supervisor:** ______________________________________

Date Completed: ________________________

8.0 GLOSSARY OF TERMS

ABSORBANCE - a measure of the decrease in incident light passing through a sample into the detector. It is defined mathematically as:

$$A = \left(\frac{\text{I (solvent)}}{\text{I (solution)}} \right) - \frac{\log \text{Io}}{\text{I}}$$

ALIQUOT - a measured portion of a field sample taken for analysis.

ANALYSIS DATE/TIME - the date and time of the introduction of the sample, standard, or blank into the analysis system.

ANALYTE - the element or ion an analysis seeks to determine; the component of interest.

ANALYTICAL SAMPLE - any solution or media introduced into an instrument on which an analysis is performed excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification and continuing calibration blank. Note the following are all defined as analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, interference check samples (ICS), CRDL standard for AA (CRA), CRDL standard for ICP (CRI), laboratory control sample (LCS), method preparation blank (MPB), laboratory fortified blank (LFB), and linear range analysis sample (LRS).

AUTOZERO - zeroing the instrument at the proper wavelength. It is equivalent to running a blank to set the absorbance to zero.

AVERAGE INTENSITY - the average of two different responses from a detector.

BACKGROUND CORRECTION - a technique to compensate for background contribution to the instrument signal in the determination.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank, Instrument Blank, Storage Blank, and Sulfur Blank.

BATCH - a group of samples prepared at the same time in the same location using the same method.

BREAKDOWN - a measure of the decomposition of certain analytes (i.e. DDT and Endrin) into by-products.

4-BROMOFLUOROBENZENE (BFB) - the compound chosen to establish mass spectral instrument performance for volatile (VOA) analyses.

CALIBRATION - the establishment of an analytical curve based on the measured response of known standards.

CALIBRATION BLANK - a volume of laboratory reagent or other inert carrier matrix.

CALIBRATION STANDARDS - a series of known standards used by the analyst for calibration of the instrument (i.e., preparation of the analytical curve).

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected during external calibration. The calibration factor is analogous to the Response Factor (RF) calculated during internal calibration.

CONTAMINATION - a component of a sample or an extract that is not representative of the environmental source of the sample. Contamination may stem from other samples, sampling equipment, while in transit, from laboratory reagents, laboratory environment, or analytical instruments.

CONTINUING CALIBRATION VERIFICATION - analytical standard run at periodic intervals to verify the initial calibration of the system.

CONTRACT REQUIRED DETECTION LIMIT (CRDL) - minimum level of detection acceptable as specified by the project to report.

CONTROL LIMITS - a range within which specified measurement results must fall to be compliant. Control limits may be mandatory, requiring corrective action if exceeded, or advisory, requiring that noncompliant data be flagged.

CORRELATION COEFFICIENT - the number (r) which indicates the degree of dependence between two variables (concentration - absorbance). The more dependent they are the closer the number (r) is. Determined on the basis of the least squares regression.

DAY - unless otherwise specified, day shall mean calendar day.

DIGESTION LOG - an official record of the sample preparation (digestion).

DISSOLVED METALS - analyte elements which have not been digested prior to analysis and which will pass through a 0.45 um filter.

DRY WEIGHT - the weight of a sample analyzed based on percent solids. The weight after drying in an oven.

DUPLICATE - a second aliquot of sample that is treated the same as the original in order to determine the precision of the collection.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass(es).

EXTRACTABLE - a compound that can be partitioned into an organic solvent from the sample matrix and is amenable to gas chromatography. Extractables include semivolatile (BNA) and pesticide/Aroclor compounds.

FIELD BLANK - any sample submitted from the field identified as a blank.

FIELD SAMPLE - Material received to be analyzed that is contained in single or multiple containers and identified by a unique Sample Number.

GAS CHROMATOGRAPH (GC) - the instrument used to separate analytes on a stationary phase within a chromatographic column. The analytes are either volatized directly from the sample (VOA water and low-soil), from the sample extract (VOA medium soil), or injected as an extracted sample (SVOA and PEST). In VOA and SVOA analysis, the compounds are detected by a Mass Spectrometer (MS). In PEST analysis, the compounds are detected by an Electron Capture Detector (ECD).

HOLD TIME - the maximum allowable elapsed time expressed in hours or days from the time the sample is collected until the time of its pre-treatment or analysis.

INDUCTIVELY COUPLED PLASMA (ICP) - a technique for the simultaneous or sequential multi-element determination of elements in solution. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique. Characteristic atomic line emission spectra are produced by excitation of the sample in a radio frequency inductively coupled plasma.

IN-HOUSE - at the laboratories facility.

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the instrument.

INJECTION - introduction of the analytical sample into the instrument excitation system for the purpose of measuring concentration of an analyte.

INSTRUMENT CALIBRATION - Series of analytical standards at different specified concentrations; used to define the quantitative response, linearity, and dynamic range of the instrument.

INSTRUMENT DETECTION LIMIT (IDL) - determined by multiplying by three the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of 3x-5x IDL on three nonconsecutive days with seven consecutive measurements per day.

INSTRUMENT CHECK SAMPLE - a solution containing both interfering and analyte elements of known concentration that can be used to verify background and interelement correction factors.

INSTRUMENT CHECK STANDARD - a multi-element standard of known concentrations prepared by the analyst to monitor and verify instrument performance on a daily basis.

INTERFERENTS - substances which affect the analysis for the element of interest.

INTERNAL STANDARDS - compounds added to analytical and quality control samples at a known concentration prior to analysis. In the methods that require them, internal standards are used as the basis for quantitation of the target compounds.

INSTRUMENT/ANALYTICAL BLANK - a blank designed to determine the level of contamination associated with the analytical instrument.

INSUFFICIENT QUANTITY - when there is not enough volume (water sample) or weight (soil/sediment) to perform any of the required operations: sample analysis or extraction, percent moisture, MS/MSD, etc.

BLANK SPIKE - a control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents, and analytical methods employed for the samples received.

LABORATORY RECEIPT DATE - the date on which a sample is received as recorded on the chain of custody.

LINEAR RANGE, LINEAR DYNAMIC RANGE - the concentration range over which the determinative instrument's analytical curve remains linear.

MATRIX - the predominant material of which the sample to be analyzed is composed. Matrix is not synonymous with phase (liquid or solid).

MATRIX EFFECT - in general, the effect of the particular sample matrix on the constituents with which is contacts. This is particularly pronounced for clay particles which may adsorb chemicals and catalyze reactions. Matrix effects may prevent extraction of target analytes, and may affect surrogate recoveries. In addition, non-target analytes may be extracted from the matrix causing interferences.

MATRIX SPIKE - aliquot of a matrix spiked with known quantities of target compounds and subjected to the entire analytical procedure. Matrix spikes are used to indicate the efficiency of the method on the matrix by measuring the recovery of the spiked analyte.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method relative to the matrix.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards that are carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD OF STANDARD ADDITIONS (MSA) - the addition of 3 increments of a standard solution (spikes) to sample aliquots of the same size. Measurements are made on the original and after each addition. The slope, x-intercept and y-intercept are determined by least-square analysis. The analyte concentration is determined by the absolute value of the x-intercept. Ideally, the spike volume is low relative to the sample volume (approximately 10% of the volume). Standard addition may counteract matrix effects; it will not counteract special effects. Also referred to as Standard Addition.

m/z - Mass to charge ratio, synonymous with "m/e"

NARRATIVE - portion of the data package which includes laboratory, contract, case and sample number identification, and descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

PERCENT DIFFERENCE (%D) - to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference).

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105° C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105° C, including water.

PERCENT SOLIDS - the proportion of solid in a soil sample determined by drying an aliquot of the sample at 105° C.

PERFORMANCE EVALUATION MIXTURE - a calibration solution of specific analytes used to evaluate both recovery and percent breakdown as measures of performance.

PERFORMANCE TESTING (PT) SAMPLE - a single blind sample of known composition obtained from an external provider for analysis. Used by clients and regulatory agencies to evaluate laboratory performance.

PREPARATION BLANK (reagent blank, method blank) - an analytical control that contains distilled/deionized water and reagents, which is carried through the entire analytical procedure – digested/distilled/extracted and analyzed. An aqueous method blank is treated with the same reagents as a sample with a water matrix; a solid method blank is treated with the same reagents as a soil sample.

PRIMARY QUANTITATION ION - a specific ion used to quantitate a target analyte.

PROTOCOL - a compilation of procedures to be followed with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control.

PURGE AND TRAP (DEVICE) - analytical technique (device) used to isolate volatile (purgeable) organics by stripping the compounds from water or soil by a stream of inert gas, trapping the compounds on an adsorbent such as a porous polymer trap, and thermally desorbing the trapped compounds onto a gas chromatographic column.

PURGEABLES – non-water soluble volatile organic compounds.

QUALITY CONTROL SAMPLE - a solution obtained from an outside source having known concentration values to be used to verify the calibration.

REAGENT BLANK - a volume of deionized, distilled water containing the same reagent matrix as the calibration standards carried through the entire analytical scheme.

REAGENT WATER - water in which an interferent is not observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - The relative percent difference is based on the mean of two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. In contrast, see percent difference.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

$$\text{RRT} = \frac{\text{RTc}}{\text{RTis}}$$

where:

RTc = Retention time for the target or surrogate compound in continuing calibration.
RTis = Retention time for the internal standard in calibration standard or in a sample.

RELATIVE STANDARD DEVIATION (RSD) - the variation of a series of results based on the standard deviation and average. Typically used in the evaluation of initial calibration curves.

$$\text{RSD} = \frac{\text{SD}}{\text{Average RF}}$$

RESOLUTION - the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

RESPONSE - or Instrumental Response: a measurement of the output of the detector in which the intensity of the signal is proportionate to the concentration detected.

RESPONSE FACTOR (RF) - a measure of the relative response of an analyte compared to an internal standard. The RF is determined by the following equation:

$$\mathrm{RF} = \left(\frac{\mathrm{Ax}}{\mathrm{Ais}} \times \frac{\mathrm{Cis}}{\mathrm{Cx}} \right)$$

where:
A = area of the characteristic ion measured
C = concentration
is = internal standard
x = analyte of interest

RETENTION TIME (RT) - the time a target analyte is retained on a GC column before elution. The identification of a target analyte is dependent on a target compound's retention time falling within the specified retention time window established for that compound. Retention time is dependent on the nature of the column's stationary phase, column diameter, temperature, flow rate, and other parameters.

ROUNDING RULES - If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.

If the figure following those to be retained is 5, and if there are no known figures beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

If a series of multiple operations is to be performed (add, subtract, divide, multiply), all figures are carried through the calculations. Then the final answer is rounded to the proper number of significant figures.

RUN - a continuous analytical sequence consisting of prepared samples and all associated quality assurance measurements.

SAMPLE - a portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

SAMPLE NUMBER - a unique identification number designated for each sample. The Sample Number appears on all laboratory documents which contain information on that sample.

SECONDARY CALIBRATION VERIFICATION (SCV) STANDARD - a standard prepared from a source other than that used to prepare the quantitation standard, and used to verify the initial calibration curve.

SEMIVOLATILE COMPOUNDS - compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with Base/Neutral/Acid (BNA) compounds.

SENSITIVITY - the slope of the analytical curve, i.e., functional relationship between emission intensity and concentration.

SERIAL DILUTION – a series of dilutions to attain a less concentrated solution.

SOIL - synonymous with soil/sediment or sediment as used herein.

SONICATOR - a device that uses the energy from controlled ultrasound applications to mix, disperse, and dissolve organic materials from a given solid matrix.

SPECTRA - a plot of the mass-to-charge ratio (m/e) versus relative intensity of the ion current.

STORAGE BLANK - a reagent water aliquot stored with samples and analyzed on a weekly basis for VOCs. The storage blank is used to determine the potential for sample contamination occurring during storage.

STOCK SOLUTION - a standard solution prepared from neat materials diluted to derive other standards.

SURROGATES (Surrogate Standard) - for semivolatiles, volatiles and pesticides/Aroclors, compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be present in the sample.

SUSPENDED - those particulates in suspension which are retained by a 0.45 um membrane filter.

TENTATIVELY IDENTIFIED COMPOUNDS (TIC) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates. Up to 30 peaks (those greater than 10% of peak areas or heights of nearest internal standards) are subjected to mass spectral library searches for tentative identification.

TOTAL METALS – analytes from the sample which have been digested to complete solvency prior to analysis.

TWELVE-HOUR TIME PERIOD - The twelve (12) hour time period for GC/MS system instrument performance check, standards calibration (initial or continuing calibration), and method blank analysis begins at the moment of injection of the DFTPP or BFB analysis that the laboratory submits as documentation of instrument performance. The time period ends after 12 hours have elapsed according to the system clock. The injection time of the last analyses in the batch must be made within 12 hours of the injection time of BFB of DFTPP.

VOLATILE COMPOUNDS – non-water soluble compounds amenable to analysis by the purge and trap technique. Used synonymously with purgeable compounds.

WET WEIGHT - the mass of a sample aliquot including moisture (un-dried) that is used for analysis.

WIDE BORE CAPILLARY COLUMN - a gas chromatographic column with an internal diameter (ID) that is greater than 0.32 mm. Columns with lesser diameters are classified as capillary columns.