3M

3M Company
St. Paul, Minnesota

Remedial Design/Response Action Plan

Oakdale Site

Oakdale, Minnesota

February 2009

WESTON SOLUTIONS

REMEDIAL DESIGN/RESPONSE ACTION PLAN

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

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LIST OF ACRONYMS

3M	3M Company
bgs	below ground surface
CCR	construction completion report
cm/sec	centimeters per second
DOT	U.S. Department of Transportation
DQOs	data quality objectives
E&S	erosion and sedimentation
EPA	U.S. Environmental Protection Agency
ERI	Electrical Resistivity Imaging
FC	fluorochemical
FS	Feasibility Study
ft MSL	feet mean sea level
GAC	granular activated carbon
gpm	gallons per minute
HAPs	hazardous air pollutants
HDPE	high density polyethylene
LED	light emitting diode
MCES	Metropolitan Council of Environmental Services
MDD	Minnesota Decision Document
mg/m^3	milligrams per cubic meter
MDH	Minnesota Department of Health
MNDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MSL	mean sea level
ND	non-detect
O&M	operation and maintenance
OVM	organic vapor monitor
PCBs	polychlorinated biphenyls
PFBA	perfluorobutanoic acid
PFBS	perfluorobutane sulfonate
PFCs	perfluorochemicals
PFHS	perfluorohexane sulfonate
PFOA	perfluorooctanoic acid

LIST OF ACRONYMS (CONTINUED)

PID	photoionization detector
ppb	parts per billion
PPE	personal protective equipment
PTE	potential to emit
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RD/RA	Remedial Design/Response Action
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SDR	Standard Dimension Ratio
SOPs	Standard Operating Procedures
SRVs	soil reference values
SSHASP	Site Specific Security, Health and Safety Plan
SVE	soil vapor extraction
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDH	total dynamic head
TSCA	Toxic Substances Control Act
VOCs	volatile organic compounds
WWTP	wastewater treatment plant

1. INTRODUCTION

1.1 BACKGROUND

Since 1980, the 3M Company (3M) has cooperated with the Minnesota Pollution Control Agency (MPCA) in the investigation and remediation of the Oakdale Site in Oakdale, Minnesota. The Site consists of three former waste disposal areas, identified as the Abresch, Brockman and Eberle areas, that had received wastes from the 3M St. Paul area facilities; the 3M Cottage Grove, Minnesota, facility; and other companies/entities from the 1940s to 1960. Investigations and any follow-up actions have been previously completed for the Brockman and Eberle areas. The subject of this Remedial Design/Response Action (RD/RA) Plan is the Abresch area, which will be referred to as the Site.

In the early 1980s, 3M conducted an investigation to characterize the presence of volatile organic compounds (VOCs) in various environmental media and to develop an understanding of site hydrogeology. In July 1983, 3M entered into a Consent Order with the MPCA and the United States Environmental Protection Agency (EPA) to perform remedial actions at the Site. Subsequently, 3M removed waste materials and associated soils from the Site and, in 1985, installed a groundwater recovery system to contain/remove shallow groundwater affected by VOCs and other constituents at, and adjacent to, suspected source areas. 3M has operated the groundwater recovery system continuously since 1985 to contain/remove the shallow groundwater affected by the VOCs. 3M conducts routine groundwater monitoring to track remediation progress and presents the results to MPCA annually.

More recently, 3M has been working with the MPCA to assess the presence and extent of perfluorochemicals (PFCs) at the Site. 3M conducted an initial screening level sampling of the Site in 2004, and PFCs were detected in the discharge from the existing groundwater recovery system. Subsequently, in March 2005 and after receiving MPCA approval, 3M implemented enhanced sampling activities at the Site. The results of the enhanced PFC sampling activities were presented in the *Groundwater Data Assessment*

Report Fluorochemical Investigation (Groundwater Data Assessment Report*)* (WESTON, 2005).

In September 2005, the MPCA approved the Groundwater Data Assessment Report and had additional requests for assessment work. Accordingly, from November 2005 through March 2006, 3M implemented the MPCA-approved supplemental PFC assessment program at the Site. The results of the program were summarized in the *Supplemental Fluorochemical (FC) Data Assessment Report* (WESTON, 2006), which was submitted to the MPCA in September 2006.

Following discussions of the *Supplemental Fluorochemical (FC) Data Assessment Report* with MPCA, additional field work was performed by WESTON at the Site in December 2006. The objectives of the additional field work were as follows:

- Refine the understanding of the site hydrogeology and evaluate the effectiveness of the existing groundwater extraction wells, and
- Collect additional soil samples from the area north of Highway 5 for PFC analysis and evaluate possible response actions for this area.

In discussions with the MPCA, it was agreed that two reports would be prepared. The first report would address the effectiveness of the groundwater recovery system. Accordingly, the *Assessment of the Effectiveness of the Existing Groundwater Recovery System* report was submitted to the MPCA on April 9, 2007 (WESTON, 2007a). The second report would present the findings of the remaining assessment activities along with proposed response actions for the Site. The second report, the *Remedial Investigation Report* [*Soil Supplemental FC Data Assessment – Addendum 1*] (RI Report), was submitted to the MPCA on June 15, 2007 (WESTON, 2007b).

During this timeframe, 3M entered into a Settlement Agreement and Consent Order (the Agreement) for the purpose of providing remedial investigations and response actions to address PFCs at the Site. The Agreement became effective on May 22, 2007. It requires that 3M conduct a Remedial Investigation/Feasibility Study (RI/FS) and prepare a

RD/RA Plan with respect to the release or threatened release of PFCs at and from the Site.

In the Agreement, MPCA recognized that 3M had already completed a significant amount of work at the Site in partial fulfillment of the RI/FS requirements. Submission of the Remedial Investigation (RI) Report in June 2007 completed 3M's RI obligation. Accordingly, the RI program for the Site consisted of the following documents, and provided the basis for the Feasibility Study (FS). Collectively, the following four documents are referenced as the RI program:

- Groundwater Data Assessment Report Fluorochemical Investigation (June 2005).
- Supplemental Fluorochemical Data Assessment Report (September 2006).
- Assessment of the Effectiveness of the Existing Groundwater Recovery System (April 2007).
- Remedial Investigation Report [Soil Supplemental FC Data Assessment – Addendum 1] (June 2007).

During the preparation of the FS, 3M submitted (in a July 20, 2007 letter) and MPCA approved, a *Feasibility Study (FS) Field Activities Work Plan.* The FS Field Activities Work Plan contained a description of activities to be completed during the preparation of the FS to better define necessary modifications to the groundwater extraction system. A summary of the field activities that were performed in July/August 2007 and data generated were provided in the *Feasibility Study: Oakdale Site* (FS Report), which was submitted to the MPCA on January 28, 2008 (WESTON, 2008a).

In accordance with the Agreement, the FS provided an evaluation of various response action alternatives which address PFCs in soil and groundwater at the Site, and a recommendation for implementation. The FS-recommended response action alternative was as follows:

- Institutional controls, access restriction, and groundwater monitoring (Sitewide Alternative SW-2), and

- Enhanced groundwater recovery, air stripping/granular activated carbon (GAC) pretreatment prior to discharge (Groundwater Alternative GW-1),

and any one of the following:

- Excavation of soils between 0 to 4 feet below ground surface and disposal in an existing permitted landfill (Soil Alternative S-1), or
- Excavation of soils between 0 to 4 feet and selective (perfluorooctane sulfonate [PFOS] > 30 parts per million [ppm]) soil removal from 4 to 8 feet; excavated soils will be disposed in an existing permitted landfill (Soil Alternative S-2), or
- Excavation of soils between 0 to 4 feet and enhanced (PFOS > 6 ppm) soil removal from 4 feet to the depth of groundwater (8 to 12 feet); excavated soils will be disposed in an existing permitted landfill (Soil Alternative S-3).

Concurrent with the agency's review of the FS Report, 3M requested approval (in a February 28, 2008 letter) from the MPCA to initiate certain Interim Response Actions at the Oakdale Site. These Interim Response Actions included the following:

- Installation of Geoprobe borings at the locations for the new extraction wells proposed under Groundwater Alternative GW-1. These borings would be installed to obtain the lithologic information necessary to design and locate the new extraction wells.
- Based on the above lithologic data, installation of the new extraction wells in the southern/south-central portion of the Site.
- Upon completion of the well installation activities, performance of short-term pump tests on the newly installed extraction wells to estimate the quality and quantity of the groundwater that would have to be treated on-site, prior to its discharge to the Metropolitan Council of Environmental Services (MCES) Wastewater Treatment Plant (WWTP).

In a letter to 3M dated March 13, 2008, the MPCA approved the Oakdale FS Report, with modifications, and 3M's request to initiate Interim Response Actions. With respect to the FS Report, the MPCA requested that additional information be provided concerning the final disposal location and handling of non-hazardous PFC-containing soil. Accordingly, in April 2008, 3M submitted an addendum to the FS Report entitled *Addendum to the Feasibility Studies for the Oakdale, Woodbury and Cottage Grove Sites, Minnesota* (WESTON, 2008b), which provided a description of the off-site disposal locations reviewed and considered, along with a recommended facility. The recommended facility was the SKB Landfill in Rosemount, Minnesota, where a separate engineered cell would be constructed to contain the excavated PFC-containing materials. This disposal location would also be used for PFC-containing material excavated from the Woodbury and Cottage Grove Sites.

3M implemented the MPCA-approved Interim Response Actions in March and April 2008 and discussed the preliminary data from the short-term pump tests at a meeting with the MPCA on May 5, 2008. It was noted that data obtained from continuous pumping of the new extraction wells would be beneficial for designing the groundwater treatment system proposed in Groundwater Alternative GW-1. These data could be obtained by installing the pumps in the new extraction wells and conveyance piping from the extraction wells to the existing manhole, which is the point of discharge to the MCES sewer system. The new extraction wells could be pumped for a period of several months to project the influent loadings to the proposed new groundwater treatment system and further refine pumping rates.

The MPCA agreed with the plan described above to install the pumps in the new extraction wells and the conveyance piping. However, the MPCA requested 3M to submit a formal request to perform these installation activities. Accordingly, 3M submitted a letter to MPCA on May 12, 2008 to request permission to install the pumps in the new extraction wells, the conveyance piping and pumping the new extraction wells for an extended period of time. Approval was received from MPCA to initiate this work in a June 4, 2008 letter to 3M. MCES provided its approval for the discharge in July 2008. Subsequently, 3M obtained contractor bids in August 2008 and installed the pumps and conveyance piping in September and October 2008. Pumping of the extraction system commenced on November 4, 2008. The installation and performance of the Interim Response Actions are described in detail in Section 3 of this RD/RA Plan.

Additionally, in May 2008, and concurrent with the implementation of the Interim Response Actions, the MPCA issued the *Proposed Cleanup Plan for PFCs* (Proposed

Plan) for the Oakdale Site, issued a public notice in the Oakdale/Lake Elmo Review, and held a public meeting on May 22 to present its recommended alternatives as follows:

- Sitewide Alternative SW-2: Institutional controls, access restriction, and groundwater monitoring.
- Groundwater Alternative GW-1: Enhanced groundwater recovery; air stripping/GAC pretreatment prior to discharge to the MCES WWTP.
- Soil Alternative S-3: Excavation from 0 to 4 feet, enhanced soil removal from 4 feet to the water table, and disposal at an existing off-site landfill.

The MPCA also indicated in the Proposed Plan that the SKB Landfill facility meets the requirement of the Agreement for an isolated, engineered permitted facility to contain the excavated PFC-containing material. The public was given the opportunity to provide written and oral comments on the proposed remedy.

One of the comments discussed during the public meeting and in written comments concerned the potential generation of odors during excavation activities since the area to be excavated does contain some VOCs. To address this issue, 3M proposed in a letter to the MPCA dated July 2, 2008, to install a temporary soil vapor extraction (SVE) system in a portion of the planned excavation area to reduce the levels of VOCs, and thus, reduce potential odor problems when excavation commences. The MPCA approved this proposal in a letter to 3M dated July 23, 2008, with requests for additional information. 3M provided to MPCA the requested information in a letter dated August 5, 2008. Final approval for SVE installation was received on August 20, 2008.

The temporary SVE system installation was conducted between August and October 2008, and operation began on October 21, 2008. It is anticipated that the system will continue to operate until excavation activities commence. The installation and performance of the SVE system operation are described in detail in Section 3 of this RD/RA Plan.

On November 4, 2008, the MPCA indicated its selection of final response actions in the Minnesota Decision Document (MDD) for the Oakdale Site. The selected final response actions were a combination of alternatives consistent with those presented in the

Proposed Plan, including Sitewide Alternative SW-2, Groundwater Alternative GW-1, and Soil Alternative S-3 as described above. The MPCA transmitted the signed MDD to 3M and indicated in its transmittal letter dated November 19, 2008, that the RD/RA Plan would be due to the MPCA by February 19, 2009 in accordance with the terms of the Agreement.

1.2 PURPOSE OF THE RD/RA PLAN

The purpose of this RD/RA Plan is to provide a design, an implementation schedule and a monitoring plan for the response actions specified in the MDD, which, upon implementation, will protect the public health and welfare, and the environment from the release or threatened release of PFCs at or from the Site.

1.3 RESPONSE ACTION OBJECTIVES

In accordance with the MDD, as described by the MPCA, the objectives for response actions at the Oakdale Site are:

- To eliminate unacceptable exposures to PFCs in soil.
- To reduce unacceptable exposures to PFCs in groundwater.
- To reduce PFC concentrations in the surface water.
- Re-establish an open space as a natural asset to the community.

1.4 REPORT ORGANIZATION

This RD/RA Plan is organized into the following sections:

- Section 1 – Introduction. This section contains the site background and assessment history, purpose of the RD/RA Plan, and response action objectives.
- Section 2 – Description of Current Conditions. This section contains a description of the site location, geology, hydrogeology, as well as a summary of site soil and groundwater data from previous assessments.

- Section 3 – Interim Response Actions. This section contains a summary of the interim response actions that are being conducted at the Oakdale Site with approval from the MPCA. The interim response actions include installation and operation of 12 groundwater pumping wells on the south side of Highway 5 and the installation and operation of a temporary SVE system on the north side of Highway 5.

- Section 4 – Design Criteria and Rationale. This section contains a description of the MDD-selected response action alternatives and presents the design basis for these response actions.

- Section 5 – Remedial Design – Methods and Techniques. This section provides additional design details for the response actions, methods to implement the response actions, specifications for materials and facilities that will be used, plans to ensure safe and effective implementation of the response actions, and design drawings/layouts for soil and groundwater remediation systems.

- Section 6 – Response Action Implementation. This section contains a discussion of key implementation parameters such as quality control, schedule, project management, recordkeeping, safety, site security, contingency planning, and community relations as they pertain to removal or response actions.

- Section 7 – Post Response Action Implementation. This section contains a description of activities to be performed following implementation of the selected soil and groundwater response action, such as maintenance of institutional controls, operation and maintenance of the groundwater extraction and treatment system, long-term groundwater monitoring, and issuance of a construction completion report.

- Section 8 – References. This section lists the referenced documents within this report.

Tables and figures are provided at the end of each section for ease of review.

2. DESCRIPTION OF CURRENT CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The focus of this report is the Abresch area (the Site), which is shown in Figure 2-1. As shown in Figure 2-1, the Site straddles Highway 5. It is bounded to the north by upper 35th Street, to the east by Hadley Avenue and commercial businesses, to the south by a railroad right-of-way, and to the west by Granada Avenue and commercial property. The Abresch area is approximately 55 acres and most of it is owned by 3M. The Thomas Griffith landscaping business is located on the southeast corner of the area. Highway 5 and associated right-of-way passes through the northern part of the area.

The site area south of Highway 5 is currently undeveloped. Access to this area is generally restricted due to natural features such as wetlands and low-lying drainage areas and fencing with locked gates that restricts access to the remaining portions of the site property.

The ground surface in the site area north of Highway 5 is slightly elevated relative to the neighboring properties. One small pond and a marsh area are present in the northwest and northeast corners of the property, respectively, and a small drainage ditch is present that originates at the pond in the northwest corner of the Site, and extends in a southerly direction under Highway 5. This drainage ditch was dry in December 2006 and has been periodically observed to contain flowing water during wet seasons and/or following storm events. Since December 2007, public access to a portion of the site area north of Highway 5 has been restricted with a construction fence.

2.2 SITE GEOLOGY

The geology at the Site has been well characterized, and is presented in detail in the RI Report. In general, the Site is immediately underlain by a complex system of unconsolidated soils. An upper (shallow) alluvium composed predominantly of silty sand with interbeds of sandy clay till is encountered in the shallow subsurface, and a lower alluvium composed of clean sand to silty sand. The upper and lower alluvium (basal) sands are separated across most of the Site by a prominent till bed approximately 20 feet in thickness. Borings constructed in the western part of the Site indicate a gap in the till allowing contact between the upper and lower sand sequences. The estimated lateral extent of this gap in the till is reflected by hatch marks shown in Figure 2-2. The alluvium and glacial till sequences are approximately 65 to 90 feet thick at the Site. Figure 2-3 presents a north-south cross-section through the Site; the cross-section orientation is shown in Figure 2-2.

The Site is located over the eastern portion of the Twin City Basin, and as a result, the underlying sedimentary bedrock formations dip, generally, to the west. The uppermost subcropping bedrock unit in the vicinity of the Site is the Decorah Shale, which is described as a greenish-gray or olive-gray, fissile, fossiliferous shale. This unit is discontinuous beneath the Site and is no more than 6 to 8 feet thick. Soil boring logs indicate that the Decorah Shale does not extend under the southern half of the area (Figure 2-2).

The unit underlying the Decorah Shale is the Platteville Limestone. This unit is described as a medium- to very fine-grained dolomite or dolomitic limestone and is approximately 20 to 35 feet thick in the area of the Site. The Platteville likely subcrops in areas where the Decorah Shale is believed to be absent. The Platteville is characterized by fractures and solution channels.

The Platteville Limestone is underlain by the Glenwood Shale, which is described as a green-gray or olive-gray, fissile, fossiliferous shale containing scattered limestone beds. The Glenwood acts as a confining unit in the area restricting the vertical movement of groundwater from the Platteville Limestone to the underlying bedrock aquifers. It has a sharp non-erosional contact with the overlying Platteville Limestone, whereas its lower boundary grades into the underlying St. Peter Sandstone. The reported thickness of the Glenwood Shale is 3 to 6 feet in the area of the Site.

Underlying the Glenwood Shale is the St. Peter Sandstone. This unit is described as a light yellow or white, well-sorted, quartzose sandstone. It is an aquifer of some importance in the Twin Cities area and is intercepted by industrial, commercial and residential wells in the Twin Cities area. The St. Peter Sandstone is estimated to be between 150 and 165 feet thick in the vicinity of the Site.

The Prairie du Chien Group underlies the St. Peter Sandstone and is predominantly comprised of fine- to medium-grained dolomite and sandy dolomite with some interbedded quartzose sandstone. The Prairie du Chien Group is 125 to 135 feet thick in the vicinity of the Site. Groundwater flow in the Prairie du Chien Group is controlled by fractures, joints and solution channels.

The Prairie du Chien Group is underlain by the Jordan Sandstone, which is described as a coarse- to medium-grained quartzose sandstone. Because no aquitard separates the Prairie du Chien and the Jordan Sandstone, they are often considered to be one hydrologic unit, although the rate of groundwater movement through the two units can be significantly different. Together, the two units form the primary bedrock aquifer in the Twin Cities area. The Jordan Sandstone is approximately 80 to 85 feet thick in the vicinity of the Site.

2.3 SITE HYDROGEOLOGY

An extensive network of monitoring wells has been used to characterize the site hydrogeology. Monitoring wells were installed in the shallow alluvium, base of the shallow alluvium, basal alluvium and Platteville Limestone. A single monitoring well (SP42) was installed in the St. Peter Sandstone in the southeast corner of the property.

2.3.1 Historic Conditions – Prior to Installation of the Initial Groundwater Extraction System

2.3.1.1 Shallow Water Table Alluvium

Figure 2-4 depicts water table elevations and interpreted direction of groundwater flow across the Site in January 1982 prior to the installation of the initial groundwater extraction system. Under non-pumping conditions, shallow groundwater north of Highway 5 flows in a southerly direction. Shallow groundwater in the southeastern area of the Site flows in a northerly direction toward wetlands and a small perennial stream in the east-central area leading to Raleigh Creek.

A review of historical groundwater elevation data collected prior to the startup of the initial groundwater extraction system indicates that the vertical hydraulic gradient to the north of Highway 5 was downward between water table monitoring wells and monitoring wells screened deeper at the base of the surficial alluvium and basal alluvium. South of Highway 5, in the vicinity of the initial groundwater extraction network, the vertical hydraulic gradient during non-pumping conditions between monitoring wells screened within these different units was not consistent. An upward hydraulic gradient was present near surface water features where groundwater may have been discharging under non-pumping conditions. During pumping conditions, the vertical hydraulic gradient is consistently downward in these areas from the less permeable surficial alluvium to the more transmissive basal alluvium. Therefore, in areas where an upward hydraulic gradient was present under non-pumping conditions, a downward hydraulic gradient is now present and groundwater is being captured by the extraction well network.

During the installation of the initial groundwater extraction system in 1985, short-term aquifer tests were performed to determine well yields and calculate aquifer parameters for the alluvium. Estimated maximum initial well yields for the groundwater extraction wells varied from 0.1 to 60 gallons per minute (gpm). Estimated permeabilities calculated from short-term aquifer tests varied from 1 x 10^{-2} centimeters per second (cm/sec) to 1 x 10^{-5} cm/sec. The wide range in well yield and permeability is due to the variability in site lithology. Where silty sand was encountered in the alluvium, well yields and estimated permeabilities are low. Where coarser soils were encountered, well yields and estimated permeability were higher. The highest well yields and permeabilities were calculated at extraction wells screened across a zone of coarse soils suspected to be associated with a buried bedrock valley (Barr, 1985). This bedrock valley is located in proximity to the drainage culvert beneath Highway 5 just to the east of well cluster W23/W2001/W2006 (see Figures 2-2 and 2-3). It is suspected that the bedrock valley and area of higher permeability in the alluvium continues to the south beneath wetlands. It then extends in an easterly direction, beneath the perennial stream (eastern drainageway) toward Hadley Avenue.

Geophysical surveys performed in the 1980s indicated the presence of a bedrock valley to the east of Hadley Avenue. Several soil borings and a series of monitoring wells to the east were installed to confirm the results of the geophysical surveys. Groundwater samples were collected from the monitoring wells and no known site-related constituents were detected at the time. Therefore, this buried valley was not considered to be a conduit for VOCs to potentially migrate from the Site.

Recent shallow groundwater elevations at the Site indicate an eastern flow component toward the suspected location of the buried bedrock valley. Based on this finding and communication with the MPCA, the potential for this bedrock valley to act as a pathway of PFC migration was evaluated and addressed as part of the FS; results of this evaluation are summarized below.

2.3.1.1.1 FS Field Activity – Geophysical Survey

A non-intrusive 2-D Electrical Resistivity Imaging (ERI) geophysical survey was conducted in July and August 2007 along four lines that transect portions of the Site. The complete geophysical report was summarized in the FS Report and provided in Appendix A of the FS Report. The results of the survey did not specifically delineate the boundary of this subsurface valley. The following conclusions were made based on the geophysical data:

- Three distinct stratigraphic layers were imaged by the ERI survey. These layers include the unconsolidated glacial/glaciofluvial deposits, a weathered shale/limestone unit (where present), and a deeper competent sandstone unit.
- The thickness of the unconsolidated glacial/glaciofluvial deposits varied from approximately 40 to 80 feet.
- A zone exhibiting low electrical resistivity values was observed at varying depths to 60 feet below ground surface (bgs) correlating to the underlying discontinuous till unit.

- At depths between approximately 50 to 100 feet bgs, a rapid transition into a highly resistive unit is interpreted as consolidated bedrock. Based on geologic information collected during drilling activities on-site, this unit is likely the St. Peter Sandstone.

- The results of an east-west transect north of Highway 5 show a depression in the bedrock surface beneath the existing drainage ditch. The interpretation of the geophysical data indicates that this depression is filled with fine-grained soils.

2.3.1.2 Bedrock Groundwater

Groundwater movement in the Platteville Limestone is controlled by solution channels and fractures and may not necessarily be perpendicular to the piezometric contours. In addition, factors such as recharge from the glacial drift where the Decorah Shale is absent and any regional pumping from this unit affect the direction of groundwater flow within the Platteville. Figure 2-5 shows groundwater elevation contours of the Platteville prior to the construction of the initial groundwater extraction system. These plots indicate a water level high east/northeast of the Abresch area. Under non-pumping conditions, piezometric levels indicate a downward gradient from the basal alluvial unit to the Platteville Limestone. Groundwater modeling performed for the Site (Barr, 2005) showed groundwater flow in the shallow alluvium toward the initial extraction well network in the northern area of the Site, and to the east/northeast in the central and southeastern area.

Groundwater movement in the Platteville Limestone appears to be influenced by the major bedrock valleys located east and west of the Site. Water levels in Platteville Limestone monitoring well PL41 were approximately 87 feet higher than water levels in the adjacent St. Peter Sandstone monitoring well SP42. This difference in groundwater levels may be attributed to the less transmissive Glenwood Shale that underlies the Platteville Limestone and the regional pumping of supply wells installed within the St. Peter Sandstone. The low permeability of the Glenwood Shale restricts groundwater flow between the Platteville Limestone and the St. Peter Sandstone, and creates a locally perched groundwater condition. Groundwater flow in the St. Peter Sandstone in the vicinity of the Site is to the west and southwest based on regional groundwater studies.

2.3.2 Initial Groundwater Extraction System – Pumping Wells PW1 through PW12

The initial groundwater extraction system has been in operation at the Site since 1985 to remediate groundwater originally known to be affected by VOCs. The groundwater extraction network originally consisted of 12 extraction wells designated as PW1 to PW12. As shown in Figure 2-6, 11 extraction wells were installed near the southern boundary of the Highway 5 right-of-way and one extraction well (PW10) was installed farther south in the central area of the Site. No information is available on the operation of extraction well PW12 except that the calculated sustainable yield was very low (<0.1 gpm). In May 2003, extraction wells PW5, PW7, PW8 and PW9 were shut down as part of a modification to the system that was approved by the MPCA. Of the seven remaining wells, extraction wells PW2, PW4, PW6 and PW11 operate continuously, and each pumps at a rate of approximately 10 to 20 gpm. Extraction wells PW1, PW3 and PW10 operate intermittently, each averaging a flow rate of less than 0.5 gpm. The reported steady-state combined flow rate of the initial extraction system is approximately 40 gpm.

WESTON evaluated the initial groundwater extraction system from December 8 to December 15, 2006 (WESTON, 2007a) to determine the effect of the extraction system on groundwater levels in the site area and to assess the capture area for the system. The effective area of groundwater capture for the extraction system was estimated using groundwater elevation data that were collected during the field program. Groundwater elevations were monitored either manually or electronically at 58 monitoring and extraction well locations during a period when the groundwater extraction system was temporarily shut down, and then restarted. A summary of the results is as follows:

- As indicated in Figure 2-7, the initial groundwater extraction system was effectively capturing shallow groundwater to the south of Highway 5 at the Site extending from well W217 to the west and monitoring well W203 to the east. The extraction system was not influencing groundwater north of Highway 5.
- Shallow groundwater to the north of Highway 5 was ultimately captured by the initial groundwater extraction system because the groundwater flows to the south. However, the time required for capture is lengthy due to the low permeability of the shallow alluvium and the slow rate of groundwater

movement. Travel time has been estimated to be about 18 years from monitoring well W26 to extraction well PW6.

- Shallow groundwater was not being completely captured in the central and southeastern area of the Site. Additional extraction wells would be required to capture groundwater in these areas to create an interception barrier for potential pathways to surface water and off-site. The long-term pumping of these additional wells would need to be adjusted to maintain the interception barrier, yet not adversely affect ecological conditions and water levels in the adjacent wetland area and stream.

- Groundwater contours for the Platteville Limestone during pumping are shown in Figure 2-8. A response to the operation of the initial groundwater extraction system was observed in the groundwater elevation data collected from Platteville monitoring well W8. Since the glacial till and Decorah Shale are absent in the area near monitoring well W8 (Figure 2-2), the overlying alluvium unit is in direct hydraulic communication with the underlying Platteville Limestone. The groundwater level data collected from monitoring well W8 during the December 2006 investigation confirm the absence of these confining units, and indicate that the pumping of the groundwater extraction system (especially extraction well PW2) induces an upward hydraulic gradient and flow from the Platteville Limestone to the overlying alluvium unit.

2.4 SUMMARY OF SITE DATA ASSESSMENT

2.4.1 Groundwater Assessment

A groundwater monitoring program was conducted at the Site between November 2005 and March 2006. Samples were collected from 15 temporary groundwater well points (GP01 through GP15), nine newly installed permanent monitoring wells (RW37, RW38, RW39, RW40, PL41, SP42, PL43, SP44, and PC45) and six existing monitoring wells (W8, W21, W26, W33, W205, and W6102), as shown in Figure 2-9.

A follow-up groundwater sampling event was completed at well W203 on August 9, 2007, in accordance with the MPCA-approved FS Field Activities Work Plan, to verify that the lateral extent of PFC concentrations within the local groundwater system did not extend beyond well W203 to the east.

The PFC analytical results for the groundwater samples are summarized in Table 2-1. Figure 2-9 depicts PFC groundwater concentrations.

In groundwater north of Highway 5, PFOS and perfluorooctanoic acid (PFOA) were found at concentrations ranging from 5.55 to 2,865 parts per billion (ppb) and from 36.4 to 23,700 ppb, respectively. Concentrations of perfluorobutane sulfonate (PFBS) and perfluorohexane sulfonate (PFHS) in groundwater samples north of Highway 5 ranged from 2.45 to 38.8 ppb and 1.55 to 58.5 ppb, respectively.

In groundwater in the area of monitoring wells W205 and W33 (e.g., south of Highway 5), PFOS and PFOA were found at concentrations ranging from 5.50 to 8,343 ppb and from 4.38 to 2,660 ppb, respectively. Detected concentrations of PFBS and PFHS in the groundwater samples ranged from 0.196 to 192 and from 0.448 to 7.04 ppb, respectively.

Groundwater collected from W203 contained PFOS and PFOA at concentrations of 0.614 ppb and 0.198 ppb, respectively. These data are below the range of concentration found elsewhere south of Highway 5; nonetheless, the modified groundwater extraction system has been designed to capture groundwater in the area of W203. This will provide containment of the easternmost edge of the PFC plume.

In summary, the PFC concentrations detected in alluvium groundwater monitoring wells ranged from non-detect (ND) to 23,700 ppb PFOA, ND to 8,343 ppb PFOS, ND to 58.5 ppb PFHS and ND to 192 ppb PFBS. It should be noted that perfluorobutanoic acid (PFBA) was not analyzed in samples collected during these monitoring programs. The individual PFC concentrations detected in groundwater from the Platteville wells ranged from ND to 0.225 ppb. The individual PFC concentrations detected in groundwater from the St. Peter wells ranged from ND to 0.0395 ppb. The detected PFC concentrations in groundwater from the Prairie du Chien well ranged from 0.0664 to 0.36 ppb.

2.4.2 Soil Assessment

Initial PFC assessment field activities were conducted from November 2005 to March 2006. A total of 54 soil samples were collected from 15 Geoprobe® boring locations and two borings from monitoring well installation. These sampling events are described in *Supplemental Fluorochemical (FC) Data Assessment Report* (WESTON, 2006).

Supplemental soil sampling was conducted in December 2006 in the area north of Highway 5. A total of 62 soil samples were collected from 13 Geoprobe® boring locations. These sampling events are described in *Remedial Investigation Report [Soil Supplemental Fluorochemical (FC) Data Assessment – Addendum 1*] (WESTON, 2007b).

2.4.2.1 Area North of Highway 5

The PFC analytical results for the soil samples in the area north of Highway 5 are summarized in Tables 2-2 and 2-3. Figures 2-10 and 2-11 depict PFC soil concentrations in the area north of Highway 5. Conclusions from the two sampling programs include:

- PFC levels in the 2006 soil samples from borings ASB31 through ASB43 confirmed concentrations that were consistent with the 2005 PFC data from soil borings GP01 through GP08.
- Generally much lower PFC concentrations were observed for surface soil samples collected. These results are expected since clean fill was brought in and graded following the waste and soil removal activities conducted during the 1983-1984 remediation program at the Site. The range of PFC concentrations for five key compounds detected in surface soils north of Highway 5 are as follows: PFOS - 24.6 to 1,460 ppb, PFOA- 0.8 to 19.0 ppb, PFHS - ND (not detected) to 9.4 ppb, PFBA - ND to 12.5 ppb, and PFBS - ND to 2.8 ppb. No surface samples for VOCs were collected based on the low organic vapor monitor (OVM) readings taken at the Site.
- The range of PFC concentrations for the December 2006 sampling, for all soil depths, are as follows: PFOS - 20.6 to 108,000 ppb, PFOA - 0.8 to 18,500 ppb, PFHS - ND to 5,585 ppb, PFBA - ND to 1,600 ppb, and PFBS - ND to 224 ppb.

2.4.2.2 Area South of Highway 5

The PFC analytical results for the site soil samples south of Highway 5 are summarized in Table 2-4; Figure 2-12 depicts PFC soil concentrations in this area. In soils south of Highway 5, PFOS was detected in all samples at concentrations ranging from 0.990 to 9,190 ppb. Concentrations of PFOA, PFHS and PFBS in the soil boring samples ranged from ND to 1,370 ppb, ND to 12.7, and ND to 2.53 ppb, respectively.

SECTION 2 TABLES

Table 2-1 Summary of PFC Concentrations Detected in Groundwater Samples December 2005/February 2006/March 2006/August 2007

Sample ID	Sample Location [(1)]	PFBS Average[(2)] (ppb)	PFHS Average[(2)] (ppb)	PFOS Average[(2)] (ppb)	PFOA Average[(2)] (ppb)
Area North of Highway 5					
OKMN-GW-GP01-0-051130	GP01	NR	1.55	16.7	54.1
OKMN-GW-GP02-0-051201	GP02	8.97	6.22	177	276
OKMN-GW-GP03-0-051201	GP03	5.94	1.86	5.55	65.6
OKMN-GW-GP04-0-051130	GP04	NR	51.7	82.1	NR
OKMN-GW-GP05-0-051201	GP05	6.85	11.5	420	86.4
OKMN-GW-GP06-0-051201	GP06	4.07	7.71	173	56.1
OKMN-GW-GP07-0-051201	GP07	38.8	33.9	141	NR
OKMN-GW-GP08-0-051130	GP08	NR	29.3	120	373
OKMN-GW-W21-0-051202	W21	2.45	3.03	166	36.4
OKMN-GW-W26-0-051201	W26	NR	58.5	2865	23700
Area South of Highway 5					
OKMN-GW-GP09-0-051202	GP09	NR	3.26	12.4	4.38
OKMN-GW-GP10-0-060215	GP10	0.390	2.42	NR	NR
OKMN-GW-GP11-0-060215	GP11	4.19	5.68	12.2	63.2
OKMN-GW-GP12-0-060215	GP12	0.439	1.46	792	92.5
OKMN-GW-GP13-0-060215	GP13	0.196	1.46	NR	NR
OKMN-GW-GP14-0-060215	GP14	5.00	2.70	5.50	73.6
OKMN-GW-GP15-0-060215	GP15	0.0861	0.448	74.8	14.2
OKMN-GW-W33-0-060303	W33	192	NR	8343	2660
OKMN-GW-W205-0-060303	W205	4.88	7.04	90.8	160
OKMN-GW-W8-0-060303	W8	0.0301	ND	ND	0.200
OKMN-GW-RW37-0-060303	RW37	0.0545	ND	2.77	0.322
OKMN-GW-RW38-0-060303	RW38	ND	ND	0.175	0.0641
OKMN-GW-RW39-0-060302	RW39	0.0511	ND	ND	ND
OKMN-GW-RW40-0-060302	RW40	ND	ND	ND	0.0366
OKMN-GW-PL41-0-060303	PL41	ND	ND	ND	0.0850
OKMN-GW-SP42-0-060302	SP42	0.0395	ND	0.0252	ND
OKMN-GW-PL43-0-060302	PL43	ND	ND	ND	ND
OKMN-GW-SP44-0-060303	SP44	0.0366	ND	ND	ND
OKMN-GW-PC45-0-060303	PC45	0.0664	0.0783	0.36	0.606
OKMN-GW-W6102-0-060303	W6102	0.0398	ND	ND	0.225
OKMN-GW-W203-0-070809	W203	<0.0795	<0.0413	0.614	0.198

(1) See Figure 2-9 for sample locations.

(2) Concentrations shown are the arithmetic mean of the primary sample and laboratory replicate sample results.

ND = Not detected at or above 25 ng/L.

NR = Not reported due to quality control issues.

Note: In instances where either the primary sample or the corresponding laboratory duplicate was designated as ND and the other a numerical value, the numerical value is displayed as the average.

Table 2-2 Summary of PFC Concentrations Detected in Soil Samples North of Highway 5
November / December 2005

Sample ID	Sample Location[1]	Sample Depth Interval (ft bgs)	PFBS Average[2] Dry Weight (ppb, ng/g)	PFHS Average[2] Dry Weight (ppb, ng/g)	PFOS Average[2] Dry Weight (ppb, ng/g)	PFOA Average[2] Dry Weight (ppb, ng/g)
OKMN-SB-GP01-0-0000	GP01	0-0.5	NR	ND	17.7	0.903
OKMN-SBC-GP01-0-0005		0.5-5	2.16	5.17	NR	83.4
OKMN-SBC-GP01-0-0050		5-10	NR	NR	1260	1690
OKMN-SBC-GP01-0-0100		10-15	7.58	1.78	64.9	NR
OKMN-SBC-GP01-0-0150		15-20	ND	ND	8.65	6.01
OKMN-SB-GP02-0-0000	GP02	0-0.5	0.622	0.759	139	5.43
OKMN-SBC-GP02-0-0005		0.5-5	3.04	8.61	1120	192
OKMN-SBC-GP02-0-0050		5-10	3.27	4.29	202	188
OKMN-SBC-GP02-0-0100		10-15	0.401	0.410	12.6	7.71
OKMN-SB-GP03-0-0000	GP03	0-0.5	1.45	0.635	30.9	10.5
OKMN-SBC-GP03-0-0005		0.5-5	16.3	16.1	650	666
OKMN-SBC-GP03-DB-0005		0.5-5	15.8	13.4	361	579
OKMN-SBC-GP03-0-0050		5-10	NR	1.89	197	155
OKMN-SBC-GP03-0-0100		10-15	0.579	0.475	27.3	25.6
OKMN-SB-GP04-0-0000	GP04	0-0.5	NR	0.691	545	4.85
OKMN-SBC-GP04-0-0005		0.5-5	NR	246	22000	2360
OKMN-SBC-GP04-0-0050		5-10	NR	252	5270	1560
OKMN-SBC-GP04-0-0100		10-15	NR	105	5650	781
OKMN-SB-GP05-0-0000	GP05	0-0.5	0.719	0.252	24.1	1.20
OKMN-SBC-GP05-0-0005		0.5-5	13.0	97.3	2720	853
OKMN-SBC-GP05-DB-0005		0.5-5	NR	99.8	NR	NR
OKMN-SBC-GP05-0-0050		5-10	25.2	161	16200	4070
OKMN-SBC-GP05-0-0100		10-15	NR	61.2	11600	NR
OKMN-SB-GP06-0-0000	GP06	0-0.5	0.647	0.590	80.3	3.72
OKMN-SBC-GP06-0-0005		0.5-5	NR	6.59	836	80.6
OKMN-SBC-GP06-DB-0005		0.5-5	NR	9.32	1150	45.6
OKMN-SBC-GP06-0-0050		5-10	NR	20.2	236	217
OKMN-SBC-GP06-0-0100		10-15	14.0	16.8	119	147
OKMN-SBC-GP06-0-0150		15-20	1.17	2.45	103	18.7
OKMN-SB-GP07-0-0000	GP07	0-0.5	NR	0.655	86.4	NR
OKMN-SBC-GP07-0-0005		0.5-5	0.842	2.00	192	18.7
OKMN-SBC-GP07-0-0050		5-10	NR	3.39	43.9	40.7
OKMN-SBC-GP07-DB-0050		5-10	NR	3.54	48.8	40.9
OKMN-SBC-GP07-0-0100		10-15	NR	8.39	75.9	64.6
OKMN-SB-GP08-0-0000	GP08	0-0.5	1.74	NR	641	74.9
OKMN-SBC-GP08-0-0005		0.5-5	NR	45.2	4700	1450
OKMN-SBC-GP08-0-0050		5-10	28.5	31.3	1050	1410
OKMN-SBC-GP08-0-0100		10-15	10.8	11.5	584	NR

(1) See Figure 2-10 for sample locations.

(2) Concentrations shown are the arithmetic mean of the primary sample and laboratory replicate sample results.

ND = Not detected at or above the Limit of Quantitation, which is 0.2 ng/g (wet weight).

NR = Not reported due to quality control issues.

DB = Field duplicate sample.

Note: In instances where either the primary sample or the corresponding laboratory duplicate was designated as ND and the other a numerical value, the numerical value is displayed as the average.

Table 2-3 Summary of PFC Concentrations Detected in Soil Samples North of Highway 5
December 2006

Sample ID	Sample Location (1)	Sample Interval (ft bgs)	Average(2) PFBA (ppb, ng/g) Dry Weight	Average(2) PFBS (ppb, ng/g) Dry Weight	Average(2) PFHS (ppb, ng/g) Dry Weight	Average(2) PFOS (ppb, ng/g) Dry Weight	Average(2) PFOA (ppb, ng/g) Dry Weight
OKMN-SB-ASB31-0-0000	ASB31	0 - 0.5	12.5	NR	NR	NR	6.35
OKMN-SB-ASB31-0-0015		1.5 - 2.0	NR	6.39	NR	2038	NR
OKMN-SB-ASB31-0-0035		3.5 - 4.0	219	40.2	581	63350	NR
OKMN-SB-ASB31-0-0055		5.5 - 6.0	227	19.4	1232	42200	6040
OKMN-SB-ASB31-0-0070		7.0 - 8.0	337	36.7	NR	64200	9130
OKMN-SB-ASB32-0-0000	ASB32	0 - 0.5	NR	2.77	9.35	1300	19.0
OKMN-SB-ASB32-0-0015		1.5 - 2.0	NR (303)	67.5 (86.2)	935 (1174)	37300 (28300)	4420 (3380)
OKMN-SB-ASB32-0-0035		3.5 - 4.0	812	84.7	NR	108000	11800
OKMN-SB-ASB32-0-0055		5.5 - 6.0	883	96.1	1180	NR	5460
OKMN-SB-ASB32-0-0075		7.5 - 8.0	1420	NR	204	NR	1960
OKMN-SB-ASB33-0-0000	ASB33	0 - 0.5	7.46	NR	0.612	129	4.29
OKMN-SB-ASB33-0-0015		1.5 - 2.0	10.8	5.70	NR	4865	642
OKMN-SB-ASB33-0-0035		3.5 - 4.0	13.1 (10.1)	3.78 (NR)	NR (50.7)	3630 (5035)	NR (NR)
OKMN-SB-ASB33-0-0055		5.5 - 6.0	NR	17.3	188	5430	755
OKMN-SB-ASB33-0-0085		8.5 - 9.0	NR	NR	1180	10105	3470
OKMN-SB-ASB34-0-0000	ASB34	0 - 0.5	NR	ND	0.455	NR	7.61
OKMN-SB-ASB34-0-0015		1.5 - 2.0	9.15	NR	22.0	5375	NR
OKMN-SB-ASB34-0-0035		3.5 - 4.0	49.3	8.65	142	8690	NR
OKMN-SB-ASB34-0-0055		5.5 - 6.0	NR	26.3	1035	69400	4640
OKMN-SB-ASB34-0-0085		8.5 - 9.0	1600	224	5585	17550	18050
OKMN-SB-ASB35-0-0000	ASB35	0 - 0.5	NR	0.570	NR	235	13.3
OKMN-SB-ASB35-0-0015		1.5 - 2.0	38.5	12.9	NR	9220	957
OKMN-SB-ASB35-0-0035		3.5 - 4.0	NR (26.3)	22.8 (20.2)	NR (115)	32100 (27950)	2975 (NR)
OKMN-SB-ASB35-0-0055		5.5 - 6.0	146	53.8	445	26600	13050
OKMN-SB-ASB35-0-0085		8.5 - 9.0	NR	98.3	83.3	NR	3875
OKMN-SB-ASB36-0-0000	ASB36	0 - 0.5	11.9	0.434	2.38	1460	16.1
OKMN-SB-ASB36-0-0015		1.5 - 2.0	52.4 (NR)	7.37 (9.42)	62.7 (68.0)	NR (23400)	1073 (1040)
OKMN-SB-ASB36-0-0030		3.5 - 4.0	NR	24.6	NR	37250	1615
OKMN-SB-ASB36-0-0055		5.5 - 6.0	400	22.4	NR	11450	2715
OKMN-SB-ASB36-0-0095		9.5 - 10	442	17.0	11.8	88.7	NR
OKMN-SB-ASB37-0-0000	ASB37	0 - 0.5	3.90	0.599	2.37	NR	NR
OKMN-SB-ASB37-0-0015		1.5 - 2.0	6.93	2.53	16.4	5515	242
OKMN-SB-ASB37-0-0035		3.5 - 4.0	NR (4.66)	0.900 (1.14)	7.68 (10.6)	2755 (3205)	88.3 (96.4)
OKMN-SB-ASB37-0-0055		5.5 - 6.0	NR	1.90	8.08	17050	10.5
OKMN-SB-ASB37-0-0075		7.5 - 8.0	NR	0.178	0.664	672	13.7
OKMN-SB-ASB38-0-0000	ASB38	0 - 0.5	1.86	0.583	1.91	346	18.6
OKMN-SB-ASB38-0-0015		1.5 - 2.0	2.01	0.798	6.04	974	82.1
OKMN-SB-ASB38-0-0035		3.5 - 4.0	7.05 (7.78)	2.01 (2.01)	8.88 (9.47)	1110 (1405)	119 (137)
OKMN-SB-ASB38-0-0055		5.5 - 6.0	12.1	2.58	10.5	1630	NR
OKMN-SB-ASB38-0-0080		8.0 - 8.5	17.6	1.76	NR	NR	NR
OKMN-SB-ASB39-0-0015	ASB39	1.5 - 2.0	28.4 (31.2)	9.13 (11.5)	73.3 (88.5)	6405 (5710)	446 (483)
OKMN-SB-ASB39-0-0035		3.5 - 4.0	82.5	10.6	172	13300	1027
OKMN-SB-ASB39-0-0055		5.5 - 6.0	306	22.7	NR	NR	1400
OKMN-SB-ASB39-0-0070		7.0 - 7.5	192	13.5	208	NR	944
OKMN-SB-ASB40-0-0000	ASB40	0 - 0.5	NR	0.287	ND	209	NR
OKMN-SB-ASB40-0-0015		1.5 - 2.0	0.368	0.504	0.865	206	6.79
OKMN-SB-ASB40-0-0035		3.5 - 4.0	1.41	0.496	2.26	374	22.1
OKMN-SB-ASB40-0-0055		5.5 - 6.0	2.69	0.536	1.01	133	14.0
OKMN-SB-ASB40-0-0090		9.0 - 9.5	4.46	0.513	0.777	37.9	27.3
OKMN-SB-ASB41-0-0015	ASB41	1.5 - 2.0	9.80	6.99	73.6	5740	658
OKMN-SB-ASB41-0-0035		3.5 - 4.0	43.8	11.1	30.5	1685	723
OKMN-SB-ASB41-0-0055		5.5 - 6.0	30.2	7.50	29.5	2350	558
OKMN-SB-ASB41-0-0090		9.0 - 9.5	107 (99.0)	4.19 (4.09)	3.90 (3.68)	20.6 (22.7)	62.4 (58.1)
OKMN-SB-ASB42-0-0000	ASB42	0 - 0.5	ND	ND	ND	24.6	0.845
OKMN-SB-ASB42-0-0015		1.5 - 2.0	ND	0.284	ND	59.7	1.03
OKMN-SB-ASB42-0-0035		3.5 - 4.0	8.46	4.19	11.6	168.5	138
OKMN-SB-ASB42-0-0055		5.5 - 6.0	9.77	4.69	16.7	NR	222
OKMN-SB-ASB42-0-0070		7.0 - 7.5	16.8	4.14	5.16	75.6	62.9
OKMN-SB-ASB43-0-0015	ASB43	1.5 - 2.0	7.39	4.28	14.1	207	53.9
OKMN-SB-ASB43-0-0035		3.5 - 4.0	34.8	6.63	103	3855	476
OKMN-SB-ASB43-0-0055		5.5 - 6.0	90.6	15.7	193	5310	964
OKMN-SB-ASB43-0-0090		9.0 - 9.5	39.3	8.78	29.6	182	259

(1) See Figure 2-11 for sample locations.

(2) Concentrations shown are the arithmetic mean of the primary sample and laboratory replicate sample results.

ND = Not detected at or above acceptable LOQ.

NR = Not reported due to quality control issues.

Notes: Concentrations in parentheses are field duplicate results.

In instances where either the primary sample or the corresponding laboratory duplicate was designated as ND and the other a numerical value, the numerical value is displayed as the average.

Table 2-4 Summary of PFC Concentrations Detected in Soil Samples South of Highway 5
December 2005 / February 2006

Sample ID	Sample Location(1)	Sample Depth Interval (ft bgs)	PFBS Average(2) Dry Weight (ppb, ng/g)	PFHS Average(2) Dry Weight (ppb, ng/g)	PFOS Average(2) Dry Weight (ppb, ng/g)	PFOA Average(2) Dry Weight (ppb, ng/g)
OKMN-SB-GP09-0-0000	GP09	0-0.5	0.300	0.762	19.2	2.09
OKMN-SBC-GP09-0-0005		0.5-5	0.400	3.52	42.4	16.3
OKMN-SB-GP10-0-0000	GP10	0-0.5	ND	2.09	24.5	68.9
OKMN-SBC-GP10-0-0005		0.5-5	ND	0.459	4.42	14.7
OKMN-SB-GP11-0-0000	GP11	0-0.5	ND	0.647	13.1	17.7
OKMN-SBC-GP11-0-0005		0.5-5	ND	0.451	5.00	13.5
OKMN-SBC-GP11-DB-0005		0.5-5	ND	0.497	4.35	13.0
OKMN-SB-GP12-0-0000	GP12	0-0.5	ND	2.24	600	72.4
OKMN-SBC-GP12-0-0005		0.5-5	0.282	1.39	130	32.8
OKMN-SB-GP13-0-0000	GP13	0-0.5	0.412	4.85	1140	11.1
OKMN-SBC-GP13-0-0005		0.5-5	ND	1.67	196	7.90
OKMN-SB-GP14-0-0000	GP14	0-0.5	2.53	12.2	2860	535
OKMN-SBC-GP14-0-0005		0.5-5	1.14	1.28	43.5	26.1
OKMN-SB-GP15-0-0000	GP15	0-0.5	0.825	1.24	2210	104
OKMN-SBC-GP15-0-0005		0.5-5	2.51	12.7	9190	1370
OKMN-SBC-GP15-DB-0005		0.5-5	1.66	6.44	3460	889
OKMN-SB-RW37-0-0000	RW37	0-0.5	ND	ND	3.20	ND
OKMN-SBC-RW37-0-0005		0.5-5	ND	0.3495	348	1.79
OKMN-SBC-RW37-DB-0005		0.5-5	ND	0.525	477	2.57
OKMN-SBC-RW37-0-0050		5-10	ND	ND	0.990	ND
OKMN-SB-RW38-0-0000	RW38	0-0.5	ND	ND	3.90	ND
OKMN-SBC-RW38-0-0005		0.5-5	ND	0.314	391	3.16
OKMN-SBC-RW38-0-0050		5-10	ND	ND	27.6	0.247

(1) See Figure 2-12 for sample locations.

(2) Concentrations shown are the arithmetic mean of the primary sample and laboratory replicate sample results.

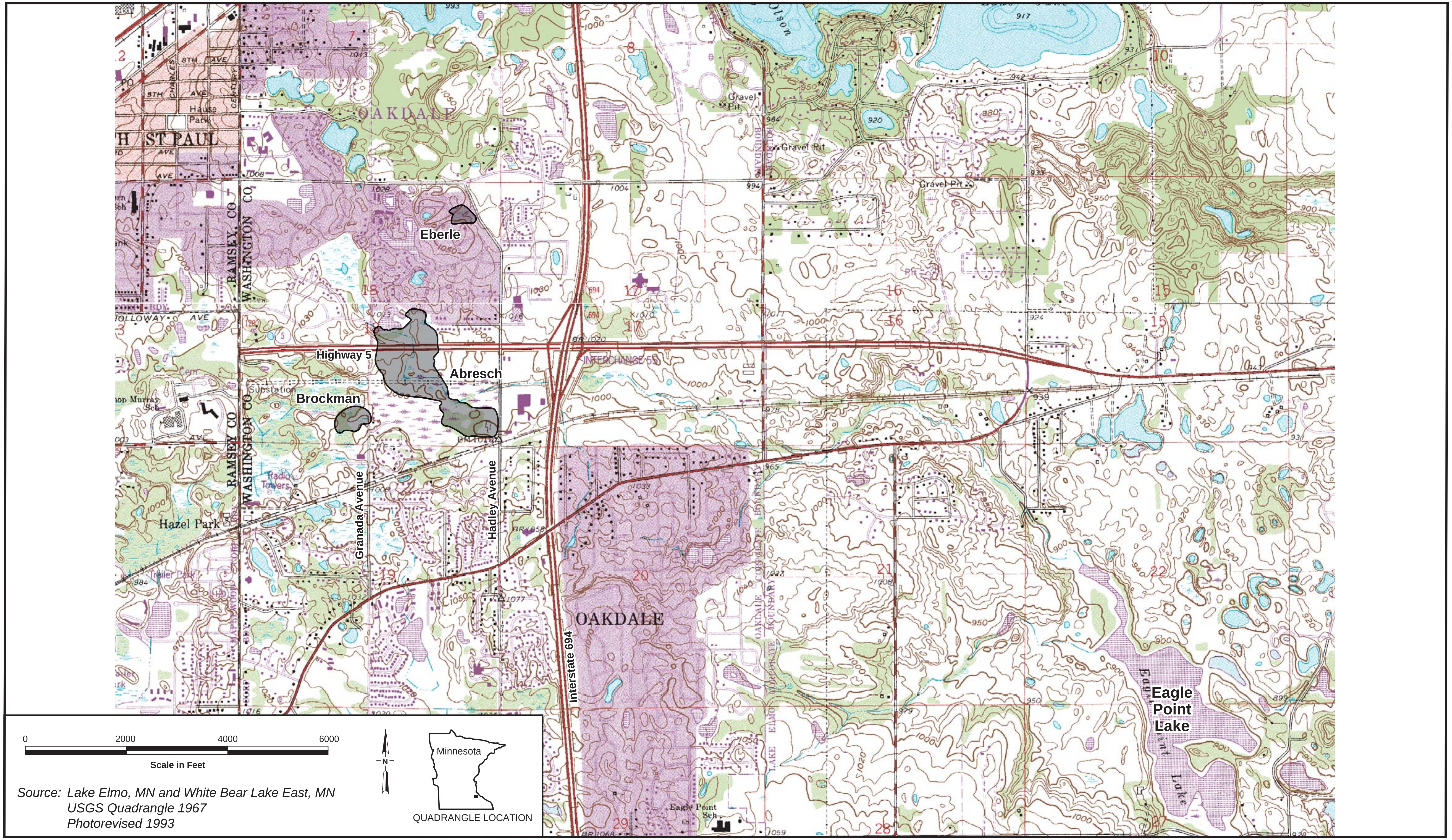
ND = Not detected at or above the Limit of Quantitation, which is 0.2 ng/g (wet weight).

DB = Field duplicate sample.

Note: In instances where either the primary sample or the corresponding laboratory duplicate was designated as ND and the other a numerical value, the numerical value is displayed as the average.

SECTION 2 FIGURES

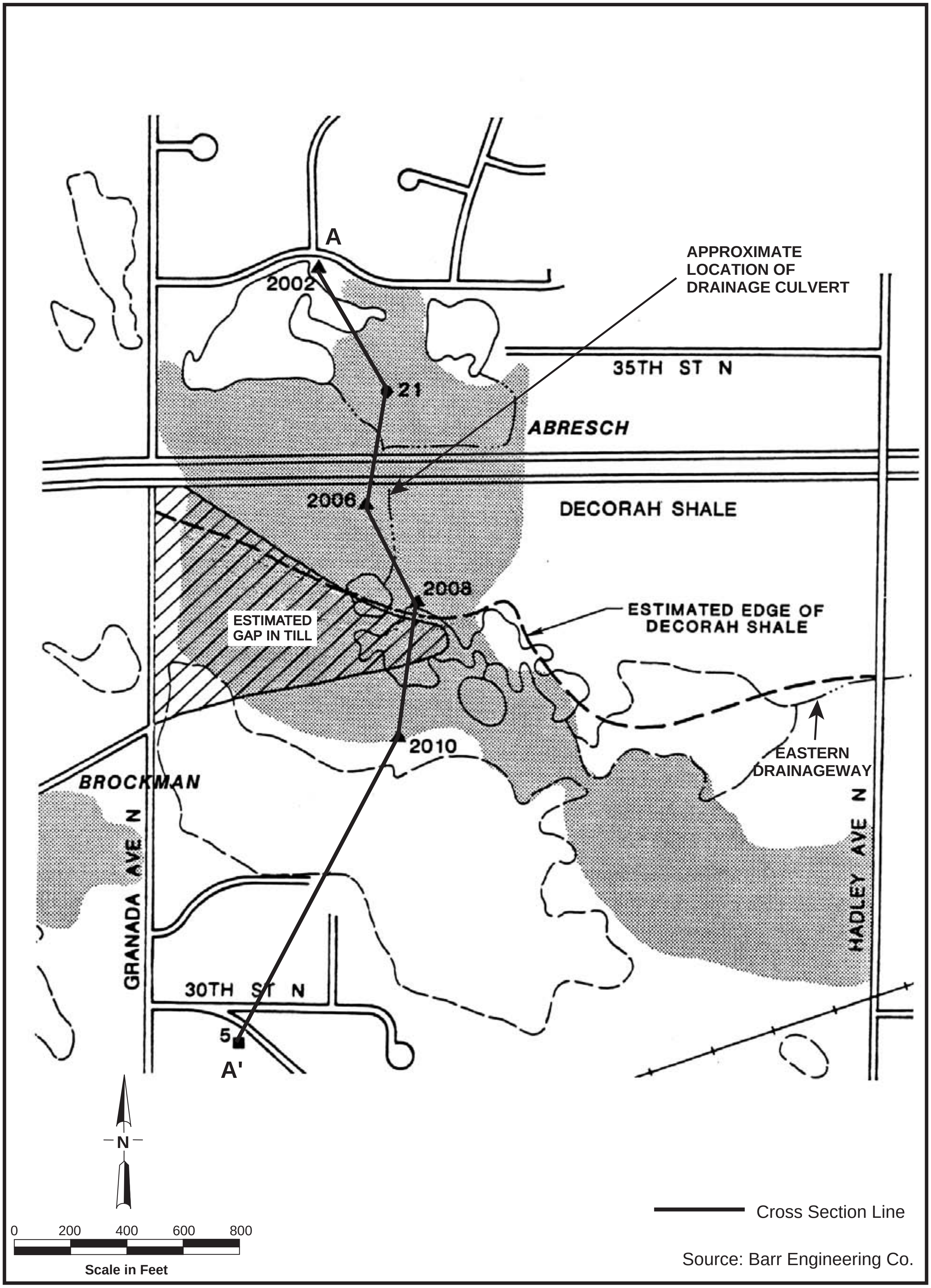
WESTON SOLUTIONS®



Source: Lake Elmo, MN and White Bear Lake East, MN
USGS Quadrangle 1967
Photorevised 1993

07P-0320-1

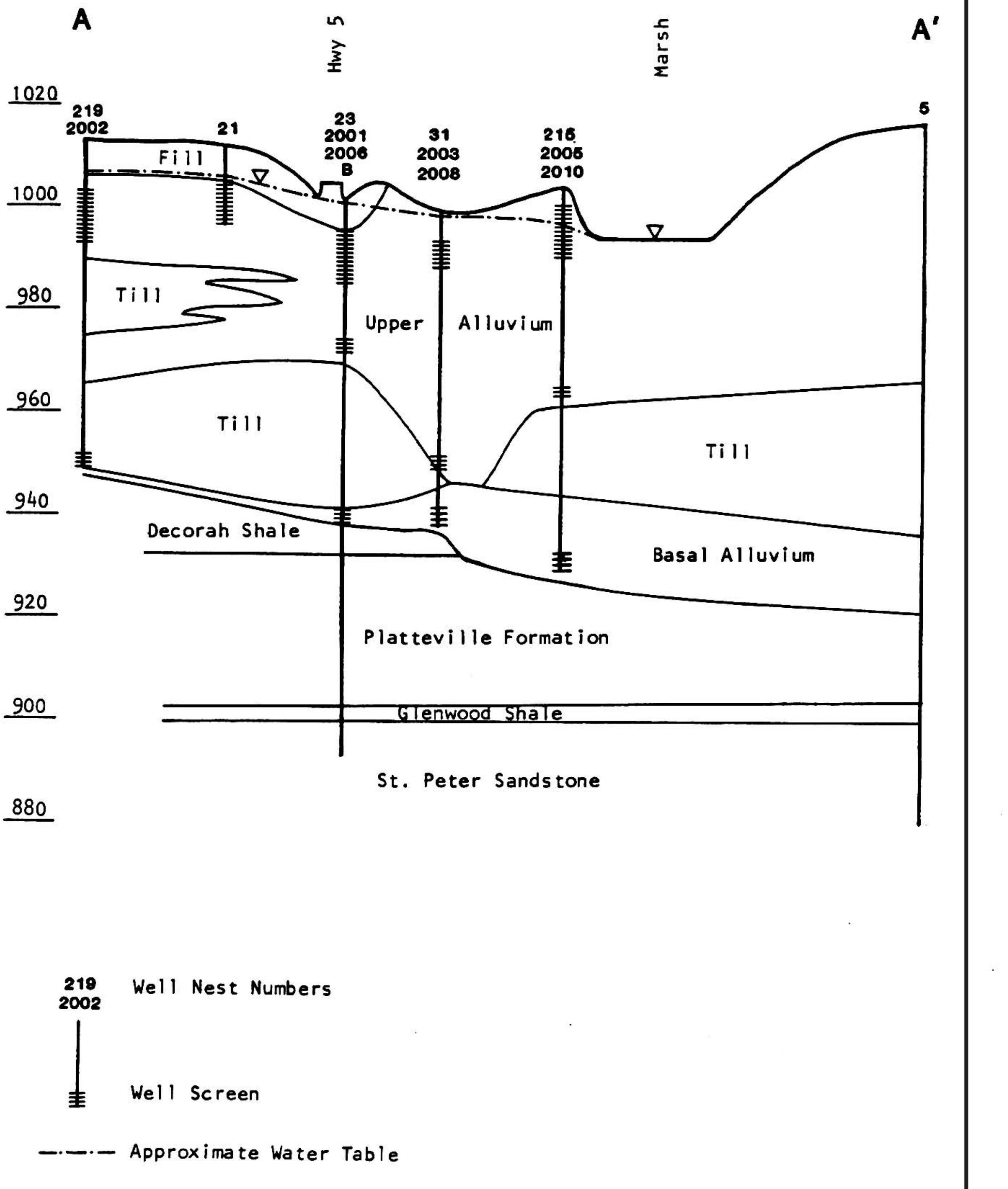
FIGURE 2-1 SITE LOCATION MAP
OAKDALE SITE, MN



Source: Barr Engineering Co.

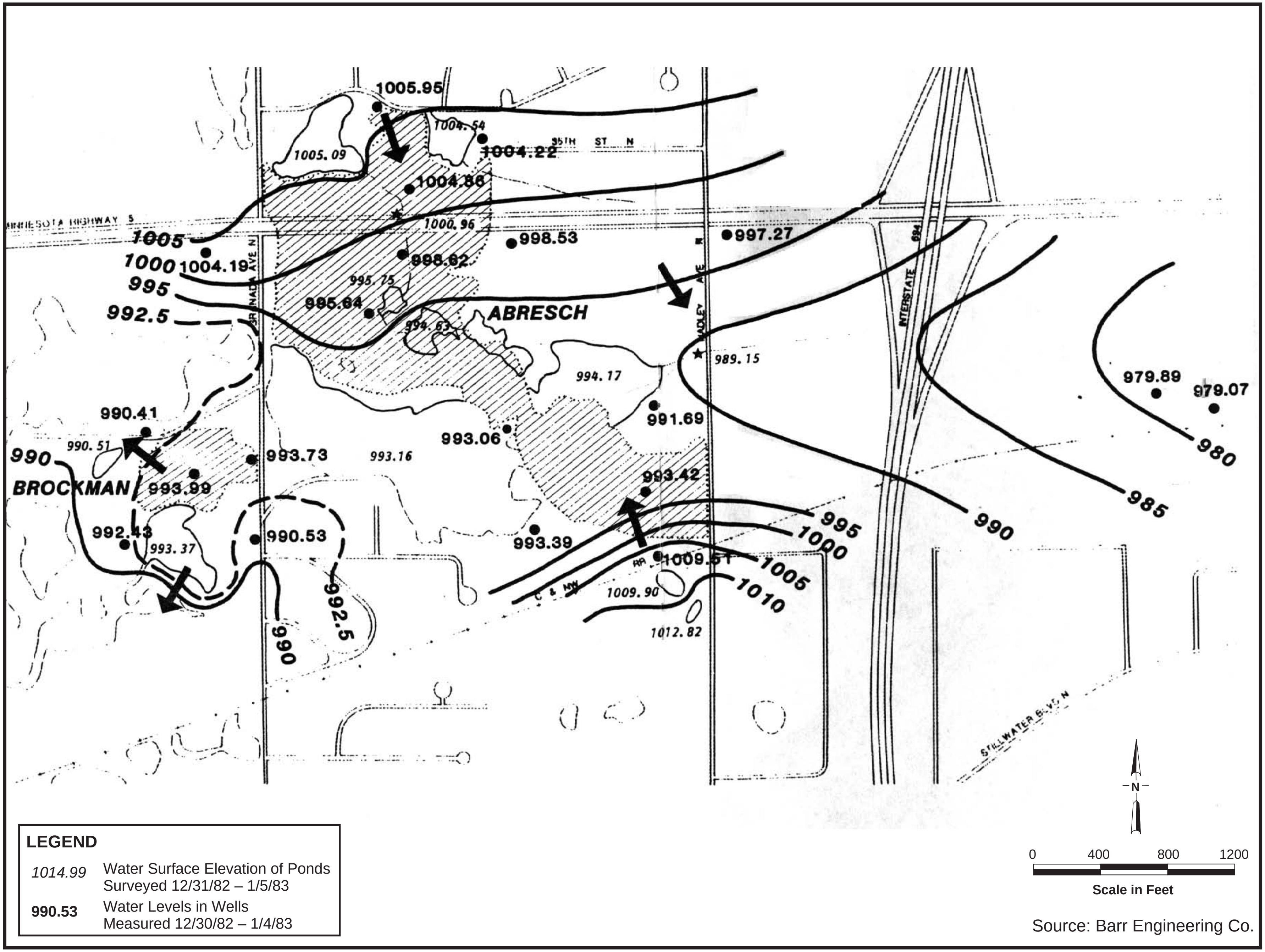
07P-0320-2

FIGURE 2-2 ESTIMATED GAP IN TILL AND EDGE OF DECORAH SHALE



Source: Barr Engineering Co.

FIGURE 2-3 GEOLOGIC CROSS SECTION A-A'
OAKDALE SITE, MN

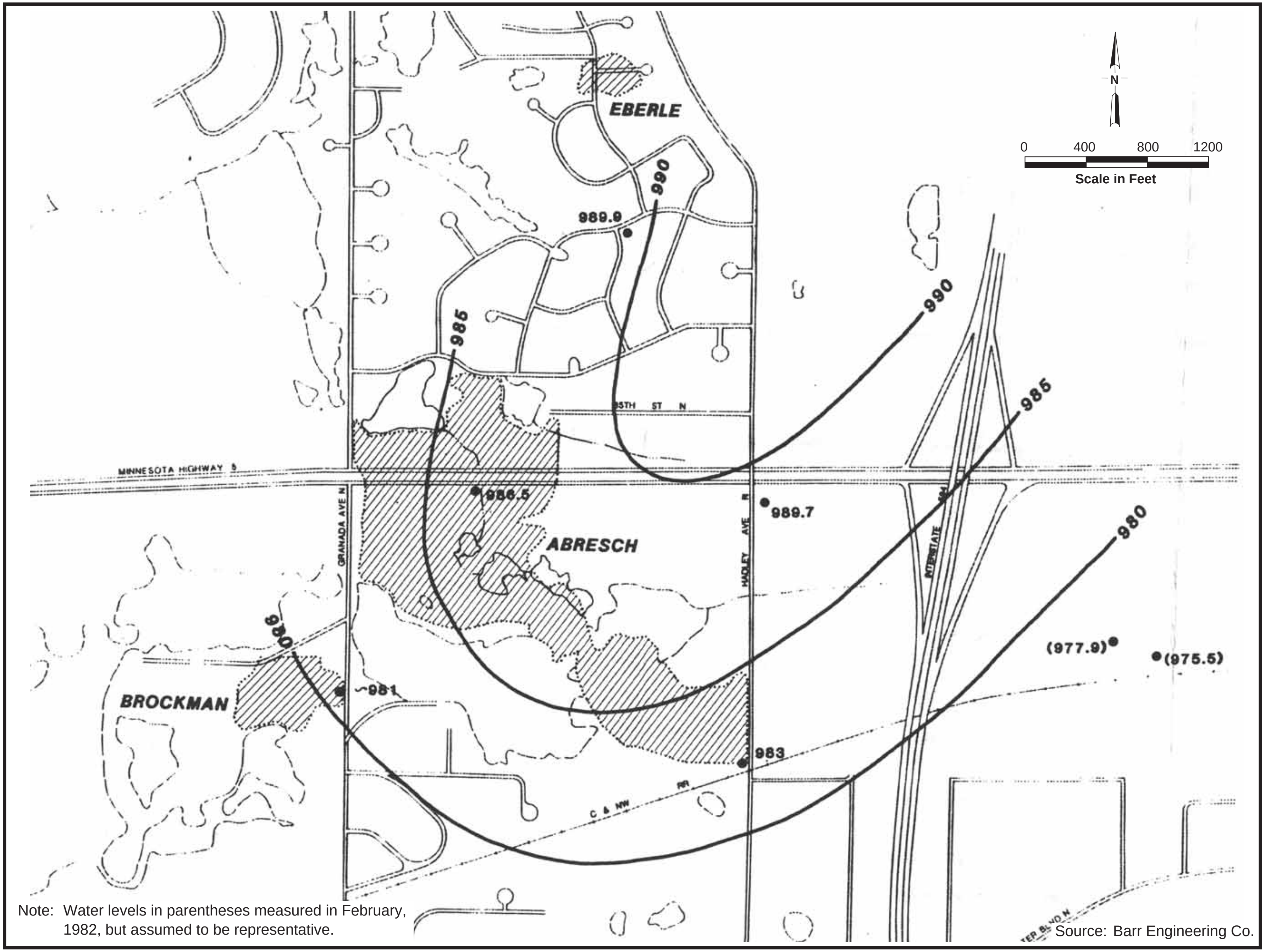


LEGEND

1014.99	Water Surface Elevation of Ponds Surveyed 12/31/82 – 1/5/83
990.53	Water Levels in Wells Measured 12/30/82 – 1/4/83

Source: Barr Engineering Co.

FIGURE 2-4 SURFICIAL GROUNDWATER CONTOURS: NON-PUMPING CONDITIONS - JANUARY 1982 (MSL) OAKDALE SITE, MN



Note: Water levels in parentheses measured in February, 1982, but assumed to be representative.

Source: Barr Engineering Co.

07P-0320-3

FIGURE 2-5 PLATTEVILLE LIMESTONE PIEZOMETRIC CONTOURS: NON-PUMPING CONDITIONS - APRIL AND JUNE, 1981 (MSL) OAKDALE SITE, MN

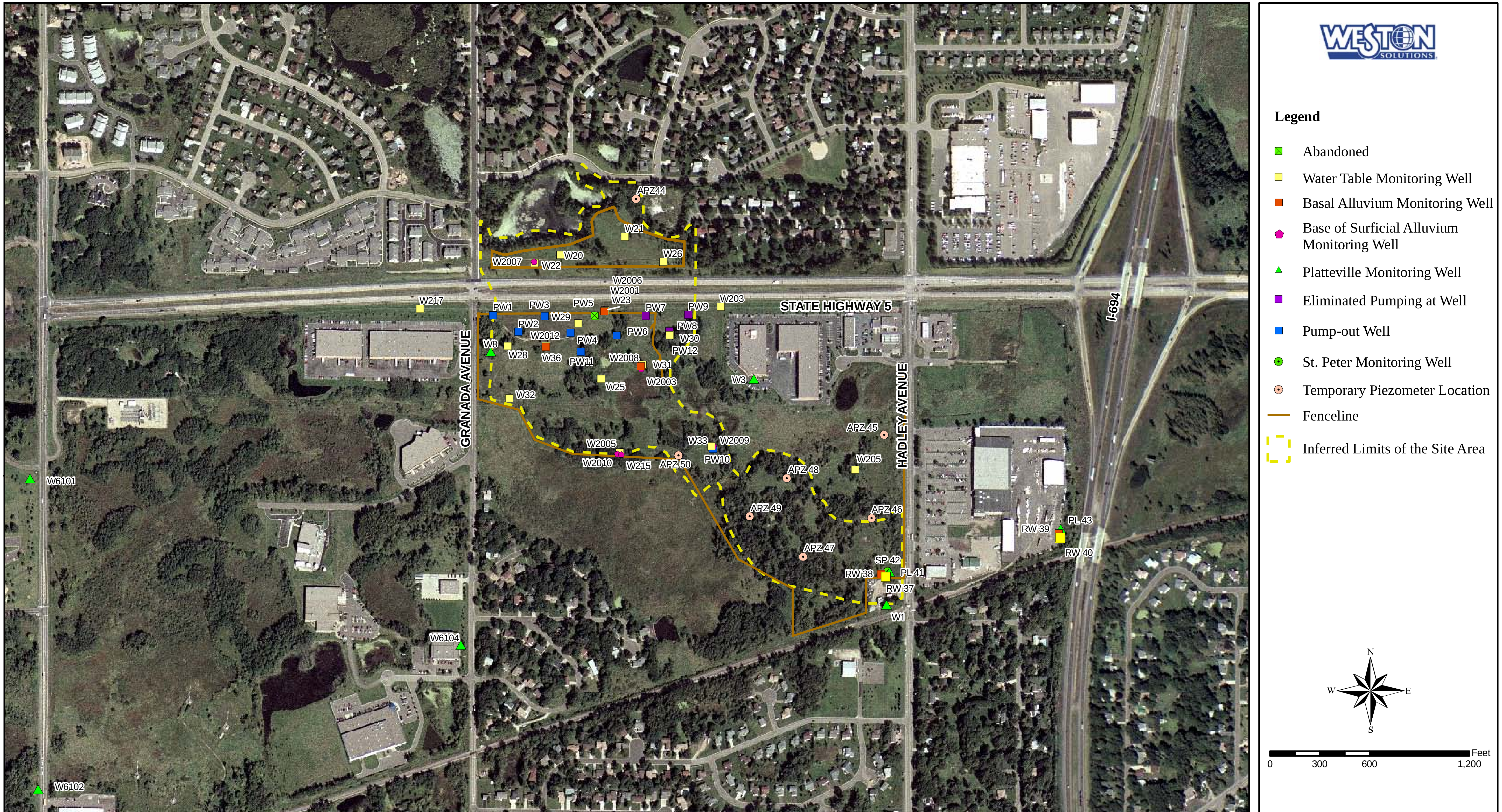
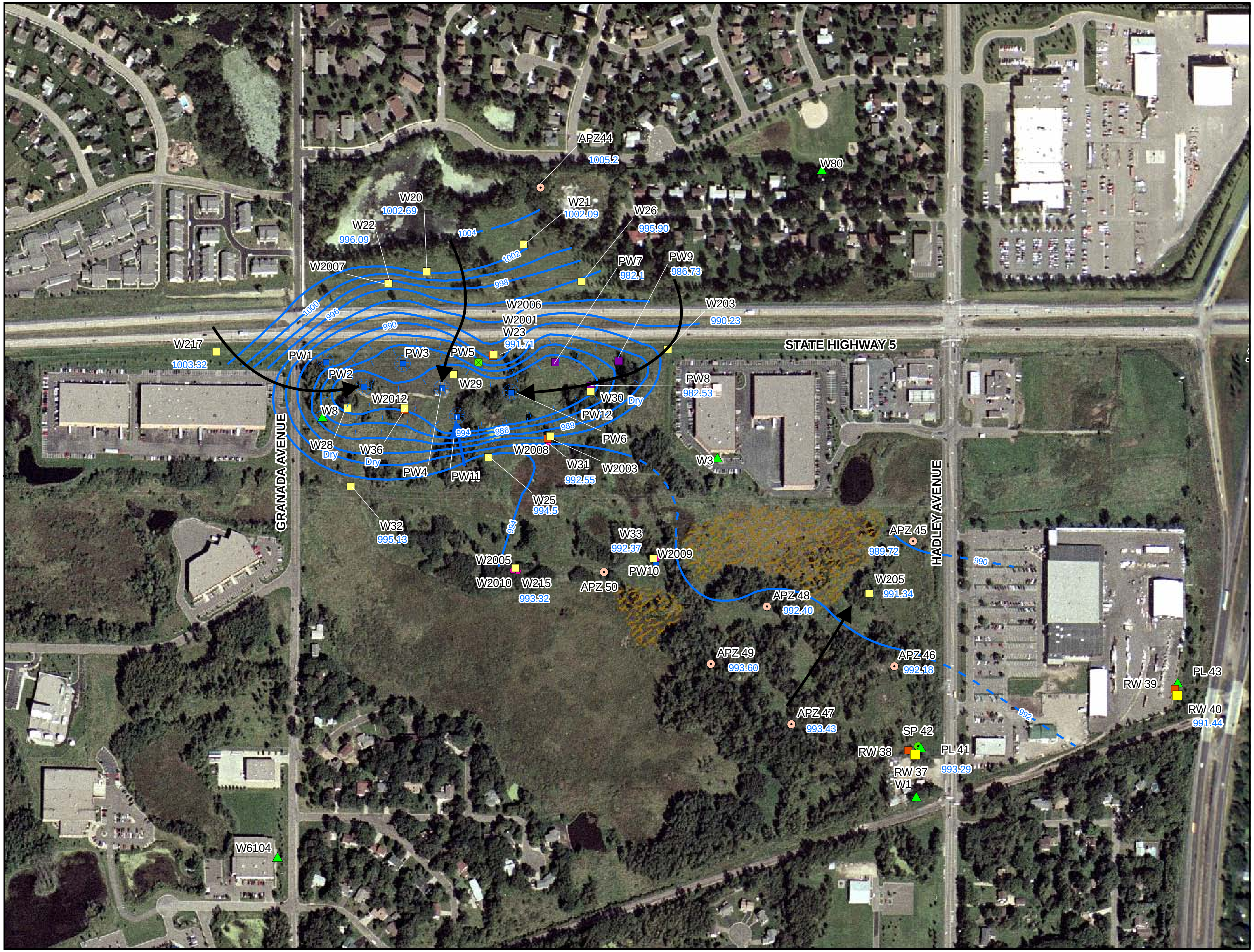


Figure 2-6
Monitoring and Initial Extraction
Well Location Map

Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\monitor_recovery_wells.mxd, 20-Jan-09 10:18, ricksc



WESTON SOLUTIONS

Legend

- ☒ Abandoned
- 🟨 Water Table Monitoring Well
- 🟧 Basal Alluvium Monitoring Well
- ⬟ Base of Surficial Alluvium Monitoring Well
- ▲ Platteville Monitoring Well
- 🟪 Eliminated Pumping at Well
- 🟦 Pump-out Well
- ⊙ St. Peter Monitoring Well
- ⊙ Temporary Piezometer Location
- — Groundwater Elevation Contour
- 990.23 Groundwater Elevation (ft MSL)
- ▨ Area of Saturated Soil/Water
- → Groundwater Flow Path

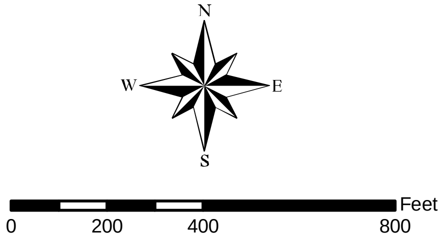
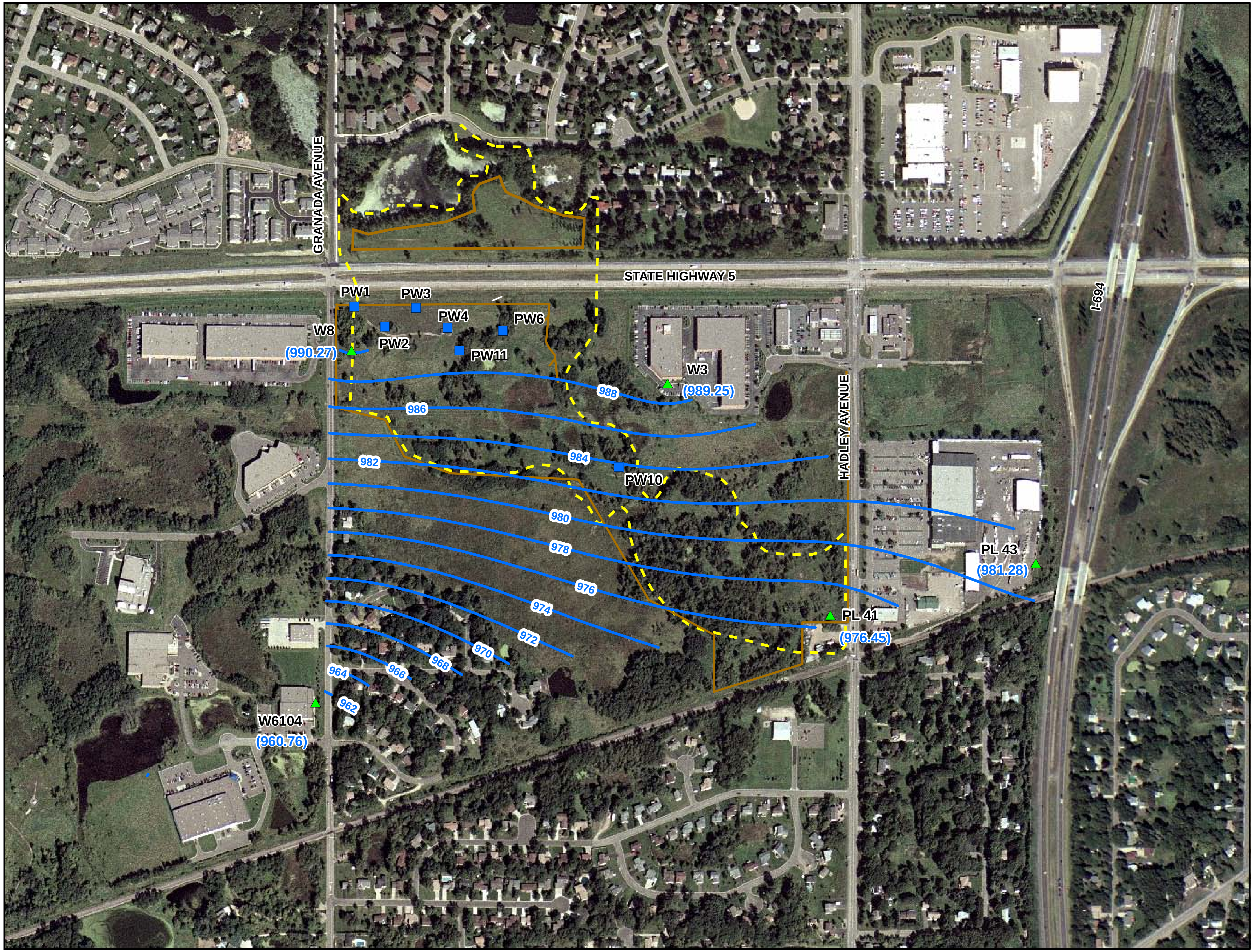


Figure 2-7
Surficial Groundwater
Conditions: Pumping
Conditions
December 2006
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\gw_elev_pumping_conditions_dec0906.mxd, 15-Jan-09 14:59, ricksc



WESTON SOLUTIONS

Legend

■ Pump-out Well

▲ Platteville Monitoring Well

— Groundwater Elevation Contours (Dec 9, 2006)

990.27 Groundwater Elevation (ft MSL)

⬚ Inferred Limits of the Site Area

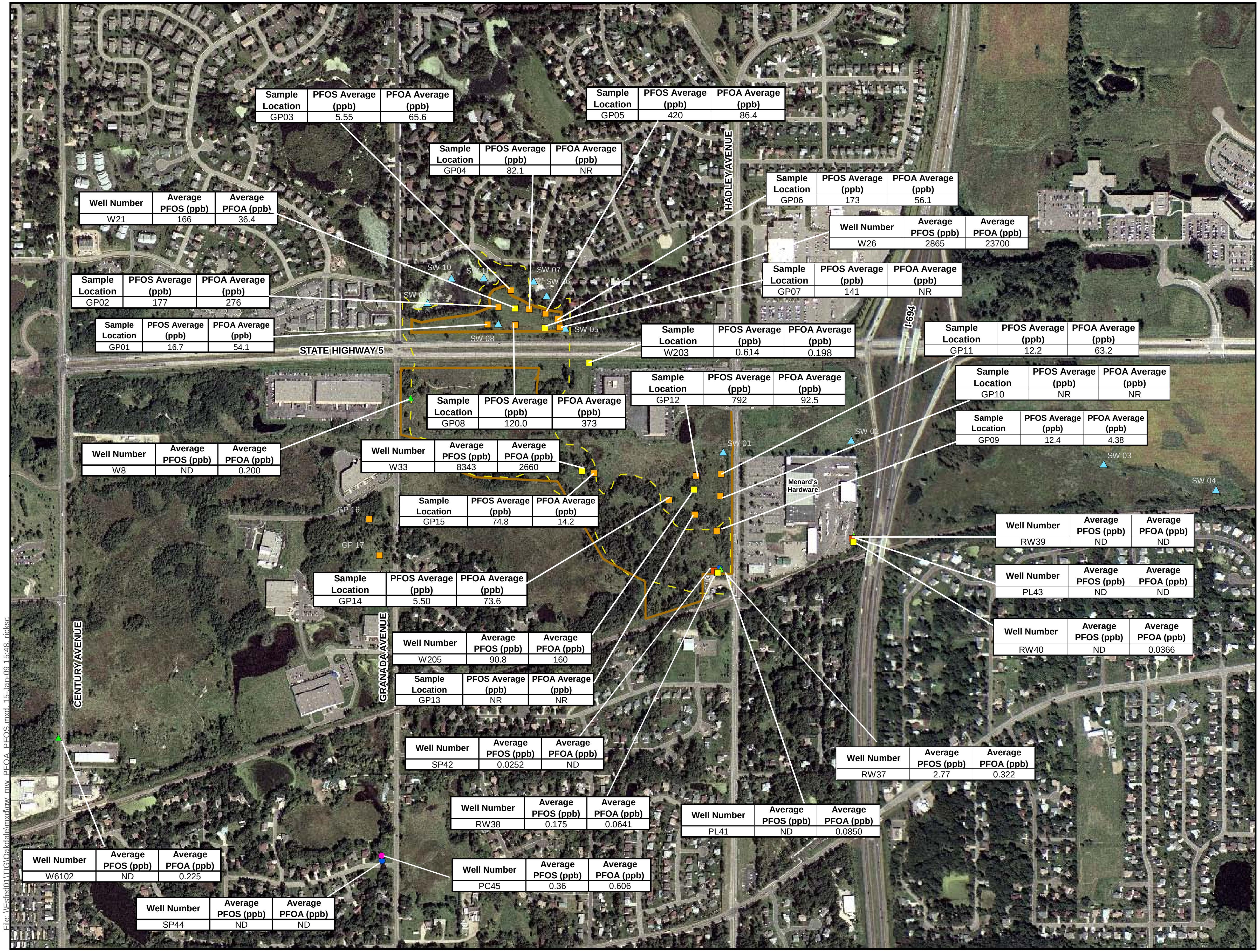
— Fenceline

N
W E
S

0 250 500 1,000 Feet

Figure 2-8
Platteville Limestone
Piezometric Contours:
Pumping Conditions
December 2006
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\gw_elevations_dec9_2006.mxd, 20-Jan-09 11:09, ricksc



Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP03	5.55	65.6

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP05	420	86.4

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP04	82.1	NR

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP06	173	56.1

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W21	166	36.4

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W26	2865	23700

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP02	177	276

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP07	141	NR

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP01	16.7	54.1

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
W203	0.614	0.198

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP11	12.2	63.2

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP10	NR	NR

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP12	792	92.5

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP08	120.0	373

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP09	12.4	4.38

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W8	ND	0.200

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W33	8343	2660

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP15	74.8	14.2

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
RW39	ND	ND

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
PL43	ND	ND

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP14	5.50	73.6

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
RW40	ND	0.0366

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W205	90.8	160

Sample Location	PFOS Average (ppb)	PFOA Average (ppb)
GP13	NR	NR

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
SP42	0.0252	ND

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
RW37	2.77	0.322

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
RW38	0.175	0.0641

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
PL41	ND	0.0850

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
W6102	ND	0.225

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
PC45	0.36	0.606

Well Number	Average PFOS (ppb)	Average PFOA (ppb)
SP44	ND	ND

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WESTON SOLUTIONS

Legend

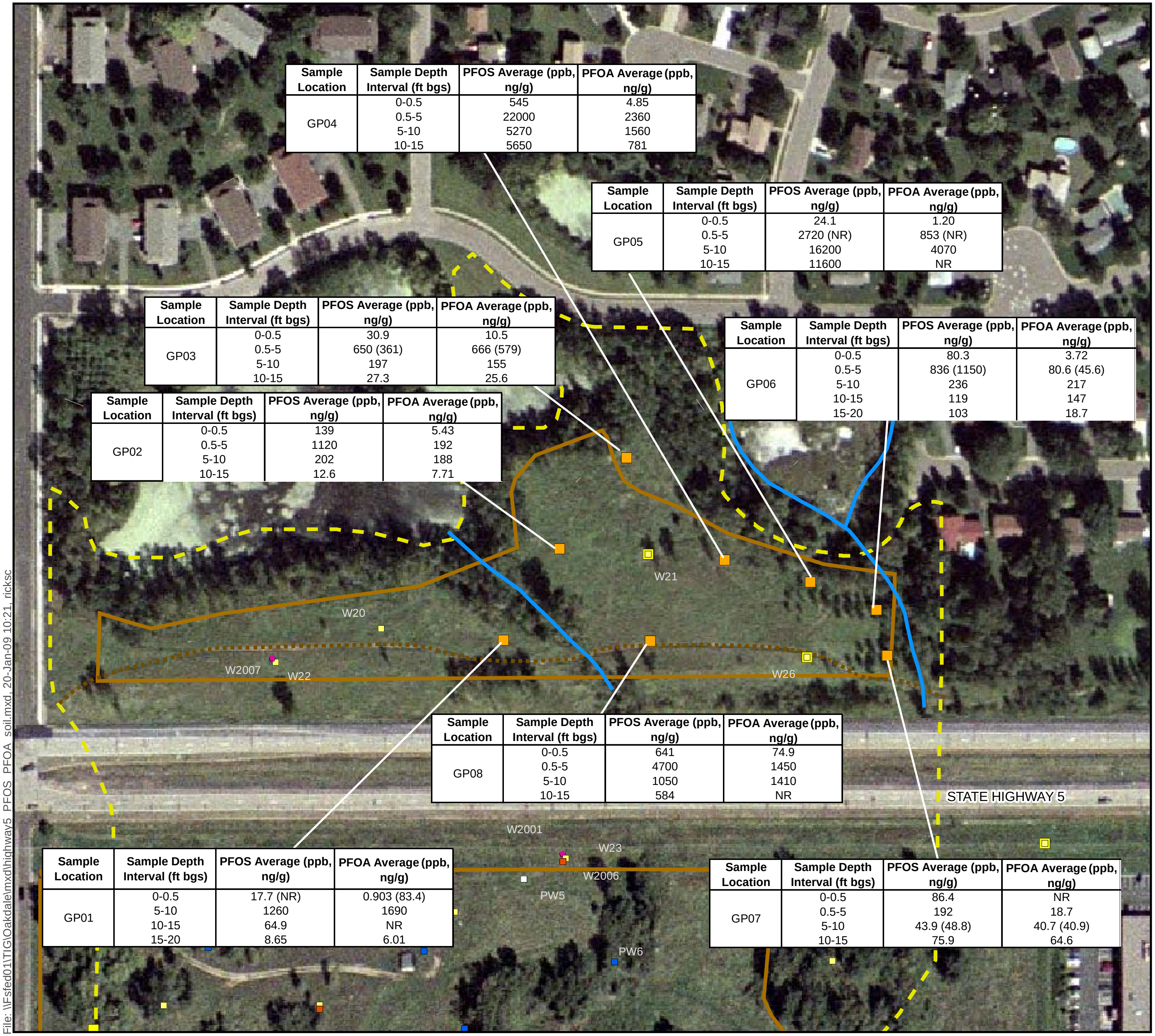
🟧	Geoprobe Location (GP01 to GP15)
△	Surface Water/Sediment Sampling Location (SW01 to SW11)
🟨	Water Table Monitoring Well (RW37, RW40, W21, W26, W33 and W203)
🟥	Basal Alluvium Monitoring Well (RW38 and RW39)
▲	Platteville Monitoring Well (PL41, PL43, W8 and W6102)
●	St. Peter Monitoring Well (SP42 and SP44)
●	Prairie du Chien Monitoring Well (PC45)
—	Fenceline
⬚	Inferred Limits of Site Area

Note: Concentrations in parenthesis are duplicate samples
ND= Not Detected at or Above 2.5 ng/l (wet weight)
NR= Not Reported due to Quality Control Issues

Figure 2-9

Groundwater Monitoring Wells-
PFOS and PFOA Concentrations
December 2005/February 2006/
March 2006/August 2007

Oakdale Site
Oakdale, Minnesota



Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP04	0-0.5	545	4.85
	0.5-5	22000	2360
	5-10	5270	1560
	10-15	5650	781

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP05	0-0.5	24.1	1.20
	0.5-5	2720 (NR)	853 (NR)
	5-10	16200	4070
	10-15	11600	NR

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP03	0-0.5	30.9	10.5
	0.5-5	650 (361)	666 (579)
	5-10	197	155
	10-15	27.3	25.6

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP06	0-0.5	80.3	3.72
	0.5-5	836 (1150)	80.6 (45.6)
	5-10	236	217
	10-15	119	147
	15-20	103	18.7

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP02	0-0.5	139	5.43
	0.5-5	1120	192
	5-10	202	188
	10-15	12.6	7.71

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP08	0-0.5	641	74.9
	0.5-5	4700	1450
	5-10	1050	1410
	10-15	584	NR

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP01	0-0.5	17.7 (NR)	0.903 (83.4)
	5-10	1260	1690
	10-15	64.9	NR
	15-20	8.65	6.01

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP07	0-0.5	86.4	NR
	0.5-5	192	18.7
	5-10	43.9 (48.8)	40.7 (40.9)
	10-15	75.9	64.6

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WESTON SOLUTIONS

Legend

🟨	Water Table Monitoring Well
🟧	Geoprobe Boring Location
☐	Abandoned
🟥	Basal Alluvium Monitoring Well
⬟	Base of Surficial Alluvium Monitoring Well
🟦	Pump-out Well
▨	Eliminated Pumping at Well
┅	Unpaved Access Road
━	Drainage Features
━	Fenceline
╍	Inferred Limits of the Site Area

Note: Concentrations in parentheses are duplicate samples.
NR= Not reported due to quality control issues.

Figure 2-10

PFOA and PFOS
Concentrations in Soil
North of Highway 5
November/December 2005

Oakdale Site
Oakdale, Minnesota

Soil Boring - ASB40			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	NR	NR	209
1.5 - 2.0 feet	0.368	6.79	206
3.5 - 4.0 feet	1.41	22.1	374
5.5 - 6.0 feet	2.69	14.0	133
9.0 - 9.5 feet	4.46	27.3	37.9

Soil Boring - ASB39			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
1.5 - 2.0 feet	28.4 (31.2)	446 (483)	6405 (5710)
3.5 - 4.0 feet	82.5	1027	13300
5.5 - 6.0 feet	306	1400	NR
7.0 - 7.5 feet	192	944	NR

Soil Boring - ASB42			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	ND	0.845	24.6
1.5 - 2.0 feet	ND	1.03	59.7
3.5 - 4.0 feet	8.46	138	169
5.5 - 6.0 feet	9.77	222	NR
7.0 - 7.5 feet	16.8	62.9	75.6

Soil Boring - ASB34			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	NR	7.61	NR
1.5 - 2.0 feet	9.15	NR	5375
3.5 - 4.0 feet	49.3	NR	8690
5.5 - 6.0 feet	NR	4640	69400
8.5 - 9.0 feet	1600	18050	17550

Soil Boring - ASB38			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	1.86	18.6	346
1.5 - 2.0 feet	2.01	82.1	974
3.5 - 4.0 feet	7.05 (7.78)	119 (137)	1110 (1405)
5.5 - 6.0 feet	12.1	NR	1630
8.0 - 8.5 feet	17.6	NR	NR

Soil Boring - ASB43			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
1.5 - 2.0 feet	7.39	53.9	207
3.5 - 4.0 feet	34.8	476	3855
5.5 - 6.0 feet	90.6	964	5310
9.0 - 9.5 feet	39.3	259	182

Soil Boring - ASB37			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	3.90	NR	NR
1.5 - 2.0 feet	6.93	242	5515
3.5 - 4.0 feet	NR (4.66)	88.3 (96.4)	2755 (3205)
5.5 - 6.0 feet	NR	10.5	17050
7.5 - 8.0 feet	NR	13.7	672

Soil Boring - ASB36			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	11.9	16.1	1460
1.5 - 2.0 feet	52.4 (NR)	1073 (1040)	NR (23400)
3.5 - 4.0 feet	NR	1615	37250
5.5 - 6.0 feet	400	2715	11450
9.5 - 10 feet	442	NR	88.7

Soil Boring - ASB31			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	12.5	6.35	NR
1.5 - 2.0 feet	NR	NR	2038
3.5 - 4.0 feet	219	NR	63350
5.5 - 6.0 feet	227	6040	42200
7.0 - 7.5 feet	337	9130	64200

Soil Boring - ASB41			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
1.5 - 2.0 feet	9.80	658	5740
3.5 - 4.0 feet	43.8	723	1685
5.5 - 6.0 feet	30.2	558	2350
9.0 - 9.5 feet	107 (99.0)	62.4 (58.1)	20.6 (22.7)

Soil Boring - ASB32			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	NR	19.0	1300
1.5 - 2.0 feet	NR (303)	4420 (3380)	37300 (28300)
3.5 - 4.0 feet	812	11800	108000
5.5 - 6.0 feet	883	5460	NR
7.5 - 8.0 feet	1420	1960	NR

Soil Boring - ASB35			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	NR	13.3	235
1.5 - 2.0 feet	38.5	957	9220
3.5 - 4.0 feet	NR (26.3)	2975 (NR)	32100 (27950)
5.5 - 6.0 feet	146	13050	26600
8.5 - 9.0 feet	NR	3875	NR

Soil Boring - ASB33			
Sample Interval (bgs)	**Average PFBA (ppb, ng/g)**	**Average PFOA (ppb, ng/g)**	**Average PFOS (ppb, ng/g)**
0 - 6 inches	7.46	4.29	129
1.5 - 2.0 feet	10.8	642	4865
3.5 - 4.0 feet	13.1 (10.1)	NR (NR)	3630 (5035)
5.5 - 6.0 feet	NR	755	5430
8.5 - 9.0 feet	NR	3470	10105

Legend

●	Soil Boring Location
🟨	Water Table Monitoring Well
—	Fenceline
⬚	Inferred Limits of the Site Area

ASB = Abresch site soil boring
bgs = below ground surface
ND = Not detected at, or above, Limit of Quantitation (LOQ) of 0.2 ng/g
NR = Not reported due to quality control issues.

Note: Values in parentheses are results from duplicate samples collected in the field.

N
W E
S

0 150 300 600
Feet

Figure 2-11

PFBA, PFOA and PFOS Concentrations in Soil - North of Highway 5
December 2006

Oakdale Site
Oakdale, Minnesota

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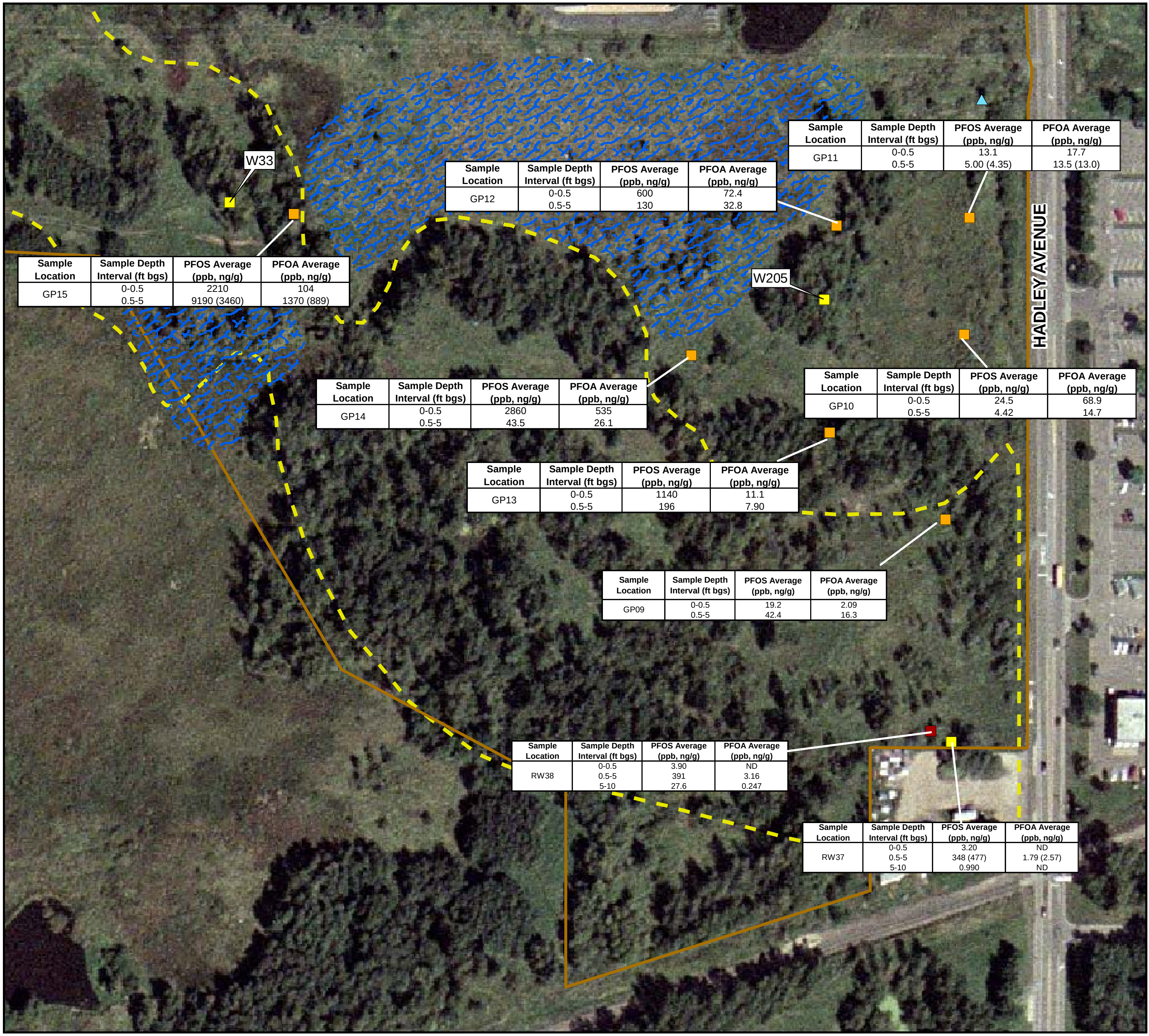

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP11	0-0.5	13.1	17.7
	0.5-5	5.00 (4.35)	13.5 (13.0)

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP12	0-0.5	600	72.4
	0.5-5	130	32.8

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP15	0-0.5	2210	104
	0.5-5	9190 (3460)	1370 (889)

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP10	0-0.5	24.5	68.9
	0.5-5	4.42	14.7

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP14	0-0.5	2860	535
	0.5-5	43.5	26.1

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP13	0-0.5	1140	11.1
	0.5-5	196	7.90

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
GP09	0-0.5	19.2	2.09
	0.5-5	42.4	16.3

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
RW38	0-0.5	3.90	ND
	0.5-5	391	3.16
	5-10	27.6	0.247

Sample Location	Sample Depth Interval (ft bgs)	PFOS Average (ppb, ng/g)	PFOA Average (ppb, ng/g)
RW37	0-0.5	3.20	ND
	0.5-5	348 (477)	1.79 (2.57)
	5-10	0.990	ND

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Legend

- 🟧 Geoprobe Boring Location
- △ Sediment/Surface Water Sampling Location
- 🟨 Water Table Monitoring Well
- ⬟ Base of Surficial Alluvium Monitoring Well
- ▲ Platteville Monitoring Well
- 🟦 Pump-out Well
- 🟥 Basal Alluvium Monitoring
- — Fenceline
- ▭ Inferred Limits of the Site Area
- ▨ Area of Saturated Soil/Water
- ND Not Detected at or Above 0.2 ng/g (wet weight)

N
W E
S

0 100 200
Feet

Figure 2-12

PFOS and PFOA
Concentrations in Soil-
South of Highway 5
December2005/February 2006

Oakdale Site
Oakdale, Minnesota

3. INTERIM RESPONSE ACTIONS

The following sections contain a description of the interim response actions that have been conducted at the Site under MPCA approval to facilitate the implementation of the MDD-selected alternatives for the Site.

3.1 ACCESS RESTRICTION

3M installed a construction fence in 2007 around the remedial area on the north side of Highway 5 to control access during project activities. The installation of the fence was discussed as part of 3M's public meeting, which was held in December 2007 and at the MPCA public meeting, which was held in May 2008. Additionally, the installation of the construction fence was mentioned in the 3M letter to local residents dated August 11, 2008, under subject matter entitled "Update on Cleanup Project at 3M Oakdale Property." Figure 3-1 shows the location of the construction fence that was installed around the remedial area on the north side of Highway 5.

On the south side of Highway 5, there is an existing fence, which restricts access to the portion of the Site where groundwater pumping activities are conducted. The location of the fence is shown in Figure 3-1.

3.2 GROUNDWATER EXTRACTION SYSTEM

3.2.1 Background

The MDD-selected alternative for groundwater as presented in the FS Report is Alternative GW-1. It consists of enhanced groundwater extraction with two primary goals:

- Provide capture, prevent off-site migration of groundwater south-southeast of Highway 5 (near monitoring wells W205 and W33), and control surface water discharge.
- Decrease the time required to capture groundwater north of Highway 5.

As stated in Section 2.3.2, four of the initial extraction wells (i.e., wells installed in 1985) (PW2, PW4, PW6 and PW11) each operate continuously at a rate of approximately 10 to 20 gpm. The other three initial extraction wells (PW1, PW3 and PW10) operate intermittently, each averaging a flow rate of less than 0.5 gpm. The steady-state combined flow rate of these extraction wells is approximately 40 gpm, and results in the capture zone presented earlier in Figure 2-7.

Based on groundwater modeling, which is discussed in detail in the FS Report, it was anticipated that 14 new extraction wells would need to be installed at the Site to provide hydraulic containment of PFCs in groundwater. As shown in Figure 3-2, one of these wells would be installed on the north side of Highway 5 and the remaining 13 extraction wells would be installed on the south side. The new extraction wells would be completed in coarser (higher yielding) materials at depth to recover groundwater containing PFCs more rapidly while acting as a “drain” to remove water from the lower yielding shallow alluvium.

It was estimated that a total flow of approximately 50 to 55 gpm would be extracted from the 14 new extraction wells. The groundwater extraction system would need to be operated such that the adjoining wetlands and water in the drainageway are maintained to the extent possible. The extraction wells would be routed to the area of the existing groundwater discharge building.

Groundwater from the existing and the proposed wells would be connected to a new system to treat PFCs. Treated groundwater would be discharged to the POTW, in accordance with a modified discharge permit.

3.2.2 Additional Extraction Well Installation Program

As noted in Section 1, the FS Report was submitted to the MPCA on January 28, 2008. Concurrent with MPCA’s review of the report, 3M requested in a letter dated February 28, 2008, approval to initiate certain interim response actions at the Site. These interim response actions included the following:

- Installation of Geoprobe® borings at the locations for the new extraction wells proposed under Groundwater Alternative GW-1. These borings would be installed to obtain the lithologic information necessary to design and locate the new extraction wells.

- Based on the above lithologic data, installation of the new extraction wells in the southern/south-central portion of the Site.

- Upon completion of the well installation activities, performance of short-term pump tests on the newly installed extraction wells to estimate the quality and quantity of the groundwater that would have to be treated on-site, prior to its discharge to the MCES WWTP.

In a letter to 3M dated March 13, 2008, the MPCA approved the FS Report and 3M's request to initiate interim response actions, as described above, at the Oakdale Site. A description of the field activities that were conducted under this approval is provided in the following sections.

3.2.2.1 Geoprobe® Boring Investigation

The Geoprobe® drilling program was performed from March 11 through 20, 2008 at the Site. Seventeen Geoprobe borings were advanced at the locations shown in Figure 3-3. One Geoprobe boring (GPRW-14) was completed in August 2007 at a proposed extraction well location along Hadley Avenue; therefore, no additional boring was drilled at this location. A Geoprobe boring (GPRW-26) was also completed north of Highway 5 where an additional extraction well is proposed for installation after the completion of soil removal activities in this area.

The primary purpose of the Geoprobe boring program was to collect samples of the subsurface soils to confirm that permeable (i.e. water-producing) zones are present at the proposed extraction well locations. Soil samples were collected continuously from ground surface to Geoprobe refusal. A licensed geologist supervised the drilling activities and described the lithologic conditions encountered including color, moisture, and texture. Each sample interval was screened for VOCs using a photoionization detector (PID). Aliquots of soil were also collected from each interval, placed in a heated area for a period of time, and then headspace readings were recorded using the PID. At drilling locations where no significant water-producing zones were encountered, another boring was drilled nearby. Once point refusal was encountered, the drill rods were removed and the boring was abandoned using a bentonite slurry.

The lithologic descriptions for the Geoprobe borings are included in Appendix A. Observations made during drilling (and noted on the boring logs) indicated the presence of a significant zone of permeable soils during the drilling of Geoprobe borings GPRW-15 through GPRW-21, GPRW-25, and GPRW-26. Less permeable soils were encountered during the drilling of the GPRW-22 (A and B), GPRW-23 (A and B), and GPRW-24 (A through D) borings in the central area of the Site. The presence of less permeable soils in this area of the Site is consistent with previous observations made during Site drilling activities.

3.2.2.2 Extraction Well Installation

The extraction well installation program was initiated on March 24, 2008 immediately following the completion of the Geoprobe drilling. Groundwater modeling results had predicted that 13 new extraction wells would be required to prevent potentially impacted groundwater in the southeast area of the Site from migrating downgradient. However, the results of the Geoprobe drilling program identified greater thicknesses of permeable soils than anticipated in the shallow alluvium unit in the southeast area of the Site. Therefore, the sustainable pumping rates for the new extraction wells would be higher than simulated in the groundwater flow model and potentially fewer new extraction wells would be required. Additional groundwater modeling was performed using higher flow rates where the more permeable soils were encountered, and the modeling results indicated that one less extraction well could be installed while maintaining groundwater capture. Based on the Geoprobe and groundwater modeling results, extraction wells RW-14 through RW-25 were installed at the 12 locations shown in Figure 3-4.

An all terrain hollow-stem auger drill rig was used to install the new extraction wells. Each well was installed advancing 12-inch diameter augers to the targeted depth based on the Geoprobe investigation results. After the targeted depth was reached, a plug installed in the bottom of the augers was removed to facilitate well installation. No soil samples were collected during drilling and all soil cuttings were containerized in 55-gallon drums that were labeled with the well ID number and any other pertinent information. The drums were staged on-site in a designated area for future management as discussed in the Construction Sampling Plan (Attachment 2).

The extraction wells were constructed of 6-inch diameter, stainless steel slotted screen and carbon steel riser. The length of screen installed, depth and slot size (0.01-inch or 0.005-inch) were determined from information obtained during the Geoprobe boring investigation. Varying slot sizes were installed at a few extraction well locations due to variations in grain size of the aquifer soils across the screened interval. A sand/gravel pack was installed in the annulus between the screen and borehole to approximately 2 feet above the top of the screen. A fine-grained sand seal was emplaced on top of the sand/gravel pack. A cement/bentonite grout was then tremie piped in the annulus from the top of the fine-grained sand seal to a depth of approximately 8 feet bgs. The top of the grout was kept below this depth to allow the installation of pitless adapters at each well. Following the installation of the pitless adapter, the area around each well was backfilled to grade with native soil. The wells were completed approximately 2 feet above ground surface with a lockable cap.

A summary of the well completion details is provided in Table 3-1. A copy of the well completion logs is included in Appendix A.

3.2.2.3 Well Development

Following well installation activities, extended well development was performed to remove any fine-grained soils present within the screened interval of each extraction well. Extended development consisted of a combination of pumping, surge-blocking, water-jetting, and air-jetting. Development continued until the discharge water was free of fine-grained soils and low in turbidity. All discharge water generated during the well development program was containerized and pumped to the permitted MCES sewer discharge point near the existing groundwater discharge building. Approximately 34,200 gallons of water were generated and discharged to the sewer during the well development program.

Additional well development activities were performed at four of the new extraction well locations in September 2008. The four wells were RW-20, RW-22, RW-23 and RW-24 and these wells are located in, or nearby, the middle of the Site identified as the “isthmus” area. Observations made during drilling activities indicated that the subsurface soils in the “isthmus” area are finer-grained than those soils encountered in other areas where the new extraction wells were installed. The purpose of the additional well development activities was to remove additional fine-grained soils across the screened intervals and increase the yields at these four extraction wells.

The additional well development consisted of high pressure water-jetting the screened interval of each well while injecting a chemical additive. The chemical additive used was a clay dispersant (NW-220 manufactured by Johnson Screens) that is a non-ionic, biodegradable, liquid-polymeric dispersant specifically designed to remove fine-grained soils from wells without the use of phosphates. It was mixed in solution in accordance with manufacturer’s recommendations and then jetted throughout the well screen. Following injection of the dispersant, the well was surged for several hours and then allowed to stand for a minimum of 12 hours. Immediately after this time, the well was pumped, surge-blocked, and water-jetted until the discharge water was free of fine-grained soils and the turbidity low. The additional well development activities were successful in removing fine-grained soils and increasing the yields at each well by approximately 25%.

3.2.2.4 Pump Tests

Following the completion of the well development activities in April 2008, the sustainable yield at each well was determined by performing short-term pumping tests. Two longer-term pumping tests were conducted at extraction wells RW-16 and RW-19 to calculate aquifer parameters and assess the lateral extent of influence due to pumping. During these longer-term pumping tests, each extraction well was pumped continuously for 8 hours and water levels were monitored at nearby observation wells. All discharge water generated during these tests was routed to the permitted discharge point located near the existing groundwater discharge building near Highway 5.

Short-Term Pumping Tests

The short-term pumping tests were performed at each new extraction well and consisted of measuring the change in water level (i.e., drawdown) during a pumping period of several hours. In some cases where the water level in the pumping well declined rapidly, the wells were pumped at gradually decreasing flow rates until the water level stabilized. Typically, the extraction wells were pumped at a series of discharge rates (steps) for a period of 30 to 60 minutes for each step until the water level stabilized. The estimated sustainable well yield for each well calculated from data collected during these tests is included in Table 3-1. The estimated well yields were used to select an appropriately sized pump for installation. As indicated in Table 3-1, the estimated sustainable well yields vary from 0.25 gpm to greater than 10 gpm. The lower well yields were measured at extraction wells RW-22, RW-23, and RW-24 located in the central Site area. As stated previously, the aquifer soils in this area are finer-grained and lower in permeability than in other areas of the Site.

During tests where pumping rates could be maintained at consistent rates, estimates of transmissivity were calculated using the recovery data collected after the completion of pumping at each well. The recovery data were analyzed using the Kawecki recovery method that is capable of providing estimates of transmissivity while taking into account a variable discharge rate. A summary of the transmissivity values calculated from these tests is provided in Table 3-2, and the complete data analyses are included in Appendix B.

As shown in Table 3-2, estimates of transmissivity calculated from data collected during the short-term tests range from 6.4 square feet per day (ft^2/day) to 1597 ft^2/day. The range in transmissivity values and sustainable flow rates calculated for the extraction wells demonstrate the variation in permeability present in the water-bearing zones across the area.

8-Hour Pumping Tests

RW-16 Pump Test - After completion of the well development activities at extraction well RW-16, an 8-hour pumping test was performed. This well was selected for a longer-term test since it is centrally located between extraction wells RW-14 through RW-18, and observations made during well development activities indicated that it was capable of sustaining a minimum of 10 gpm. Transducers equipped with dataloggers were installed in the pumping well and nearby wells RW-17, W205 and APZ-45 to monitor changes in water levels. Manual depth-to-groundwater measurements were also collected from nearby wells to assess the effect of pumping on groundwater levels.

The measured drawdown in extraction well RW-16 after 8 hours of pumping at 8.5 gpm was 1.24 feet. A response to pumping was apparent in nearby extraction wells RW-14, RW-15, RW-17, RW-18 and RW-19. This indicates that there is good hydraulic communication in the alluvium soils in this area of the Site. No discernible response to pumping was apparent in the groundwater levels collected in shallow monitor wells W205 and APZ-45. These wells are screened within a shallow silty sand alluvium that is lower in permeability than the underlying sandy alluvium. A response to pumping will take longer to develop in these less permeable soils. After the new groundwater extraction system is operating continuously, water levels in the silty sand alluvium will gradually decline as groundwater in the silty sand unit flows downward via gravity drainage into the underlying permeable sand unit.

As shown in Table 3-2, the estimates of transmissivity calculated from water level data collected during the RW-16 pump test range from 1307.6 ft^2/day to 1481.7 ft^2/day, with a geometric mean of 1378.4 ft^2/day and a standard deviation of 74.7 ft^2/day. Using the transmissivity geometric mean and an average aquifer thickness of 40 feet (calculated for extraction wells RW-15, RW-16 and RW-17), a hydraulic conductivity of 34.5 ft/day is calculated. The values of storativity calculated from the pumping test data range from 1.71×10^{-4} to 1.91×10^{-4}.

RW-19 Pump Test - After completion of the pump test at extraction well RW-16, it was apparent that the extraction wells in this area of the Site were capable of sustaining higher pumping rates than initially anticipated. Since similar lithologic conditions were encountered during drilling at extraction wells RW-16 and RW-19, a larger pump was used to perform the second pump test at extraction well RW-19. A pumping rate of 30 gpm was used to perform the 8-hour test at this well. Transducers equipped with dataloggers were installed in the pumping well and nearby extraction wells RW-18, RW-20 and RW-21 to monitor changes in water levels. Manual depth-to-groundwater measurements were also recorded during the test at additional nearby wells.

The measured drawdown in extraction well RW-19 after 8 hours of pumping was 4.54 feet. The water column in extraction well RW-19 prior to the start of the pump test was 49.1 feet. Figure 3-5 presents the measured change in water level between non-pumping and pumping conditions for wells in southeast site area. As shown in Figure 3-5, a response to pumping at extraction well RW-19 was present over an extensive area, despite minimal drawdown in the pumping well. A drawdown of 0.83 feet was measured in monitor well W2005 located approximately 990 feet to the west, and a drawdown of 0.76 feet was measured in monitor well RW-38 approximately 815 feet to the east. The response to pumping was more apparent in wells screened deeper in the more permeable alluvial sand soils than in the shallow silty sand unit. This results in an increase in the downward vertical hydraulic gradient that enhances the potential for groundwater to flow from the less permeable silty sand unit downward into the more permeable sand.

3.2.3 Installation of Pumps and Conveyance Piping

During a meeting with MPCA on May 5, 2008, 3M and WESTON indicated that the interim response actions described in 3M’s February 28, 2008 letter had been completed. It was also noted that 12, instead of the planned 13, extraction wells had been installed in the south/south-central portion of the Site, based upon the field lithological conditions that had been encountered. Further, the pump test data would be utilized to optimize (via modeling) the pumping rates in each of the 12 new extraction wells and to achieve the desired groundwater capture.

During the May 5, 2008 meeting, it was also noted that while preliminary data from the short-term pump tests would be used to project the influent loadings to the proposed new groundwater treatment system, data obtained from continuous pumping of the new extraction wells would be more beneficial for designing the proposed new groundwater treatment system. These data could be obtained by installing the pumps in the 12 new extraction wells and pumping the wells for a period of several months. Conveyance piping would also be installed from the extraction wells to the existing manhole, which is the point of discharge to the MCES sewer system. Approval would be obtained from MCES prior to discharge of the extracted groundwater to their sewer system during this continuous pumping test period.

The MPCA was in agreement with the above plan. Subsequently, in a letter dated May 5, 2008, 3M formally requested approval to install pumps in the 12 new extraction wells, install the conveyance piping, and pump the new extraction wells for an extended period of time, for the following reasons:

- The new extraction wells, pumps, and the associated conveyance piping are part of the site-wide groundwater alternative (Alternative GW-1) selected by the MPCA.
- Contingent upon obtaining MCES approval, extended pumping of the new extraction wells would provide a better basis for designing the proposed new groundwater treatment system.
- Drier conditions at the Site in summer 2008 would better facilitate the necessary equipment access and trenching activities for installation of the extracted groundwater conveyance piping network.

Approval was received from MPCA in a letter to 3M dated June 4, 2008. MCES provided its approval for the discharge in July 2008. Following the receipt of these approvals, the design of the extraction well pumping and conveyance systems was completed in August 2008.

Based on the hydraulic modeling that was completed, maximum potential flow rates were established for the 12 extraction wells. Utilizing the anticipated flow rates and the elevation difference between the pump invert and the discharge location in the groundwater discharge building, the required total dynamic head (TDH) was calculated for each well pump. Table 3-3 summarizes these design criteria.

Installation of the well pumps and the conveyance piping occurred from September to November 2008. Individual Standard Dimension Ratio (SDR) 11 high density polyethylene (HDPE) pipes were installed between each extraction well and the groundwater discharge building. In order to expedite construction and minimize site disturbance, all extraction well piping was installed using horizontal directional drilling. Pipes were installed below the frost line, at approximately 7 to 8 feet bgs. An identifiable tracer wire was installed with each HDPE pipe to facilitate future utility location activities. One additional HDPE pipe was installed from the groundwater discharge building, beneath Highway 5 (within a carrier pipe), to a termination point above grade north of the highway. This pipe was installed in accordance with a State of Minnesota Department of Transportation (MNDOT) utility permit on trunk highway right-of-way. This pipe will serve the extraction well to be installed north of Highway 5 following soil removal activities.

At each well, the HDPE transfer pipe was connected through the well casing using a pitless adaptor. These connections were made using an open well-head excavation. During the installation process, the atmosphere within the excavation was monitored using a MultiRAE monitor to verify that a safe work atmosphere was maintained (monitored parameters included total VOC levels, oxygen content and carbon monoxide concentration). Each excavation was treated as a permit-required confined space; therefore, the appropriate confined space and excavation inspection documentation was completed.

The thirteen HDPE pipes were routed from the individual wells to the edge of the groundwater discharge building where they were brought up to grade, transitioned to Schedule 40 polyvinyl chloride (PVC) pipe and turned to penetrate the building wall. An insulated enclosure mounted on a new concrete slab was installed around the exposed HDPE/PVC piping exterior to the building. The enclosure has a removable panel for access on one wall and is heated to prevent freezing.

Within the building, each line passes through a globe valve, a totalizing flow meter, and another globe valve before discharging into a common 4-inch PVC discharge line. The common line passes through the concrete lid of, and into, the existing discharge sump. To prevent the transfer and/or accumulation of VOCs in the air within the groundwater discharge building, the penetration was sealed vapor tight.

Each pump is individually controlled by a Franklin Electric Pumptec-Plus controller, installed within the groundwater discharge building. The controller monitors motor load from each well pump to provide protection from dry well conditions and motor overload. Direct-bury electrical power cable was installed between each new pump controller and the well pump. As-built drawings for the extraction system are included in Appendix C.

3.2.4 System Startup and Operation

During the final week in October 2008, extraction system startup activities were initiated. All systems were checked to verify that the equipment operated as intended and that system interlocks were operational. The system officially began operation on November 4, 2008. During startup, minor modifications were required to certain extraction well pump motors to ensure consistent operation.

Currently, the system is operating under a special discharge permit issued by MCES. This permit allows extracted groundwater from the 12 new extractions wells to be discharged directly into the MCES sewer without treatment. The total flow into the sewer is limited to no more than 120 gallons per minute (gpm). Table 3-4 is a summary of the average flow rates that have been measured from each extraction well during system operations; these data are used to document compliance with the MCES requirements.

MCES issued the permit and allowed the temporary pumping of the 12 extraction wells for a period of 6 months to allow 3M to further characterize the extracted groundwater in order to develop a design basis for the FS-recommended groundwater treatment system. Therefore, analytical samples have been collected on a monthly basis from each individual extraction well and the combined sewer discharge. The use of these data is further discussed in Section 5.2.

3.3 SOIL VAPOR EXTRACTION SYSTEM

3.3.1 Background

On May 22, 2008, the MPCA held a public meeting at the Oakdale City Hall to present the results of the Oakdale FS along with the recommended alternatives and address comments from the public. The MPCA-recommended soil alternative included excavation of PFC-containing soil from the area north of Highway 5 as depicted in Figure 3-6.

An issue raised by local citizens at the public meeting was the generation of odors which may occur during excavation activities. Considering the history of the Site and analysis of soils as part of the remedial investigation (RI), it is expected that soils containing VOCs, as well as the targeted PFCs, would be encountered during excavation activities, particularly in the eastern portion of the excavation area, in the vicinity of groundwater monitoring well W-26. During construction, the generation of odors from VOCs in the soils will be addressed by using techniques such as controlled excavation, placement of daily cover (i.e., soil, plastic, etc.), application of a mist or spray, dust control, etc. However, odors could still possibly be noticed by residents in proximity to this work area. It should be noted that based on known physical/chemical properties, the volatilization of PFCs would not be expected.

At meetings between the MPCA and 3M on June 10 and 25, 2008, the benefits of installing a temporary soil vapor extraction (SVE) system in the portion of the excavation area that contain higher concentrations of VOCs and proximate to residents was discussed. SVE is a proven technology for removing VOCs from vadose zone soils. Removal of VOCs would reduce the source of VOC odors, which could be produced during excavation at the Site. Figure 3-7 depicts the basic components of SVE. As shown, vents are installed into the unsaturated zone soils within the treatment area and these vents are connected via manifolds to a vacuum blower. The subsurface portion of the vents are perforated or slotted so that the induced vacuum draws in vapor from the surrounding soil. Soil vapor containing VOCs is drawn by the blower through a knockout pot to remove moisture and the vapor-laden air is treated with activated carbon prior to its discharge to the atmosphere.

In a letter to MPCA dated July 2, 2008, 3M requested permission to install and operate a temporary SVE system as an Interim Response Action, which would facilitate the planned soil excavation. Approval was received from MPCA to initiate this work in a July 23, 2008 letter; however, MPCA requested that 3M submit additional design information. 3M provided the requested information to the MPCA in an August 5, 2008 submittal and received final approval from MPCA on August 20, 2008.

3.3.2 Temporary SVE System Installation

From August 25 to 27, 2008, 22 SVE vents were installed in the eastern portion of the planned excavation area north of Highway 5 at locations shown in Figure 3-8. The SVE vents were constructed using an auger drill rig and 6-inch (approximate outer diameter) hollow-stem augers. Soil cuttings were visually inspected during construction for signs of discoloration and waste material. The cuttings were containerized and placed in the staging area south of Highway 5 for future management as discussed in the Construction Sampling Plan (Attachment 2). Vent depths were adjusted in the field based on the visual observations and the potential for encountering groundwater at each location. Vent depths ranged from 8.1 to 8.8 feet bgs. Due to instability of the boreholes, the SVE vents were constructed within the augers. The vents were constructed of 2-inch diameter flush-threaded PVC with 5 feet of 0.01-inch slotted screen. Once in place, a filter pack of clean pea gravel was constructed across the screen interval. This was followed by a grout seal (medium-grained sand) and bentonite grout slurry to grade. The vents were left unfinished at the surface for tie-in to the vacuum manifold system. Table 3-5 is a summary of the SVE vent construction data. A copy of the SVE vent logs and construction diagrams are presented in Appendix D.

Once completed, the vents were capped and allowed to stabilize for approximately 30 minutes. A PID was then used to monitor the headspace of each SVE vent for total volatile organics. The PID readings and the dates the measurements were taken are summarized in Table 3-5.

Following completion of the vents, Schedule 40 PVC piping was installed aboveground to connect individual vents to the trailer-mounted SVE treatment system. The SVE treatment system consists of a moisture knockout pot inside the trailer to remove moisture from the extracted soil vapor, followed by two 1,500-lb vapor phase granular activated carbon (GAC) units connected in series (lead and lag configuration) outside the trailer to treat the extracted soil vapor for removal of VOCs, and a blower inside the trailer enclosure to draw the air through the piping and SVE equipment and discharge to the atmosphere. The GAC units were installed prior to the blower to remove potentially flammable compounds and their associated potential explosion hazard. Once the vapor concentrations decrease, the GAC units will be repositioned to the discharge side of the blower. Installation of the SVE system was completed on October 21, 2008. Figure 3-8 shows the layout of the SVE vent system and the location of the trailer enclosure containing the blower and associated equipment.

3.3.3 Temporary SVE System Operation

Startup and shakedown of the SVE system were conducted during the period extending from October 21 to October 31, 2008. During this time period until November 14, 2008, the system was operated on weekdays (Monday through Friday) and was turned off during the weekends so that operation conditions could be confirmed. Periodic measurements of soil vapor total VOC concentrations were obtained by using a PID, and flow rates at individual vents and the system inlet manifold were measured. Manifold PID and flow rate measurements were collected at the inlet, between, and at the discharge of the GAC vessels.

PID measurements from between the GAC vessels were used to determine the need for GAC vessel changeout. Generally a GAC changeout was scheduled when the “between” measurement was 50 to 75% of the inlet measurement. PID outlet measurements were recorded to document the VOC removal.

For the first month of operation, at least one air sample per week was collected, by using a summa canister, at the inlet of the GAC units to track VOC removal and to quantify specific organic compound concentrations. The air samples were submitted to either

Pace Analytical Laboratory or Test America for VOC analysis by EPA Method TO-15 and methane analysis by EPA Method 3C.

Since November 14, 2008, the SVE system has operated continuously, with brief downtimes primarily for maintenance, automatic shutdowns, and GAC changeout. Periodic measurements for VOCs by PID and flow continue to be collected and recorded at the system manifold and individual vents to track system performance.

After the first month of operation, at least one summa canister air sample per month has been collected at the inlet to the GAC units to track VOC removal and to quantify specific organic compound concentrations. The air samples have been submitted to Pace Analytical for VOC analysis by EPA Method TO-15. The methane analytical results from the first month of operation indicated that methane was not present and, therefore, this parameter was omitted from the analyses.

Mass removal for the SVE system is calculated using routine PID measurements and is speciated for individual compounds using the summa canister analytical results. The run time for the system during the time period of each analytical result and the average of the flow rate measurements collected during the time period were used to calculate mass removal. It is expected that the Oakdale SVE system will be operated as long as VOCs are being effectively extracted to facilitate the removal and disposal of soils containing PFCs in accordance with the MDD. It is expected that the quantity of VOCs removed in the extracted soil vapor will decrease over time and this trend is being tracked as part of the operating program discussed above.

A final report will be issued to MPCA to present all relevant operational data following the completion of SVE activities.

SECTION 3 TABLES

Table 3-1 Summary of Extraction Well Construction Data
Oakdale Site

Extraction Well ID	Geoprobe Boring ID	Total Depth (ft bgs)	Screened Interval (ft bgs)	Screen Slot Size	Top of Sand Filter Pack (ft bgs)	Top of Fine Sand Seal (ft bgs)	Approximate Yield (gpm)
RW-14	GPRW-14	30.7	15.4-30.4	10 slot	13	9.5	1.5
RW-15	GPRW-15	51.2	20.9-50.9	10 slot	18.5	15	>10
RW-16	GPRW-16	39.4	19.1-39.1	10 slot	16.5	13	>10
RW-17	GPRW-17	38.9	18.6-38.6	10 slot	16	12	>10
RW-18	GPRW-18	57.3	17.0-57.0	10 slot	15.5	11.5	>10
RW-19	GPRW-19	54.2	28.9-53.9	10 slot	26.5	23.5	>10
RW-20	GPRW-20	51.8	31.5-51.5	10 slot	27	23	3
RW-21	GPRW-21	57.8	37.5-57.5	10 slot - 47.5 to 57.5 ft bgs 5 slot - 37.5 to 47.5 ft bgs	34	31	>10
RW-22	GPRW-22A	25.3	15.0-25.0	10 slot	13	10	0.75
RW-23	GPRW-23B	57.5	32.2-57.2	10 slot	28	24	0.25
RW-24	GPRW-24D	33.0	12.7-32.7	10 slot - 22.7 to 32.7 ft bgs 5 slot - 12.7 to 22.7 ft bgs	12	10	0.25
RW-25	GPRW-25	60.5	20.2-60.2	10 slot	18.05	14.05	>10

Table 3-2 Summary of Aquifer Parameters
Extraction Well Aquifer Tests
Oakdale Site
April 2008

Pumping Well	Observation Well	Distance to Pumping Well	Method of Analysis	Transmissivity (ft^2/day)	Storativity
Short-term single well tests					
RW14	RW14	0	Kawecki Recovery	6.4	NC
RW17	RW17	0	Kawecki Recovery	1597.0	NC
RW22	RW22	0	Kawecki Recovery	3.5	NC
RW25	RW25	0	Kawecki Recovery	562.8	NC
8-hour pumping tests					
RW16	RW16	0	Theis Recovery	1307.6	NC
	RW15	154.2	Theis Recovery	1432.7	NC
	RW17	191.6	Theis Recovery	1481.7	NC
	RW17	191.6	Cooper-Jacob	1355.7	1.71E-04
	RW17	191.6	Theis Drawdown	1322.2	1.91E-04
			Geometric Mean	1378.4	1.81E-04
			Standard Deviation	74.7	NC
RW19	RW18	128.1	Cooper-Jacob	1253.6	1.63E-04
	RW18	128.1	Theis Drawdown	1312.2	1.41E-04
	RW18	128.1	Theis Recovery	1092.2	NC
	RW19	0	Theis Recovery	1565.6	NC
	RW20	131.0	Cooper-Jacob	1566.1	5.68E-04
	RW20	131.0	Theis Drawdown	1685.4	5.33E-04
	RW20	131.0	Theis Recovery	1431.4	NC
	RW21	257.5	Cooper-Jacob	1017.5	1.23E-04
	RW21	257.5	Theis Drawdown	1140.6	1.06E-04
	RW21	257.5	Theis Recovery	1107.7	NC
	RW25	436.0	Theis Drawdown	1379.6	7.70E-05
	RW25	436.0	Theis Recovery	1442.6	NC
	RW25	436.0	Cooper-Jacob	1325.0	8.25E-05
			Geometric Mean	1317.5	1.66E-04
			Standard Deviation	205.9	2.04E-04

NC - Not calculable

Table 3-3 Extraction Well Design Criteria
Oakdale Site

Well Name	TDH (ft)	Flow (gpm)	Grundfos Pump: Redi-Flo4, Model	Pump Discharge Size (inches)	Motor Spec (2-wire)
RW-14	63	2	5E5 PEO	1"	1/3 HP, 230V, 1Ø
RW-15	79	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-16	73	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-17	67	10	10E5 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-18	78	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-19	67	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-20	82	2	5E5 PEO	1"	1/3 HP, 230V, 1Ø
RW-21	82	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø
RW-22	46	2	5E5 PEO	1"	1/2 HP, 230V, 1Ø
RW-23	71	3	5E8 PEO	1"	1/2 HP, 230V, 1Ø
RW-24	50	2	5E5 PEO	1"	1/3HP, 230V, 1Ø
RW-25	79	10	10E8 PEO	1-1/4"	1/2 HP, 230V, 1Ø

Table 3-4 Groundwater Extraction System Flow Rates
Oakdale Site

Well ID	11/16/2008	12/1/2008	12/16/2008	12/22/2008	12/29/2008	12/31/2008	1/7/2009	1/14/2009	1/21/2009
PW-01	1.23	1.17	1.24	1.24	0.00	0.68	1.32	1.32	1.38
PW-02	9.26	7.37	6.34	6.40	6.59	6.51	6.53	6.53	6.20
PW-03	0.54	0.50	0.54	0.50	0.41	0.46	0.56	0.56	0.43
PW-04	4.95	5.12	5.70	5.77	6.35	6.44	6.50	6.50	6.32
PW-06	15.38	14.30	15.65	16.24	16.94	16.89	17.77	17.77	18.33
PW-10	0.01	0.01	0.02	0.04	0.02	0.03	0.04	0.04	0.03
PW-11	14.11	15.49	17.70	12.18	0.00	1.91	0.00	0.00	9.28
RW-14	Off	Off	Off	0.23	0.86	1.39	1.12	1.12	NA
RW-15	Off	Off	Off	Off	4.30	8.46	8.55	8.55	8.31
RW-16	11.83	11.85	10.40	10.24	10.29	10.23	10.36	10.36	10.14
RW-17	10.61	10.61	6.09	10.33	10.29	10.31	10.43	10.43	10.20
RW-18	11.34	11.21	10.46	10.36	10.37	10.33	10.44	10.44	16.27
RW-19	11.20	11.27	10.31	10.03	10.10	10.00	10.13	10.13	9.93
RW-20	4.78	4.57	3.77	Off	1.03	3.54	3.58	3.58	3.54
RW-21	11.08	0.01	0.63	7.23	7.49	8.03	8.12	8.12	7.94
RW-22	0.82	0.41	1.13	1.01	0.94	0.39	0.14	0.14	NA
RW-23	0.05	Off	0.32	0.22	0.20	0.21	0.21	0.21	0.20
RW-24	Off	Off	Off	0.31	0.36	0.15	0.13	0.13	0.12
RW-25	11.17	11.22	4.44	9.45	Off	Off	Off	Off	Off
Total Measured Flow	118.36	105.10	94.77	101.78	86.56	95.99	95.93	95.93	108.63

All data in gpm

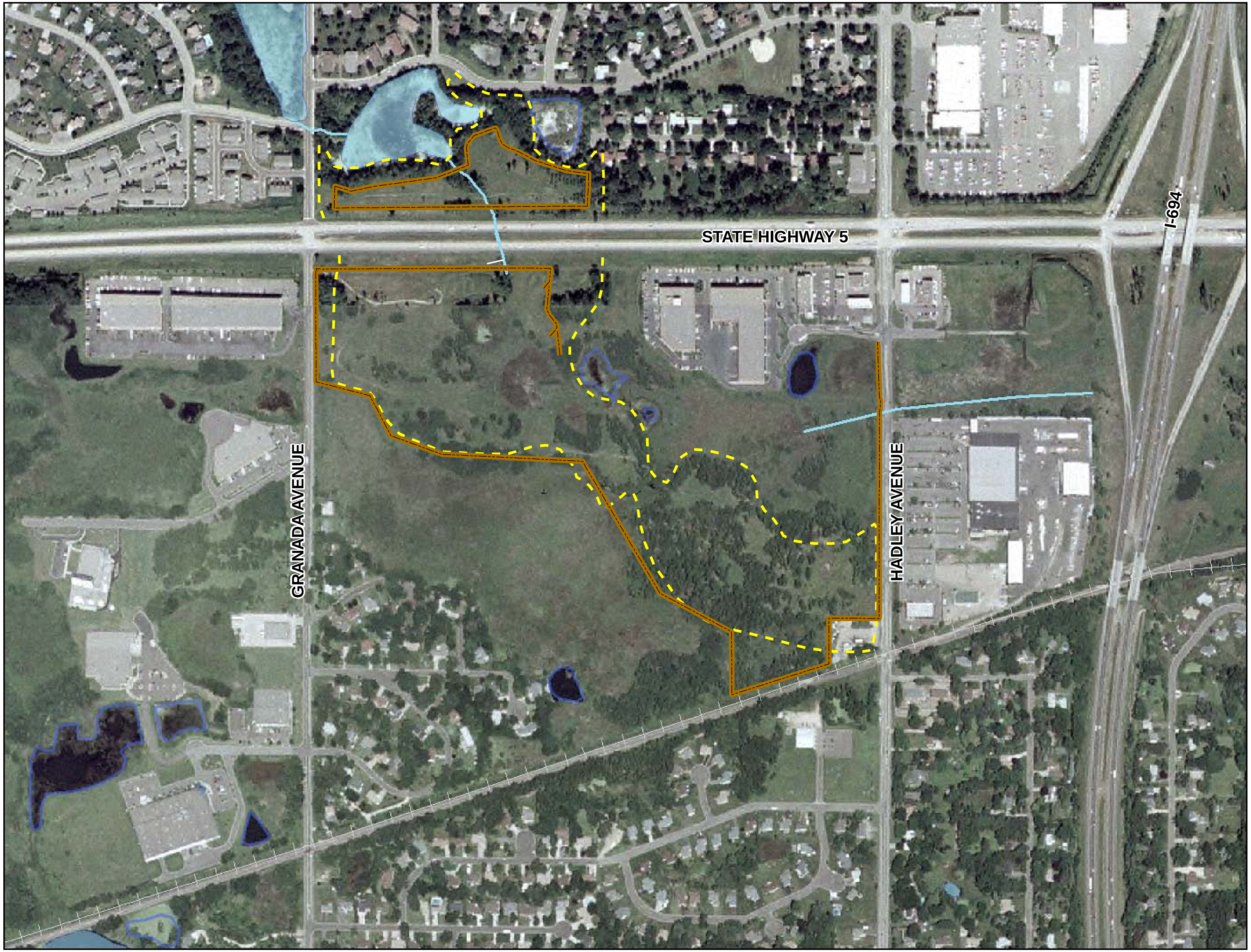
NA - Not available, meter not operating

Reported pumping rates represent the calculated average flow rate based on totalizer readings measured on the indicated date.

Table 3-5 Summary of SVE Vent Construction Data
Oakdale Site

SVE Vent No.	Total Depth (ft bgs)	Screen Interval (ft bgs)	Vent PID Reading	Date of PID Reading
A-1	8.8	3.0-8.0	3132	8/25/2008
A-2	8.1	2.9-7.9	2872	8/25/2008
A-3	8.7	3.4-8.4	3458	8/26/2008
A-4	8.7	3.5-8.5	1947	8/26/2008
A-5	8.7	3.5-8.5	2973	8/26/2008
A-6	8.7	3.4-8.4	1667	8/26/2008
A-7	8.7	3.5-8.5	1542	8/26/2008
A-8	8.6	3.3-8.3	2607	8/26/2008
A-9	8.7	3.4-8.4	3752	8/27/2008
A-10	8.7	3.4-8.4	3609	8/27/2008
A-11	8.7	3.4-8.4	3410	8/27/2008
B-1	8.3	3.2-8.2	2845	8/25/2008
B-2	8.5	3.2-8.2	2258	8/25/2008
B-3	8.5	3.3-8.3	1532	8/26/2008
B-4	8.3	3.0-8.0	2925	8/25/2008
B-5	8.6	3.3-8.3	1030	8/26/2008
B-6	8.8	3.5-8.5	1957	8/26/2008
B-7	8.6	3.3-8.3	3347	8/27/2008
B-8	8.8	3.5-8.5	1952	8/26/2008
B-9	8.6	3.3-8.3	3792	8/27/2008
B-10	8.4	3.1-8.1	2369	8/27/2008
B-11	8.7	3.4-8.4	2766	8/27/2008

SECTION 3 FIGURES



Legend

▬ Fenceline

— Drainageway

┼ Railroad

▭ Inferred Limits of the Site Area

🟦 Ponds and Water

Map Source:
U.S. Department of Agriculture, Farm Services Agency, Aerial Photography Field Office; National Agricultural Imagery Program (NAIP) Digital Orthorectified Images (DOQ), Minnesota, 2003

N
W E
S

Feet
0 225 450 900

Figure 3-1
Site Features Map
Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\basemap_tabloid.mxd, 16-Feb-09 10:31, ricksc

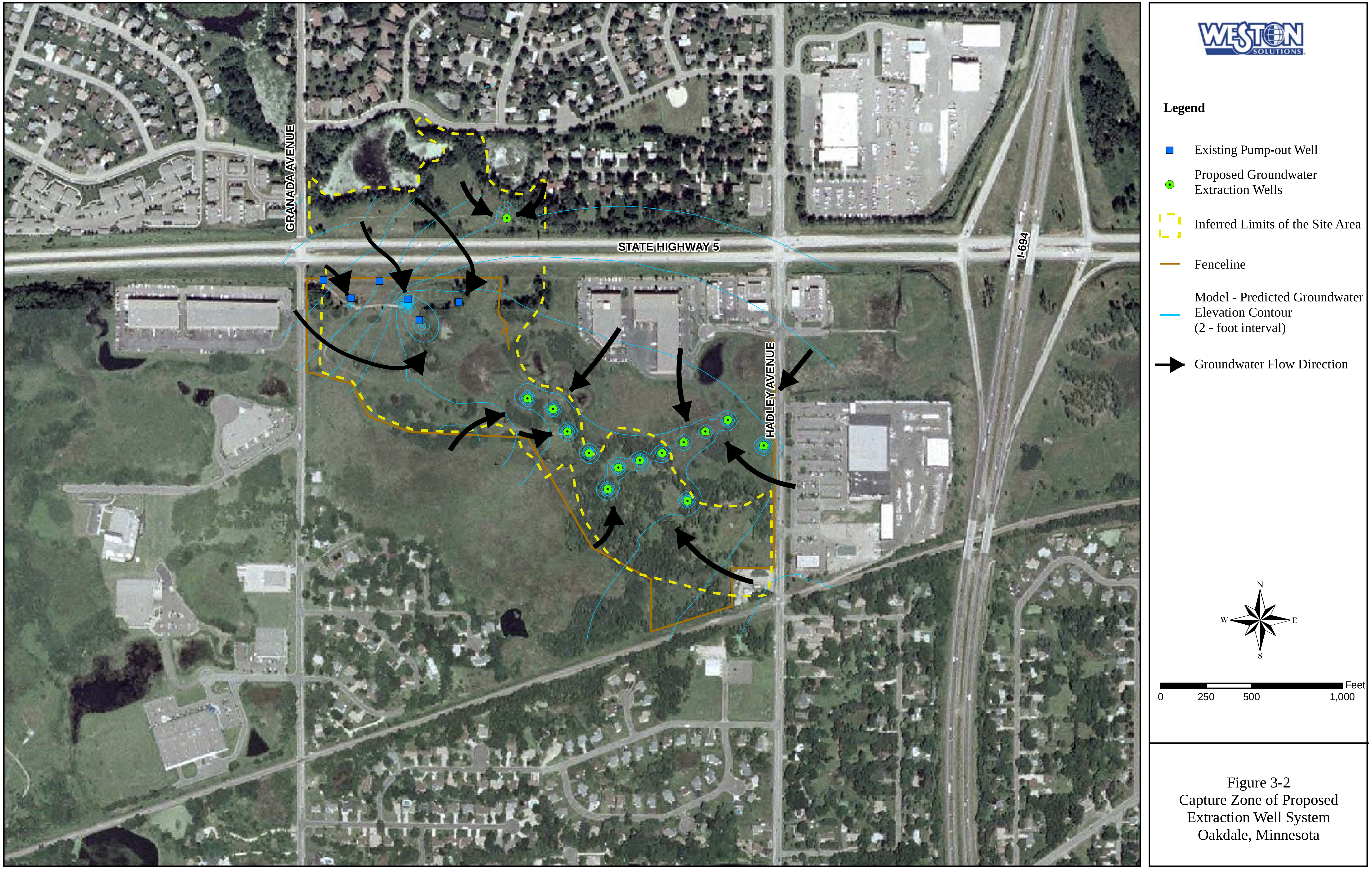


Figure 3-2
Capture Zone of Proposed
Extraction Well System
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\proposed_gw_wells_jan08_capture_new.mxd, 12-Feb-09 14:25, ricksc

WESTON SOLUTIONS

Legend

- 🟨 Water Table Monitoring Well
- ● Geoprobe Boring Location
- — Fenceline
- ▨ Inferred Limits of the Site Area

Note: GPRW-19 was completed in August 2007

N
W E
S

0 200 400
Feet

Figure 3-3

Geoprobe Locations
March 2008

Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\proposed well gp locs mar08.mxd, 12-Feb-09 14:36, ricksc

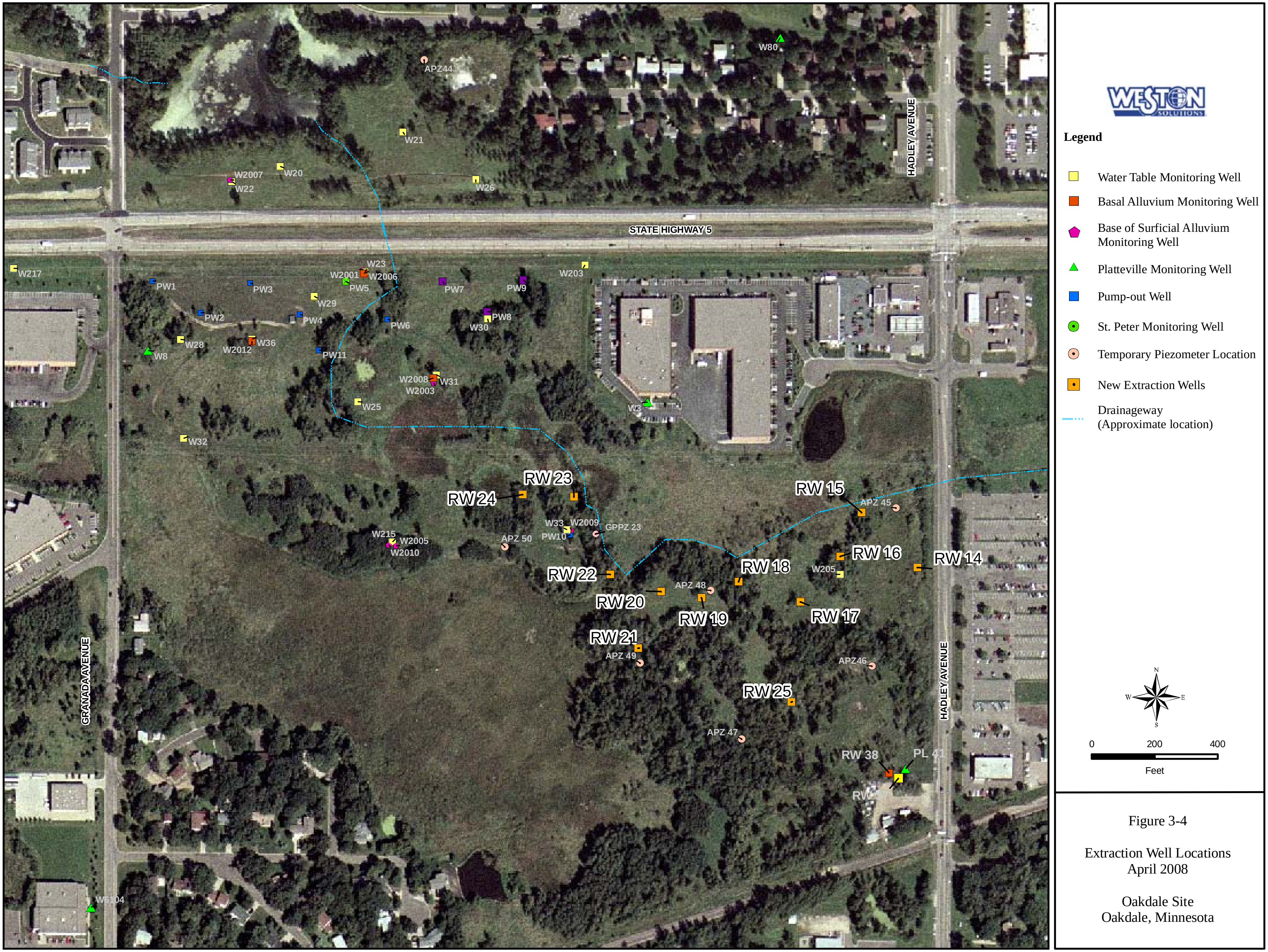


Figure 3-4

Extraction Well Locations
April 2008

Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\results_2008.mxd, 20-Jan-09 10:27, ricksc

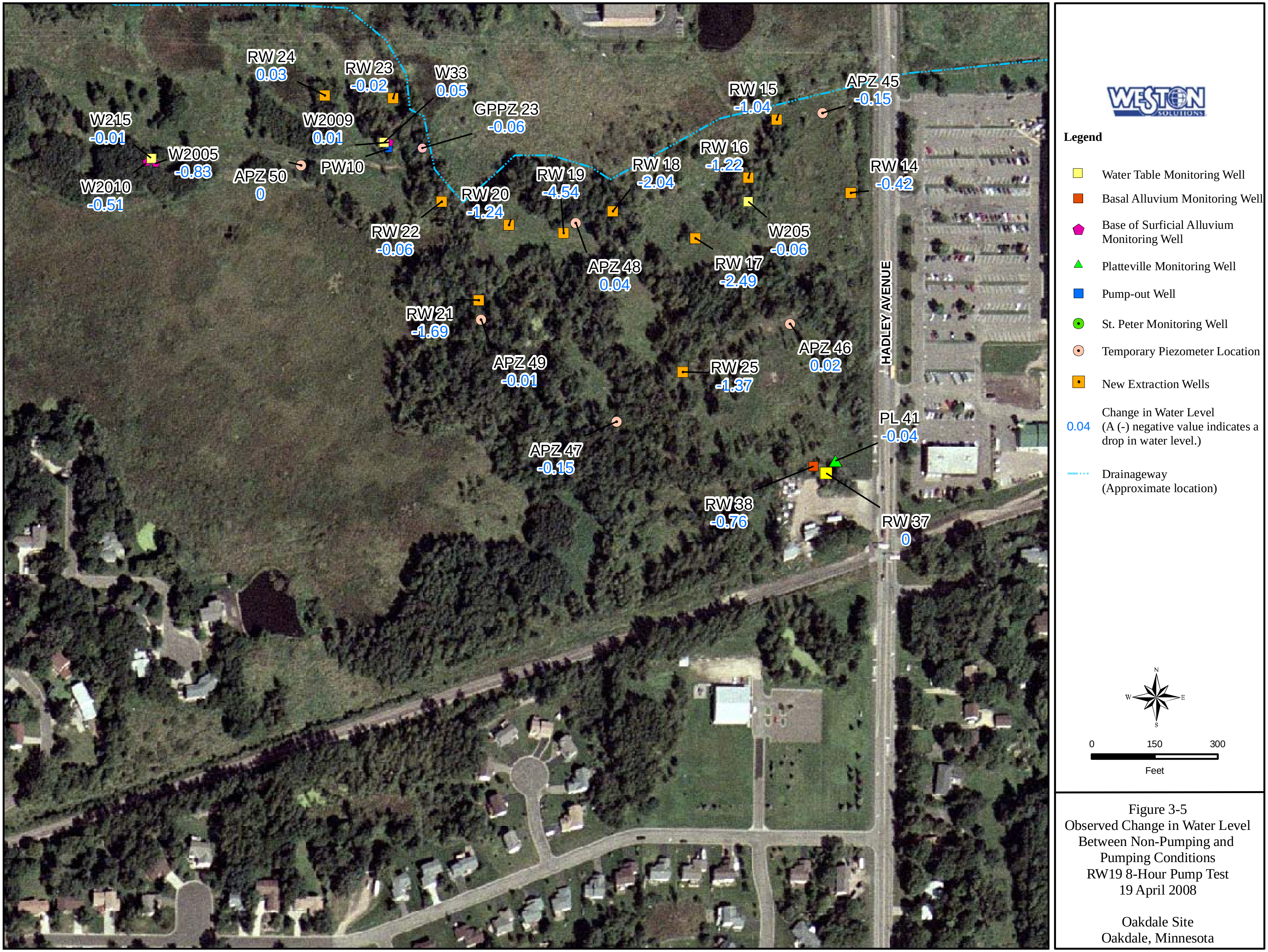


Figure 3-5
Observed Change in Water Level
Between Non-Pumping and
Pumping Conditions
RW19 8-Hour Pump Test
19 April 2008

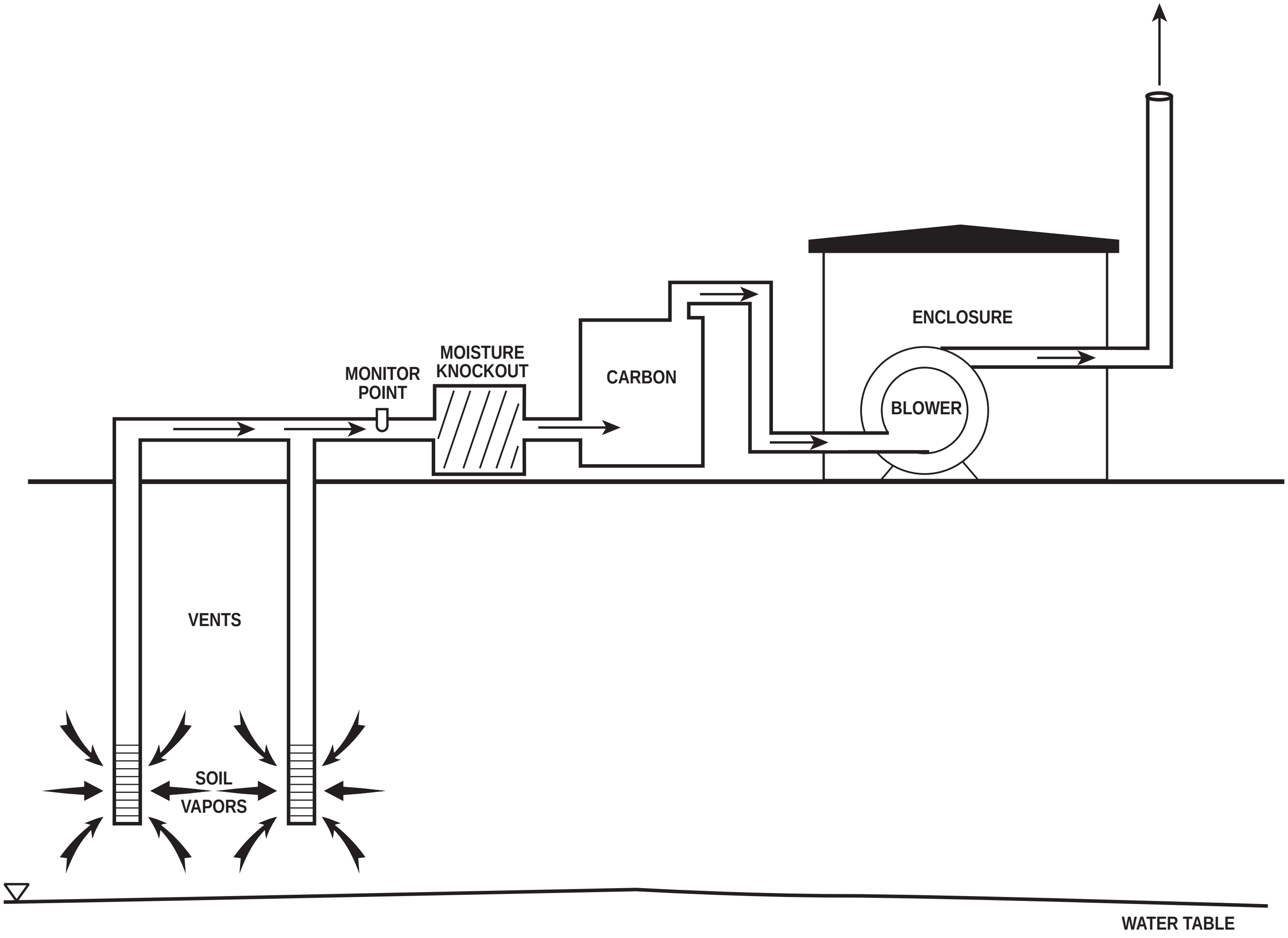
Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\results_2008_waterchange.mxd, 20-Jan-09 10:28, ricksc

Figure 3-6
Soil Alternative S-3

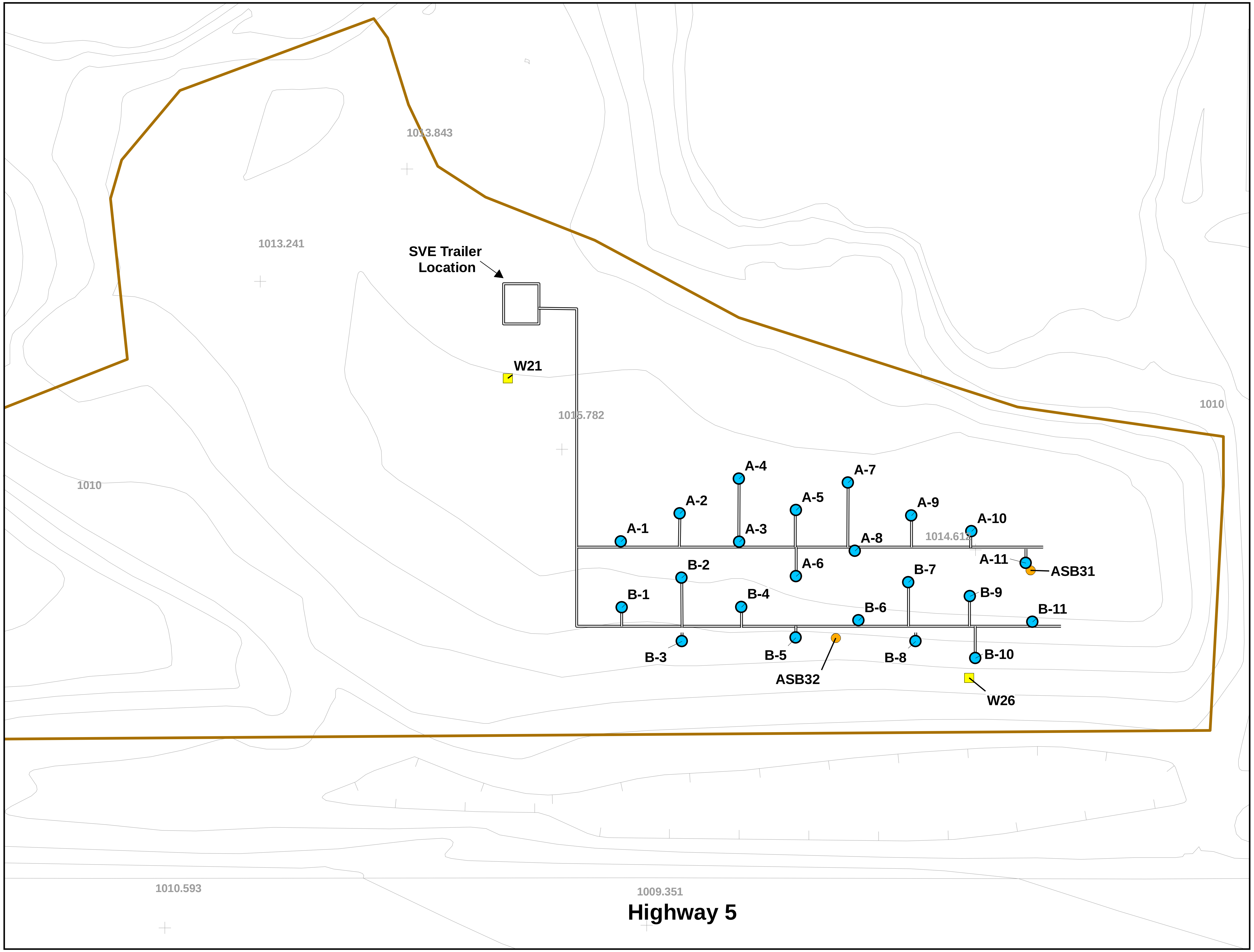
Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\impacted_soil_alt3_v2.mxd, 12-Feb-09 14:41, ricksc



08P-0097-3

FIGURE 3-7 SOIL VAPOR EXTRACTION SCHEMATIC



WESTON SOLUTIONS

Legend

Figure 3-8

SVE Layout
Area North of Highway 5
Oakdale Site
Oakdale, Minnesota

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4. DESIGN CRITERIA AND RATIONALE

4.1 MDD-SELECTED RESPONSE ACTION ALTERNATIVE

The MDD for the Oakdale Site was issued on November 4, 2008. As stated in the MDD, the MPCA has selected a combination of the following alternatives outlined in the January 2008 FS Report as the remedy to address PFC releases at and from the Site. The alternatives include the following:

- Alternative SW-2: Institutional controls, access restrictions, and groundwater monitoring. The MPCA has indicated that the long-term groundwater monitoring plan will also include the appropriate monitoring of Raleigh Creek, which extends from the eastern drainageway from the Site.
- Alternative GW-1: Enhanced groundwater recovery; air stripping/GAC pretreatment prior to sanitary sewer discharge. The MPCA has directed 3M to obtain the appropriate MCES permit for discharge of water to the sanitary sewer and that monitoring of treated groundwater will be in accordance with the RA long-term monitoring plan.
- Alternative S-3: Excavation from 0 to 4 feet, enhanced soil removal in areas with greater than 6 ppm PFOS from 4 feet to the water table, and disposal at an existing off-site landfill. In the MDD, it was stated that the MPCA had determined the permitted SKB industrial waste disposal facility in Rosemount, Minnesota, with a separate cell for the PFC wastes, meets the requirement of the May 2007 Agreement for an isolated, engineered containment facility for the excavated PFC waste material.

The MPCA further stated that this combination of alternatives best meets the response action objectives for the Site, and meets the terms and conditions of the May 2007 Agreement between 3M and the MPCA. The following sections contain the design criteria and rationale for each of the MPCA-selected alternatives.

4.2 ALTERNATIVE SW-2: INSTITUTIONAL CONTROLS, ACCESS RESTRICTIONS, AND GROUNDWATER MONITORING

For the design and implementation of this alternative the following have been considered:

- The Site is zoned commercial/industrial and will need to retain this classification. Institutional controls such as a deed restriction/environmental covenant can be used as an instrument to ensure that the Site retains commercial/industrial classification and future use and to prevent activities which may lead to an exposure to PFCs or affect the function of the selected remedy. 3M will complete an evaluation of existing deed restrictions and/or environmental covenants and ensure that measures are in place to comply with the Minnesota Uniform Environmental Covenants Act, Minn. Stat. Ch. 114E.

- The existing fence at the Site, shown in Figure 3-1, restricts access during remediation activities.

- The long-term groundwater monitoring, surface water monitoring from Raleigh Creek, and pretreated water discharge monitoring will occur and are discussed in Section 7.

4.3 ALTERNATIVE GW-1: ENHANCED GROUNDWATER RECOVERY; AIR STRIPPING/GAC PRETREATMENT PRIOR TO POTW DISCHARGE

For the design and implementation of this groundwater alternative the following have been considered:

- During the FS, groundwater modeling was performed to determine the number of additional extraction wells and their locations that would achieve the remedial objectives of preventing off-site migration of groundwater south-southeast of Highway 5, controlling groundwater discharge to the eastern drainageway, and decreasing the time to capture groundwater north of Highway 5. Figure 3-2 shows the proposed additional 14 extraction wells and associated capture zone as presented in the FS.

- As discussed in Section 3, the results of the March 2008 Geoprobe investigation were used to update the groundwater model and refine the number of additional extraction wells from 14 to 13 and to determine their locations. Twelve additional extraction wells have been installed south of Highway 5 at the locations shown on the extraction system as-built drawing, which is provided in Appendix C. The purpose of these 12 wells is to capture and prevent off-site migration of groundwater south-southeast of Highway 5 and control groundwater discharge to the eastern drainageway, which flows to Raleigh Creek. The thirteenth well will be installed in the area north of Highway 5 following excavation and restoration activities.

- The 12 new extraction wells have been in operation since November 2008. The MPCA and MCES have agreed that the system can operate for a period of 6 months without pretreatment prior to discharge. During this initial operating period, groundwater quality data and flow rate data are being collected to provide the basis for the groundwater treatment design. Groundwater extraction system flow rates recorded since November 2008 were presented in Table 3-4. These data will continue to be collected and compiled during the 6-month operating period. Groundwater samples are collected on a monthly basis and analyzed for PFCs, VOCs and certain inorganic parameters. Operation of the groundwater extraction system will continue to be monitored periodically to optimize pumping rates and capture.

- One additional final extraction well will be installed north of Highway 5 after completion of excavation activities as prescribed by Alternative S-3. The approximate location of this well was previously shown in Figure 3-2. The final location of the well will be based on updated groundwater modeling that incorporates the actual pumping rates from the expanded extraction wells system. The purpose of this well is to decrease the time required to capture groundwater north of Highway 5.

4.4 ALTERNATIVE S-3: EXCAVATION FROM 0 TO 4 FEET, ENHANCED SOIL REMOVAL (PFOS > 6 PPM) FROM 4 FEET TO GROUNDWATER, DISPOSAL AT AN EXISTING OFF-SITE LANDFILL

The horizontal and vertical limits of excavation are defined in the FS and are based on the results of analytical sampling that was completed during the RI. The horizontal limit of excavation was delineated by locations where RI soil samples contained greater than 1 ppm PFOS. The horizontal limits of excavation have been included on the Construction Drawings in Appendix E. It should be noted that the toe of the excavation sidewall slope is consistent with the excavation/removal limit as delineated in the FS. Required sidewall sloping (for stability) results in a larger overall horizontal footprint of excavation. This excess slope soil outside of the delineated FS limits would not have to be handled for removal and disposal.

The FS defined the vertical limits of excavation to be the groundwater table (between 8 feet and 12 feet bgs) in the eastern area of the Site where RI soil samples contained greater than 6 ppm PFOS. This area of deeper excavation is referred to as the area of enhanced soil removal. In the remaining area (western portion of the Site), where RI soil samples contained greater than 1 ppm PFOS, the excavation will be to 4 feet bgs. The vertical limits of excavation have been included on the Construction Drawings in Appendix E.

To prepare the excavation Construction Drawings, the vertical depths below ground surface need to be converted to elevations above mean sea level (MSL). The majority of the ground surface within the western portion of the Site (where a 4-foot excavation is specified) is located at or above the 1,010-foot MSL elevation contour. Therefore, the majority of the excavation bottom within this area has been set at 1,006 feet MSL. The western corner of this area, which includes a drainage swale, will be excavated deeper.

To set the excavation bottom elevation within the deeper area of excavation, historic groundwater elevation measurements from monitoring wells W21 and W26 were reviewed. These data are presented in Figure 4-1. As shown in the figure, groundwater elevation fluctuates. However, in general, the average groundwater elevation in W21 since 1998 has been approximately 1,003 feet MSL; and the average groundwater elevation in W26 since 1998 has been approximately 997 feet MSL. For purposes of depicting the vertical limits of excavation in the construction drawings, these two points were used to set the excavation bottom elevation for the deeper excavation area. The bottom of the excavation was sloped to match the approximate groundwater contours in the area, which are oriented approximately 20° north of east.

A review of Figure 4-1 shows that the depth to groundwater in the excavation area can fluctuate over multiple feet within a relatively short period of time. Therefore, the actual bottom elevation in the area of deeper excavation may differ from the Construction Drawings. Prior to commencing excavation activities, sampling for waste disposal profiling (as discussed in the Construction Sampling Plan) will be completed. During these activities, the groundwater elevation will be measured, and these data will be used to update the final excavation bottom elevation.

Groundwater fluctuation between the time of profile sampling and construction implementation may still be expected. Therefore, the final excavation depth in the deeper excavation area will be determined based on field conditions at the time of excavation so that excavation or construction into groundwater does not occur for the following reasons:

- Saturated soils or soils containing free water are not being removed for trucking and landfill disposal.

- The excavation should not collect groundwater that will need to be managed or removed.

- Construction stability, both for the excavation bottom and sidewalls, can be best maintained in unsaturated conditions.

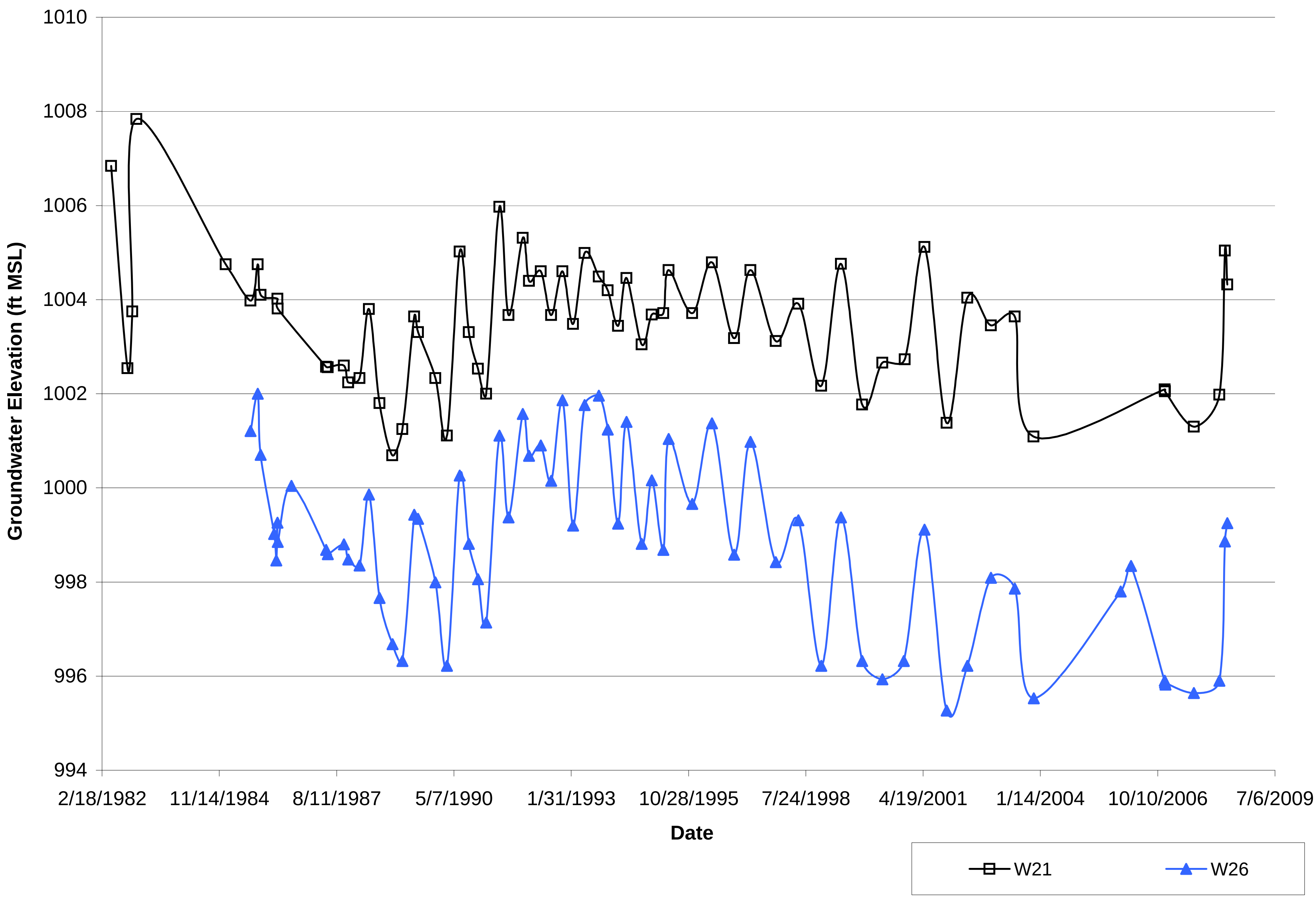
- Construction equipment can operate in dry/drained conditions without becoming stuck.

- Muddy conditions will impact decontamination requirements and may result in excess tracking of material onto public roadways.

To minimize the volume of groundwater requiring handling and to facilitate construction, an approximate 1-foot buffer will be maintained between the bottom of excavation and the field-identified level of area groundwater.

SECTION 4 FIGURES

Figure 4-1 W21 and W26 Historic Groundwater Elevations
Oakdale Site



5. REMEDIAL DESIGN – METHODS AND TECHNIQUES

5.1 OPERATIONAL CONTROLS

Deed restrictions (e.g., an environmental restrictive covenant and/or real property notification/affidavit) are required as part of the soil removal alternative to ensure that the site use remains compatible with the remedy (i.e., open space) and that the remedy is not disturbed. As part of the RA, 3M will review and update all restrictions and environmental covenants to make them consistent with MPCA guidance/requirements, in particular, the Minnesota Environmental Covenants Act, Minn Stat. Ch. 114E. Currently, the entire Oakdale Site is in a groundwater drinking well prohibition area. This prohibition will prevent a potential on-site groundwater exposure pathway.

Access control, by means of fencing, is already in place both north and south of Highway 5 to prevent unauthorized access and potential contact with soils containing PFCs before and during construction activities.

South of Highway 5, the presence of numerous monitoring and extraction wells and the groundwater discharge building requires that access restriction to this area be maintained. Therefore, following RA activities, this area will remain fenced to prevent unauthorized access. Following RA activities north of Highway 5, the construction fence will be removed and the property will be restored and returned to open space. In preparing the restoration plan for the area north of Highway 5, 3M will discuss the plan with the City of Oakdale.

Groundwater monitoring will continue for an assumed period of up to 30 years to ensure that the groundwater recovery system remains effective and to evaluate the progress of the remedial activities. Long-term RA monitoring is described in Section 7.3 of this document.

5.2 GROUNDWATER EXTRACTION AND TREATMENT

Alternative GW-1 consists of enhanced groundwater extraction with two primary goals:

- Provide capture, prevent off-site migration of groundwater south-southeast of Highway 5 (near monitoring wells W205 and W33), and control groundwater discharge to surface water.

- Reduce the time to capture groundwater north of Highway 5.

As described in Section 3.2, 12 new extraction wells and associated electrical and mechanical components were installed in October 2008 and have been in operation since that time. In accordance with the agreement with MPCA and MCES, the extraction system will operate for a period of 6 months (from November 4, 2008). During this time, the extracted groundwater is directly discharged to the MCES sewer in accordance with the industrial discharge permit. Analytical data will be collected for use in establishing the final groundwater treatment design basis. The industrial discharge permit will be modified to allow discharge of extracted groundwater beyond the initial 6-month period.

Due to the 90-day requirement for submission of the RD/RA Plan following the issuance of the MDD, insufficient analytical and flow data will be available to fully design the treatment components. Also, the MCES discharge requirements, which will affect the treatment process and design, are not known at this time. Based on the initial data (summarized in Table 5-1), a conceptual approach to treatment has been completed; however, final design will occur following the 6-month interim groundwater pumping period.

As discussed in Section 3.2, groundwater extracted from south of Highway 5 is currently being discharged directly to the MCES sewer adjacent to the existing groundwater discharge building. As part of the RA, groundwater will be directed through a new system to treat PFCs. It is assumed that the new treatment system will be configured as follows:

- A new building will house the new treatment process. The treatment building may include the following process units in addition to the pumps, piping and instrumentation.
  - An equalization tank.
  - Equipment for VOC removal.

- Equipment for iron removal.
- A minimum of two liquid-phase GAC units installed in a lead/lag configuration to treat PFCs present in the groundwater.

The design will include techniques to minimize the impact to neighbors in the surrounding area (i.e., impacts with respect to building height, noise from operations, and lighting). Final treatment design will be based on analytical data and MCES permit requirements. Treated groundwater will be discharged to the MCES sewer, in accordance with a modified discharge permit.

As part of the interim activities, a 2-inch diameter HDPE pipe has been installed from the existing discharge building, beneath Highway 5, to a capped termination point north of the highway. This pipe was installed in accordance with a State of Minnesota Department of Transportation (MNDOT) Utility Permit on Trunk Highway Right-of-Way. As such, the pipe is contained within a 4-inch diameter HDPE carrier pipe in the area beneath the highway.

Following the completion of RA soil excavation activities north of Highway 5, a new extraction well will be installed in the approximate location shown in Figure 3-2. This well will be installed in a manner consistent with the extraction wells south of the highway and will be used primarily to reduce the time for capture of groundwater north of the highway.

5.2.1 Collection of Design Data

In accordance with the current agreement with MPCA and the MCES, the expanded extraction system (installed as an interim action) will operate for a period of 6 months. During this time, no treatment will be required; however, analytical data will be collected for use in establishing the final groundwater treatment design basis. A partial data set has been completed; however, ongoing operation and data collection will occur through at least April 2009 to provide additional information for the design. A permit modification will be requested to continue operation of the new extraction wells beyond the initial 6-month period.

In conjunction with groundwater analytical data that are being collected, a number of treatability tests are currently planned or underway to assist in designing the groundwater treatment system. For example, initial analytical results indicate that the concentration of iron in the groundwater may cause iron fouling of a GAC column. Therefore, testing to determine if a chemical additive (such as potassium permanganate or an organic polymer) can be used to precipitate iron is underway. Also, VOC concentrations appear to be very low, and air stripping may not be needed to remove VOCs prior to GAC treatment.

Once these data are available, a remedial design will be finalized; this activity is anticipated to begin in May 2009. To provide continued groundwater capture during the design and installation period, 3M plans to request an extension to the interim pumping period in the current MCES permit.

5.2.2 Overall Sequence of Construction

Although the detailed construction activities cannot be determined until the design of the treatment system has been completed, the general sequence of construction can be described. Initially, geotechnical evaluation of potential treatment building locations will be completed (data from initial test borings have already been collected) to identify a suitable location and define the type of building foundation that may be required.

Following the completion of treatability testing, analysis of extracted groundwater samples, geotechnical review, and determination of sewer discharge requirements, the final design of the treatment system will be prepared. This design will specify the required treatment units, building design, piping interconnections, system interlocks, site access/security and utility requirements. Equipment and process specifications will be prepared, based on the finalized design.

Construction contractor selection, permit applications (Section 5.2.3) and treatment plant construction will occur following detail design activities. Information on these activities will be communicated to MPCA as required by permits and documented in the Final Construction Completion Report.

If necessary, site grading and on-site access road improvements will be completed. Since the frequency of site access will likely increase once the treatment system becomes operational, the primary point of access from Granada Avenue may be relocated to an existing gate farther south from the Highway 5 intersection. This will reduce traffic congestion issues that may arise when accessing the site at the current location (which is very close to the intersection of Granada Avenue and Highway 5).

The new building foundation and any site regrading will result in the excavation of site soils and potentially historic industrial waste debris. Any excavated site soil will be maintained and managed on-site as fill or grading material. Any excavated debris will be characterized and sent for off-site disposal at an approved landfill.

Once construction activities are completed, a startup and shakedown period will occur. During this time, all components of the treatment system will be tested and optimized. Once all systems are running consistently, a construction completion report will be prepared for the groundwater treatment process.

5.2.3 Identification of Applicable Permits (Groundwater Treatment)

The construction contractor and/or 3M will be required to obtain and comply with the permits necessary to complete these activities. A summary of the permits which may be applicable and their basic requirements are presented below. Other permits or approvals may be identified as the project progresses.

5.2.3.1 MCES Permit

As part of the groundwater treatment design and prior to construction, discussions with MCES will occur to determine the final permitting and discharge requirements. An application for a modified discharge will be required. This application will present the analytical data that have been collected, the anticipated treatment process and anticipated treatment effectiveness, and the resulting anticipated constituent discharge concentrations and effluent flow rate. Based on this information, it is assumed that MCES will issue a revised discharge permit that outlines any modified effluent discharge criteria and authorizes the construction of the groundwater treatment system.

5.2.3.2 Stormwater General Permit for Construction Activities - MPCA

Based on the area of land disturbance, a stormwater general permit for construction activities will be required. Minnesota regulations and MPCA require that a stormwater permit be obtained when more than 1 acre of an area is disturbed during a construction activity. As part of the treatment plant design, stormwater management requirements, erosion and sedimentation (E&S) controls, and best management practices will be defined. These measures will be applied regardless of whether a stormwater permit for construction is required.

5.2.3.3 Land Alteration and Grading Application – Washington County and Valley Branch Watershed

Chapter 2, Part 3, Section 1.6 of the Washington County Zoning Ordinance includes a requirement that a grading permit be obtained when land alteration and grading of more than 50 cubic yards and/or the disturbance of more than 1,000 square feet occurs. Additionally, Section VI, Subdivision 2 of the Rules and Regulations of the Valley Branch Watershed District requires that a Valley Branch Watershed District permit be obtained when land alterations, including grading and filling that remove or cover surface vegetation of more than 1 acre, occur. Based on the final construction plans, the construction contractor may be required to obtain Washington County and Valley Branch Watershed grading permits for earthwork and grading activities associated with the construction of the treatment building and road modifications.

5.2.3.4 Monitoring and Extraction Well Construction Permit - MDH

One new extraction well will be installed north of Highway 5 following the completion of excavation activities. A Minnesota Department of Health (MDH) well permit will be obtained prior to the construction of this well. As described above, the extraction well north of Highway 5 will be installed to reduce the groundwater travel time prior to capture. Monitoring well(s) may be installed to track the performance of this extraction well and potentially to replace wells W21 and W26 that will be sealed and abandoned prior to excavation activities. These wells will be installed by a certified driller in accordance with the State of Minnesota Water Well Code.

5.2.3.5 City of Oakdale Construction Permits

Preliminary discussions with the City of Oakdale have identified a number of potential city permits and/or approvals that may be required. Due to the construction of a new building, a Special Use Permit for excavation will be required to ensure that the constructed building meets City of Oakdale requirements. In addition, mechanical, electrical and plumbing permits and inspections will be required prior to and following construction.

5.2.3.6 Right-of-Way Management (Curb Cutting) – City of Oakdale

In accordance with the City of Oakdale Code of Ordinances Chapter 20 – Right-of-Way Management, a permit is required to excavate or obstruct a right-of-way in a manner that hinders free and open passage. Although the activities associated with the RD/RA will not require excavation or obstruction of the right-of-way, Chapter 20 also imposes requirements for curb cutting. Specifically, the following requirements must be observed:

- Existing curbs must be removed in whole sections.
- Portions of the existing pavement structure that are disturbed during the curb cut must be repaired with similar materials of equal or greater structural capacity. Repair limits must be defined by right-angle saw cuts.
- The period between removing the existing curb and constructing the new entrance must not exceed 72 hours.

This work may be performed when the access road is reconstructed and the curb cut moved south from its current location on Granada Avenue.

5.2.3.7 Minnesota Air Permitting Review

In accordance with the MPCA requirements, facilities that have the potential to emit (PTE) a regulated pollutant above designated threshold amounts will need to obtain an air emission permit. If an air stripper or other VOC reduction process is included as part of the groundwater treatment design, an evaluation of the corresponding PTE will be performed.

In accordance with the permit requirements, there are two categories of regulated pollutants: criteria pollutants and hazardous air pollutants (HAPs).

The regulations (Chapter 7001 of the Minnesota Administrative Rules) define a number of criteria pollutants; however, only total VOC emissions that have a threshold quantity of 100 tons per year appear to be applicable to this process. The maximum total VOC concentration measured in the combined discharge to the POTW since the new extraction wells have been put online is 5.6 mg/L. The maximum design flow rate for the extraction system is 120 gpm. Assuming 100% of the VOCs are emitted during continuous maximum operation, the VOC PTE is 1.5 tons per year. Since this value is far below the 100 ton per year threshold criteria, it is expected that no permit is required for the criteria pollutants.

Of the parameters anticipated in the extracted groundwater, and therefore regularly measured as part of the MCES permit, a number of compounds are considered HAPs. Table 5-2 summarizes these compounds, the maximum concentration measured in the combined discharge to the POTW since the new extraction wells have been operational, and the resulting PTE for each compound.

As referenced in Table 5-2, the maximum individual HAP PTE is 0.206 ton per year based on data collected in December 2008 and January 2009. No individual HAP PTE is above the 10 ton per year threshold, nor is the total combined HAP PTE above the 25 ton per year threshold; therefore, it is expected that no permit is required for HAP emissions.

As part of the final design of the treatment system and based on the revised MCES discharge permit, this evaluation will be reviewed and updated at system startup to verify that the PTE remains below regulatory thresholds.

5.3 SOIL EXCAVATION

As described in the FS, soil removal will be conducted to prevent contact with all accessible surface soil (defined as soil between 0 and 4 feet below the ground surface [MPCA, 1998a]) within the defined area and to reduce the mass of PFCs in soil.

The approved FS defined the area of soil to be excavated (see Figure 3-6). Throughout this area, the upper 4 feet of soil will be removed and transported to an existing permitted off-site landfill to provide engineered isolation and containment of PFCs. Additional soil below the 4-foot accessible zone with PFOS concentrations greater than 6 ppm was also defined in the approved FS, and will be removed. Therefore, the soil excavation activities included the following components as shown in Figure 3-6.

- Excavate the upper 4 feet of soil within the defined area.
- Excavate soil with a PFOS concentration greater than 6 ppm as defined in the FS at depths above the groundwater table (approximately 8 to 12 feet).
- Backfill the excavation with clean fill and top soil, and grade the area to facilitate stormwater drainage.
- Transport excavated soil to an existing permitted off-site landfill to provide engineered isolation and containment of PFCs.

5.3.1 Overall Sequence of Construction

The initial step will be to close out, seal, and abandon the two monitoring wells (W21 and W26) located within the area of excavation. The SVE system will be decommissioned by removing the trailer, GAC and aboveground piping. The SVE subsurface vents will be removed as part of the soil excavation.

Site preparation will be initiated to clear excess vegetation from the construction area, place the site construction trailer(s) and sanitary facilities, set up survey control and delineate excavation areas. Following site clearing activities, sediment and erosion controls will be installed. Silt fence will be placed along the limits of clearing and in other areas of concern, as necessary (see the Construction Drawings in Appendix E).

An all-weather temporary access road will be constructed to accommodate trucks hauling out excavated soil and delivering soil backfill. This temporary access road is currently an unimproved road which requires upgrading to accommodate heavy truck traffic. The access road will have a width of approximately 20 to 25 feet to allow for two-way traffic. A temporary fence and gate structure currently exists at the entrance off Granada Avenue. This entrance will be moved north approximately 200 feet from the intersection with Highway 5 and will be gated to provide access control to the Site. Details of this access road improvement are included in the Construction Drawings.

A stormwater swale crosses the western portion of the excavation footprint and must be relocated to avoid interference with site access and excavation activities. This swale drains the overflow from the western pond, and drainage is conveyed south under Highway 5. Flow through this swale is seasonal and dependent upon precipitation and runoff. Following improvements to the access road, the swale will be relocated to the west so it is not within the excavation footprint, and water flow will be piped under the access road.

Detailed site operations and construction sequencing of the excavation will be determined by the extraction contractor. As part of the contract bid documents, potential contractors must provide a Site Operations Plan, including an excavation phasing plan to describe their proposed approach, including maintenance of haul roads and exclusion and clean zones. Following contractor selection, the contractor will be required to submit a formal Site Operations and Excavation Plan for 3M to review and approve. These plans will describe phasing of excavation and backfilling, on-site traffic flow, stockpile planning and decontamination requirements. Mobilization will not commence until these plans have been approved by 3M.

Soil generated from grading activities (road construction, swale management, etc.) that occur outside the limits specified for soil removal will not require disposal and will be managed on-site. Soils within the specified limits of removal will be transferred for off-site disposal.

Following the completion of excavation activities, the site will be restored to the approximate pre-excavation grade, with the exception of the new relocated drainage swale. The swale will remain in its new location; however, the concrete drainage pipes will be removed and the bottom of the swale will be graded to match the current swale elevation of 1,008 feet mean sea level (feet MSL). Construction Drawings included in Appendix E provide additional details.

The surface of the haul road will be removed, the site will be seeded, and the perimeter construction fence will be removed. Following communication with the City of Oakdale, the ultimate long-term plan for the site will be determined.

5.3.2 Contractor Selection

To ensure flexibility in the field and to take advantage of contractor expertise and preference, performance-based construction bid documents will be prepared. Table 5-3 presents a preliminary list of the performance-based requirements that the contractors will be required to meet. These documents may be supplemented by applicable 3M-specfic requirements during the bidding phase. The bid documents will also be supplemented by a number of the plans included as part of this RD/RA document.

As part of the bid documents, contractors will be required to submit a number of conceptual plans that will present their overall approach to construction. Potential contractors have not yet been identified. However, at a minimum, a Site Operations and Excavation Plan, Environmental Protection Plan and a Health and Safety Plan will be required. The submittals from all contractors will be reviewed during the selection process to ensure that the contractor has the required experience, capabilities and approach to perform the excavation successfully and not spread or release site constituents. The qualified contractors that meet these requirements will be considered by 3M for selection.

Following selection, and prior to mobilization, the selected contractor(s) will be required to provide formal submittals of the following documents (at a minimum), as applicable to their activities:

- Site Operations and Excavation Plan: This plan will describe the overall approach to completing the construction and include a construction schedule. Specifically, the contractor must describe the anticipated excavation method and equipment, on-site truck routing, excavation phasing, the placement and removal of temporary haul roads, the placement and protection of on-site clean and PFC-containing soil stockpiles, the placement of construction trailers and sanitary facilities, maintenance of E&S controls, management of stormwater and access control.

- Environmental Protection Plan: This plan will describe how the contractor plans to maintain the exclusion zone and prevent cross-contamination between clean soils and soils containing PFCs. The plan will define exclusion zones, the process for allowing vehicles and equipment to enter and exit exclusion zones, and any decontamination that will be required prior to allowing vehicles or equipment to exit the exclusion zone. If vehicles will be crossing from the exclusion zone into the clean zone, then the plan must describe the method of decontamination, as well as the source and disposition of decontamination water and solids. This plan will also describe the mitigation of dust, noise, mud and odor, and the safety methods to be employed.

- Health and Safety Plan: The contractor will be required to submit a project specific health and safety plan that outlines the methods, procedures and PPE that will be used to ensure the safety of the contractor’s employees. At a minimum, the Contractor’s HASP must be as protective as the Site-Specific Security, Health and Safety Plan described in Section 6.5.

Mobilization of contractors to the site will not be permitted prior to approval of these and other required documents.

5.3.3 Identification of Applicable Permits (Excavation Activities)

It will be necessary for the contractor and/or 3M to obtain and comply with the permits necessary to complete these activities. A summary of the permits which are likely to be applicable and their basic requirements are further described below. This permit list may change as the project develops.

5.3.3.1 Stormwater General Permit for Construction Activities - MPCA

Based on the area of land disturbance, a stormwater general permit for construction activities is required. Minnesota regulations and MPCA require that a stormwater permit be obtained when more than 1 acre of an area is disturbed during a construction process. Attachment 1 presents in detail the proposed stormwater management process, and includes a draft stormwater permit application and a draft Stormwater Pollution Prevention Plan (SWPPP). These documents will be finalized following contractor selection to include contractor input and reference any contractor-provided plans.

The existing stormwater drainage swale which conveys overflow from the west pond will be relocated and reconstructed west of its current location prior to site excavation activities to prevent stormwater from coming into the open excavation area. Enclosure (piping) of this swale will also be completed as part of the access road improvement. Soil generated during the installation of the new drainage swale is outside the impacted area (as defined in the FS), and can therefore be managed on-site.

The new swale will be constructed with a pipe invert elevation of approximately 1,007 feet MSL on the north and south sides of the access road. Two new 12-inch diameter concrete pipes will be installed beneath the access road; masonry wingwalls north and south of the concrete pipe inlet will direct stormwater into the pipes and beneath the road. Riprap will be installed south of the road at the discharge of the concrete pipe to dissipate hydraulic energy as stormwater is returned to the natural watercourse. The Construction Drawings included in Appendix E present additional detail on the relocation and reconstruction of the swale.

The concrete pipe will be covered with stone to form a passable driving surface for the truck traffic entering and leaving the site. The elevation of the new access road surface will be approximately 1,009 feet MSL.

Additional temporary diversion berms or barriers may be constructed around the area of open excavation to divert run-on of stormwater during rain events. The two existing ponds and natural topography will serve to collect and divert much of the stormwater and run-on around the excavation area. Other methods will be employed to minimize the quantity of construction water, such as managing the area of open excavation as a small footprint and backfilling when the excavation is completed. This approach will result in the site excavation and backfilling to proceed in segments or phases. Any rainwater that enters the active excavation will be designated as construction water and treated as potentially containing PFCs. To the extent practicable, this water will be allowed to infiltrate into the ground for recharge to minimize the volume of water required to be managed. Excess water will be pumped from the excavation area and into on-site temporary tankage (likely 20,000-gallon Baker Tanks, or similar) to contain the stormwater prior to discharge. It is anticipated this water will be pumped through the existing 2-inch diameter HDPE pipe beneath Highway 5 and into the MCES sewer system on the south side of the property. The discharge of this construction water will occur in accordance with an approved MCES discharge permit.

Erosion will be controlled during construction primarily by using silt fence and straw hay bales placed adjacent to and downslope of disturbed areas, along access roads, surrounding stockpiles, and in areas most susceptible to erosion as shown on the construction drawings. These measures will prevent the uncontrolled transport of soil off-site from the disturbed construction areas until permanent vegetation is established. The access road will include placement of stone to serve as a “tire scrubber” on the haul road to remove soil or mud that is adhered to vehicles before the vehicles leave the site. The contractor will be required to remove any mud and dirt that is deposited on Granada Avenue and to maintain/repair E&S controls.

During construction activities, all E&S controls will be inspected at least once every 7 days and within 24 hours after a rainfall event greater than 0.5 inches in 24 hours. A written log of these inspections will be kept which will record information such as the date of the inspection, name of the inspector, weather conditions, observations, corrective actions completed and the date the actions were taken. A copy of a typical inspection log is presented in Attachment 1.

For silt fencing, accumulated sediments will be removed as necessary to keep the fence functional. Typically, sediment deposits that reach approximately one-third the ground height of the fence will be removed. Undercutting or erosion of the toe anchor will be promptly repaired with compacted backfill materials. Any filter fabric material that has deteriorated or is damaged due to weathering or storm events will be replaced.

Riprap aprons may be used as tire scrubbers to remove dirt/mud from vehicle tires before vehicles leave the site. They may also be used for outlet protection to dissipate velocity. Accumulated sediments that collect in the riprap and affect its function will be removed or new riprap added. Areas in which riprap has been displaced or is missing will promptly be repaired.

If inclement weather adversely affects construction or the ability to control sediment tracking, the work activities will be reduced or temporarily suspended. An improved site access road will be constructed to facilitate vehicle access during most weather conditions. Additional temporary haul roads will be constructed on-site by the contractor to facilitate truck traffic to the various excavation and backfill areas. These temporary haul roads will also minimize the potential for tracking mud or dirt outside of the work areas. Haul roads will be maintained as needed by the contractor to remove any accumulated mud and dirt to provide all-weather access.

5.3.3.2 Well Abandonment - MDH

Two existing monitoring wells (W21 and W26) located within the excavation area will be plugged and abandoned in accordance with the State of Minnesota Water Well Code. Following the excavation activities, these wells may be reinstalled if required.

5.3.3.3 Land Alteration and Grading Application – Washington County and Valley Branch Watershed

Chapter 2, Part 3, Section 1.6 of the Washington County Zoning Ordinance requires that a grading permit be obtained when land alteration and grading of more than 50 cubic yards and/or the disturbance of more than 1,000 square feet occurs. Additionally, Section

VI, Subdivision 2 of the Rules and Regulations of the Valley Branch Watershed District requires that a Valley Branch Watershed District permit be obtained when land alterations, including grading and filling that remove or cover surface vegetation of more than 1 acre, occur. These permits will be required prior to access road improvement, site grading and excavation activities.

5.3.3.4 City of Oakdale Construction Permits

Preliminary discussions with the City of Oakdale have identified a number of potential city permits and/or approvals that may be required. Due to the excavation activities, a Special Use Permit for excavation will be required.

5.3.3.5 Right-of-Way Management (Curb Cutting) – City of Oakdale

In accordance with the City of Oakdale Code of Ordinances Chapter 20 – Right-of-Way Management, a permit is required to excavate or obstruct a right-of-way in a manner that hinders free and open passage. Although the activities associated with the RD/RA will not require excavation or obstruction of the right-of-way, Chapter 20 also imposes requirements for curb cutting. Specifically, the following requirements must be observed:

- Existing curbs must be removed in whole sections.
- Portions of the existing pavement structure that are disturbed during the curb cut must be repaired with similar materials of equal or greater structural capacity. Repair limits must be defined by right-angle saw cuts.
- The period between removing the existing curb and constructing the new entrance must not exceed 72 hours.

This work may be performed when the access road is reconstructed and the curb cut moved north from its current location on Granada Avenue.

5.3.4 In Situ Soil Profiling

Prior to conducting any excavation activities, the soil within the limits of excavation will be sampled in situ for disposal profiling and acceptance at identified disposal facilities. The primary disposal facility is the SKB Landfill; however, it can accept only non-hazardous material. Soils that do not meet non-hazardous acceptance criteria may be stockpiled during excavation for additional ex situ profiling. The Construction Sampling Plan (Attachment 2) describes this process in detail.

For the in situ sampling layout, the excavation footprint will be overlain by a grid pattern. Areas with the potential for higher VOC concentrations (e.g., the area where the excavation goes to the groundwater table) will use a 50-foot grid pattern; other areas will use a 75-foot grid. Samples will generally be collected every 4 feet below grade.

All soil samples will be analyzed for total VOCs and polychlorinated biphenyls (PCBs). One in every 10 soil samples will also be analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP metals, reactivity and flammability. Based on these results, and in accordance with MPCA's August 19, 2008 letter, 3M will request a formal waste characterization determination from MPCA.

Areas containing soils with VOC, PCB and metal concentrations that are below TCLP criteria and certain VOCs that are below industrial Soil Reference Values (SRVs) will be excavated and may be direct-loaded for non-hazardous disposal (i.e., SKB Landfill). Areas containing soils with VOC, PCB and/or metal concentrations that exceed TCLP criteria SKB acceptance criteria or soils with VOCs that exceed industrial SRVs will be excavated and the soils staged in a designated area on-site for ex situ disposal profiling and subsequent off-site disposal (see Attachment 2, Construction Sampling Plan).

The purpose of this sampling effort is to develop a waste stream profile for subsequent off-site disposal. This profile will be used so that the material is transported in accordance with Resource Conservation and Recovery (RCRA) and U.S. Department of Transportation (DOT) regulations to an appropriate permitted facility for final disposition. Quality assurance/quality control (QA/QC) samples will be collected as discussed in the Quality Assurance Project Plan (QAPP) (included as Attachment 3).

It is currently assumed that the majority of the excavated soil will go to the SKB Landfill for disposal. The SKB Waste Acceptance Plan (April 2008) describes their required sampling frequency and criteria to achieve waste acceptance ("pre-approval"). The following criteria have been described in the SKB Waste Acceptance Plan:

- Soils must be sampled at a frequency of one sample per 2,000 cubic yards.
- If the TCLP analytical results indicate that a sample contains greater than 75% of the regulatory TCLP threshold, then soils must be sampled at a frequency of one sample per 500 cubic yards.
- Waste Receipt Screening: Organic vapor in the headspace of a sample is used as an indicator of the level of VOC in a waste load. Detection of organic vapors above 200 ppm may result in further characterization, e.g., flashpoint data may be collected.

The sampling methodology described in this Construction Sampling Plan is consistent with the SKB requirements, assuming that the area gridded on 75-foot intervals does not exceed 75% of the TCLP threshold.

5.3.5 Site Preparation

As described above, a Stormwater Pollution Prevention Plan (SWPPP) is required, and is included in Attachment 1 to this document. It will be the excavation contractor's responsibility to comply with the requirements of the SWPPP.

Minor clearing and grubbing activities will be completed to provide access to all areas of the excavation footprint, as well as establish locations for potential soil stockpile and/or equipment staging.

Currently, the site is accessed from an existing curb cutout on Granada Avenue located less than 10 feet north of the intersection with Highway 5. A new access point and curb cut to Granada Avenue will be installed approximately 200 feet north (as measured to the centerline of the new access road) of the intersection to allow truck traffic to safely enter and exit the site. An improved all-weather access road will be constructed on-site (wide enough for two trucks to pass) to allow access to the excavation area and minimize the tracking of mud and debris onto the public roadway. Swale diversion (see Section 5.3.3.1) will be completed as part of the road improvement. Road construction details are presented on the Construction Drawings.

In situ soil sampling will be conducted prior to excavation, for disposal profiling of the excavated soil as described in Section 5.3.4. The temporary SVE blower system, vapor-phase GAC, and aboveground piping will be decommissioned, and the SVE equipment will be removed prior to mobilization of the excavation contractor. The two GAC vessels will be emptied, the GAC characterized, and the vessels removed from the site. The SVE trailer will be disconnected from electrical service, and the unit will be removed from the site. Xcel Energy will be contacted to lock out power to the site, which consists of underground service from the power pole south of Highway 5 to the transformer installed north of Highway 5.

As part of site preparation, construction trailer(s), sanitary facilities and construction water collection tanks (Baker tanks) will be set up on-site in a support area outside the exclusion area. The existing underground power line will be rerouted to the construction trailer support area.

All E&S controls will be installed according to the plans and an underground utility clearance will be completed prior to excavation field activities.

5.3.6 Installation of a Meteorological Monitoring Station

Continuous monitoring and documentation of on-site meteorological conditions are required to achieve a number of goals:

- Data collected during perimeter air monitoring for dust and VOCs (as discussed in Section 5.3.8 and in Attachment 2, Construction Sampling Plan) will be evaluated based on wind direction and speed.
- Potential off-site odor concerns will be managed based on wind direction and speed.

- On-site stormwater management and inspections will utilize rainfall data.

- Site contingency and emergency response measures may require real-time weather data.

Therefore, a meteorological monitoring station will be installed on-site and will consist of equipment and sensors installed on an approximate 18-foot tripod. The meteorological monitoring will be conducted initially to establish baseline conditions and then for the duration of the excavation and backfill activities. The meteorological variables to be monitored include:

- Wind speed
- Wind direction
- Standard deviation of horizontal wind direction (sigma theta)
- Ambient air temperature
- Precipitation

The sensors will be connected to a data logging system. The data logger will measure the sensor responses and store averaged data at regular intervals.

Wind speed will be monitored with a three-cup anemometer assembly mounted on a crossarm. Horizontal wind direction will be monitored by a wind vane coupled to a precision low torque potentiometer. Precipitation will be measured with a tipping bucket rain gauge.

5.3.7 Excavation Activities

As presented in the approved FS, soil will be removed from a defined boundary to a depth of 4 feet. Further removal, to the groundwater table, will be completed in the specified area on the eastern portion of the site. The Construction Drawings present the overall limits of excavation; these limits will be surveyed and marked in the field prior to contractor mobilization.

The details of the construction sequence will be proposed by the excavation contractor and will comply with the performance requirements specified in the project documents. Based on the results of the in situ soil profiling, it is anticipated that the majority of the excavated soil will be directly loaded onto the transfer trucks for hauling to the disposal facility. An exclusion zone will be set up and maintained to prevent tracking of PFC-containing soil onto the roadways by haul trucks.

It is anticipated that activities will begin on the east end of the excavation area. Prior to initiating excavation, the exclusion zone will be established and a temporary haul road will be built to allow haul truck access to the eastern area. The haul road and vehicle traffic will be set up to operate outside of the exclusion zone. Excavation equipment contacting the PFC-containing soil will remain in the exclusion zone. The boundary of the exclusion zone will be adjusted periodically as the excavation and backfilling progress. The details of this site preparation and excavation will be presented in the Site Operations Plan and the Environmental Protection Plan. Decontamination is further discussed in Section 5.3.9.

The contractor will be required to control the size of the open area of excavation to as small as practicable to minimize potential odor issues and collection of construction water from precipitation. Therefore, it is anticipated that the excavation will be opened in a discrete area, and characterized excavated materials will be direct-loaded onto haul trucks. An independent surveyor will document that the excavation meets the specified limits and depth before backfill can be placed in the area. This step will be documented and included in the project certification. Once a sufficient area has been excavated and removal limits have been verified, clean backfill will be placed and initially compacted. In this manner, the site disturbance, excavation and backfill will progress in segments or phases until the entire excavation footprint is completed.

To minimize truck traffic and improve efficiency, it is anticipated that the same trucks that haul PFC-containing soil to the landfill may be used to backhaul clean backfill soil to the site. This type of hauling will be dependent upon the use of environmental controls such as inspections, documentation and lining of truck bed procedures which will be detailed in the project documents. Additional details are provided in the Soil Transportation Plan (Attachment 4).

In situ and potentially ex situ sampling will be conducted as described in Section 5.3.4 and in the Construction Sampling Plan (Attachment 2) for disposal profiling. Based on the sampling plan, soils will be profiled and the appropriate disposal facility will be identified. Three categories of soil profiles are possible and will be handled accordingly: non-hazardous soil, soil that meet hazardous waste criteria; and soils with a PCB concentration greater than 50 ppm.

Non-hazardous soil is defined as material that is below the TCLP limits for VOCs and metals, contains total VOC concentrations less than the applicable Industrial SRV, is not ignitable or reactive, and has PCB concentrations less than 50 ppm. Non-hazardous soil will be sent to:

SKB Environmental
Rosemount Industrial Waste Facility
13425 Courthouse Blvd.
Rosemount, MN 55068

Soils that meet hazardous waste criteria will consist of material that exceeds the regulatory limits for the TCLP analysis or exceeds SRVs for certain VOCs. These soils will be sent to RCRA-permitted facilities. The following facilities may be used; however, other RCRA-permitted facilities may also be considered:

Chemical Waste Management Inc.
1550 Balmer Road
Model City, NY 14107

Clean Harbors Lone Mountain
Route 2, Box 170
Waynoka, OK 73860

Wayne Disposal, Inc.
49350 North I-94 Service Drive
Belleville, Michigan 48111

Soils that contain PCB concentrations in excess of 50 ppm will be sent to a Toxic Substances Control Act (TSCA)-permitted disposal facility. TSCA soil may be sent to:

Wayne Disposal, Inc.
49350 North I-94 Service Drive
Belleville, Michigan 48111

Clean Harbors Lone Mountain
Route 2, Box 170
Waynoka, OK 73860

Other TSCA-permitted facilities may also be considered.

Additional information is provided in the Soil Transportation Plan (Attachment 4).

Clean fill will be obtained locally to backfill the excavation. Although many sources of clean fill are available, it is initially anticipated that the fill will be obtained from the SKB Landfill site. This will increase efficiency by allowing the same truck to deliver clean soil and haul excavated material. In addition, the overall benefit to the environment is improved through reduced fuel consumption and vehicle emissions, and a smaller carbon footprint associated with these activities. As described in the Construction Sampling Plan (Attachment 2), analytical results will be used to verify clean fill characteristics.

Backfill will be compacted in 8- to 12-inch lifts in accordance with the notes provided on the Construction Drawings.

5.3.8 Additional Control Measures (Odor, Dust, Noise)

Potential construction activities that may require additional control measures may include:

- Mud and dirt could be tracked by vehicles from the site to the public roadways.
- Dust generated by construction activities could leave the property boundary.
- Odors could be generated due to excavation of VOC-containing soils.
- There will be noise associated with construction equipment.

These concerns and mitigation techniques are discussed in the following subsections.

5.3.8.1 Tracking of Mud and Dirt

An improved access road and entrance apron onto Granada Avenue along with operational controls will be utilized to prevent the movement of mud out of the areas of construction. Vehicles that will be travelling on public roads will be limited to using only the improved entrance road for all access to the site. A riprap “tire scrubber” will be set up on the access road to remove mud/dirt from the truck’s tires before leaving the site. The access road will be maintained to remove mud/dirt buildup and to add stone as needed to control dirt tracking and buildup. On-site construction haul roads may also need to be surfaced with stone/riprap to control tracking of mud/dirt onto the access road. In addition, regular inspections of vehicles entering and leaving the site will be part of the site operations plan and, if required, street sweeping/cleaning will be conducted on Granada Avenue to remove dirt or mud carried off-site by the haul trucks.

5.3.8.2 Migration of Dust

Dust will be monitored visually as well as through particulate monitoring at perimeter locations, as described in the Construction Sampling Plan (Attachment 2). Dust generation will typically be controlled by application of water spray from a water truck using a potable water source. Other operating techniques that may be applied include control of vehicle speed, addition of stone to haul roads, covering loaded trucks, limiting the area of open excavation to the extent practical and providing surface vegetation, mulch, or cover. If dust conditions are severe and cannot be controlled, certain work activities generating the dust will be temporally suspended.

5.3.8.3 Off-Site Odor

As described in the Construction Sampling Plan (Attachment 2), perimeter ambient air monitoring will be performed to verify and document the level of airborne volatiles. In addition, baseline conditions will be established to define pre-construction concentrations.

The perimeter action level for VOC concentration will be developed based on the concentration of a constituent that has been detected in site soils and has the lowest exposure limits. The associated action level will be defined as discussed in the Construction Sampling Plan (Attachment 2). Conformance to this action level may not eliminate the presence of all odors.

Following the completion of the in situ profile sampling, the VOC ambient air action level will be developed to address the most conservative compounds (based on potential exposure) identified in the soil. Certain work activities will be suspended if VOC measurements are greater than the action level defined in the Construction Sampling Plan (Attachment 2).

5.3.8.4 Noise

As described in the Construction Sampling Plan (Attachment 2), perimeter noise monitoring will be performed to verify and document compliance with the City of Oakdale Noise Ordinance (Chapter 19) and the State of Minnesota Noise Pollution Control Rules (Minnesota Administrative Rules, Chapter 7030). Perimeter noise monitoring will be conducted periodically in two locations, and noise reduction methods (i.e., construction technique modifications and equipment changeout) will be employed if regulatory action levels are exceeded.

Baseline noise monitoring will be conducted to establish preconstruction levels which will include traffic noise along Highway 5. Backup signals on heavy equipment will be included in the baseline condition as these are necessary for safety.

5.3.9 Decontamination

The excavation contractor will prepare an Environmental Protection Plan for approval prior to mobilization in the Site. The Environmental Protection Plan will outline the measures that will be used at the Site to decontaminate equipment and vehicles leaving the exclusion zone.

Attachment 6 presents a Decontamination Plan that represents the operational procedures that will be conducted at the Site. The plan defines the three operational zones that will be established (exclusion zone, contamination reduction zone, and the clean zone), as well as wet and dry control measures that may be employed to achieve decontamination. Typically, a decontamination station will be needed for equipment which leaves the exclusion zone. Water generated during the decontamination process will be managed as construction water, in the method described in Attachment 1.

5.3.10 Restoration Activities

The Construction Drawings, included in Appendix E, define the site conditions and final contours to be established at the completion of excavation and backfill activities. Basically, the Site will be backfilled to pre-excavation grades, with the exception of the relocated drainage swale. The relocated swale will remain; however, the concrete drainage pipes will be removed and the bottom of the swale will be deepened to match the current swale elevation of approximately 1,008 feet MSL.

The Site will be seeded, and the construction fence will be removed. Following completion of backfill placement, a groundwater extraction well and associated monitoring points will be installed (see Section 5.2.3.4). The ultimate long-term plan for the Site will be discussed with the City of Oakdale and communicated to nearby residents.

Stormwater management inspections and repairs will be completed until the Site is stabilized and a Notice of Termination from the Stormwater General Permit has been issued. Temporary erosion control measures will be removed when the vegetation is established. Information on stormwater management is included in Attachment 1.

SECTION 5 TABLES

Table 5-1 Groundwater Extraction System Sample Results
Oakdale Site

Sample Location:	RW01		RW02		RW03	RW04		RW06		RW10	RW11		RW14	RW15	RW16		RW17		RW18		RW19		RW20		RW21	RW22	RW23	RW24	RW25	Combined[a]	
Sample Date:	12/5/2008	1/7/2009	12/4/2008	1/7/2009	1/7/2009	12/5/2008	1/7/2009	12/5/2008	1/7/2009	1/7/2009	12/5/2008	1/7/2009	1/7/2009	1/7/2009	12/4/2008	1/7/2009	12/4/2008	1/7/2009	12/4/2008	1/7/2009	12/4/2008	1/7/2009	12/4/2008	1/7/2009	1/7/2009	1/7/2009	1/7/2009	1/7/2009	12/4/2008	12/4/2008	1/7/2009
Volatile Organic Compounds (mg/L)																															
1,1-Dichloroethane	< 0.02	< 0.025	< 0.05	< 0.05	< 0.25	< 0.1	< 0.1	< 0.01	< 0.02	< 0.1	< 0.05	< 0.05	**0.001**	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
1,1-Dichloroethene	< 0.02	< 0.025	< 0.05	< 0.05	< 0.25	< 0.1	< 0.1	< 0.01	< 0.02	< 0.1	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
1,2-Dichloroethane	< 0.02	< 0.025	< 0.05	< 0.05	< 0.25	< 0.1	< 0.1	< 0.01	< 0.02	< 0.1	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
2-Butanone (MEK)	< 0.08	< 0.1	**5.71**	**7.60**	**75.6**	**1.32**	**1.74**	< 0.04	< 0.08	< 0.4	< 0.2	< 0.2	< 0.004	< 0.004	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.004	< 0.008	< 0.004	< 0.008	< 0.02	< 0.004	< 0.008	< 0.4	< 0.008	< 0.008	**0.750**	**0.784**
2-Propanol	< 0.8	< 1	**7.94**	**11.5**	**91.5**	< 4.0	**4.04**	< 0.4	< 0.8	< 4	< 2.0	< 2	< 0.04	< 0.04	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.04	< 0.08	< 0.04	< 0.08	< 0.2	< 0.04	< 0.08	< 4	< 0.08	< 0.08	**1.01**	**0.665**
4-Methyl-2-pentanol	< 0.8	< 1	< 2.0	**2.30**	**13.0**	< 4.0	< 4	< 0.4	< 0.8	< 4	< 2.0	< 2	< 0.04	< 0.04	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.04	< 0.08	< 0.04	< 0.08	< 0.2	< 0.04	< 0.08	< 4	< 0.08	< 0.08	< 0.2	< 0.2
4-Methyl-2-pentanone (MIBK)	< 0.08	< 0.1	**0.874**	**1.26**	**17.9**	< 0.4	< 0.4	< 0.04	< 0.08	< 0.4	< 0.2	< 0.2	< 0.004	< 0.004	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.004	< 0.008	< 0.004	< 0.008	< 0.02	< 0.004	< 0.008	< 0.4	< 0.008	< 0.008	**0.139**	**0.144**
Acetone	< 0.2	< 0.25	**11.8**	**15.0**	**80.3**	**4.57**	**4.97**	< 0.1	< 0.2	< 1	< 0.5	< 0.5	< 0.01	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.01	< 0.02	< 1	< 0.02	< 0.02	**1.31**	**1.45**
Benzene	< 0.02	**0.0552**	< 0.05	< 0.05	**0.727**	**0.134**	**0.147**	**0.0143**	< 0.02	**1.61**	**0.0790**	**0.0807**	**0.0028**	**0.0179**	**0.0204**	**0.0214**	**0.0174**	**0.0214**	**0.0266**	**0.0324**	**0.00240**	**0.0020**	**0.00580**	**0.0380**	< 0.001	**0.0025**	< 0.1	**0.00310**	**0.0286**	**0.0186**	**0.0177**
Diisopropyl ether	**4.32**	**10.7**	**7.31**	**9.42**	**49.4**	**15.8**	**17.6**	**1.71**	**2.48**	**12.6**	**7.65**	**8.86**	**0.612**	**0.0927**	**0.296**	**0.397**	**0.243**	**0.393**	< 0.008	**0.0121**	< 0.008	**0.00970**	**0.566**	**1.07**	< 0.004	**0.142**	**7.31**	**0.360**	**0.119**	**1.86**	**2.09**
Ethylbenzene	< 0.02	< 0.025	< 0.05	< 0.05	**0.314**	< 0.1	< 0.1	< 0.01	< 0.02	**0.290**	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
Methylene Chloride	< 0.08	< 0.1	< 0.2	< 0.2	< 1	< 0.4	< 0.4	< 0.04	< 0.08	< 0.4	< 0.2	< 0.2	< 0.004	< 0.004	< 0.008	< 0.008	< 0.008	< 0.008	< 0.008	< 0.004	< 0.008	< 0.004	< 0.008	< 0.020	< 0.004	<.008	< 0.4	< 0.008	< 0.008	< 0.020	< 0.020
Tetrahydrofuran	< 0.2	< 0.25	< 0.5	< 0.5	< 2.5	< 1	< 1	< 0.1	< 0.2	< 1	< 0.5	< 0.5	**0.0273**	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.01	< 0.02	< 0.05	< 0.01	< 0.02	< 1	**0.0297**	< 0.02	< 0.050	< 0.050
Toluene	**0.0309**	**0.0960**	**0.111**	**0.116**	**3.93**	**0.199**	**0.171**	< 0.01	< 0.02	**0.990**	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	**0.0213**
Xylene (Total)	< 0.06	**0.143**	< 0.15	< 0.15	**0.817**	< 0.3	< 0.3	< 0.03	< 0.06	**0.733**	< 0.15	< 0.15	< 0.003	< 0.003	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.003	< 0.006	< 0.003	< 0.006	< 0.015	< 0.003	< 0.006	< 0.3	< 0.006	**0.0196**	< 0.015	< 0.015
cis-1,2-Dichloroethene	< 0.02	< 0.025	< 0.05	< 0.05	< 0.25	< 0.1	< 0.1	< 0.01	< 0.02	< 0.1	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
sec-Butyl Alcohol	< 0.8	< 1	**4.10**	**4.14**	**51.9**	< 4.0	< 4.0	< 0.4	< 0.8	< 4	< 2.0	< 2	< 0.04	< 0.04	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.04	< 0.08	< 0.04	< 0.08	< 0.2	< 0.04	< 0.08	< 4	< 0.08	< 0.08	**0.501**	**0.217**
trans-1,2-Dichloroethene	< 0.02	< 0.025	< 0.05	< 0.05	< 0.25	< 0.1	< 0.1	< 0.01	< 0.02	< 0.1	< 0.05	< 0.05	< 0.001	< 0.001	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.001	< 0.002	< 0.001	< 0.002	< 0.005	< 0.001	< 0.002	< 0.1	< 0.002	< 0.002	< 0.005	< 0.005
PFCs (mg/L)																															
PFBA	**35.9**	**33.5**	**29.3**	**37.9**	**83.9**	**111**	**117**	**26.1**	**28.7**	**616**	**138**	**126**	**42.0**	**66.5**	**45.9**	**58.5**	**35.0**	**48.6**	**47.4**	**54.2**	**42.8**	**46.4**	**64.0**	**83.2**	**32.5**	**55.7**	**1610**	**107**	**34.2**	**58.4**	**109**
PFOA	**13.6**	**9.20**	**7.99**	**5.41**	**138**	**48.5**	**51.0**	**27.7**	**26.6**	**545**	**79.2**	**67.1**	**38.0**	**26.9**	**25.0**	**29.1**	**19.4**	**29.2**	**34.5**	**41.1**	**12.1**	**15.4**	**14.7**	**35.1**	**19.4**	**62.8**	**512**	**112**	**10.0**	**35.4**	**54.3**
PFBS	**1.40**	**1.42**	**0.830**	**1.08**	**4.73**	**4.21**	**4.79**	**2.03**	**2.21**	**7.27**	**7.25**	**7.20**	**2.00**	**1.80**	**1.59**	**2.15**	**1.24**	**1.69**	**3.02**	**3.76**	**1.31**	**0.866**	**0.643**	**1.07**	**1.35**	**2.44**	**32.1**	**10.0**	**0.680**	**2.35**	**3.81**
PFHS	**1.27**	**1.16**	**0.914**	**1.32**	**12.1**	**6.03**	**7.03**	**7.13**	**7.28**	**18.4**	**12.2**	**13.1**	**3.36**	**2.19**	**2.15**	**3.01**	**1.83**	**2.62**	**3.44**	**4.39**	**1.63**	**1.13**	**0.819**	**1.39**	**2.06**	**4.80**	**66.1**	**28.7**	**1.21**	**3.33**	**6.98**
PFOS	**7.46**	**10.1**	**0.287**	**0.494**	**30.2**	**24.9**	**35.4**	**37.9**	**49.0**	**2160**	**59.3**	**73.6**	**21.1**	**11.7**	**18.2**	**32.0**	**21.0**	**42.7**	**5.36**	**7.69**	**2.64**	**3.07**	**7.09**	**29.3**	**5.13**	**59.4**	**301**	**96.8**	**22.6**	**16.4**	**31.3**
Conventionals (mg/L)																															
Calcium	**95.9**	**98.6**	**106**	**105**	**253**	**134**	**114**	**175**	**155**	**130**	**173**	**156**	**101**	**118**	**135**	**109**	**120**	**104**	**131**	**115**	**135**	**119**	**163**	**142**	**118**	**112**	**197**	**77.4**	**112**	**135**	**144**
Calcium (Dissolved)	**86.9**	**89.0**	**96.6**	**93.8**	**262**	**123**	**120**	**152**	**157**	**137**	**158**	**156**	**105**	**124**	**110**	**110**	**105**	**103**	**122**	**119**	**124**	**122**	**142**	**149**	**127**	**116**	**212**	**71.4**	**97.6**	**106**	**112**
Iron	**25.2**	**42.6**	**5.98**	**6.20**	**42.0**	**25.3**	**21.3**	**28.4**	**32.5**	**52.8**	**18.8**	**20.4**	**5.24**	**14.6**	**16.0**	**16.6**	**17.4**	**17.6**	**16.1**	**15.8**	**16.0**	**16.7**	**19.0**	**19.6**	**16.0**	**11.6**	**12.7**	**41.3**	**18.6**	**23.2**	**90.7**
Iron (Dissolved)	**5.57**	**18.3**	< 0.05	**0.405**	**17.1**	**3.16**	**8.78**	**1.51**	**4.87**	**13.2**	**0.302**	**4.40**	<0.05	**2.58**	< 0.05	<2.5	**0.169**	**5.18**	**0.119**	**3.21**	**0.0949**	**3.02**	< 0.05	**6.27**	**6.00**	<0.05	**0.0995**	**17.0**	**0.669**	<0.05	**2.00**
Magnesium	**29.4**	**28.9**	**34.9**	**32.9**	**108**	**45.6**	**42.5**	**54.0**	**59.6**	**55.0**	**62.5**	**55.6**	**36.1**	**35.5**	**45.3**	**38.3**	**43.1**	**36.0**	**41**	**35.8**	**44.5**	**36.9**	**44.7**	**44.6**	**37.0**	**37.4**	**77.6**	**22.0**	**40.4**	**41.8**	**41.1**
Magnesium (Dissolved)	**28.3**	**27.0**	**32.6**	**30.0**	**91.6**	**44.9**	**41.2**	**50.8**	**48.6**	**52.2**	**55.5**	**51.1**	**33.7**	**35.1**	**38.2**	**34.8**	**35.5**	**33.4**	**38.8**	**34.6**	**36.6**	**33.9**	**43.1**	**41.4**	**35.5**	**34.8**	**72.1**	**22.1**	**36.2**	**33.5**	**37.3**
Manganese	---	**1.21**	---	**0.233**	**0.582**	---	**0.676**	---	**1.63**	**0.427**	---	**1.44**	**0.418**	**0.379**	---	**0.486**	---	**0.510**	---	**0.356**	---	**0.383**	---	**0.492**	**0.399**	**0.405**	**0.823**	**1.49**	---	---	**0.761**
Manganese (Dissolved)	---	**1.18**	---	**0.225**	**0.540**	---	**0.708**	---	**1.41**	**0.397**	---	**1.42**	**0.414**	**0.390**	---	**0.475**	---	**0.494**	---	**0.359**	---	**0.376**	---	**0.468**	**0.383**	**0.380**	**0.799**	**1.52**	---	---	**0.533**
Total Dissolved Solids	**460**	**429**	**376**	**386**	**1280**	**535**	**533**	**784**	**794**	**721**	**774**	**710**	**504**	**521**	**506**	**507**	**447**	**485**	**527**	**532**	**540**	**534**	**576**	**628**	**568**	---	**947**	**374**	**436**	**554**	**584**
Total Suspended Solids	**61.2**	**70.7**	< 10.0	<10	**29.8**	**43.8**	**35.5**	**59.1**	**61.5**	**120**	**40.0**	**41.9**	**22.2**	**30.6**	**34.1**	**31.9**	**36.2**	**35.0**	**36.9**	**36.3**	**36.8**	**34.7**	**46.1**	**44.1**	**31.5**	---	**73.2**	**80.5**	**40.0**	**72.6**	**244**
Total Organic Carbon	---	**13.4**	---	**38.1**	**0.311**	---	**23.6**	---	**8.4**	**53.1**	---	**13.9**	**7.5**	**15.9**	---	**13.5**	---	**11.5**	---	**14.3**	---	**12.9**	---	**19.8**	**14.6**	**16.6**	**36.1**	**32.2**	---	---	**16.2**
Alkalinity, Total as $CaCO_3$	---	**268**	---	**315**	**0.591**	---	**426**	---	**372**	**528**	---	**441.0**	**459**	**505**	---	**473**	---	**441**	---	**496**	---	**500**	---	**544**	**529**	---	**780**	**289**	---	---	**470**
pH at 25 Degrees C[b]	**6.7**	**6.9**	**7.0**	**7.5**	**7.0**	**6.9**	**7.2**	**7.0**	**7.3**	**6.8**	**7.0**	**7.4**	**7.4**	**7.4**	**6.8**	**7.4**	**6.8**	**7.4**	**6.8**	**7.5**	**6.8**	**6.8**	**6.8**	**6.8**	**6.8**	---	**7.0**	**6.9**	**6.8**	---	---

NOTES:

BOLD indicates a concentrations above the reporting limit (RL).

--- Sample not analyzed for this constituent.

[a] Sampled by Pace Analytical Field Services.

[b] Measured in Standard Units.

Table 5-2 Potential HAPs Measured in Extraction System Discharge
Oakdale Site

Potential HAPs (1)	Maximum Measured Concentration (mg/L)	PTE (2) (tons/yr)
1,1-Dichloroethane	< 0.005	NA
1,1-Dichloroethene	< 0.005	NA
1,2-Dichloroethane	< 0.005	NA
2-Butanone (MEK)	0.784	0.206
Benzene	0.0186	0.0049
Ethylbenzene	< 0.005	NA
Methylene Chloride	< 0.020	NA
Toluene	0.0213	0.0056
Xylene (Total)	< 0.015	NA

(1) Potential HAPs are based on the list of volatile compounds measured as part of the MCES discharge permit.

(2) PTE - Potential to Emit - calculated based on a maximum groundwater flow rate of 120 gpm.

Table 5-3 Preliminary List of Performance-Based Requirements

Spec. No.	Scope	Requirement
1	Silt fence	Silt fences will be installed beyond the limits of excavation, as shown in the drawings or adjacent to the construction fence. Excavate a trench 4 to 6 inches deep and embed material into the ground and compact soil around fabric. Install posts approximately 6 feet apart. Install posts securely into the ground. Allow at least 18 inches of exposed fabric. See drawing details.
2	Clearing and grubbing	All aboveground woody vegetation (i.e., trees) inside the excavation footprint will be cut above ground level and hauled off-site for landfill disposal. All plant roots and stumps from inside the excavation footprint will remain in-place and be excavated and disposed of with the soil. Material that is cleared and grubbed from outside the excavation footprint will be managed either on- or off-site in accordance with applicable regulations.
3	Haul roads	A 4 to 6-inch thick layer of stone over geotextile fabric if needed, suitable for truck hauling. 20 to 25-foot width.
4	Excavation	Establish survey control and excavate soil to the levels and limits shown on the drawings. Backfill may not commence until extent of excavation has been surveyed and confirmed by a 3M independent surveyor. Portions of the soils will be loaded directly into trucks. The trucks will not enter the exclusion zone (area of excavation), and will stay on the designated haul roads outside of the exclusion zone. Exclusion Zone controls and practices will be followed. Tracking of soils off-site onto public roadways will be minimized. Ex situ profiling of soil will be performed in accordance with the Construction Sampling Plan (Attachment 2). Construction water will be collected and handled for proper disposal.
5	Stormwater	Stormwater will be managed in accordance with the drawings and the Stormwater Permit for Construction Activity. Erosion and sedimentation controls are to be installed in accordance with the drawings and maintained.
6	Permits	The contractor will procure all local construction permits. 3M to procure POTW discharge permit.

Table 5-3 Preliminary List of Performance-Based Requirements (Continued)

Spec. No.	Scope	Requirement
7	Backfill	The source for soil backfill material will be sampled and approved. All backfill material will be brought on-site in clean trucks. Trucks will operate only on designated haul roads. Backfill will be placed in loose lifts not exceeding a thickness of approximately 12 inches. Each lift will be compacted using a vibratory roller. Backfilling may be required to an intermediate level (e.g., just one lift) as an odor control measure.
8	Revegetation and Stabilization	The soil surface will be revegetated after the backfilling is complete. This will include removal of the surface stone layer from the temporary haul roads. Grasses will be used to revegetate. After soils are revegetated and stabilized, temporary E&S controls can be removed. Erosional damage will be repaired until the site is fully stabilized.
9	Fencing	The construction fencing surrounding the site will be maintained until the site is backfilled and stabilized. Site security will be maintained and the gate locked whenever contractor personnel are not on-site.
10	Stockpiling	Both clean backfill material and excavated material may require temporary stockpiling. Stockpiles of clean material will be handled in a manner to prevent cross contamination. E&S controls will be established around stockpile areas.

6. RESPONSE ACTION IMPLEMENTATION

In accordance with the Agreement, elements of the Response Action implementation must be defined within this RD/RA Plan. This section further defines those elements.

6.1 ON-SITE QUALITY CONTROLS

The purpose of a quality assurance/quality control (QA/QC) program is to produce analytical measurement data of known quality that satisfy the project data quality objectives (DQOs). DQOs are data quality planning and evaluation tools for all sampling and analysis activities. A consistent and comprehensive approach for developing and using these tools is necessary to ensure that enough data are produced and are of sufficient quality to make decisions and to provide accurate documentation.

The procedures of the overall QA/QC program, including the development of the DQOs, are described in the QAPP, included as Attachment 3. The QAPP has been developed to ensure that the analytical data collected through implementation of the RA are of a known and acceptable level of quality.

Field sampling activities will involve the collection of samples necessary to complete profiling of the site soils for non-PFC parameters, measure operational conditions (i.e., noise and perimeter air monitoring), and document performance of the work.

Chemical analyses will be conducted to determine the concentrations in soils for non-PFC disposal profiling. The overall Construction Sampling Plan (Attachment 2) discusses the rationale and purpose for the sampling program and the types of samples to be collected during the RD/RA disposal profiling. Analytical methods for the various environmental media are contained in the Construction Sampling Plan.

Sampling will be performed on the environmental media in accordance with the Standard Operating Procedures (SOPs) contained in the QAPP.

6.2 PROJECT MANAGEMENT

The RD/RA process will involve a number of entities, including 3M personnel, WESTON personnel and subcontractors. The following subsections provide a generalized description of the organization and responsibilities of key individuals in the performance of the RA to ensure proper communication is maintained throughout the project. The organization of the project responsibilities described in this section is depicted in Figure 6-1. It should be noted that this description is primarily oriented to the soil excavation and removal work north of Highway 5 since this construction is more defined at this point. The design of the groundwater treatment system is not yet completed and its construction will be initiated after the design is completed. Although project management for the construction of the groundwater system will be similar to that presented in this section, some modifications may be made for construction-specific needs.

6.2.1 3M Company Personnel

Mr. Jim Kotsmith, P.E., QEP, will serve as the 3M Project Manager. To the maximum extent possible, communications between 3M and the MPCA concerning the terms and conditions of the Agreement as they apply to response actions for the Site will be directed through the 3M and MPCA-designated Project Managers. The 3M Project Manager will be responsible for assuring that all communications from the MPCA Project Manager are appropriately disseminated and processed.

In accordance with the Agreement, the 3M Project Manager, as well as the MPCA Project Manager, has the authority to (1) take samples or direct that samples be taken; (2) direct that work at a Site stop for a period not to exceed 72 hours if the Project Manager determines that activities at the Site may create a danger to public health or welfare or the environment; (3) observe, take photographs and make such other reports on the progress of the work as the Project Manager deems appropriate; (4) review records, files and documents relevant to the Agreement; and (5) make or authorize minor field modifications or clarifications during the RA in techniques, procedures or methods utilized in carrying out the RA which are necessary to the completion of those activities. Any field changes that require necessary notification will be approved orally by both the

3M and MPCA Project Managers. If the 3M Project Manager makes a field change, he will, within 72 hours following the change, prepare a memorandum detailing the field change and the reasons therefore and will provide or mail a copy of the memorandum to the MPCA Project Manager. The 3M Project Manager, or designate, will either be on the Site or available on call by telephone during all hours of active work at the Site.

3M will provide a designated representative for all on-site activities. The designated representative will be the on-site point of contact for non-3M personnel and contractors. The designated representative will assure that 3M policy, requirements and procedures are being followed. The designated representative is responsible for site access and control throughout the duration of the RA.

6.2.2 WESTON Personnel

6.2.2.1 Project Manager

Mr. Robert Junnier, P.E., will serve as the WESTON Project Manager. He will be responsible for day-to-day activities on the project and planning, coordinating, integrating and managing project activities, including the activities of subcontractors to WESTON. Mr. Junnier will also be responsible for the identification and ultimate resolution of technical problems and the technical coordination of the field efforts and the subsequent data assessment. Field audits are also the responsibility of the WESTON Project Manager.

6.2.2.2 Technical Advisors/Project Certification

Mr. Michael Corbin, P.E., and Mr. Jaisimha Kesari, P.E., will serve as the WESTON Technical Advisors. Messrs. Corbin and Kesari will be responsible for guiding and providing technical oversight in the performance of the RA and ensuring that it meets the requirements of the Agreement and follows applicable regulatory guidance and requirements of the RD/RA. At the completion of the remedial construction, a Construction Completion Report will be prepared, including a certification that the work was performed in accordance with the approved plans and MDD.

6.2.2.3 Field Team Site Manager/Health and Safety Officer

It is anticipated that a WESTON employee will serve as the Field Team Site Manager and another WESTON employee will serve as Health and Safety Officer. The Field Team Site Manager will be responsible for oversight of environmental activities in the field. He will be responsible for ensuring that all procedures for the field activities related to soil sampling and disposal profiling are executed in accordance with the approved plans and are documented according to the procedures presented in the QAPP. The Health and Safety Officer will be responsible for: (1) having an up-to-date Site-Specific Security, Health and Safety Plan (SSHASP) in place; (2) ensuring that all WESTON and subcontractor personnel adhere to the SSHASP; (3) training all personnel involved in health and safety procedures; (4) maintaining control and exercising proper response in emergencies; and (5) keeping a logbook of activities.

During periods of active excavation and site activity, additional sampling, inspections and documentation will be required. An environmental technician may be needed so that construction work is not delayed. The technician will be responsible for collecting samples (soil, water, perimeter air) for compliance purposes and submission to the laboratory and for preparing project documentation and records. Data will be compiled and tabulated for review and decisionmaking.

A construction superintendent will be assigned during the soil excavation and removal portion of the project. The superintendent will work with the designated 3M representative to oversee the activities of the excavation and transportation contractor to assure that the work is compliant with the RD/RA. Key assignments will be to assure that the excavation is completed to the specified limits without overexcavation, construction activities are compliant with exclusion and clean zones, only the specified soil is hauled for disposal, construction water is properly handled and construction practices are safe and environmentally compliant.

6.2.3 Subcontractors

One or more subcontractors will be retained to complete the RA as described in this RD/RA Plan. These contractor(s) have not yet been selected. It is anticipated that independent contractors will be selected for soil excavation and transportation activities, groundwater treatment plant construction, surveying and analytical laboratory. The selected RA subcontractors will be responsible for implementing the RA in accordance with applicable regulations, this RD/RA Plan, specifications and associated procurement documents.

6.3 SCHEDULE OF IMPLEMENTATION

The estimated project schedule is presented in Figure 6-2. The schedule assumes 10 hour per day, 5-day per week operations between 7 a.m. and 5 p.m.; however, in accordance with the Soil Transportation Plan (Attachment 4) for the soil excavation and removal, haul truck traffic entering and leaving the site will be permissible on local roadways only between the hours of 9 a.m. and 3 p.m. Following subcontractor selection and prior to field mobilization, a detailed construction schedule for individual RA activities will be developed.

The schedule shown in Figure 6-2 was developed based on the following assumptions:

- MCPA approval of the RD/RA is received within 45 days of submission.
- Soil vapor extraction (SVE) system operations are sufficiently complete by mid-summer to fall 2009.
- The evaluation for groundwater treatment requirements (i.e., based on groundwater quality and flow data and modified MCES permit) will be completed in the 2nd quarter 2009 and the design will be completed.
- The treatment plant construction can be initiated in summer 2009.

It is currently anticipated that excavation activities for the soil removal in the area north of Highway 5 will not commence until fall 2009. By implementing intrusive activities following the hotter summer months, it is anticipated that the potential volatilization of

VOCs from site soils being excavated (and therefore odors) will be reduced in the cooler weather.

6.4 RECORDKEEPING, DOCUMENTATION AND RETENTION

This section includes a summary description of the records required to document the ongoing RA activities and attainment of RA objectives. In addition, the data format and document retention requirements are briefly described.

6.4.1 Records Retention

All records required by this document and/or to document performance and completion of field activities will be maintained in either the WESTON home office at 1400 Weston Way, West Chester, PA (under the control of the Project Manager), or in the field under the control of the WESTON Site Supervisor. Final versions of records will also be maintained by 3M. Records will be retained for a minimum of 3 years, or until authorized for disposal by the MPCA in writing.

6.4.2 Laboratory Records

As described in the QAPP, laboratories will maintain the documentation necessary to demonstrate that the results reported were gathered in accordance with the laboratory's QA/QC procedures. The laboratory analytical reports will be maintained in one or both of the locations named above.

6.5 SITE-SPECIFIC SECURITY, HEALTH AND SAFETY PLAN

RD/RA actions must ensure that the site remains secure throughout the duration of field activities, and that both on-site workers and the general public health and safety concerns are fully addressed.

6.5.1 Site Security

Access to the site will be fully controlled during all RA activities. The site is fenced and the gate on the access road will be locked during nonworking hours.

During active construction, a list of authorized contractor and construction personnel will be maintained and the personnel will be required to sign in on a daily basis. During operating hours, security control will be maintained at the site access road. All visitors and non-construction personnel will be required to check in upon entering the site and be approved for access. Haul trucks entering and leaving the site will be required to stop for inspection and check in before processing. This sign-in maintains site security and provides an accounting of personnel on-site for health and safety and emergency response purposes.

6.5.2 On-Site Workers

A preliminary SSHASP has been developed to identify and address health and safety issues on-site. The SSHASP (see Attachment 5) includes:

- A project health and safety evaluation.
- Task-by-task risk assessment.
- Personnel protective equipment (PPE) evaluation.
- Field action levels defining PPE requirements.
- Emergency actions and telephone numbers.
- Specific field procedures to govern health and safety related activities.

All contractors performing intrusive work or in potential contact with excavated soils or construction water will be 40-hour HAZWOPER trained, with annual refresher training, and will be required to provide documentation of this training. In addition, the excavation contractor will provide a site-specific HASP for its personnel and site activities, and all contractors on-site will be required to review and sign the SSHASP. Typically truck drivers will not be 40-hour trained if they stay in their cabs or outside of the exclusion zone.

The SSHASP included in Attachment 5 is currently in draft form. Following the pre-excavation in situ profiling sampling, the SSHASP will be reviewed and revised to fully address the parameter concentrations anticipated to be encountered.

6.6 CONTINGENCY PLANNING

Contingency planning is a critical element in the overall planning of the RA. Prior to any mobilization, a careful review of potential contingencies and associated responses will be performed. Contingency planning as part of the RD/RA process is discussed in this section, as well as in other sections of the RD/RA Plan. It should be noted that the planning completed in this section is based on the current understanding of the RA process and activities. As changes to the RA implementation occur in the field, the contingency plans and associated documents will be updated, if warranted.

The following potential events have been considered and contingency planning has been described.

- **Worker Injury.** As with any construction activity, the possibility of onsite worker injury exists. At this site, excavation activities and the presence of VOCs and other chemicals are the primary concerns north of Highway 5, and general construction activities are of concern south of Highway 5. These activities, and associated contingency planning, are discussed in the SSHASP, included as Attachment 5.

- **Off-Site Odor, Airborne VOCs, or Dust.** Excavation activities, primarily north of Highway 5, have the potential to generate odors, VOCs, or dust at or beyond the site perimeter. Therefore, VOC concentrations will be actively monitored, while odor will be addressed qualitatively. The Construction Sampling Plan (Attachment 2) describes the methods of perimeter ambient air monitoring that will be employed to detect off-site VOCs or dust, and associated action levels.

  To address odors and VOCs, the contractor will be required to minimize the open excavation footprint, especially in areas of elevated VOCs in soils. If warranted, other operational controls as described in Section 5.3.8 will be implemented to reduce the release of odors or VOCs. This requirement will be based on the judgment of the Superintendent/Health and Safety Officer or the 3M-designated representative.

Dust will be controlled through standard operating procedures, such as cessation of activities, water misting, etc., as described in Section 5.3.8.

- **Excavated Soil Disposal Limitations.** It is anticipated that the majority of the excavated soil will go to the SKB Landfill for disposal. If in situ and ex situ soil profiling indicate that SKB may not accept a portion of the excavated soils, three alternate disposal locations have been identified (see Section 5 and Attachment 4) that can accept hazardous and/or PCB-containing soils. Prior to mobilization, the regulatory elements required for a large-quantity hazardous waste generator (i.e., EPA identification number, management operating procedures, Hazardous-Waste Specific Contingency Plan, etc.) will be reviewed and put in place.

- **Truck Accident/Soil Spill Enroute to Disposal Location.** Only the selected contractor will be allowed to transport and haul materials, and all materials will be shipped under an appropriate manifest or shipping papers. The selected contractor will have a response plan in place along with the equipment and personnel to respond to spill or accident situations. In the event of an off-site spill or release, 3M will be notified and the transportation contractor will coordinate the cleanup and disposal of the released material, in accordance with all local, state, and federal requirements.

- **Inclement Weather/Excessive Rain.** Inclement weather and/or excessive rain may cause construction delays, but should not pose any off-site concerns. An agreement will be reached with MCES regarding management of construction water within the excavation area through the existing MCES sewer discharge.

Other concerns or emergencies not described within the RD/RA Plan will be managed by the personnel identified in the project management description and organizational chart, included in Section 6.2. Discussions and/or responses will be in conjunction with MPCA, as applicable.

6.7 COMMUNITY RELATIONS AND PUBLIC INVOLVEMENT

3M is committed to keeping local residents and public officials informed of activities at the Site and responding to inquiries they may have. This section outlines some of the approaches that will be used to conduct the community relations and public involvement components of the project. Throughout the implementation of the Agreement requirements, 3M will be coordinating with the MPCA on the community relations activities described herein, along with many other aspects of the site activities and remediation of the Oakdale Site.

The communication tools below are intended to serve as options for use in communicating to local residents and public officials. 3M will seek the advice from the MPCA, city officials and others regarding the most appropriate and effective public communications tools.

During past activities, the following have been used in communicating project activities with various stakeholders and may be considered for use during the RD/RA:

- **3M Fluorochemical Website:** 3M has established and maintains a website for disseminating important information on fluorochemicals. The URL for this site is: www.3M.com/pfos-pfoa. The site will include a link to the Oakdale Disposal Site, on which information will exist to direct local residents and public officials to the availability of relevant documents and information about meeting dates and project progress. Additionally, the website will indicate that people can contact 3M via a telephone helpline, "1-800-3M HELPS," to make inquiries about the status of the remediation efforts.

- **Public Repository at Local Library:** Key documents for the project have been maintained and are available for the public to review at the Oakdale Branch Library located at 1010 Heron Avenue. Examples of the types of documents that have been available at this location include the Agreement and key submittals to the MPCA such as the Site Assessment, Feasibility Study Work Plan, Feasibility Study Report and RD/RA Plan.

- **Informational and Public Meetings:** 3M recognizes the importance of input from the public, including public officials and staff at the municipal level. Previously, information meetings have been conducted to update interested local residents and public officials and to provide opportunities for their input. The following list briefly describes some of the forums that have been used previously for public communication:

    - **Elected Officials and Staff:** 3M has provided periodic updates to Oakdale public officials and staff. These updates may be formal or informal. At these meetings, public officials can provide input relative to opportunities for public participation.

    - **Permit Meetings:** Meetings may be necessary as part of the issuance process for various permits and approvals to implement the RD/RA Plan.

SECTION 6 FIGURES

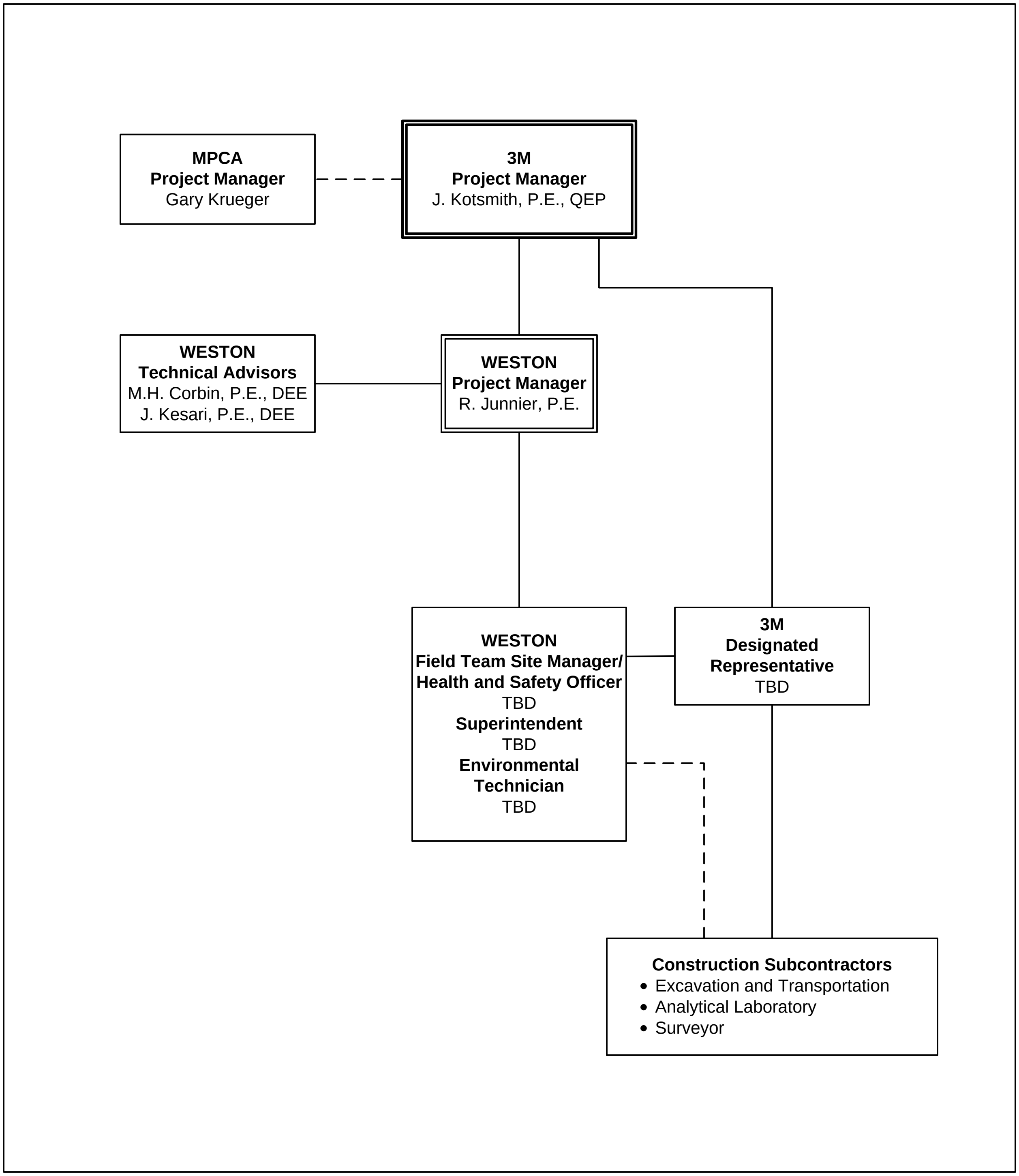
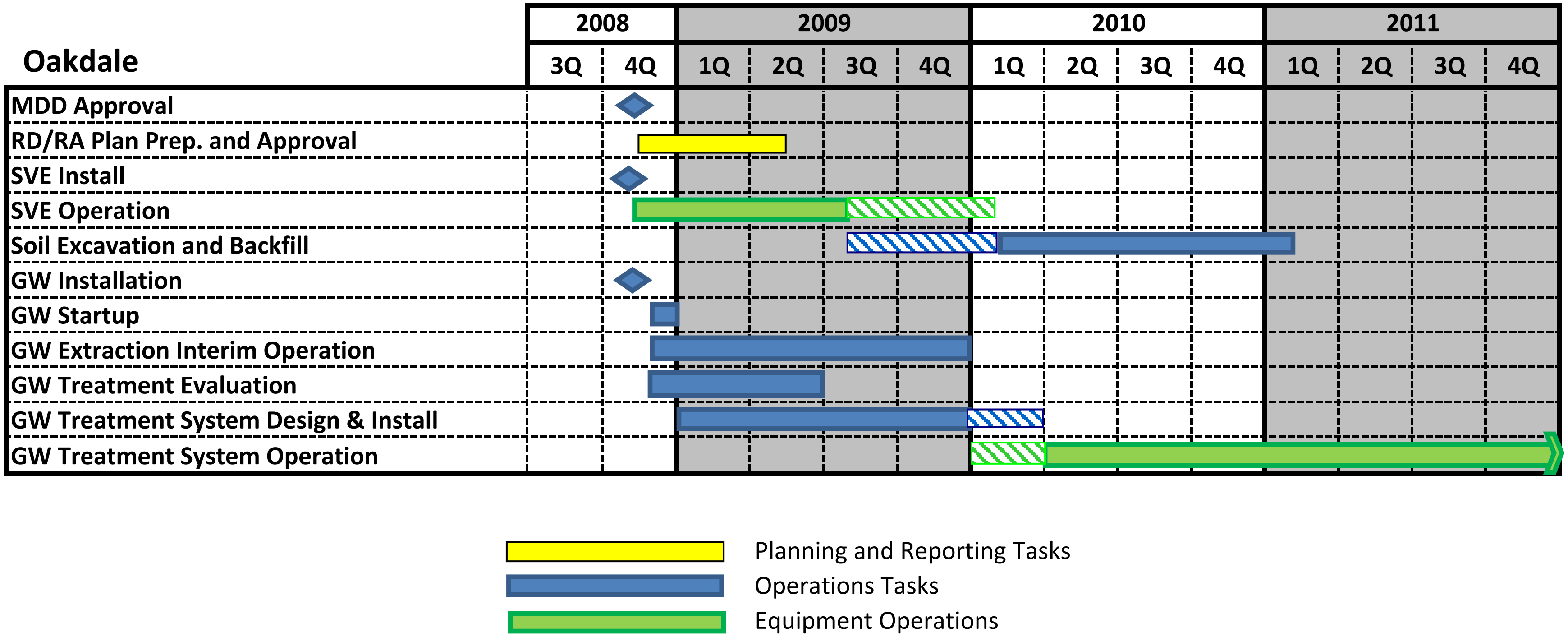


FIGURE 6-1 PROJECT ORGANIZATION CHART
RA IMPLEMENTATION
3M OAKDALE SITE

Figure 6-2 Project Schedule Oakdale Site
Oakdale, MN



NOTE: Hatched lines indicate potential schedule variability.

7. POST RESPONSE ACTION REQUIREMENTS

In accordance with the 2007 Agreement, elements of the post-RA activities must be defined within this RD/RA Plan. This section further defines those elements.

7.1 MAINTENANCE OF INSTITUTIONAL CONTROLS

At the completion of the RA activities, institutional controls will be reevaluated to ensure that they continue to be protective of human health, and minimize potential exposure pathways. It is currently anticipated that the deed restrictions, environmental covenants and the groundwater prohibitions developed during the RA process will be maintained. The existing covenants will be modified, if necessary, to comport with the MPCA requirements. Property transfers related to the Oakdale Site will include the applicable requirements and notifications.

Fencing north of Highway 5 will be removed following the RA activities; this area will be returned to an open space. 3M will communicate with the City of Oakdale and nearby residents about site restoration and use.

South of Highway 5, the presence of numerous monitoring and extraction wells and the groundwater treatment building requires that access control to this area be maintained. Therefore, following RA activities, this area will remain fenced to prevent unauthorized access. Periodic inspection and repair of the fence will be included as part of the Operation and Maintenance (O&M) Plan for the Site.

7.2 OPERATIONS AND MAINTENANCE

7.2.1 Groundwater Extraction and Treatment System O&M

Once the groundwater treatment system has been designed and installed, a comprehensive O&M Manual will be developed. The O&M Manual will address the groundwater extraction system, the treatment processes and overall site and building maintenance. Elements of the O&M Manual will include:

- Site introduction.
- Review and discussion of discharge criteria.
- A detailed description of all major process units, including process control, operating procedures, and troubleshooting.
- Facility startup and shutdown.
- Monitoring and sampling requirements for the extraction and treatment system, including quality control requirements.
- Maintenance requirements, including a maintenance schedule and vendor literature.
- Recordkeeping requirements.

Also included in the O&M Manual will be as-built drawings of the system, a copy of the current MCES industrial discharge permit, a list of applicable vendor literature, and other information deemed necessary to successfully operate the groundwater extraction and treatment system.

Table 7-1 is an example of the Table of Contents for an O&M Manual for the Site.

7.2.2 North of Highway 5 O&M

Following the RA, it is expected that there will be no long-term O&M required for the area north of Highway 5, with the exception of any new wells that are included in the groundwater extraction and treatment system O&M or installed for monitoring purposes.

Depending on the ultimate use of the property, some form of ongoing maintenance and/or landscaping may be required; however, such activities are unrelated to the continued effectiveness of the RA.

7.3 RA LONG-TERM MONITORING PLAN

There are three components that will be addressed as part of the RA long-term monitoring plan:

- Verification that the extraction system maintains hydraulic capture of site groundwater.

- Documentation of groundwater and surface water (Raleigh Creek) quality as required by the MDD.

- Documentation that treated groundwater is discharged in accordance with the issued MCES permit.

7.3.1 Verification of Hydraulic Capture

The primary long-term goal of the RA involves the continued capture of PFC containing groundwater from the site through the groundwater extraction and treatment system. The RA long-term monitoring plan will, therefore, be in place to verify and document that groundwater capture is maintained.

To document that hydraulic capture of site groundwater is maintained, it is necessary to show that the onsite horizontal hydraulic gradient is toward the extraction wells. This hydraulic control of groundwater flow is documented by measuring water levels in all onsite monitoring wells and piezometers screened within the shallow water table alluvium, and by constructing a map of potentiometric surface elevations. Contours of equal elevations are drawn; the groundwater flow is perpendicular to these contours in a downgradient direction. The extraction wells should lower water levels in the surrounding areas such that the cones of depressions from adjacent wells overlap, and provide site-wide hydraulic capture.

It is important that the extraction rates be optimized such that excess water is not being removed in order to achieve satisfactory capture. The objective will be to balance the groundwater extraction so that the adjoining eastern drainageway is not unnecessarily dewatered.

During the first 4 years of operation, water level measurements will be collected from all onsite monitoring wells and piezometers screened within the shallow water table alluvium on a quarterly basis to observe seasonal aspects. Thereafter, annual measurements will be collected to verify capture.

7.3.2 Groundwater and Surface Water Quality

Raleigh Creek is the one location on-site where groundwater discharge has the potential to impact off-site surface water. In order to document and track the trend in groundwater quality, and determine whether there is any off-site impact to the surface water quality of Raleigh Creek, analytical sampling will be conducted.

During the first 4 years of operation, groundwater samples will be collected in seven permanently installed monitoring wells south of Highway 5 (W8, W33, RW37, RW38, PL41, SP42 and W205) on a quarterly basis and all operating extraction wells on an annual basis. Thereafter, annual measurements will be collected from these locations to document historic trends. Groundwater samples will be analyzed for PFOS and PFOA.

During the first year, a surface water sample will be collected from Raleigh Creek on the east side of Hadley Avenue on a quarterly basis (weather permitting). Follow-up sampling will be based on a review of the results and consultation with MPCA.

Prior to implementing the post-RA sampling program, the site QAPP will be reviewed and updated to ensure that the sampling procedures and analytical methods are correct and appropriate.

7.3.3 Treated Effluent Discharge Monitoring

Following issuance of the modified MCES discharge permit, certain parameters and conditions will be defined. Discharge monitoring will occur in accordance with, and at the frequency defined by, the permit.

Prior to beginning post-RA discharge sampling, the site QAPP will be revised and updated to ensure that the sampling procedures and analytical methods are correct and appropriate.

Additional monitoring may be required associated with the ongoing operation of the groundwater treatment system (e.g., operational performance monitoring); however, this monitoring will be defined in the extraction and treatment system O&M Manual.

7.4 CONSTRUCTION COMPLETION REPORT

Following the completion of the RA activities, a construction completion report (CCR) will be prepared. The CCR will provide documentation of the remedial actions that have been completed as part of the RD/RA process.

The CCR will reiterate the overall RAOs, describe the activities approved and implemented to achieve the RAOs, and document that all approved activities were implemented in accordance with this RD/RA Plan. Since the completion schedules will not be concurrent, the CCR will be comprised of two separate documents: one for the excavation activities north of Highway 5 and one for the extraction and treatment system south of Highway 5. For the excavation activities, the CCR will include:

- Construction chronology.
- Permits and approvals.
- Survey control and excavation limit documentation.
- Operational records summary.
- In situ and ex situ soil profiling sampling results.
- Operations monitoring and inspections documentation.
- Disposal locations and volumes for soils and water.
- Shipping documentation (e.g., manifests).
- Backfill documentation.
- Backfill material sources and characterization.
- Final grading plans.

For the groundwater extraction and treatment system activities, the CCR will include:

- Construction chronology.
- Design basis for groundwater treatment system.
- Documentation of the make and model of all major equipment.

- As-built extraction and treatment system drawings.
- Well installation logs and documentation.
- Extraction and treatment system O&M Manual.

The purpose of the CRR is to provide permanent documentation that the RA was implemented in accordance with these plans, and to provide a consolidated source of information for all aspects of the RA implementation.

SECTION 7 TABLE

Table 7-1 Example O&M Manual Table of Contents

TABLE OF CONTENTS

Table 7-1 Example O&M Manual Table of Contents (continued)

Table 7-1 Example O&M Manual Table of Contents (continued)

8. REFERENCES

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APPENDIX A

GEOPROBE BORING LOGS AND WELL CONSTRUCTION LOGS

GEOPROBE BORING LOGS

SOIL BORING LOG

SITE ID: GPRW-14
Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site
PROJECT NO.: 02181-202-005-0001
DRILLING CO.: Matrix Environmental
LOGGED BY: Tim Frinak
DRILL METHOD: GeoProbe Rig
SITE TYPE: Soil Boring

ELEV. (GRND): 992.08
(TOC): 995.40
NORTHING: 16346293.33 (UTM-FT)
EASTING: 1649511.573 (UTM-FT)
DEPTH TO BEDROCK (fbgs): 40.00
RESIDUUM BOREHOLE DIA. (in): 3
BDRK BOREHOLE DIA. (in):

DATE BEGIN: 14-Aug-07
DATE END: 14-Aug-07
DEPTH TO WATER (TOC): 3.55
TOTAL BORING DEPTH (fbgs): 50.00
TOTAL WELL DEPTH (fbgs): 30.70

COMMENTS: Geophysics Confirmatory Boring located along Hadley Avenue across (west) of Menards

LOCATION DESCRIPTION

Recovery well RW-14 installed at this location. Installed 15 feet of 10 slot screen from 15.7 to 30.7 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	ROCK TEXTURE	ELEVATION (feet msl)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4	1/4	**0**	**0.5**	Wet	Soft		40	35	20	5				Qal	2.5Y 5/2	Grayish brown organic silty sand, mottled with brown, rooty
		0.5	**4**												10YR 4/3	As above, mottled with FeO nodules to approximately 2 feet
4-8	3/4	**4**	**5.5**	Wet	Soft		55	30	10	5					2.5Y 4/1	Dark gray silty sand, some FeO and weak mottling
		5.5	**8**					65	30	5					10YR 4/1	Dark gray clayey silt, some light gray mottling
8-12	3.5/4	**8**	**12**	Wet	Soft		10	50	40						10YR 4/1	Dark gray clayey silt, some roots, plastic, some f.g. sand lenses
12-16	3.5/4	**12**	**16**	Sat	Loose		97	2	1						10YR 4/2	Dark grayish brown sand; moderate to poor sorted, f.g. to m.g. 12 - 13
																fbgs coarsening to v.c.g. to m.g. at 15 fbgs; 15-16 fbgs m.g. to c.g.
																slight solvent odor
16-20	3.5/4	**16**	**20**	Sat	Loose		95	4	1						10YR 4/2	Dark grayish brown sand, f.g. to c.g. to 18 fbgs becoming v.g.c. to 19
						10	85	4	1							fbgs; 19-20 fbgs f.g. to m.g. with gravel
20-24	3.5/4	**20**	**24**	Sat	Loose		95	4	1						10YR 4/2	Dark grayish brown sand, f.g. to m.g. coarsening to c.g. to v.c.g. at 21.5
						2	70	20	8						10YR 4/2	fbgs; 21.5 - 23.5 fbgs dark grayish brown silty sand with gravel
																23.5 - 24 fbgs sand
24-28	3/4	**24**	**25.5**	Sat	Loose		95	4	1						10YR 4/2	Dark grayish brown Sand grading to v.c.g.
		25.5	**28**		Soft	1	80	15	5						10YR 4/2	f.g. - m.g.sand to silty sand with some gravel, sandy clay at 28 fbgs
28-32	0															NO RECOVERY
32-37	0													Till		NO RECOVERY
37-40	3/3	**37**	**40**	Wet	V. Firm	2	15	35	48						10YR 4/1	Dark gray TILL, very stiff, silty clay with some clay sand
						2	50	20	28							Driller estimates TILL began approximately 30 fbgs.
40-44	4/4	**40**	**44**	Wet	V. Firm			10	90					DS	Gley1 5/1	Greenish gray clay, no alluvial clasts (sand or gravel), weak platey
																fracture, DECORAH SHALE
44-48	3.5/4	**44**	**48**	Wet	V. Firm			10	90						Gley1 5/1	Greenish gray clay, no alluvial clasts (sand or gravel), weak platey
																fracture, DECORAH SHALE
48-50	2/2	**48**	**50**	Dry	V. Firm			10	90						Gley1 5/1	Greenish gray clay, no alluvial clasts (sand or gravel), prominent
																platey fracture, very hard 49-50 fbgs; point refusal at 50 fbgs

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

				SITE ID:	**GPRW-15**
CLIENT:	**Confidential**	**ELEV. (GRND):**	**992.30**	**Page**	1 of 2
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**995.60**	**DATE BEGIN:**	**11-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346467.89 (UTM-FT)**	**DATE END:**	**11-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649335.039 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**3.40**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**53.50**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**51.50**

COMMENTS:

LOCATION DESCRIPTION

Near eastern property boundary along tributary. Installed recovery well RW-15 at this location. Well construction consists of 30 feet of 10 slot screen installed from 21.5 to 51.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
0-4'	1.3'	**0**	**0.4**	Moist/ Wet	Soft	5	15	60	20		Bkg	Bkg		Qal	10YR2/2	very dark brown PEAT, some roots and other organics - grasses,
																wet-frozen
		0.4	**1.3**	Wet	Loose	10	80	10			Bkg	Bkg			10YR4/2	dark grayish-brown SAND (m), some f. to cs., subrounded, loose,
																trace pebbles and clay.
4-8'	2.5'	**4**	**5.9**	Wet	Loose	5	75	15	5		Bkg	1.8			10YR4/2	dark grayish-brown SAND (m-cs), moderately to poorly sorted,
																loose, water-producing zone.
		5.9	**6.5**	Wet	Soft		30	60	10		Bkg	1.8			10YR3/2	very dark grayish brown sandy SILT, trace clay, soft, sand is v.f to fine
8-12'	2.6'	**8**	**9.7**	Wet	Soft		20	50	30		Bkg	3.3			10YR3/2	very dark grayish brown clayey SILT, some sand, soft
		9.7	**10.6**	Wet	Loose	10	80	10							2.5Y3/0	very dark gray SAND(m-cs), trace fine gravel/pebbles, silt,
																loose, water-producing zone.
12-16'	2.9'	**12**	**13.6**	Wet	Loose	10	80	10			Bkg	3.5			2.5Y3/0	SAND, as above
		13.6	**14**	Wet	Loose	15	75	10			Bkg	3.5			2.5Y4/0	dark gray SAND (cs-v.cs), little gravel, sand/gravel subrounded, trace
																silt, loose
		14	**14.9**	Wet	Mod	10	65	15			Bkg	3.5			2.5Y3/0	very dark gray SAND (f-m), little silt, wet-moderate producer
16-20'	1.9'	**16**	**17.9**	Wet	Mod	10	65	15			Bkg	3.3			2.5Y3/0	SAND, as above, denser, likely not as permeable.
20-24'	2.1'	**20**	**22.1**	Wet	Mod	5	45	30	20		Bkg	1.8			10YR3/2	very dark grayish brown SAND (v.f.) and SILT, some clay, some
																thin zones of SILT and CLAY interbedded.
24-28'	2.4'	**24**	**25.7**	Wet	Mod	5	45	30	20		Bkg	1.0			10YR3/2	SAND and SILT, as above
		25.7	**25.9**	Wet	Soft		10	20	70		Bkg	1.0			10YR3/1	very dark gray CLAY, little silt, trace sand, soft, mod plasticity
		25.9	**26.4**	Wet	Mod	5	80	15			Bkg	1.0			10YR3/2	very dark grayish brown SAND (v.f. - f), trace silt and gravel, somewhat
																dense
28-32'	2.2'	**28**	**30.2**	Wet	Loose	15	75	10			Bkg	0.3			10YR3/2	very dark grayish brown SAND (m-cs), trace v.f. to fine sand, trace
																silt, slight solvent odor, rubbilized gravel zone at 28.5 ft bgs, good
																water producing zone.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp F	Competent rock retrived as loose gravel

WESTON ® MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-15**		
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CLIENT:	**Confidential**	**ELEV. (GRND):**	**992.30**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**995.60**	**DATE BEGIN:**	**11-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346467.89 (UTM-FT)**	**DATE END:**	**11-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649335.039 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**3.40**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**53.50**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**51.50**

COMMENTS:

LOCATION DESCRIPTION

Near eastern property boundary along tributary. Installed recovery well RW-15 at this location. Well construction consists of 30 feet of 10 slot screen installed from 21.5 to 51.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT		
		from	to			G	S	Sl	C	O					Munsell Code	LITHOLOGIC DESCRIPTION
32-36'	2.1'	**32**	**34.1**	Wet	Loose	20	70	10			Bkg	0.1	░	Qal	2.5Y3/0	very dark gray SAND (f-m), some coarse to v. coarse zones,
													░			encountered "running" sands in this interval, some pebbles, gravel
36-40'	1.5'	**36**	**37.5**	Wet	Loose	10	80	10			Bkg	Bkg	░		2.5Y3/2	very dark grayish brown SAND (m), trace pebbles/small gravel, silt,
													░			moderately to well-sorted, zome quartz grains - gravel variegated.
40-44'	2.1'	**40**	**41.8**	Wet	Loose	10	80	10			Bkg	Bkg	░		2.5Y3/2	SAND, as above
		41.8	**42.1**	Wet	Loose	65	35				Bkg	Bkg	░		2.5Y4/2	dark grayish-brown sandy GRAVEL, sub-round to rounded, poorly sorted,
													░			gravel up to 1",
44-48'	0.2'	**44**	**44.2**	Wet	Loose	65	35				Bkg	Bkg	░		2.5Y4/2	GRAVEL, as above, encountering "running" sands
48-52'	0.2'	**48**	**48.2**	Wet	Loose	10	90				Bkg	Bkg	░		2.5Y4/2	dark grayish-brown SAND (m-v.cs), trace pebbles - subangular,
													░			not as coarse as previous interval.
52-54.5'	1.5	**52**	**53.5**	Wet	Loose	10	90				Bkg	Bkg	░		2.5Y4/2	SAND, as above
		53.5											≡	DS		refusal, weathered shale in bottom of sleeve - Decorah

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-16**				
Page	1	of	2		
CLIENT:	**Confidential**	**ELEV. (GRND):**	**993.12**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**996.18**	**DATE BEGIN:**	**11-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346329.23 (UTM-FT)**	**DATE END:**	**11-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649267.468 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**3.83**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**51.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**39.40**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-16 at this location. Installed 20 feet of 10 slot screen 19.4 to 39.4 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
0-4'	0.3	**0**	**0.3**	Moist	Loose		5	80	15		Bkg	Bkg	🟫	Qal	5YR2.5/1	black PEAT, some roots/grasses, frozen.
4-8'	3.7'	**4**	**4.8**	Wet	Loose		90	10			Bkg	Bkg	░		2.5Y5/3	gray-brown SAND (f-cs), trace to little silt, wet.
		4.8	**5.1**	Wet	Soft		10	75	15		Bkg		▒		2.5Y4/2	dark gray SILT, little clay, trace v.f. sand, soft, wet
		5.1	**7.7**	Wet	Loose		90	10			Bkg		░		2.5Y5/3	light olive brown SAND (f-m), trace coarse sand, finer-grained
													░			interval from 6.1 to 6.2 ft bgs.
8-12'	3.8'	**8**	**11.8**	Wet	Loose		95	5			Bkg	3.2	░		2.5Y5/3	light olive brown SAND (f-cs), poorly sorted, angular, sand
													░			v.cs. From 10-10.2 ft bgs, productive (water) zone.
12-16'	3.8'	**12**	**12.5**	Wet	Loose		95	5			Bkg	2.8	░		2.5Y5/3	SAND, as above
		12.5	**14**	Moist/W	Firm		15	70	15		1		▒		2.5Y5/3	light olive brown SILT, little sand, caly, slight solvent odor, firm
		14	**16**	Moist/W	Soft		15	25	60		1		▓		2.5Y4/2	dark grayish brown CLAY, little silt and fine sand, soft, slightly
													▓			plastic
16-20'	3.5'	**16**	**19**	Wet	Soft		10	20	70		Bkg	4.1	▓		2.5Y4/2	dark grayish brown CLAY, little silt and fine sand, soft, sl. Plastic
		19	**19.5**	Wet	Loose	10	80	10					░		2.5Y5/3	light olive brown SAND (f-cs), trace silt and sub-round pebbles, some
20-24'	2.1'	**20**	**22.1**	Wet	Loose	10	80	10			0.2	3.7	░		2.5Y5/3	SAND, as above, some coarse zones in matrix
24-28'	3.0'	**24**	**24.5**	Wet	Loose	10	80	10			Bkg	1.0	░		2.5Y4/3	olive brown SAND, as above
		24.5	**27**	Wet	Loose	10	75	15			Bkg		░		2.5Y4/3	olive brown SAND (f-m), finer-grained than previous interval, trace
													░			pebbles, silt, a few silt/clay stringers @25 ft and 25.5 ft bgs.
28-32'	3.5'	**28**	**31.5**	Wet	Loose	10	85	5			Bkg	1.0	░		2.5Y4/3	olive brown SAND (f-m), some coarser grained zones in matrix,
													░			loose, encountered "running" sands in interval
32-36'	3'	**32**	**35**	Wet	Loose		95	5			Bkg	0.1	░		2.5Y4/3	olive brown SAND (m-cs), some fine sand, loose, good water-producing
													░			zone
36-40'	1.2'	**36**	**37**	Wet	Loose		95	5			Bkg	Bkg	░		2.5Y4/3	SAND, as above
		37	**37.2**	Wet	Loose	60	40						░		2.5Y4/3	olive brown sandy GRAVEL, clasts are variegated, some quartz, feldspars

MOISTURE	
Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS			
v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH	
Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-16**		
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CLIENT:	**Confidential**	**ELEV. (GRND):**	**993.12**
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**996.18**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346329.23 (UTM-FT)**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649267.468 (UTM-FT)**
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	
COMMENTS:			

DATE BEGIN:	**11-Mar-08**
DATE END:	**11-Mar-08**
DEPTH TO WATER (TOC):	**3.83**
TOTAL BORING DEPTH (fbgs):	**51.00**
TOTAL WELL DEPTH (fbgs):	**39.40**

LOCATION DESCRIPTION

Installed recovery well RW-16 at this location. Installed 20 feet of 10 slot screen 19.4 to 39.4 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT		
		from	to			G	S	Sl	C	O					Munsell Code	LITHOLOGIC DESCRIPTION
40-44'	2.3'	**40**	**41.5**	Wet	Loose	15	80	5			Bkg	Bkg	░	Qal	2.5Y5/3	light olive brown SAND, little gravel/pebbles in matrix.
		41.5	**42**	Moist	Firm		5	15	80		Bkg	Bkg	■		5G4/1	gley CLAY/highly weathered Shale (piece of Decorah?)
		42	**42.3**	Moist	Firm		5	10	85		Bkg	Bkg	■	Till	5Y4/1	dark gray CLAY (TILL), trace silt, v.f. to f. sand
44-48'	2.8	**44**	**46.8**	Moist	Firm	10	10	15	65		Bkg	Bkg	■		5GY4/1	dark greenish gray CLAY (TILL), some silt, sand pebbles,
													■			dense
48-51'	3.0	**48**	**51**	Sl. Moist	Firm	10	10	15	65		Bkg	Bkg	■		5GY4/1	TILL, as above. Geoprobe refusal at 51 ft. bgs. No rock in bottom of
																sleeve, but could not advance probe beyond this depth.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-17**
Page	1 of 2

CLIENT:	**Confidential**	**ELEV. (GRND):**	**994.19**
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**996.75**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346185.18 (UTM-FT)**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649141.068 (UTM-FT)**
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	

DATE BEGIN:	**12-Mar-08**
DATE END:	**12-Mar-08**
DEPTH TO WATER (TOC):	**4.31**
TOTAL BORING DEPTH (fbgs):	**54.50**
TOTAL WELL DEPTH (fbgs):	**38.90**

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-17 at this location. Well construction consists of 20 feet of 10 slot screen from 18.9 to 38.9 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	1.8'	**0**	**0.35**	Moist	Firm		10	50	40		Bkg	0.1			2.5Y2/0	black organic SILT (PEAT), some roots, grasses, firm, moist-frozen
		0.35	**0.8**	Moist	Firm		15	70	15		Bkg	0.1			2.5Y5/0	gray SILT, little clay/fine sand, moist.
		0.8	**1.8**	Moist	Soft		30	30	40		Bkg	0.1			2.5Y5/6	light olive brown silty/sandy CLAY, sand is v.f to fine with trace
																coarse grains, soft, plastic
4-8'	2.2'	**4**	**6.2**	Wet	Soft		65	25	10		Bkg	0.7			2.5Y4/3	olive brown SAND (m), w/ interbedded (~0.05') lt. brownish gray clayey
																SILT; sand becoming coarser toward bottom of interval. Grades from
																f-m to m-cs, moderately sorted.
8-12'	2.8'	**8**	**10.8**	Wet	Loose		90	10			Bkg	0.1			2.5Y4/4	olive brown SAND (m-cs), trace silt, moderately sorted, loose, grains
																sub-angular to sub rounded, water-producing zone.
12-16'	2.9'	**12**	**14**	Wet	Loose		90	10			Bkg	0.7			2.5Y4/4	SAND, as above, slight solvent odor, becoming coarser toward
																bottom of interval
		14	**14.9**	Wet	Mod		40	50	10		Bkg	0.7			2.5Y4/3	olive brown SAND (v.f.) to SILT, two interbedded zones of f-m sand,
																bedding visible, trace clay, wet.
16-20'	2.4'	**16**	**16.2**	Wet	Mod		40	50	10		Bkg	0.7			2.5Y4/3	SAND and SILT, as above
		16.2	**17**	Wet	Loose	5	85	10			Bkg	0.7			2.5Y4/3	olive brown SAND (m-cs), some f. sand, poorly sorted, loose,
																saturated - good water producing zone.
		17	**18.4**	Wet	Loose	30	65	5			Bkg	0.7			2.5Y5/2	grayish brown SAND (m-cs), some pebbles, v. cs. Sand, grades to a
																v.cs. @ bottom of interval w/gravel
20-24'	2.6'	**20**	**22.6**	Wet	Loose	10	80	10			Bkg	0.9			2.5Y4/2	dark gray brown SAND (m), some coarse sand/pebbles/gravel w/in
																matrix
24-28'	2.3'	**24**	**24.6**	Wet	Soft	5	30	30	35		Bkg	0.5			2.5Y5/2	grayish brown SILT/ v.f. SAND/ CLAY, mod. Plasticity, soft,
																wet, 1/2" pieces of gravel in matrix
		24.6	**26.3**	Wet	Loose	5	65	25	5		Bkg	0.5			2.5Y4/2	dark grayish brown SAND (f-cs), poorly sorted, some silt, loose
																moderately productive zone.
28-32'	2.0'	**28**	**30**	Wet	Loose	15	80	5			Bkg	0.1			2.5Y4/3	olive brown SAND (m-cs), some zones of v.cs. Sand/small gravel,
																subrounded

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

SOIL BORING LOG

SITE ID: GPRW-17
Page 2 of 2

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site
PROJECT NO.: 02181-202-005-0001
DRILLING CO.: Matrix Environmental
LOGGED BY: Dave Cairns
DRILL METHOD: GeoProbe Rig
SITE TYPE: Soil Boring
COMMENTS:

ELEV. (GRND): 994.19
(TOC): 996.75
NORTHING: 16346185.18 (UTM-FT)
EASTING: 1649141.068 (UTM-FT)
DEPTH TO BEDROCK (fbgs):
RESIDUUM BOREHOLE DIA. (in): 3
BDRK BOREHOLE DIA. (in):

DATE BEGIN: 12-Mar-08
DATE END: 12-Mar-08
DEPTH TO WATER (TOC): 4.31
TOTAL BORING DEPTH (fbgs): 54.50
TOTAL WELL DEPTH (fbgs): 38.90

LOCATION DESCRIPTION

Installed recovery well RW-17 at this location. Well construction consists of 20 feet of 10 slot screen from 18.9 to 38.9 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
32-36'	2.1'	**32**	**34.1**	Wet	Loose	9	90	1			Bkg	0.9		░	2.5Y4/4	olive brown SAND (m-cs), moderate to well-sorted, sub-round to
														░		sub-angular, good water producing zone.
36-40'	2.0'	**36**	**37**	Wet	Loose	9	90	1			Bkg	0.2		░	2.5Y4/4	SAND, as above
		37	**38**	Moist	Firm	10	15	15	70		Bkg	0.2		█	2.5Y4/2	dark grayish-brown CLAY (TILL), little sand/silt, sand is subangular,
														█		some pebbles - subangular to subround, mod. Plasticity
40-44'	3.5'	**40**	**43.5**	Sl. Moist	Firm	10	15	15	70		Bkg	0.6		█	2.5Y4/2	TILL, as above
44-48'	3.3'	**44**	**47.3**	Sl. Moist	Firm	10	15	15	70		Bkg	0.5		█	2.5Y4/2	TILL, as above
48-52'	3.7'	**48**	**51.7**	Sl. Moist	Firm	10	15	15	70		Bkg	0.6		█	2.5Y4/2	TILL, as above
52-54.5'	--	**52**	**54.5**											█		TILL-as above, sleeve shattered within the core barrel, shoe of spoon
																had "platy" buff colored limestone pieces - Platteville. Refusal at
																54.5 ft bgs

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

				SITE ID:	**GPRW-18**
CLIENT:	**Confidential**	**ELEV. (GRND):**	**993.80**	Page	1 of 2
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**996.86**	**DATE BEGIN:**	12-Mar-08
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346249.37 (UTM-FT)**	**DATE END:**	12-Mar-08
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648944.721 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**4.41**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**57.30**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**57.30**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-18 at this location. Well construction consists of 40 feet of 10 slot screen from 17.3 to 57.3 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	1.35'	**0**	**1.35**	Moist	Loose		15	50	10	25	0.1	Bkg			2.5Y3/2	very dark grayish brown SILT, some roots/grasses, wood debris (FILL),
																paper, plastic, moist.
4-8'	1.3'	**4**	**5.3**	Moist	Loose		10	80	10		0.3	0.4			2.5Y3/2	very dark grayish brown PEAT, organics/roots, decomposed wood,
																no fill material present.
8-12'	1.7'	**8**	**9.6**	Wet	Soft		10	80	10		Bkg	0.2			2.5Y3/2	PEAT, as above
		9.6	**9.7**	Wet	Soft		30	30	40		Bkg	0.2			2.5Y5/2	grayish-brown silty/sandy CLAY, sand v.f. to fine, angular, moderate
																plasticity, soft
12-16'	1.6'	**12**	**12.5**	Wet	Soft		15	15	70		Bkg	0.1			2.5Y5/0	grayish-brown CLAY, little silt, sand is v.f to fine, soft, wet.
		12.5	**13.6**	Wet	Loose		80	15	5		Bkg	0.1			2.5Y4/2	dark grayish-brown SAND (m-cs), some fine sand, little silt, trace clay,
																poorly sorted, saturated, good water-producing zone.
16-20'	2.2'	**16**	**18.2**	Wet	Loose		90	10			Bkg	Bkg			2.5Y4/2	SAND, as above.
20-24'	1.4'	**20**	**21.4**	Wet	Loose	5	90	5			Bkg	0.3			2.5Y4/2	SAND, as above, a few pebbles and coarse sand in matrix.
24-28'	0	**--**	**--**													No recovery, driller indicates that gravel is likely blocking the rods.
																Ran solid point down to unclog rods.
28-32'	0.9'	**28**	**28.9**	Wet	Loose	35	60	5			Bkg	0.2			2.5Y5/2	grayish-brown gravelly SAND (m), loose-saturated, gravel 1-2" - likely
																the cause for no recovery in the previous interval, good water-
																producing zone.
32-36'	1.1'	**32**	**33**	Wet	Loose	10	90				Bkg	0.3			2.5Y5/2	grayish-brown SAND (m), little coarse sand and small pebbles,
																angular to sub-angular
36-40'	1.1'	**36**	**37.1**	Wet	Loose	10	90				Bkg	0.3			2.5Y5/2	SAND, as above, good water producer
40-44'	1.6'	**40**	**41.6**	Wet	Loose	10	90				Bkg	0.1			2.5Y5/2	SAND, as above, good water producer
44-48'	1.8'	**44**	**45.8**	Wet	Loose	10	90				Bkg	0.1			2.5Y5/2	SAND, as above, good water producer
48-52'	0	**--**	**--**													No recovery, gravel?

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

SOIL BORING LOG

				SITE ID:	**GPRW-18**
				Page	2 of 2
CLIENT:	**Confidential**	**ELEV. (GRND):**	**993.80**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**996.86**	**DATE BEGIN:**	**12-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346249.37 (UTM-FT)**	**DATE END:**	**12-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648944.721 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**4.41**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**57.30**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**57.30**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-18 at this location. Well construction consists of 40 feet of 10 slot screen from 17.3 to 57.3 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
52-56'	1.8'	**52**	**53.8**	Wet	Loose		80	15	5		Bkg	0.3			2.5Y5/2	grayish-brown SAND(m), trace coarse sand, silt and clay, moderately sorted, wet.
56-59'	1.2'	**56**	**56.2**	Wet	Loose	5	65	15	15		Bkg	0.2			2.5Y5/2	grayish-brown SAND(f-m), little silt/clay, somewhat plastic, finer-grained than previous interval.
																Encountered refusal at 59 ft bgs, could not advance geoprobe beyond this depth. No rock fragments in sleeve.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID: GPRW-19

Page 1 of 3

CLIENT:	Confidential	**ELEV. (GRND):**	997.25		
SITE NAME:	Oakdale Disposal Site	**(TOC):**	100.53	**DATE BEGIN:**	13-Mar-08
PROJECT NO.:	02181-202-005-0001	**NORTHING:**	16346197.85 (UTM-FT)	**DATE END:**	13-Mar-08
DRILLING CO.:	Matrix Environmental	**EASTING:**	1648827.446 (UTM-FT)		
LOGGED BY:	Dave Cairns	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	8.01
DRILL METHOD:	GeoProbe Rig	**RESIDUUM BOREHOLE DIA. (in):**	3	**TOTAL BORING DEPTH (fbgs):**	64.10
SITE TYPE:	Soil Boring	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	54.20

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-19 at this location. Well Construction consists of 35 feet of 10 slot screen from 19.2 to 54.2 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
0-4'	3.4'	**0**	**0.3**	Frozen												Ice/Snow
		0.3	**1.7**	Moist	Soft	5	15	60	10	10	Bkg	15.1	▒	Qal	2.5Y3/3	dark olive brown SILT, roots, topsoil - FILL material
		1.7	**3.4**	Moist	Soft		25	60	15		Bkg	15.1	▒		2.5Y2/0	black SILT/PEAT, high organic layer - wetland sediment, roots
4-8'	1.9'	**4**	**4.6**	Moist	Soft		25	60	15		2	22.0	▒		2.5Y2/0	PEAT, as above
		4.6	**5.9**	Moist	--					100	2	22.0	▒			FILL, paper, plastic, insulation
8-12'	2.0'	**8**	**9.4**	Moist	Soft		20	60	20		Bkg	0.7	▒		2.5Y2/0	black SILT/PEAT, as above
		9.4	**10**	Wet	Loose		85	10	5		Bkg	0.7	░		2.5Y5/2	grayish-brown SAND (m), moderately well sorted, sub-round to sub-
													░			angular, saturated.
12-16'	2.8'	**12**	**12.5**	Wet	Loose		85	10	5		Bkg	Bkg	░		2.5Y5/2	SAND, as above
		12.5	**12.7**	Wet	Soft	5	25	60	10		Bkg	Bkg	▒		2.5Y4/2	dark grayish-brown sandy SILT
		12.7	**12.9**	Wet	Loose	40	30	20	10		Bkg	Bkg	░		2.5Y4/2	dark grayish-brown GRAVEL/cs SAND, loose, sand/gravel is round
													░			to sub-round
		12.9	**14.5**	Wet	Loose		60	30	10		Bkg	Bkg	░		2.5Y4/2	dary grayish-brown SAND (f), some silt, trace clay, sand sub-rounded.
		14.5	**14.8**	Moist	Soft		10	15	75		Bkg	Bkg	▓		2.5Y5/3	lt. olive brown CLAY, little silt, trace v.f. sand, mod to high plasticity
16-20'	3.0'	**16**	**17.6**	Wet	Soft		45	45	10		Bkg	2.1	░		2.5Y5/3	interbedded lt. olive brown sandy SILT and silty SAND, sand v.f to f.,
													░			some intervals have a higher % of clay
		17.6	**19**	Moist	Mod		5	15	80		Bkg	2.1	▓		2.5Y4/3	olive-brown CLAY, mod dense, low plasticity.
20-24'	3.5'	**20**	**20.8**	Moist	Soft		5	15	80		Bkg	0.6	▓		2.5Y4/3	CLAY, as above but not as dense
		20.8	**21**	Wet	V. Soft		20	40	40		Bkg	0.6	▒		2.5Y5/2	grayish-brown SILT/CLAY, very soft-"runny", some v.f. to f. grained
													▒			sand, wet
		21	**23.5**	Wet	Soft		20	40	40		Bkg	0.6	▒		2.5Y5/2	grayish-brown interbedded SILT/CLAY with CLAY, variations in
								to					▒			density and moisture in interval, more CLAY in bottom of interval
							10	20	70				▒			
24-28'	2.3'						80	15	5		Bkg	1.2	░		2.5Y4/4	olive brown SAND (f-m), some cs. Sand, little silt, trace clay, poorly
													░			sorted, sub-angular to sub-round, moderate producer.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-19**			**Page**	2 of 3
CLIENT:	**Confidential**	**ELEV. (GRND):**	**997.25**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**100.53**	**DATE BEGIN:**	**13-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346197.85 (UTM-FT)**	**DATE END:**	**13-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648827.446 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**8.01**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**64.10**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**54.20**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-19 at this location. Well Construction consists of 35 feet of 10 slot screen from 19.2 to 54.2 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		25.8	**26.3**	Wet	Soft		20	60	20		Bkg	1.2	▓	Qal	2.5Y3/3	dark olive brown SILT, little to some sand/clay, mod plasticity,
													▓			wet, soft
28-32'	1.1'	**28**	**29**	Moist/ Wet	Soft		35	50	15		Bkg	1.0	▓		2.5Y4/2	dark grayish-brown sandy SILT, little clay, sand f-cs, poorly sorted.
		29	**29.1**	Wet	Loose	20	45	20	15		Bkg	1.0	░		2.5Y4/2	dark grayish-brown SAND (cs-v.cs.), some small gravel/pebbles, little
													░			silt and clay, bottom of sleeve has v. cs. Sand and pebbles, appear to have
													░			penetrated cs. Sand zone.
32-36'	--												░			No recovery, ran in borehole with solid tip to try to remove gravel
													░			from within bottom of rods.
36-40'	--												░			No recovery, advanced sleeve through this interval, but still gravel
													░			blocking bottom of rods, advanced solid tip again.
40-44'	1.5'	**40**	**41.5**	Wet	Loose	15	80	5			Bkg	0.8	░		2.5Y4/3	olive brown SAND (m-cs), gravel up to 1" with fragments of other
													░			larger pieces, poorly sorted, sub-angular to sub-rounded, saturated.
44-48'	1.2'	**44**	**45.2**	Wet	Loose	20	80				Bkg	1.8	░		2.5Y4/3	olive brown SAND, as above, clasts variegated - quartz, feldspar,
													░			heavy minerals.
48-52'	2.2'	**48**	**48.5**	Wet	Loose	5	90	5			Bkg	2.2	░		2.5Y4/3	SAND, as above, but with lesser amounts of gravel, sand is m-cs,
													░			moderately sorted.
		48.5	**50.2**	Wet	Loose		80	20			Bkg	2.2	░		2.5Y4/3	SAND, as above but coarsening downward. Bottom of interval is
													░			a medium grained sand, well sorted.
52-56'	3.7'	**52**	**55.2**	Wet	Loose		90	10			Bkg	0.1	░		2.5Y4/3	olive brown SAND (f-m), some v.f to fine sand.
		55.2	**55.7**	Wet	Soft		25	35	40		Bkg	0.1	▓		2.5Y4/3	olive brown silty CLAY, some sand (v.f.-f.), slightly plastic.
56-60'	3.8'	**56**	**59.8**	Wet	Loose		95	5			Bkg	Bkg	░		2.5Y4/3	interbedded olive brown SAND(f-m) to
							40	40	20		Bkg	Bkg	▓		2.5Y4/3	olive brown silty SAND, trace to little clay, fine SAND in bottom of
													▓			interval, wet
60-64'	3.9'	**60**	**62.1**	Wet	Soft		25	50	25		Bkg	Bkg	▓		2.5Y4/3	olive brown sandy/clayey SILT, sand is v.f to fine, very soft, wet.
		62.1	**63.3**	Wet	Soft		90	10			Bkg	Bkg	░		2.5Y4/3	olive brown SAND (f), some v.f. and med sand, well sorted,
													░			sub-round

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp F	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-19**			**Page**	3 of 3
CLIENT:	**Confidential**	**ELEV. (GRND):**	**997.25**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1000.53**	**DATE BEGIN:**	**13-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346197.85 (UTM-FT)**	**DATE END:**	**13-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648827.446 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**8.01**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**64.10**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**54.20**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-19 at this location. Well Construction consists of 35 feet of 10 slot screen from 19.2 to 54.2 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		63.3	**63.9**	Wet	Soft		50	20	30		Bkg	Bkg	▨	Qal	2.5Y4/2	dark grayish-brown clayey SAND (v.f-f), moderate plasticity,
													▨			sand sub-round
64-64.1'	0.1'	**64**	**64.1**	Wet	Soft		85	15			Bkg	Bkg	░		2.5Y4/3	olive brown SAND (v.f.-f), little silt, well sorted. Encountered
													░			geoprobe refusal at 64.1 ft bgs. No rock fragments in recovery.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-20**		
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CLIENT:	**Confidential**	**ELEV. (GRND):**	**996.93**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1000.24**	**DATE BEGIN:**	**13-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346217.25 (UTM-FT)**	**DATE END:**	**13-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648697.854 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**7.64**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**59.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**51.50**

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-20 at this location. Installed 20 feet of 10 slot screen from 31.5 to 51.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	2.7'	**0**	**1.7**	Moist	Soft		10	60	30		Bkg	3.8	▨	Qal	2.5Y3/2	very dark grayish brown SILT (FILL), some clay, moist-frozen.
		1.7	**2.7**	Moist	--					100	Bkg	3.8	▨		--	FILL material mixed with silt and clay, fill consists of metal, shingles
4-8'	1.6'	**4**	**5.6**	Moist	--					100	Bkg	8.3	▨		--	FILL, various - paper, insulation, pieces of metal.
8-12'	2.4'	**8**	**10.4**	Moist	Soft		10	60	20		Bkg	1.4	▨		2.5Y2/0	black PEAT, some clay, soft.
12-16'	3.4'	**12**	**12.3**	Moist	Soft		10	60	20		Bkg	Bkg	▨		2.5Y2/0	PEAT, as above
		12.3	**12.7**	Wet	Loose	15	80	5			Bkg	Bkg	▨		2.5Y3/3	dark olive brown SAND (f-cs), little gravel, trace silt, poorly sorted,
													▨			angular to sub-angular, saturated.
		12.7	**13.6**	Wet	Soft		45	40	15		Bkg	Bkg	▨		2.5Y4/3	olive brown silty SAND (v.f.), little clay, soft, well sorted, saturated
		13.6	**15.4**	Wet	Loose		90	10			Bkg	Bkg	▨		2.5Y4/3	olive brown SAND, trace silt, grades from a fine sand in top of interval
													▨			to a m. sand in bottom, moderate to well-sorted
16-20'	2.1'	**16**	**16.3**	Wet	Loose		90	10			Bkg	2.1	▨		2.5Y4/3	SAND, as above
		16.3	**17.3**	Wet	Soft		40	30	30		Bkg	2.1	▨		2.5Y4/2	dark grayish brown silty/clayey SAND (v.f.), somewhat plastic.
		17.3	**18.1**	Wet	Loose	5	90	5			Bkg	2.1	▨		2.5Y4/2	dark grayish brown SAND (f-cs), trace v.cs. Sand, poorly sorted,
													▨			sub-angular
20-24'	2.3'	**20**	**21.5**	Wet	Loose	10	85	5			Bkg	0.6	▨		2.5Y4/2	dark grayish brown SAND (m-cs) grading to a f-m sand, some v.cs.
													▨			SAND and small gravel, loose, saturated.
		21.5	**22.3**	Wet	Loose	15	50	30	5		Bkg	0.6	▨		2.5Y3/3	dark olive brown silty SAND (m-v.cs), poorly sorted, some rounded
													▨			small gravel.
24-28'	2.5'	**24**	**24.6**	Wet	Loose	5	85	10			Bkg	1.2	▨		2.5Y4/3	olive brown SAND (f-m), trace pebbles and small gravel, mod to well-
													▨			sorted, saturated.
		24.6	**25.4**	Moist/ Wet	Soft		20	50	30		Bkg	1.2	▨		2.5Y4/2	dark grayish brown SILT, some clay, little fine sand, soft,
													▨			somewhat plastic.
		25.4	**26.5**	Wet	Soft		30	50	20		Bkg	1.2	▨		2.5Y4/2	interbedded SILT and SAND (f-m), little clay
							50	30	20		Bkg	1.2	▨			

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

SOIL BORING LOG

SITE ID:	**GPRW-20**	**Page**	2 of 2

CLIENT:	**Confidential**	**ELEV. (GRND):**	**996.93**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1000.24**	**DATE BEGIN:**	**13-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346217.25 (UTM-FT)**	**DATE END:**	**13-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648697.854 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**7.64**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**59.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**51.50**

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-20 at this location. Installed 20 feet of 10 slot screen from 31.5 to 51.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
28-32'	2.5'	**28**	**28.5**	Wet	Soft						Bkg	1.0		Qal		interbedded SILT and SAND (f), as above
		28.5	**30.5**	Wet	Loose	30	65	5			Bkg	1.0			2.5Y3/3	dark olive brown gravelly SAND (m-cs), gravel sub-round to round,
																poorly sorted, loose - good producer.
32-36'	2.8'	**32**	**33.1**	Wet	Soft	5	75	20			Bkg	1.2			2.5Y4/3	olive brown SAND (m-cs), some silt, trace small gravel and pebbles,
																poorly sorted, loose.
		33.1	**34.2**	Wet	Loose	15	55	30			Bkg	1.2			2.5Y4/2	dark grayish brown silty SAND (f-m), some pebbles/small gravel,
																sub-round to round, poorly sorted.
		34.2	**34.8**	Wet	Loose	50	30	20			Bkg	1.2			2.5Y3/0	very dark gray sandy GRAVEL, encountered cobble - limestone?
																in interval
36-40'	1.4'	**36**	**36.8**	Wet	Loose	30	50	20			Bkg	0.8			2.5Y4/3	olive brown gravelly SAND (f-cs), little silt, very poorly sorted,
																sub-round to sub-angular, loose.
		36.8	**37.4**	Wet	Mod		60	30	10		Bkg	0.8			2.5Y4/2	dark grayish brown silty SAND (f-m), trace coarse sand, poorly sorted
40-44'	1.65'	**40**	**40.7**	Wet	Loose		95	5			Bkg	0.8			2.5Y4/2	dark grayish brown SAND (m-cs), poorly sorted, some/little v.cs
																sand, loose, good water producing zone.
		40.7	**41.2**	Moist	Firm		10	80	10		Bkg	0.8			2.5Y5/2	grayish-brown SILT, trace clay and v.f. sand, moist.
		41.2	**41.65**	Wet	Loose	5	90	5			Bkg	0.8			2.5Y3/3	dark olive brown SAND(m-cs), sub-angular to sub-rounded, loose,
																clasts primarily quartz but some feldspar, others.
44-48'	1.9'	**44**	**44.9**	Wet	Loose	25	70	5			Bkg	1.8			2.5Y3/3	dark olive brown SAND - as above but coarser, some gravels,
																moderate to poorly sorted.
		44.9	**45.9**	Wet	Loose		35	35	30		Bkg	1.8			2.5Y3/2	interbedded very dark grayish brown silty SAND (v.f.) to sandy SILT,
																some clay, soft, saturated.
48-52'	1.7'	**48**	**48.5**	Wet	Loose	15	80	5			Bkg	2.2			2.5Y4/2	dark grayish brown SAND (m-cs), some very coarse sand, trace
																silt, sub-round, poorly sorted.
		48.5	**49.7**	Wet	Loose	65	30	5			Bkg	2.2			2.5Y4/2	dark grayish brown sandy GRAVEL, gravel pieces >1", sub-round,
																channel deposits??
52-56'	0.3'	**52**	**52.3**	Wet	Loose	65	30	5			Bkg	Bkg			2.5Y4/2	GRAVEL, as above
56-60'	3.0'	**56**	**59**	Sl. Moist	Firm						Bkg	Bkg		DS	5GY5/1	greenish gray highly weathered SHALE, becoming more competent at
																bottom of interval.

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-21**
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CLIENT:	**Confidential**	**ELEV. (GRND):**	**995.29**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**998.41**	**DATE BEGIN:**	**14-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346037.43 (UTM-FT)**	**DATE END:**	**14-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648626.066 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**5.87**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**61.80**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**57.75**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-21 at this location. Well construction consists of 10 feet of 10 slot screen from 47.75 to 57.75 ft bgs, and 10 feet of 5 slot screen from 37.75 to 47.75 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	3.4'	**0**	**1.6**	Moist	Soft	5	40	50	5		Bkg	0.6	▨		10YR5/6	yellowish-brown sandy SILT (FILL), some f-m sand, some roots,
													▨			moist
		1.6	**1.7**	Moist	Firm	100							▨			rubbilized GRAVEL/Limestone (FILL)
		1.7	**3.4**	Moist	Soft		20	50	30		Bkg	0.6	🟫	Qal	10YR2/1	black clayey SILT (PEAT), some sand - reworked soil/fill.
4-8'	3.0'	**4**	**6.6**	Moist	Soft		15	40	20	25	Bkg	0.6	▨		10YR2/1	as above, fill/reworked soil, some shingle pieces in matrix.
		6.6	**7**	Moist	Soft					100	Bkg	0.6	▨			FILL-white spongy material - insulation?
8-12'	1.7'	**8**	**8.4**	Moist/ Wet	Loose					100	Bkg	1.5	▨			FILL, as above
		8.4	**9.7**	Moist/ Wet	Soft		5	10	5	75	Bkg	1.5	🟫		2.5Y2/0	black PEAT, high in organic material - roots and other decomposed
													🟫			material, moist to wet - likely within water table
12-16'	3.2'	**12**	**15.2**	Moist/ Wet	Soft		5	10	5	75	Bkg	0.4	🟫		2.5Y2/0	black PEAT, as above
16-20'	3.3'	**16**	**19.1**	Wet	Soft			15	85		Bkg	Bkg	■		2.5Y5/0	gray CLAY, varies from very soft to slightly dense, no sand
													■			or coarse sediments.
		19.1	**19.3**	Wet	Soft		30	35	35		Bkg	Bkg	▒		2.5Y5/3	lt. olive brown sandy SILT/CLAY, sand is v.f. to f., moderate
													▒			plasticity, soft, saturated.
20-24'	3.6'	**20**	**20.3**	Wet	Loose	5	75	15	5		Bkg	Bkg	░		2.5Y4/3	olive brown SAND (f-cs), little silt, poorly sorted, sub-angular to
													░			angular, piece of 1" gravel in bottom of interval, saturated.
		20.3	**22.7**	Wet	Loose	5	35	30	30		Bkg	Bkg	▒		2.5Y5/4	lt. olive brown silty/clayey SAND, trace pebbles and small gravel, loose,
													▒			saturated
		22.7	**23.6**	Wet	Loose		60	20	20		Bkg	Bkg	░		2.5Y4/3	olive brown SAND (v.f-f), little silt and clay, subrounded, saturated.
24-28'	1.9'	**24**	**24.4**	Wet	Loose		60	20	20		Bkg	Bkg	░		2.5Y4/3	SAND, as above
		24.4	**25.9**	Wet	Soft		5	10	85		Bkg	Bkg	■		2.5N3/2	very dark grayish-brown CLAY, trace silt and sand, soft-"runny"
28-32'	3.4'	**28**	**28.5**	Wet	Loose		95	5			Bkg	Bkg	░		2.5N4/3	olive-brown SAND (f-m), moderately sorted, sub-angular to sub-round,
													░			moderate water-producing zone.
		28.5	**31.4**	Moist	Soft		10	20	70		Bkg	Bkg	■		2.5N4/2	dark grayish-brown CLAY, some silt, trace v.f. sand, moist,
													■			soft, slightly plastic.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

				SITE ID:	**GPRW-21**
				Page	2 of 2
CLIENT:	**Confidential**	**ELEV. (GRND):**	**995.29**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**998.41**	**DATE BEGIN:**	**14-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346037.43 (UTM-FT)**	**DATE END:**	**14-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648626.066 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**5.87**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**61.80**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**57.75**

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-21 at this location. Well construction consists of 10 feet of 10 slot screen from 47.75 to 57.75 ft bgs, and 10 feet of 5 slot screen from 37.75 to 47.75 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
32-36'	3.8'	**32**	**33.9**	Wet	Soft		10	20	70		Bkg	Bkg	■	Qal	2.5Y4/2	CLAY, as above
		33.9	**35.8**	Wet	Mod	5	85	10			Bkg	Bkg	░		2.5Y3/2	very dark grayish-brown SAND(f-m), poorly sorted, some angular
																coarse sand, tight - will produce a little water.
36-40'	3.4'	**36**	**36.6**	Wet	Loose	5	85	10			Bkg	Bkg	░		2.5Y3/2	SAND, as above, slightly higher coarse sand
		36.6	**37.8**	Wet	Soft		20	40	40		Bkg	Bkg	▒		2.5Y4/2	dark grayish brown sandy SILT/CLAY, sand is poorly sorted - f-cs
		37.8	**38**	Moist	Firm		5	5	90		Bkg	Bkg	■		2.5Y4/0	dark gray CLAY, trace coarse sediments, dense
		38	**39.4**	Wet	Loose	20	60	10	10		Bkg	Bkg	░		2.5Y4/2	dark grayish-brown SAND (f-cs), very poorly sorted, loose - fair
																water producing zone.
40-44'	2.8'	**40**	**42.8**	Wet	Firm	5	80	15			Bkg	Bkg	░		2.5Y4/3	olive-brown SAND(f), some coarser sand, trace pebbles, dense,
																moderately sorted
44-48'	3.6'	**44**	**45.4**	Wet	Firm	5	80	15			Bkg	Bkg	░		2.5Y4/3	SAND, as above, coarse sand zone in bottom of interval
		45.4	**47.1**	Moist	Firm	10	10	10	70		Bkg	Bkg	■		2.5Y5/3	light olive brown CLAY(TILL), dense, little sand/silt/pebbles
		47.1	**47.5**	Moist	Firm	10	10	10	70		Bkg	Bkg	■		2.5YR3/3	TILL, as above but color change to dark reddish-brown
48-52'	1.4'	**48**	**49.4**	Wet	Loose	10	90				Bkg	Bkg	░		2.5Y4/3	olive brown SAND (m-cs), some fine sand, moderately sorted,
																sub-rounded, gravelly zone in bottom 0.2'
52-56'	2.3'	**52**	**54.3**	Wet	Loose	10	90				Bkg	Bkg	░		2.5Y4/3	SAND, as above, no coarse zones, good water-producing zone
56-60'	1.8'	**56**	**57.2**	Wet	Loose	10	90				Bkg	Bkg	░		2.5Y4/3	SAND, as above
		57.2	**57.8**	Wet	Soft/Loose	20	50	20	10		Bkg	Bkg	░		2.5Y3/2	very dark grayish brown gravelly SAND(m-cs), some silt, little clay,
																saturated.
60-62'	1.8'	**60**	**61.75**	Wet	Soft/Loose	20	50	20	10		Bkg	Bkg	░		2.5Y3/2	SAND, as above
		61.75	**61.8**		Comp	100					Bkg	Bkg	☰	PL	2.5Y4/2	dark grayish-brown Limestone - Platteville.

MOISTURE	
Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS			
v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH	
Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID: GPRW-22A

CLIENT:	**Confidential**	**ELEV. (GRND):**	**995.56**	**Page**	1 of 1
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**998.47**	**DATE BEGIN:**	**14-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346271.88 (UTM-FT)**	**DATE END:**	**14-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648537.515 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**48.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**
COMMENTS:					

LOCATION DESCRIPTION

Installed recovery well RW-22 at this location. Well construction consists of 10 feet of 10 slot screen from 15.3 to 25.3 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT		
		from	to			G	S	Sl	C	O					Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	3.2'	**0**	**0.2**	Moist	Loose	100							▨			GRAVEL - FILL
		0.2	**2**	Moist	Soft			100			Bkg	Bkg	▨		2.5Y3/0	very dark gray to 2.5Y6/3 lt yellowish brown SILT with highly
													▨			organic soil - reworked FILL material
		2	**2.7**	Moist	Soft		20	30	50		Bkg	Bkg	▨		2.5Y4/0	dark gray CLAY, some silt, sand, FILL material
		2.7	**3.2**										▨			FILL - shingles
4-8'	1.25'	**4**	**5.25**	Wet	--					100	Bkg	Bkg	▨			FILL, as above - shingles clogging bottom of rods, use solid point
													▨			to clear bottom of rods.
8-12'	0.6'	**8**	**8.5**	Wet	--					100	Bkg	Bkg	▨			FILL - shingles
		8.5	**8.6**	Wet	Loose	30	50	10	10				░	Qal	5GY4/1	dark greenish gray gravelly SAND, very poorly sorted, wet.
12-16'	1.9'	**12**	**12.9**	Wet	Loose	50	30	10	10		Bkg	Bkg	░		7.5YR4/0	dark gray sandy GRAVEL, very poorly sorted, gravel is subround and
													░			up to 1", loose, grades to a v. coarse sand in bottom of interval.
16-20'	2.5'	**16**	**16.4**	Wet	Loose	15	80	5			Bkg	0.3	░		2.5Y4/2	dark grayish brown SAND (m-cs), some v.cs sand with pebbles,
													░			sub-rounded, wet - productive zone.
		16.4	**17.6**	Wet	Loose	5	60	35			Bkg		░		2.5Y4/3	olive brown silty SAND (f-cs), poorly sorted.
		17.6	**17.8**	Wet	Loose	5	85	10			Bkg		░		2.5Y4/3	olive brown SAND (coarse)
		17.8	**18.5**	Wet	Loose	5	25	35	35		Bkg		▒		2.5Y4/2	dark grayish brown sandy CLAY/SILT, sand f-cs grained, poorly sorted
20-24'	0.3'	**20**	**20.3**	Wet	Loose		95	5			Bkg	0.6	░		2.5Y4/2	dark grayish brown SAND (f-m), well-sorted, bottom of sleeve is a silty
													░			SAND, solvent odor.
24-28'	3.7'	**24**	**27.7**	Moist	Soft	5	15	50	30		0	10.0	▒		2.5Y3/3	dark olive brown SILT with some clay (TILL), little sand, trace pebbles.
28-32'	4.0'	**28**	**32**	Moist	Firm	10	10	15	65		Bkg	3.2	▓		2.5Y4/0	dark gray CLAY (TILL), some silt, little sand, gravel, sand is angular
													▓			to subangular, poorly sorted, trace coarse sand.
32-34'	2.0'	**32**	**34**	Moist	Firm	10	10	50	30		Bkg	Bkg	■	Till	2.5Y4/0	dark gray TILL, more silt than clay
34-36'	2.0'	**34**	**36**	Moist	Firm	5	10	55	30		Bkg	Bkg	■		2.5Y4/0	dark gray TILL, more silt than clay
36-40'	4.0'	**36**	**40**	Moist	Firm	10	10	50	30		Bkg	Bkg	■		2.5Y4/0	dark gray TILL, more silt than clay
40-44'	4.0'	**40**	**44**	Moist	Firm	10	10	50	30		Bkg	Bkg	■		2.5Y4/0	dark gray TILL, more silt than clay
44-48'	4.0'	**44**	**48**	Moist	Firm	5	10	60	25		Bkg	Bkg	■		2.5Y4/0	dark gray TILL, more silt than clay, hit refusal at 48 ft bgs. Could not
													■			advance geoprobe beyond this depth.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	**Dry**	**v.f.g.**	**Very Fine-Grained**	**Fr**	**Friable**	**Soft**	**Soft unconsolidated material, i.e. clay to silt**
Mst	**Moist**	**f.g.**	**Fine-Grained**	**Blk**	**Blocky**	**Loose**	**Will not retain shape, i.e. clean sand**
Wet	**Wet**	**m.g.**	**Medium-Grained**	**Str**	**Streaked**	**Mod**	**Retains shape but friable or crumbles with pressure.**
Sat	**Saturated**	**c.g.**	**Coarse-Grained**	**Mtl**	**Mottled**	**Firm**	**Retains shape and difficult to crumble**
Wpr	**Wet Perched**	**v.c.g.**	**Very Coarse-Grained**	**grd**	**Graded**	**Comp C**	**Competent rock retrieved as core sections**
				trn	**Transitional**	**Comp F**	**Competent rock retrived as loose gravel**

SOIL BORING LOG

SITE ID: GPRW-22B
Page 1 of 2

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site
PROJECT NO.: 02181-202-005-0001
DRILLING CO.: Matrix Environmental
LOGGED BY: Dave Cairns
DRILL METHOD: GeoProbe Rig
SITE TYPE: Soil Boring
COMMENTS:

ELEV. (GRND):
(TOC):
NORTHING:
EASTING:
DEPTH TO BEDROCK (fbgs):
RESIDUUM BOREHOLE DIA. (in): 3
BDRK BOREHOLE DIA. (in):

DATE BEGIN: 18-Mar-08
DATE END: 18-Mar-08
DEPTH TO WATER (TOC):
TOTAL BORING DEPTH (fbgs): 42.00
TOTAL WELL DEPTH (fbgs): NA

LOCATION DESCRIPTION

Located approximately 25 feet north of GPRW-22. Boring only, no well installed.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
0-4'	3.9'	**0**	**2**	Moist	Loose	25	50	25			Bkg	48.0	▨	Fill	2.5Y3/2	very dark grayish brown SAND, some gravel, silt, moist, poorly
													▨			sorted (FILL)
		2	**3.8**	Moist	Loose	25	25	50			1		▨		2.5Y3/2	very dark grayish brown sandy SILT, some v. cs sand and small
													▨			gravel, poorly sorted, slight solvent odor.
		3.8	**3.9**	Moist	--					100			▨			FILL - shingles
4-8'	2.6'	**4**	**5.8**	Moist	Soft	10	10	50	30		3	10	▨		10YR2/2	very dark brown clayey SILT (FILL), some sand and gravel, odor -
													▨			petroleum/solvent?
		5.8	**6.3**	Moist	Soft		5	75	20		3		🟫	Qal	10YR2/2	black PEAT, soft, high in organics, slight solvent odor
		6.3	**6.6**	Wet	Loose	60	25	10	5				░		2.5Y3/3	dark olive brown sandy GRAVEL, saturated, very poorly sorted - FILL?
8-12'	1.5'	**8**	**9**	Wet	Loose						22	1	░		2.5Y3/3	dark olive brown sandy GRAVEL, saturated, very poorly sorted - FILL?
		9	**9.5**	Wet	Loose		90	10					░		2.5Y4/3	olive-brown SAND (f-m), some coarse sand, trace silt, poorly sorted
12-16'	1.8'	**12**	**13.1**	Wet	Loose		90	10			Bkg	2.1	░		2.5Y4/3	SAND, as above, becoming coarser toward bottom of interval, some
													░			gravel
		13.1	**13.15**	--	Comp	100							▩			very dark gray SANDSTONE cobble.
		13.15	**13.8**	Wet	Soft	20	20	50	10		Bkg		▒		10YR3/3	dark brown gravelly/sandy SILT, little clay, wet, soft.
16-20'	2.8'	**16**	**18.8**	Moist/Wet	Soft	10	10	50	30		Bkg	2.9	▒		10YR3/2	very dark grayish brown clayey SILT, some sand and pebbles,
													▒			mod. Plasticity, gravel 1"
20-24'	3.0'	**20**	**20.9**	Moist	Soft	10	10	50	30		Bkg	12.0	▒			clayey SILT, as above
		20.9	**23**	Moist	Firm	10	15	60	5				▒		10YR5/8	yellowish-brown SILT, little sand/pebbles, trace clay, pebbles angular
													▒			to sub-round.
24-28'	3.2'	**24**	**26**	Moist	Firm	10	15	60	5		Bkg	0.1	▒			SILT, as above
		26	**27.2**	Moist	Firm	10	15	60	5				▒			yellowish-brown SILT, as above with 10YR4/1 dark gray SILT,
													▒			slight color change from previous.
28-32'	3.8'	**28**	**31.8**	Moist	Firm	10	20	60	10		Bkg	0.1	■	Till	2.5Y3/0	very dark gray SILT (TILL), little sand and pebbles, dense, pebbles
													■			are sub-round to angular, sand primarily f-m grained.

MOISTURE	
Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS			
v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH	
Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

				SITE ID:	**GPRW-22B**
				Page	2 of 2
CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**18-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**18-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**42.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**
COMMENTS:					

LOCATION DESCRIPTION

Located approximately 25 feet north of GPRW-22. Boring only, no well installed.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
32-35'	3.0'	**32**	**35**	Sl. Moist	Firm	5	15	65	15		Bkg	Bkg	■	Till		TILL, as above, slightly higher % of clay with slightly less gravel, dense
35-39'	4.0'	**35**	**39**	Dry	Firm	5	15	60	20		Bkg	Bkg	■			TILL, as above, dense
39-42'	3.0'			Dry	Firm								■			TILL, as above, dense - geoprobe refusal at 42 ft bgs, could not advance probe beyond this depth. No bedrock in sleeve.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

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MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-23A**		
Page	1	of	1

CLIENT:	**Confidential**	**ELEV. (GRND):**	**995.36**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**998.32**	**DATE BEGIN:**	**17-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346399.92 (UTM-FT)**	**DATE END:**	**17-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648491.159 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**5.40**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**38.50**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**38.00**
COMMENTS:					

LOCATION DESCRIPTION

Located east of recovery well PW-10, near GP-15 boring. Installed a temporary piezometer at this location

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	1.7'	**0**	**0.4**	Moist	Soft		5	70	10	15	Bkg	0.1	🟫	Qal	2.5Y2/0	black SILT (PEAT), roots, wetland sediments
		0.4	**1.7**	Moist	Soft		30	35	35		Bkg	0.1	▒		2.5Y5/4	light olive brown sandy SILT/CLAY, sand is f-m grained,
																slightly plastic, moist
4-8'	0.4'	**4**	**4.4**	Wet	Soft		15	25	60		6	5.5			2.5Y4/0	dark gray CLAY, some silt, trace to little sand (f-m), soft,
																moderate plasticity, wet
8-12'	1.7'	**8**	**9.7**	Wet	Soft	5	25	60	10		2	14.5			2.5Y4/2	dark grayish brown sandy SILT, sand is f-m, sub-round, trace
																gravel, slight solvent odor, wet
12-16'	3.6'	**12**	**13.8**	Wet	Loose	5	40	50	5		Bkg	1.6			2.5Y3/2	very dark grayish-brown sandy SILT, sand f-m, trace cs sand
		13.8	**15.6**	Moist	Firm	5	10	75	10		Bkg	1.6			2.5Y3/2	very dark grayish-brown SILT, trace sand and clay, firm
16-20'	2.8'	**16**	**17**	Moist	Firm	10	15	60	15		Bkg	0.5	■	Till	2.5Y4/2	dark grayish brown SILT (TILL), some clay and sand, trace pebbles.
		17	**17.1**	--	Comp	100										rubblized piece of gray Limestone
		17.1	**18.8**	Moist	Firm	15	15	60	10		Bkg	0.5			2.5Y4/3	olive brown SILT (TILL), little sand and pebbles, trace clay,
																becoming denser with depth
20-24'	3.8'	**20**	**23.8**	Moist-Wet	Firm	10	25	60	5		0.1	2.0			2.5Y4/2	dark grayish-brown SILT (TILL), some sand, little pebbles, trace clay
																sand f-m grained, trace coarse, slight odor
24-28'	3.7'	**24**	**27.7**	Moist	Firm	10	25	60	5		Bkg	0.2			2.5Y4/2	As above, TILL
28-32'	3.9'	**28**	**31.9**	Moist	Firm	10	25	60	5		Bkg	Bkg			2.5Y4/2	As above, TILL
32-36'	4.0'	**32**	**33.5**	Moist	Mod	10	10	50	30		Bkg	Bkg			5Y5/1	gray TILL, slightly higher % of clay, less sand
		33.5	**35.6**	Wet	Loose	5	30	35	30		Bkg	Bkg	▒	Qal	5Y4/1	dark gray clayey SILT/SAND, soft/loose - "runny", saturated,
																poorly sorted
		35.6	**36**	Wet	Loose	80	15	5			1	Bkg	░		2.5Y3/0	very dark gray GRAVEL, sub-round to sub-angular, loose,
																gravel up to 1/2", slight solvent odor.
36-38.5'	2.5'	**36**	**37.2**	Wet	Loose	80	15	5			Bkg	2.0			2.5Y3/0	GRAVEL, as above
		37.2	**38.5**	Moist	Firm	10	10	70	10		Bkg	2.0	■		2.5Y3/0	very dark gray SILT (TILL), dense, hit refusal at 38.5 ft bgs, possible
																boulder - tried to drill through but could not advance rods

MOISTURE	
Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS			
v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH	
Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp F	Competent rock retrived as loose gravel

SOIL BORING LOG

SITE ID: GPRW-23B
Page 1 of 2

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site
PROJECT NO.: 02181-202-005-0001
DRILLING CO.: Matrix Environmental
LOGGED BY: Dave Cairns
DRILL METHOD: GeoProbe Rig
SITE TYPE: Soil Boring
COMMENTS:

ELEV. (GRND): 997.44
(TOC): 1000.75
NORTHING: 16346518.19 (UTM-FT)
EASTING: 1648421.985 (UTM-FT)
DEPTH TO BEDROCK (fbgs):
RESIDUUM BOREHOLE DIA. (in): 3
BDRK BOREHOLE DIA. (in):

DATE BEGIN: 19-Mar-08
DATE END: 19-Mar-08
DEPTH TO WATER (TOC):
TOTAL BORING DEPTH (fbgs): 61.30
TOTAL WELL DEPTH (fbgs): NA

LOCATION DESCRIPTION

Installed recovery well RW-23 at this location. Well construction consists of 25 feet of 10 slot screen from 32.5 to 57.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT		
		from	to			G	S	Sl	C	O					Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	2.2'	0	0.8	Moist	Soft		60	30		10	Bkg	1.0	▨		10YR4/4	dark yellowish-brown sandy SILT (Fill), moist-frozen, some
													▨			roots/grass, rubbilized gravel
		0.8	1	Moist	Soft	100							▨			rubbilized GRAVEL (FILL)
		1	2	Moist	Soft	15	15	60		10			▨		10YR3/3	dark brown SILT, some sand, gravel, decomposed wood (FILL)
		2	2.2	Moist	Soft	10	20	60	10	20			▨		10YR4/2	dark grayish-brown SILT, some paper, other waste material, moist
4-8'	1.3'	4	5.3	Moist	Soft						Bkg	0.9	▨			SILT, as above - FILL material, plastic, other waste.
8-12'	0.05'			M-Wet							Bkg	1.9	▨			Poor recovery, small piece of black peat in bottom of sleeve
12-16'	0.1'	12	12.1	Wet	V. Soft		15	50	10	25	Bkg	Bkg	▨		2.5Y3/3	dark olive brown SILT (FILL), little sand, piece of plastic.
16-20'	2.4'	16	16.6	Wet	Loose		90	10			Bkg	2.4	▨		2.5Y4/2	dark grayish-brown SAND (f-cs), poorly sorted, wet
		16.6	17.1	Wet	Loose					100			▨			FILL - piece of paper - slough?
		17.1	18.4	Wet	V. Soft		10	70	20				🟫		2.5Y3/2	very dark grayish-brown SILT (PEAT), little clay, trace to little
													🟫			sand, very soft, wet.
20-24'	0.6'	20	20.6								Bkg	Bkg	🟫			SILT/PEAT, as above
24-28'	1.9'	24	25.9	Wet	Soft	15	50	30	5		Bkg	Bkg	░		2.5Y2/4	dark grayish-brown silty SAND (f-cs), little gravel - 1/2", poorly
													░			sorted, wet
28-32'	0.7'	28	28.7	Wet	Loose						Bkg	Bkg	░			As above, poor recovery - very loose.
32-36'	2.3'	32	33.4	Wet	Loose		95	5			Bkg	0.2	░		2.5Y4/3	olive brown SAND (m-cs), some fine sand, moderately to poorly
													░			sorted, trace silt; some "running" sands in this interval.
		33.4	34.3	Wet	Soft	5	40	50	5				░		2.5Y4/3	olive brown silty SAND (f-m), a few pebbles in matrix, soft.
36-40'	2.3'	36	38.3	Wet	Loose	5	75	15	5		1	0.9	░		2.5Y4/3	olive brown SAND (f-m), little silt, saturated, slight solvent odor.
40-44'	2.6'	40	41.8	Wet	Loose		100				1	0.3	░		2.5Y4/4	olive brown SAND (m-cs), some pebbles in bottom of interval, slight
													░			solvent odor.
		41.8	42.1	Moist	Mod		40	50	10		2		░		2.5Y4/2	dark grayish-brown sandy SILT, trace to little clay, moist
		42.1	42.4	Wet	Loose	10	80	10					░		2.5Y4/2	dark grayish-brown SAND (f-cs), poorly sorted - thin zone
		42.4	42.6	Moist	Mod		40	50	10				░			SILT, same as 41.8 to 42.1 interval.

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

				SITE ID:	**GPRW-23B**
CLIENT:	**Confidential**	**ELEV. (GRND):**	**997.44**	**Page**	2 of 2
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1000.75**	**DATE BEGIN:**	**19-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346518.19 (UTM-FT)**	**DATE END:**	**19-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648421.985 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**61.30**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**

COMMENTS:

LOCATION DESCRIPTION

Installed recovery well RW-23 at this location. Well construction consists of 25 feet of 10 slot screen from 32.5 to 57.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
44-48'	0															No recovery - potentially pushing gravel, run solid point down to clean
																out inside of probe.
48-52'	0.5'	**48**	**48.5**	Wet	Loose	15	75	10			Bkg	0.6	░		2.5Y5/3	light olive-brown SAND (f-cs), poorly sorted, sub-rounded, a few pieces
													░			of 1" gravel, saturated.
52-56'	0												░			No recovery, likely caused by gravel. Run solid point down inside
													░			probe again.
56-60'	4.0'	**56**	**56.1**	Wet	Loose	70	20	10			Bkg	Bkg	░			variegated GRAVEL - loose, likely cause for no recovery in previous
													░			zone.
		56.1	**60**	Moist	Firm	5	15	40	40				█		2.5Y4/0	dark gray SILT/CLAY (TILL), little fine to coarse sand, poorly
													█			sorted, dense.
60-61.3'	1.3'	**60**	**61.3**	Moist	Firm				100		Bkg	Bkg	☰		5GY5/1	greenish-gray CLAY - highly weathered Decorah Shale.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®

MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-24A**		
Page	1	of	2

CLIENT:	**Confidential**	**ELEV. (GRND):**	
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	

DATE BEGIN:	**17-Mar-08**
DATE END:	**17-Mar-08**
DEPTH TO WATER (TOC):	
TOTAL BORING DEPTH (fbgs):	**52.80**
TOTAL WELL DEPTH (fbgs):	**NA**

COMMENTS: original location for RW-24

LOCATION DESCRIPTION

CORE INTERVAL	**RECOVERY**	**DESC. DEPTH INTERVAL (Feet bgs)** from	to	**MOISTURE**	**STRENGTH**	**SOIL TEXTURE** G	S	Sl	C	O	**OVM Reading (screening)**	**OVM Reading (Headspace)**	**COLUMN**	**GEOLOGIC UNIT**	**Munsell Code**	**LITHOLOGIC DESCRIPTION**
0-4'	3.7'	**0**	**0.2**	Moist	Soft		10	75		15	Bkg	0.1	🟫		2.5Y3/2	very dark grayish-brown TOPSOIL, silty, some roots, moist - frozen.
		0.2	**2.9**	Moist	Soft	15	50	20	15				🟫		10YR5/6	yellowish-brown silty SAND (fill), little clay and gravel, poorly sorted,
													🟫			reworked soil.
		2.9	**3.7**	Moist	Loose	10	60	20	10				▒		5YR5/6	yellowish-red SAND (fill), some silt, trace clay and gravel - reworked
													▒			soil, some 1/2" to 1" gravel.
4-8'	2.9'	**4**	**5.6**	Moist	Loose	10	60	20	10		Bkg	0.6	▒			SAND, as above
		5.6	**6.9**	Moist	Soft	10	40	40	10				▒		2.5Y4/2	dark grayish-brown SAND/SILT, sand is fine to medium grained, sub-
													▒			rounded, soft, moist.
8-12'	2.8'	**8**	**10.8**	Wet	Soft	10	50	30	10		3.5	25	▒		2.5Y4/2	dark grayish-brown silty SAND, some limestone gravel in top of
													▒			interval (fill), soft, moist to wet.
12-16'	2.4'	**12**	**14.4**	Moist	Loose	15	50	30	5		7.2	47	▒		2.5Y4/2	dark grayish-brown silty SAND, as above but with slightly higher % of
													▒			gravel.
16-20'	3.0'	**16**	**19**	Moist	Loose	15	50	30	5		87	107	▒		2.5Y4/2	silty SAND, as above, a few zones with higher % of pebbles/gravel
20-24'	4.0'	**20**	**20.5**	Wet	Loose	15	50	30	5		207	171	▒		2.5Y4/2	silty SAND, as above
		20.5	**21.7**	Moist	Firm		10	75	15				▓		2.5Y4/3	olive brown SILT, somewhat dense, moist
		21.7	**22.6**	Wet	Loose	5	65	20	10				▒		2.5Y4/3	olive brown silty SAND (f-cs), poorly sorted, wet - loose, solvent odor.
24-28'	3.1'	**24**	**27.1**	Moist	Firm	15	15	65	5		32	209	■		2.5Y4/2	dark grayish-brown SILT (TILL), some sand/gravel (pebbles), gravel up
													■			to 1", trace clay.
28-32'	2.1'	**28**	**30.1**	Moist	Firm	15	15	65	5		79	177	■		2.5Y4/2	TILL, as above
32-36'	0.5'	**32**	**32.4**	Moist	Firm	15	15	65	5		16	79	■		2.5Y4/2	TILL, as above
		32.4	**32.5**	Moist	Firm	5	15	70	10				■		5Y3/1	very dark gray SILT (TILL), denser than previous interval - poor
													■			recovery due to gravel in shoe of sleeve?
36-40'	4.0'	**36**	**40**	Dry-Moist	Firm	15	15	35	35		Bkg	1.5	■		2.5Y4/0	dark gray SILT/CLAY (TILL), little sand and gravel, dry to
																slightly moist.

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-24A**		
Page	2	of	2

CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**17-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**17-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**52.80**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**

COMMENTS: original location for RW-24

LOCATION DESCRIPTION

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
40-43'	3.0'	**40**	**43**	Dry	Firm						Bkg	0.3	■		2.5Y4/0	dark gray TILL, as above
43-46'	3.0'	**43**	**46**	Dry	Firm						Bkg	0.1	■		2.5Y4/0	dark gray TILL, as above
46-49'	3.0'	**46**	**49**	Dry	Firm						Bkg	Bkg	■		2.5Y4/0	dark gray TILL, as above
49-52'	3.0'	**49**	**52**	Dry	Firm						Bkg	Bkg	■		2.5Y4/0	dark gray TILL, as above
52-52.8'	0.8'	**52**	**52.8**	Dry	Firm						Bkg	Bkg	■		2.5Y4/0	dark gray TILL, as above, could not advance geprobe any further.
													■			No rock cuttings in sleeve.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-24B**		
Page	1	of	2
DATE BEGIN:	**18-Mar-08**		
DATE END:	**18-Mar-08**		

CLIENT:	**Confidential**	**ELEV. (GRND):**	
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	

DEPTH TO WATER (TOC):	
TOTAL BORING DEPTH (fbgs):	**50.50**
TOTAL WELL DEPTH (fbgs):	**NA**

COMMENTS:

LOCATION DESCRIPTION

drilled in low area between GPRW24A and GPRW24C

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	1.8'	**0**	**1**	Moist	Soft		5	80	5	10	Bkg	Bkg	🟫	Qal	2.5Y2/0	black SILT (PEAT), some roots, organic matter, moist.
		1	**1.6**	Moist	Loose		30	60	10		Bkg	Bkg	░		2.5Y4/3	olive brown sandy SILT, trace clay, sand f. grained.
		1.6	**1.8**	Moist	Soft		20	20	60		Bkg	Bkg	▒		2.5Y4/2	dark grayish brown CLAY, some sand and silt, slightly plastic,
													▒			sand is v.f. to fine grained.
4-8'	3.3'	**4**	**6.9**	Moist	Soft		20	20	60		Bkg	Bkg	▒		2.5Y4/2	CLAY, as above, becoming coarser grained in bottom of interval.
		6.9	**7.3**	Wet	Soft		30	35	35		Bkg	Bkg	░		2.5Y4/2	dark olive brown sandy/silty CLAY, soft, saturated.
8-12'	3.4'	**8**	**11.4**	Wet	Soft	2	40	40	18		Bkg	Bkg	░		2.5Y3/2	very dark grayish brown SILT/SAND (v.f-f.), little clay - slightly
													░			plastic, trace gravel.
12-16'	2.5'	**12**	**14.5**	Wet	Soft	5	45	40	10		Bkg	Bkg	░		2.5Y3/2	as above, but with slightly higher sand/pebbles/small gravel, gravel
													░			is sub-round.
16-20'	1.7'	**16**	**17.7**	Wet	Soft	5	45	40	10		Bkg	Bkg	░		2.5Y3/2	as above, some larger pieces of rounded 1" gravel, poorly sorted.
20-24'	3.3'	**20**	**23.3**	Wet	Soft	5	45	40	10		Bkg	Bkg	░		2.5Y3/2	as above
24-28'	3.9'	**24**	**24.7**	Wet	Loose	5	45	40	10		Bkg	Bkg	░		2.5Y3/2	as above, some coarse gravel in bottom of interval
		24.7	**26.3**	Wet	Loose	10	50	10	30		Bkg	Bkg	░		2.5Y3/3	dark olive brown clayey SAND (v.f-f.), saturated - "runny"
		26.3	**27.9**	Wet	Mod	10	45	40	5		Bkg	Bkg	░		2.5Y4/2	dark grayish brown silty SAND to sandy SILT, denser than previous
													░			intervals, sand if v.f. to f. grained.
28-32'	1.6'	**28**	**29.6**	Wet	Mod	10	45	40	5		Bkg	Bkg	░		2.5Y4/2	
32-36'	2.9'	**32**	**32.5**	Wet	Loose	10	85	5			Bkg	Bkg	░		2.5Y4/3	olive brown SAND (f-cs), little to some v.cs. Sand/pebbles, sub-round to
													░			sub-angular, trace silt.
		32.5	**34.9**	Moist	Firm	10	15	40	35		Bkg	Bkg	■	Till	2.5Y3/0	very dark gray SILT/CLAY (TILL), little sand/small gravel, sub-round,
													■			moist, poorly sorted, stiff.
36-40'	4.0'	**36**	**40**	Moist	Firm	10	15	40	35		Bkg	Bkg	■		2.5Y3/0	TILL, as above
40-43'	3.0'	**40**	**43**	Moist	Firm	10	15	40	35		Bkg	Bkg	■		2.5Y3/0	TILL, as above
43-47'	4.0'	**43**	**47**	Moist	Firm	10	15	40	35		Bkg	Bkg	■		2.5Y3/0	TILL, as above

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-24B**
Page	1 of 2
DATE BEGIN:	**18-Mar-08**
DATE END:	**18-Mar-08**

CLIENT:	**Confidential**	**ELEV. (GRND):**	
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	3
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	
COMMENTS:			

DEPTH TO WATER (TOC):	
TOTAL BORING DEPTH (fbgs):	**50.50**
TOTAL WELL DEPTH (fbgs):	**NA**

LOCATION DESCRIPTION

drilled in low area between GPRW24A and GPRW24C

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
47-50'	3.0'	**47**	**48.8**	Moist	Firm	10	15	40	35		Bkg	7.4	■	Till	2.5Y3/0	TILL, as above
		48.8	**50.1**	Wet	Loose	40	50	10			Bkg	7.4	▒	Qal	2.5Y4/3	olive brown gravelly SAND (m-cs), little silt/fines, slight solvent
													▒			odor, becoming coarser in bottom of interval.
		50.1	**50.5**	Moist	Firm	10	25	55	10		Bkg	7.4	■	Till	2.5Y5/2	grayish brown sandy SILT (TILL), sand is poorly sorted - f. to cs.
													■			grained, dense, trace clay. Bottom of sleeve has a few pieces of
													▤	DS		weathered shale - possibly Decorah?
													▤			-encountered geoprobe refusal at 50.5 ft bgs, could not advance probe
																beyond this depth

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®
MANAGERS DESIGNERS CONSULTANTS

SOIL BORING LOG

				SITE ID:	**GPRW-24C**
				Page	1 of 2
CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**17-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**17-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**55.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**
COMMENTS:					

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	LOCATION DESCRIPTION	
		from	to			G	S	Sl	C	O					Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	2.9'	**0**	**0.4**	Moist	Mod		5	80	5	10	Bkg	Bkg	▨	Fill	2.5Y3/2	very dark grayish brown SILT (TOPSOIL), some roots, crumbly.
		0.4	**1**	Moist	Soft	10	30	50		10	Bkg	Bkg	▨		10YR4/4	dark yellowish-brown sandy SILT (FILL), piece of plastic in matrix,
													▨			moderately sorted, gravel in bottom of interval.
		1	**2.9**	Moist	Soft	15	15	70			Bkg	Bkg	░	Qal	10YR3/3	dark brown SILT, trace to little sand/pebbles/small gravel.
4-8'	2.6'	**4**	**4.9**	Moist	Loose	10	35	50	5		Bkg	3.0	░		10YR3/2	very dark grayish-brown sandy SILT, some pebbles/small gravel, sand
													░			is f.-m., angular, loose.
		4.9	**5.1**	Moist	Loose	15	75	10			Bkg	3.0	░		10YR4/4	dark yellowish-brown SAND (f-cs), poorly sorted, some gravel
													░			in bottom of interval.
		5.1	**6.6**	Moist	Firm	15	45	30	10		Bkg	3.0	░		10YR3/0	dark yellowish-brown silty SAND (f-cs), little gravel, poorly sorted
8-12'	3.8'	**8**	**8.4**	Moist	Firm	15	45	30	10		Bkg	Bkg	░		10YR3/0	silty SAND, as above
		8.4	**10.9**	Moist	Firm	5	20	45	30		Bkg	Bkg	░		5YR4/6	yellowish-red clayey SILT, some sand (f-cs), moist
		10.9	**11.8**	Moist-Wet	Soft	10	30	50	10		Bkg	Bkg	░		10YR4/6	dark yellowish-brown silty SAND (f-cs), little clay and small pebbles/
													░			gravel, wet in very bottom of sleeve
12-16'	4.0'	**12**	**16**	Wet	Soft	10	50	30	10		Bkg	Bkg	░		10YR4/3	brown silty SAND, trace gravel and clay, saturated - will not produce
													░			much water, soft
16-20'	3.3'	**16**	**19.3**	Wet	Soft	10	50	30	10		Bkg	0.1	░		10YR4/3	silty SAND, as above, some 1/2" to 1" sub-round gravel, saturated
20-24'	1.8'	**20**	**21.8**	Moist-Wet	Soft/ Loose	10	35	40	15		Bkg	Bkg	░		10YR3/6	dark yellowish-brown sandy SILT, sand is f-m grained, trace cs. Sand,
													░			trace pebbles and clay.
24-28'	2.35'	**24**	**26.35**	Moist-Wet	Firm	15	15	40	30		Bkg	Bkg	░		2.5Y4/3	olive brown clayey SILT, little sand (f-m), little gravel (round to
													░			sub-round), moist
28-32'	1.2'	**28**	**29.2**	Moist-Wet	Soft	15	15	40	30		Bkg	Bkg	░		2.5Y3/2	very dark grayish-brown clayey SILT, little gravel and sand, gravel up
													░			to 1", poorly sorted.
32-36'	3.6'	**32**	**35.6**	Moist-Wet	Soft	15	15	40	30		Bkg	Bkg	░		2.5Y4/3	as above, but slight color change to olive brown.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

SITE ID:	**GPRW-24C**
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CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**17-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**17-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**55.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**NA**

COMMENTS:

LOCATION DESCRIPTION

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
36-40'	3.7'	**36**	**39.2**	Moist	Soft	10	10	40	40		Bkg	Bkg	▨	Qal	2.5Y4/3	olive brown CLAY and SILT, little sand and pebbles, pebbles
													▨			sub-round, somewhat plastic, pices of sandstone gravel @ 39.2'.
		39.2	**39.7**	Moist	Firm	15	15	20	50		Bkg	Bkg	■	Till	2.5Y3/2	very dark grayish-brown CLAY (TILL), some pebbles, coarse sand,
													■			poorly sorted, slightly moist.
40-44'	4.0'	**40**	**44**	Sl. Moist	Mod	15	15	30	40		Bkg	Bkg	■		2.5Y3/0	very dark gray CLAY (TILL), some silt, little sand and small gravel,
													■			slightly moist.
44-47'	3.0'	**44**	**47**	Sl. Moist	Mod	15	15	30	40		Bkg	Bkg	■		2.5Y3/0	TILL, as above
													■			
47-50'	3.0'	**47**	**50**	Sl. Moist	Mod	15	15	30	40		Bkg	Bkg	■		2.5Y3/0	TILL, as above
													■			
50-53'	3.0'	**50**	**53**	Sl. Moist	Mod	15	15	30	40		Bkg	Bkg	■		2.5Y3/0	TILL, as above
													■			
53-55'	2.0'	**53**	**55**	Sl. Moist	Mod	15	15	30	40		Bkg	Bkg	■		2.5Y3/0	TILL, as above, hit refusal at 55 ft bgs, could not advance geoprobe
													■			any further

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-24D**				
				Page	1 of 1
CLIENT:	**Confidential**	**ELEV. (GRND):**	**996.44**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**999.42**	**DATE BEGIN:**	**20-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16346525 (UTM-FT)**	**DATE END:**	**20-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1648259.226 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**5.04**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**45.00**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**32.99**

COMMENTS:

LOCATION DESCRIPTION

Boring completion in small wooded area near overhead power lines.
Location for RW-24.
Well Installed at this location. Screened interval is from 13 to 33 ft bgs.
5 slot screen installed from 13 to 23 ft, 10 slot screen installed 23 to 33 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
0-4'	2.4'	**0**	**0.4**	Moist	--	5	30	60		5	2.3	25.4	▨	Fill	10YR3/3	dark brown SILT/TOPSOIL, some sand, roots, frozen, FILL
		0.4	**1.1**	Moist	Loose	15	50	30	5				▨		10YR4/3	brown sitly SAND, some gravel, poorly sorted, slight solvent odor,
		1.1	**1.5**										▨			FILL - rubbilized gravel in matrix
		1.5	**2.4**	Moist	Soft		20	65	5	10			■	Qal	10YR2/2	very dark brown SILT (PEAT), trace clay, slight solvent odor
4-8'	2.3'	**4**	**5.3**	Moist	Soft		10	20	70		9.0	18.1	■		5YR4/1	dark gray silty CLAY, little sand, high plasticity, soft, moist.
		5.3	**5.6**	Wet	Loose	10	30	50	10				▒		2.5Y4/2	dark grayish brown SAND (f-m), some silt, slight solvent odor, wet
		5.3	**6**	Moist	Soft		10	20	70				■		5YR4/1	dark gray silty CLAY, little sand, high plasticity, soft, moist.
		6	**6.3**	Wet	Loose	10	30	50	10				▒		2.5Y4/2	dark grayish brown SAND (f-m), some silt, slight solvent odor, wet
8-12'	2.9'	**8**	**9**	Wet	Loose	5	90	5			0.2	2	░		2.5Y3/3	dark olive brown SAND (m-cs), moderate to poorly sorted, wet
		9	**10.3**	Wet	Mod	5	60	30	5				░		2.5Y3/3	dark olive brown silty SAND (f-m), trace clay and pebbles.
		10.3	**10.9**	Wet	Loose								░			As above but less silt and no clay.
12-16'	2.8'	**12**	**14.8**	Wet	Mod	5	65	35	5		0.3	2	░		2.5Y4/2	dark grayish brown SAND (f-m), some silt, trace clay, slight
													░			solvent odor
16-20'	0.3'	**20**	**20.3**	Wet	Loose	10	30	50	10		0	3	▒		2.5Y4/2	dark grayish brown sandy SILT, some gravel - likely casusing the
													▒			poor recovery.
20-24'	0										--	--	░			No recovery - gravel?
24-28'	0.4'										Bkg	1	░			Poor recovery, bottom of sleeve is a coarse sand/gravel. Ran solid
													░			point down to clear inside of rods. "Running" sands encountered.
28-32'	0										--	--	░			Piece of gravel in shoe, driller thinks zone is primarily sand and gravel
32-36'	0.1'	**32**	**32.1**	Wet	Loose	10	90				Bkg	1	░		2.5Y3/2	very dark grayish brown SAND (f-m), trace coarse sand, loose,
													░			saturated.
36-40'	4.0'	**36**	**40**	Moist	Firm	5	15	60	20		Bkg	0.3	■	Till	2.5Y4/2	dark grayish-brown SILT (TILL), little sand, pebbles, clay, dense
40-43'	3.0'	**40**	**43**	Moist	Firm	15	15	60	10		Bkg	0.5	■			TILL, as above
43-45'	2.0'	**43**	**45**										■			TILL, as above, refusal at 45 ft bgs - no bedrock in shoe of sleeve.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

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SOIL BORING LOG

SITE ID:	**GPRW-25**
Page	1 of 2
DATE BEGIN:	**19-Mar-08**
DATE END:	**19-Mar-08**

CLIENT:	**Confidential**	**ELEV. (GRND):**	**1000.19**
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1003.21**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16345867.21 (UTM-FT)**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649111.576 (UTM-FT)**
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**	

DEPTH TO WATER (TOC):	**10.54**
TOTAL BORING DEPTH (fbgs):	**61.10**
TOTAL WELL DEPTH (fbgs):	**61.50**

COMMENTS:

LOCATION DESCRIPTION

In southeast area of property in small wooded area near the gate to Hadley Avenue.
Well installed at this location. 40 feet of 10 slot screen installed from 21.5 to 61.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	2.9'	**0**	**0.5**	Moist	Loose	10	15	65			Bkg	1.7	▨	Fill	10YR3/3	dark brown SILT/TOPSOIL, some f-cs sand, roots/organics, upper 0.1'
													▨			frozen, loose - FILL
		0.5	**1.5**	Moist	Loose		90	10			Bkg	1.8	▨		10YR3/3	very dark gray to 10YR6/2 lt. brownish gray SAND (f-cs), loose,
													▨			very poorly sorted, FILL
		1.5	**2.9**	Moist	Loose		50	40	10		Bkg	Bkg	░	Qal	10YR4/4	dark yellowish brown silty SAND (f-cs), trace clay, moist, some roots
4-8'	2.6'	**4**	**6.6**	Sl. Moist	Loose	10	85	5			Bkg	0.1	░		2.5YR5/6	lt. olive brown SAND (f-cs), sub-round to sub-angular, loose, some
													░			coarse zones in matrix, poorly sorted
8-12'	3.85'	**8**	**8.6**	Wet	Soft		65	30	5		Bkg	Bkg	░		10YR4/6	dark yellowish brown silty SAND (f-cs), poorly sorted, wet.
		8.6	**10.8**	Wet	Soft	5	85	10			Bkg	Bkg	░		10YR3/2	very dark grayish-brown SAND (f-m), some coarse sand, poorly
													░			sorted, wet.
		10.8	**11.5**	Wet	Soft		30	50	20		Bkg	Bkg	░		10YR3/1	very dark gray sandy SILT, some clay, moderate plasticity,
													░			very soft.
		11.5	**11.85**	Wet	Loose		80	20			Bkg	Bkg	░		10YR4/1	dark gray SAND (f-m), some silt and very fine sand, loose, saturated
12-16'	3.8'	**12**	**13**	Wet	Loose		95	5			Bkg	Bkg	░		10YR3/6	dark yellowish-brown SAND (f-m), some coarse to very coarse sand,
													░			trace silt, saturated
		13	**15.8**	Wet	Loose	1	94	5			Bkg	Bkg	░		10YR4/2	dark grayish-brown SAND (f-m), little coarse sand, trace silt and gravel,
													░			saturated
16-20'	4.0'	**16**	**20**	Wet	Loose		95	5			Bkg	Bkg	░		10YR4/1	dark gray SAND (m-cs), loose, sub-round,
20-24'	2.6'	**20**	**20.4**	Wet	Loose						Bkg	Bkg	░			SAND, as above
		20.4	**20.9**	Wet	Loose		100				Bkg	Bkg	░		10YR4/1	dark gray SAND (cs-v.coarse), sub-rounded, moderately sorted.
		20.9	**22.6**	Wet	Loose	5	85	10			Bkg	Bkg	░		2.5Y5/3	light olive brown v. coarse SAND and medium grained SAND, little
													░			silt, trace sub-round pebbles, becoming finer-grained toward bottom
													░			of interval. Thin (~.02') silt layer in bottom of interval.

MOISTURE

Dry	Dry
Mst	Moist
Wet	Wet
Sat	Saturated
Wpr	Wet Perched

TEXTURAL TERMS

v.f.g.	Very Fine-Grained	Fr	Friable
f.g.	Fine-Grained	Blk	Blocky
m.g.	Medium-Grained	Str	Streaked
c.g.	Coarse-Grained	Mtl	Mottled
v.c.g.	Very Coarse-Grained	grd	Graded
		trn	Transitional

STRENGTH

Soft	Soft unconsolidated material, i.e. clay to silt
Loose	Will not retain shape, i.e. clean sand
Mod	Retains shape but friable or crumbles with pressure.
Firm	Retains shape and difficult to crumble
Comp C	Competent rock retrieved as core sections
Comp R	Competent rock retrived as loose gravel

WESTON®
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SOIL BORING LOG

SITE ID:	**GPRW-25**	**Page**	2 of 2

CLIENT:	**Confidential**	**ELEV. (GRND):**	**1000.19**		
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**	**1003.21**	**DATE BEGIN:**	**19-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**	**16345867.21 (UTM-FT)**	**DATE END:**	**19-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**	**1649111.576 (UTM-FT)**		
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	**10.54**
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	**3**	**TOTAL BORING DEPTH (fbgs):**	**61.10**
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	**61.50**
COMMENTS:					

LOCATION DESCRIPTION

In southeast area of property in small wooded area near the gate to Hadley Avenue. Well installed at this location. 40 feet of 10 slot screen installed from 21.5 to 61.5 ft bgs.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
24-28'	1.3'	**24**	**25.3**	Wet	Loose		85	15			Bkg	Bkg	░	Qal	2.5Y3/3	dark olive brown SAND (v.f.-f), some coarse sand, little silt,
													░			sub-rounded, clay stringer .02' thick in matrix
28-32'	2.85'	**28**	**29**	Moist	Firm			20	80		Bkg	Bkg	▓		2.5Y4/2	dark grayish-brown CLAY, somewhat dense, moist
		29	**31.85**	Wet	Loose	5	90	5			Bkg	Bkg	░		2.5Y4/2	dark grayish-brown SAND (f-m), some coarse sand, trace silt and pebbles
32-36'	2.8'	**32**	**33.1**	Wet	Loose	10	85	5			Bkg	Bkg	░		2.5Y4/2	dark grayish-brown SAND (f-m), trace coarse sand/pebbles/silt
		33.1	**34.8**	Moist	Firm			10	90		Bkg	Bkg	▓		2.5Y5/2	grayish-brown CLAY, firm, dense, dry to sl. Moist.
36-40'	4.0'	**36**	**40**	Moist	Soft			5	95		Bkg	Bkg	▓		2.5Y4/2	dark grayish brown "fat" CLAY, moist, mod. Plasticity.
40-44'	2.0'	**40**	**40.5**	Moist	Soft						Bkg	Bkg	▓		2.5Y4/2	CLAY, as above
		40.5	**41.4**	Wet	Loose	5	90	5			Bkg	Bkg	░		2.5Y4/2	dark grayish brown SAND (cs-v. cs), trace v.f to fine, moderately
													░			sorted, saturated, trace gravel up to 1"
		41.4	**42**	Wet	Loose	5	85	10			Bkg	Bkg	░		2.5Y4/2	dark grayish brown SAND (m-cs), slightly finer than previous interval,
													░			moderately sorted.
44-48'	0.3'	**44**	**44.3**	Wet	Loose	50	50				Bkg	Bkg	░			SAND, as above, but with pieces of granite gravel in bottom of sleeve,
													░			poor recovery due to gravel.
49-52'	2.6'	**49**	**50.1**	Wet	Loose	15	50	30	5		Bkg	Bkg	▒		2.5Y3/2	very dark grayish-brown SAND (f-m), some silt/coarse sand/gravel.
													▒			wet.
		50.1	**50.5**	Moist	Soft		40	40	20		Bkg	Bkg	▒		5Y4/1	dark gray SAND/SILT, sand is very fine-grained, little clay
		50.5	**51.6**	Wet	Loose	10	90						░		2.5Y3/2	vary dary grayish brown SAND (f-cs)
52-56'	0.5'	**52**	**52.5**	Wet	Loose	35	60	5			Bkg	Bkg	░		2.5Y4/2	dark grayish-brown gravelly SAND (cs-v.cs), gravel up to 2", poor
													░			recovery - again pushing gravel,
56-60'	0.1'	**56**	**56.1**										░			SAND, as above, poor recovery due to gravel.
60-64'	1.1'	**60**	**60.6**	Wet	Loose		100				Bkg	Bkg	░		2.5Y4/4	olive brown SAND (m-cs), moderately to well-sorted, sub-round.
		60.6	**61.1**	Wet	Loose	30	70						░			becoming much coarser than previous - gravelly SAND
64-65.5	0'												░			refusal at 65.5' - nothing in sleeve probably due to gravel.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON®
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SOIL BORING LOG

SITE ID:	**GPRW-26**		
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CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**20-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**20-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	3	**TOTAL BORING DEPTH (fbgs):**	
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	

COMMENTS:

LOCATION DESCRIPTION

Boring drilled north of Highway 5. Location is 33 feet due west of W-26.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs) from	to	MOISTURE	STRENGTH	SOIL TEXTURE G	S	Sl	C	O	OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
0-4'	3.0'	**0**	**3**	Moist	Loose	15	30	50	5		0.4	0.6	▨	Fill	10YR4/3	brown sandy SILT - topsoil in upper 0.1' (FILL), some gravel,
													▨			poorly sorted, reworked soil, slight odor.
4-8'	3.0'	**4**	**5.1**	Moist	Soft	5	15	60	15	5	32.0	17.2	▨		10YR2/1	black SILT, little sand, loose, some roots (FILL)
		5.1	**7**	Moist	Loose	5	25	35	35				▨		5GY5/1	gray sandy SILT/CLAY, loose, (FILL), moist
8-12'	2.0'	**8**	**8.1**	Moist	Loose	5	25	35	35		13.0	2.3	▨		5GY5/1	SILT/CLAY, as above
		8.1	**8.9**	Moist	Loose		60	25	15				░	Qal	5GY4/1	dark greenish gray SAND (f-m), some silt, trace clay, moist
		8.9	**10**	Moist	Loose		80	20					░		2.5Y4/3	olive brown SAND (m), moderately sorted, wet in very bottom of sleeve
12-16'	1.4'	**12**	**12.8**	Wet	Loose	5	90	5			3.8	5.5	░		2.5Y4/2	dark grayish brown SAND (m-cs), some fine sand, moderately sorted,
													░			sub-round, trace silt/gravel, slight solvent odor
		12.8	**13.2**	Wet	Loose	5	30	50	15				▒		2.5Y4/2	dark grayish brown sandy SILT, some clay, soft
		13.2	**13.4**	Wet	Loose	5	90	5					░			SAND, same as 12-12.8 ft interval
16-20'	1.5'	**16**	**16.5**	Wet	Loose	30	45	20	5		1.3	4	░		2.5Y4/2	dark grayish brown gravelly SAND, little silt, fairly tight zone, will
													░			produce a little water
20-24'	2.8'	**20**	**22.2**	Wet	Loose	10	85	5			3	23	░		2.5Y4/3	olive brown SAND (f-m), little gravel up to 1/2", loose, sub-round
													░			moderately sorted.
		22.2	**22.8**	Wet	Loose		100				13		░		2.5Y4/3	olive brown SAND (m-cs), saturated, solvent odor.
24-28'	1.0'	**24**	**25**	Wet	Loose		100				2	42	░		5Y5/1	gray SAND (m), encountered "running" sands in this interval.
28-32'	2.1'	**28**	**30.1**	Wet	Loose	35	60	5			7	8	░		5GY5/1	gray gravelly SAND (cs-v.cs), poorly sorted, sub-round, gravel up to
													░			1".
32-36'	2.8'	**32**	**33.6**	Wet	Soft	2	8	70	20		0.3	3	▒		5Y5/1	gray SILT, little v.f. to fine sand, little clay, moist.
		33.6	**34.8**	Wet	Loose	5	90	5					░		5Y4/1	dark gray SAND (m-v.cs.), poorly sorted, loose, subangular to
													░			sub-round, trace silt.
36-40'	1.8'	**36**	**37.8**	Wet	Loose	5	90	5					░			SAND (alluvium), as above

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WESTON® MANAGERS DESIGNERS/CONSULTANTS

SOIL BORING LOG

SITE ID: GPRW-26
Page 2 of 2

CLIENT:	**Confidential**	**ELEV. (GRND):**			
SITE NAME:	**Oakdale Disposal Site**	**(TOC):**		**DATE BEGIN:**	**20-Mar-08**
PROJECT NO.:	**02181-202-005-0001**	**NORTHING:**		**DATE END:**	**20-Mar-08**
DRILLING CO.:	**Matrix Environmental**	**EASTING:**			
LOGGED BY:	**Dave Cairns**	**DEPTH TO BEDROCK (fbgs):**		**DEPTH TO WATER (TOC):**	
DRILL METHOD:	**GeoProbe Rig**	**RESIDUUM BOREHOLE DIA. (in):**	3	**TOTAL BORING DEPTH (fbgs):**	
SITE TYPE:	**Soil Boring**	**BDRK BOREHOLE DIA. (in):**		**TOTAL WELL DEPTH (fbgs):**	

COMMENTS:

LOCATION DESCRIPTION

Boring drilled north of Highway 5. Location is 33 feet due west of W-26.

CORE INTERVAL	RECOVERY	DESC. DEPTH INTERVAL (Feet bgs)		MOISTURE	STRENGTH	SOIL TEXTURE					OVM Reading (screening)	OVM Reading (Headspace)	COLUMN	GEOLOGIC UNIT	Munsell Code	LITHOLOGIC DESCRIPTION
		from	to			G	S	Sl	C	O						
40-44'	2.6'	**40**	**42.6**	Wet	Loose	5	90	5			Bkg	Bkg	░	Qal		SAND (alluvium), as above
44-48'	1.6'	**44**	**45.6**	Wet	Loose	5	90	5			Bkg	Bkg	░			SAND (alluvium), as above
48-52'	0.1'	**48**	**48.1**										░			poor recovery, sediment in sleeve same as above, pushing gravel?
													░			clear bottom of rods with solid point
52-53.1'	1.1	**52**	**53.1**	Moist	Firm	10	15	25	40		Bkg	Bkg	■	Till	2.5Y4/2	dark grayish-brown CLAY (TILL), some silt, little sand and pebbles,
													■			dense, sl. Moist. Encountered geoprobe refusal at 53 ft. bgs., could
													■			not advance rods beyond this point.

MOISTURE		TEXTURAL TERMS				STRENGTH	
Dry	Dry	v.f.g.	Very Fine-Grained	Fr	Friable	Soft	Soft unconsolidated material, i.e. clay to silt
Mst	Moist	f.g.	Fine-Grained	Blk	Blocky	Loose	Will not retain shape, i.e. clean sand
Wet	Wet	m.g.	Medium-Grained	Str	Streaked	Mod	Retains shape but friable or crumbles with pressure.
Sat	Saturated	c.g.	Coarse-Grained	Mtl	Mottled	Firm	Retains shape and difficult to crumble
Wpr	Wet Perched	v.c.g.	Very Coarse-Grained	grd	Graded	Comp C	Competent rock retrieved as core sections
				trn	Transitional	Comp R	Competent rock retrived as loose gravel

WELL CONSTRUCTION LOGS

WELL CONSTRUCTION LOG

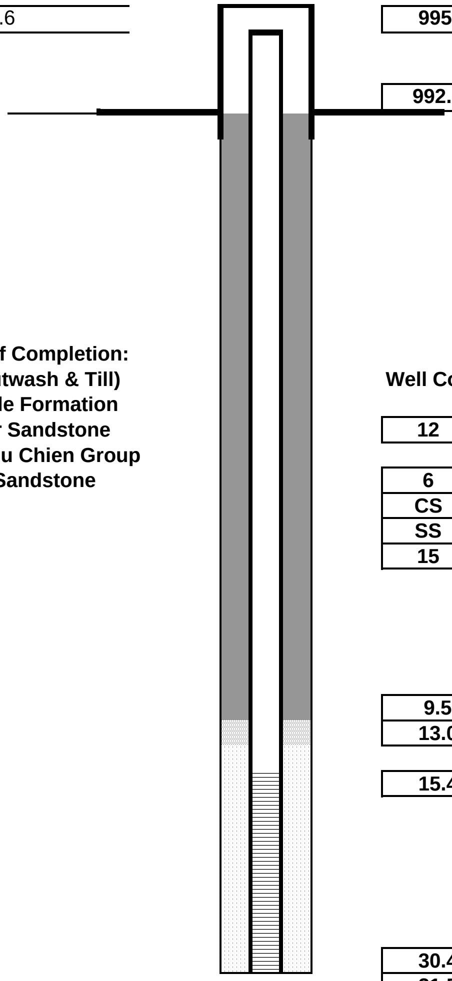
Site ID: RW-14

Page 1 **of** 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: Dave Cairns

DATE OF WELL CONSTRUCTION: 26-Mar-08
DEPTH TO WATER (TOC): 3.25

Northing: 16346293.3
Easting: 1649511.6



995.4	**TOC Elevation (fmsl)**
992.08	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (X) Drift (Outwash & Till)
- (   ) Platteville Formation
- (   ) St. Peter Sandstone
- (   ) Prairie du Chien Group
- (   ) Jordan Sandstone
- (   ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
15	**Screen Length (ft)**

9.50	**Top of Fine-grained Sand**
13.00	**Top of Coarse-grained Sand**
15.40	**Top of Screen**
10	**Screen Slot**
30.40	**Bottom of Screen**
31.50	**Total Boring Depth**

Lithologic Contact Depths (fbgs)

0	to	40	**Glacial Drift (Outwash Gravels / Till)**
40	to	50	**Decorah Shale**

geoprobe boring drilled to 50 ft bgs

CS	**Carbon Steel**	**gal.**	**Gallons**
SS	**Stainless Steel**	**TOC**	**Top of casing**

Depths are presented as feet below ground surface unless otherwise indicated.

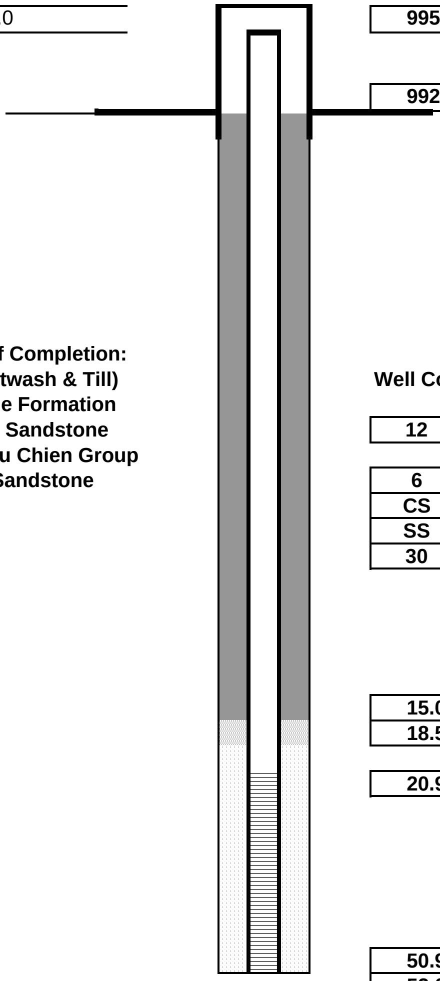
WESTON®
MANAGERS DESIGNERS CONSULTANTS

WELL CONSTRUCTION LOG

Site ID:	RW-15
Page	1 of 1
DATE OF WELL CONSTRUCTION:	26-Mar-08
DEPTH TO WATER (TOC):	2.92

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter/ D. Cairns

Northing: 16346467.9
Easting: 1649335.0



995.6	TOC Elevation (fmsl)
992.3	GND Elevation (fmsl)

Lithologic Unit of Completion:
(x) Drift (Outwash & Till)
( ) Platteville Formation
( ) St. Peter Sandstone
( ) Prairie du Chien Group
( ) Jordan Sandstone
( ) Other:

Well Construction:

12	Boring Diameter (in)
6	Well Diameter (in)
CS	Riser Material
SS	Screen Material
30	Screen Length (ft)
15.00	Top of Fine-grained Sand
18.50	Top of Coarse-grained Sand
20.90	Top of Screen
10	Screen Slot
50.90	Bottom of Screen
52.00	Total Boring Depth

Lithologic Contact Depths (fbgs)

0	to	52	Glacial Drift (Outwash Gravels / Till)
	to		Platteville Formation
	to		Glenwood Formation
	to		St. Peter Sandstone
	to		Prairie du Chien Formation
	to		Jordan Sandstone

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

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MANAGERS DESIGNERS CONSULTANTS

WELL CONSTRUCTION LOG

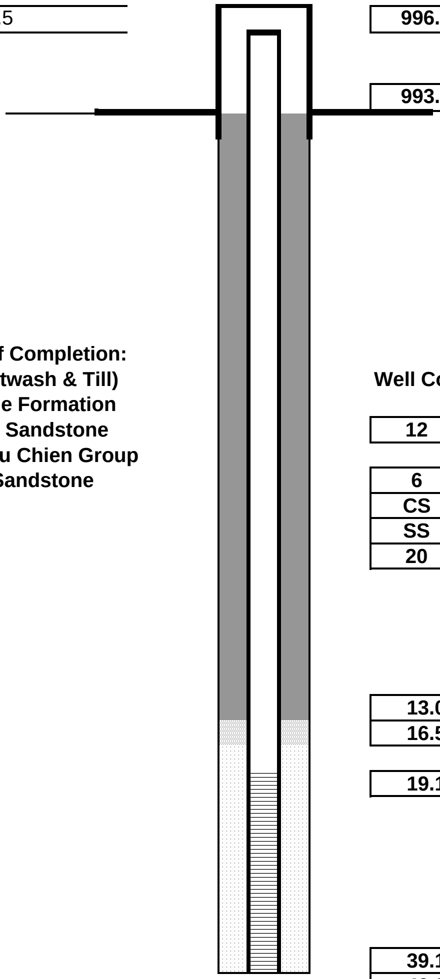
Site ID: RW-16

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: John Hunter

DATE OF WELL CONSTRUCTION: 28-Mar-08
DEPTH TO WATER (TOC): 3.73

Northing: 16346329.2
Easting: 1649267.5



996.18	TOC Elevation (fmsl)
993.12	GND Elevation (fmsl)

Lithologic Unit of Completion:
(X) Drift (Outwash & Till)
( ) Platteville Formation
( ) St. Peter Sandstone
( ) Prairie du Chien Group
( ) Jordan Sandstone
( ) Other:

Well Construction:

12	Boring Diameter (in)
6	Well Diameter (in)
CS	Riser Material
SS	Screen Material
20	Screen Length (ft)

13.00	Top of Fine-grained Sand
16.50	Top of Coarse-grained Sand
19.10	Top of Screen
39.10	Bottom of Screen
40.00	Total Boring Depth

Screen Slot: 10

Lithologic Contact Depths (fbgs)

0	to	51	Glacial Drift (Outwash Gravels / Till)
	to		Decorah Shale
	to		Platteville Formation

geoprobe boring drilled to 51 ft bgs

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

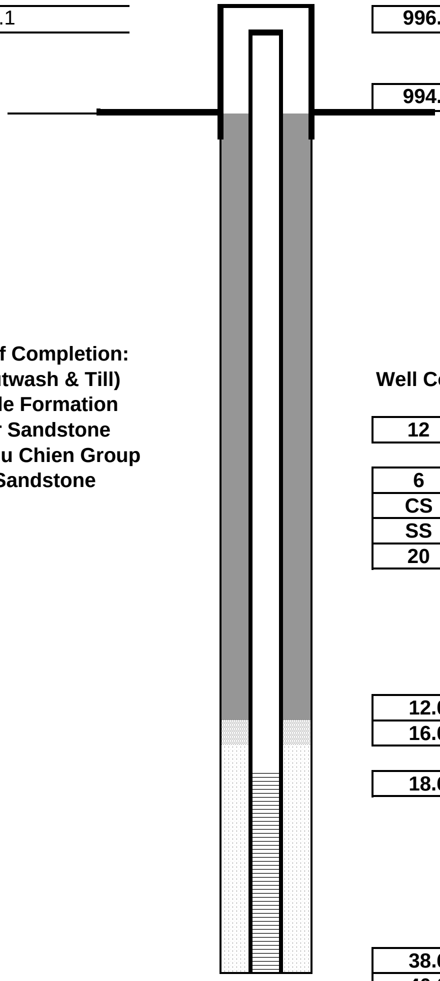
WELL CONSTRUCTION LOG

Site ID: **RW-17**

Page 1 of 1

CLIENT:	Confidential
SITE NAME:	Oakdale Disposal Site, Oakdale, MN
PROJECT NO.:	02181-202-006-0001
DRILLING CO.:	Boart-Longyear Drilling Co.
LOGGED BY:	J. Hunter
DATE OF WELL CONSTRUCTION:	28-Mar-08
DEPTH TO WATER (TOC):	3.73

Northing: 16346185.2
Easting: 1649141.1



996.75	TOC Elevation (fmsl)
994.19	GND Elevation (fmsl)

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- ( ) Platteville Formation
- ( ) St. Peter Sandstone
- ( ) Prairie du Chien Group
- ( ) Jordan Sandstone
- ( ) Other:

Well Construction:

12	Boring Diameter (in)
6	Well Diameter (in)
CS	Riser Material
SS	Screen Material
20	Screen Length (ft)

12.00	Top of Fine-grained Sand
16.00	Top of Coarse-grained Sand
18.60	Top of Screen
10	Screen Slot
38.60	Bottom of Screen
40.00	Total Boring Depth

Lithologic Contact Depths (fbgs)

0	to	40	Glacial Drift (Outwash Gravels / Till)
	to		Platteville Formation
	to		Glenwood Formation
	to		St. Peter Sandstone
	to		Prairie du Chien Formation
	to		Jordan Sandstone

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

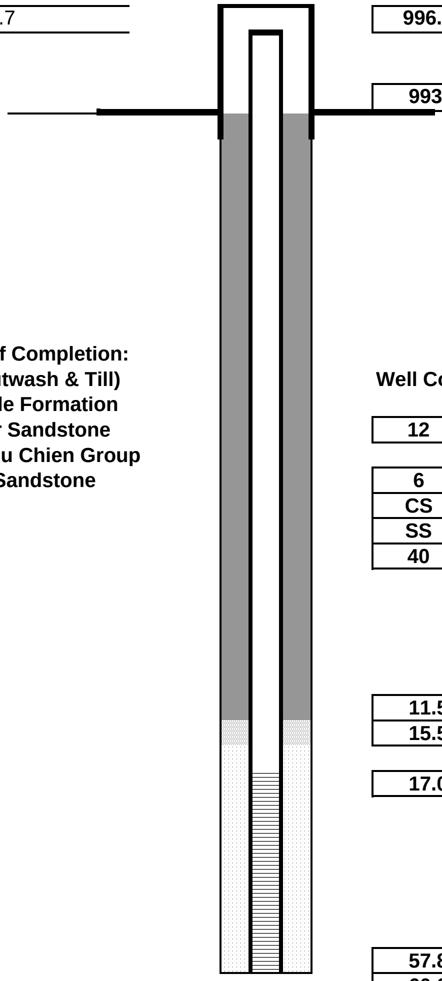
Depths are presented as feet below ground surface unless otherwise indicated.

WELL CONSTRUCTION LOG

Site ID: RW-18

CLIENT:	Confidential	**Page**	1 of 1
SITE NAME:	Oakdale Disposal Site, Oakdale, MN	**DATE OF WELL CONSTRUCTION:**	13-Apr-08
PROJECT NO.:	02181-202-006-0001		
DRILLING CO.:	Boart-Longyear Drilling Co.	**DEPTH TO WATER (TOC):**	3.82
LOGGED BY:	D. Cairns		

Northing: 16346249.4
Easting: 1648944.7



996.86	**TOC Elevation (fmsl)**
993.8	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- (   ) Platteville Formation
- (   ) St. Peter Sandstone
- (   ) Prairie du Chien Group
- (   ) Jordan Sandstone
- (   ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
40	**Screen Length (ft)**
11.50	**Top of Fine-grained Sand**
15.50	**Top of Coarse-grained Sand**
17.00	**Top of Screen** — 10 **Screen Slot**
57.80	**Bottom of Screen**
60.00	**Total Boring Depth**

Lithologic Contact Depths (fbgs)

0	to	60	**Glacial Drift (Outwash Gravels / Till)**
	to		**Platteville Formation**
	to		**Glenwood Formation**
	to		**St. Peter Sandstone**
	to		**Prairie du Chien Formation**
	to		**Jordan Sandstone**

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WELL CONSTRUCTION LOG

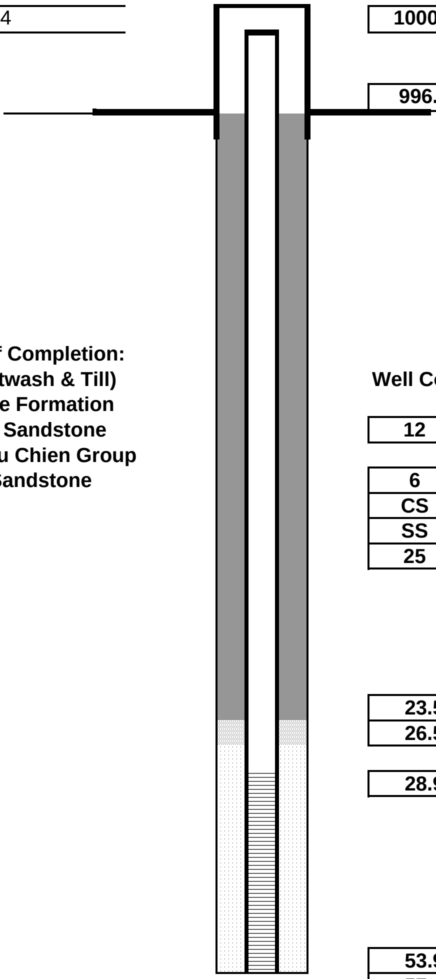
Site ID: **RW-19**

Page 1 **of** 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 30-Mar-08
DEPTH TO WATER (TOC): 7.41

Northing: 16346197.9
Easting: 1648827.4



1000.53 **TOC Elevation (fmsl)**
996.86 **GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- ( ) Platteville Formation
- ( ) St. Peter Sandstone
- ( ) Prairie du Chien Group
- ( ) Jordan Sandstone
- ( ) Other:

Well Construction:

12 **Boring Diameter (in)**
6 **Well Diameter (in)**
CS **Riser Material**
SS **Screen Material**
25 **Screen Length (ft)**

23.50 **Top of Fine-grained Sand**
26.50 **Top of Coarse-grained Sand**
28.90 **Top of Screen** 10 **Screen Slot**

53.90 **Bottom of Screen**
57.00 **Total Boring Depth**

Lithologic Contact Depths (fbgs)

0	to	57	Glacial Drift (Outwash Gravels / Till)
	to		Platteville Formation
	to		Glenwood Formation
	to		St. Peter Sandstone
	to		Prairie du Chien Formation
	to		Jordan Sandstone

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WELL CONSTRUCTION LOG

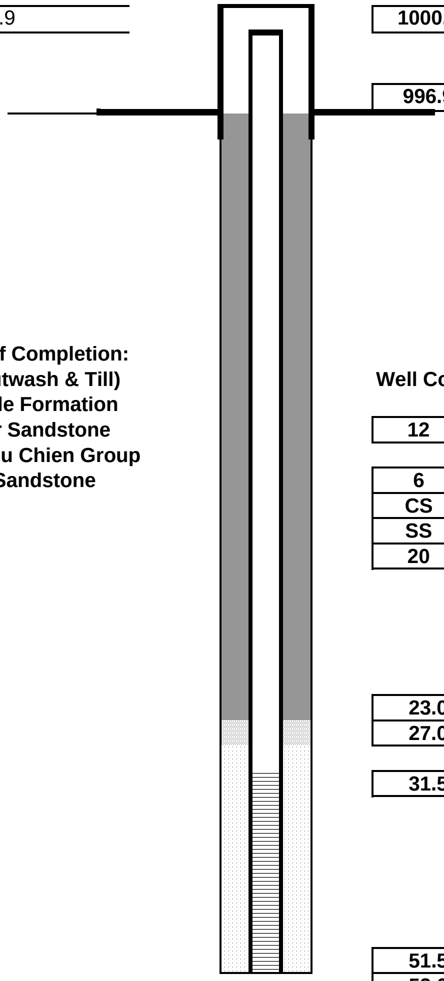
Site ID: RW-20

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 30-Mar-08
DEPTH TO WATER (TOC): 7.10

Northing: 16346217.3
Easting: 1648697.9



1000.24	TOC Elevation (fmsl)
996.93	GND Elevation (fmsl)

Lithologic Unit of Completion:
(x) Drift (Outwash & Till)
( ) Platteville Formation
( ) St. Peter Sandstone
( ) Prairie du Chien Group
( ) Jordan Sandstone
( ) Other:

Well Construction:

12	Boring Diameter (in)
6	Well Diameter (in)
CS	Riser Material
SS	Screen Material
20	Screen Length (ft)

23.00	Top of Fine-grained Sand
27.00	Top of Coarse-grained Sand
31.50	Top of Screen
10	Screen Slot
51.50	Bottom of Screen
52.00	Total Boring Depth

Lithologic Contact Depths (fbgs)

0	to	52	Glacial Drift (Outwash Gravels / Till)
	to		Platteville Formation
	to		Glenwood Formation
	to		St. Peter Sandstone
	to		Prairie du Chien Formation
	to		Jordan Sandstone

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WESTON® MANAGERS DESIGNERS CONSULTANTS

WELL CONSTRUCTION LOG

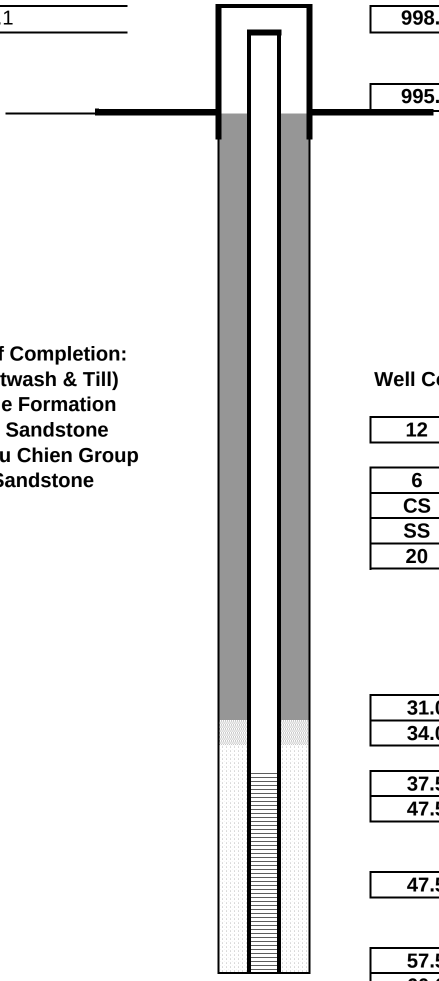
Site ID: RW-21

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 1-Apr-08
DEPTH TO WATER (TOC): 5.29

Northing: 16346037.4
Easting: 1648626.1



998.41	**TOC Elevation (fmsl)**
995.29	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- ( ) Platteville Formation
- ( ) St. Peter Sandstone
- ( ) Prairie du Chien Group
- ( ) Jordan Sandstone
- ( ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
20	**Screen Length (ft)**
	Depth to Water (ft)

31.00	**Top of Fine-grained Sand**		
34.00	**Top of Coarse-grained Sand**		
37.50	**Top of Screen**	5	**Screen Slot**
47.50	**Bottom of Screen**	5	**Screen Slot**
47.50	**Top of Screen**	10	**Screen Slot**
57.50	**Bottom of Screen**	10	**Screen Slot**
60.00	**Total Boring Depth**		

Lithologic Contact Depths (fbgs)

0	to	60	**Glacial Drift (Outwash Gravels / Till)**
	to		**Platteville Formation**
	to		**Glenwood Formation**
	to		**St. Peter Sandstone**
	to		**Prairie du Chien Formation**
	to		**Jordan Sandstone**

CS	**Carbon Steel**	**gal.**	**Gallons**
SS	**Stainless Steel**	**TOC**	**Top of casing**

Depths are presented as feet below ground surface unless otherwise indicated.

WESTON®
MANAGERS DESIGNERS CONSULTANTS

WELL CONSTRUCTION LOG

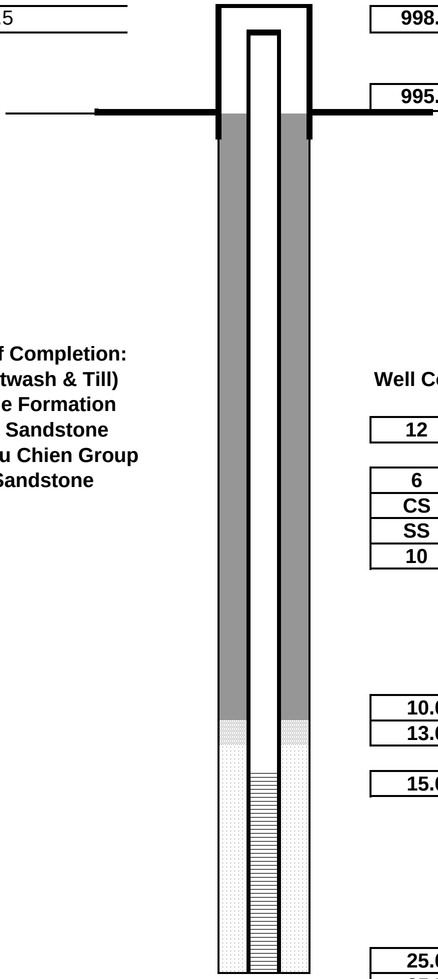
Site ID: RW-22

Page 1 **of** 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 9-Apr-08
DEPTH TO WATER (TOC): 5.10

Northing: 16346271.9
Easting: 1648537.5



998.47	**TOC Elevation (fmsl)**
995.56	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- (   ) Platteville Formation
- (   ) St. Peter Sandstone
- (   ) Prairie du Chien Group
- (   ) Jordan Sandstone
- (   ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
10	**Screen Length (ft)**

10.00	**Top of Fine-grained Sand**
13.00	**Top of Coarse-grained Sand**
15.00	**Top of Screen** 10 **Screen Slot**
25.00	**Bottom of Screen**
25.50	**Total Boring Depth**

Lithologic Contact Depths (fbgs)

0	to	60	**Glacial Drift (Outwash Gravels / Till)**
	to		**Platteville Formation**
	to		**Glenwood Formation**
	to		**St. Peter Sandstone**
	to		**Prairie du Chien Formation**
	to		**Jordan Sandstone**

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WELL CONSTRUCTION LOG

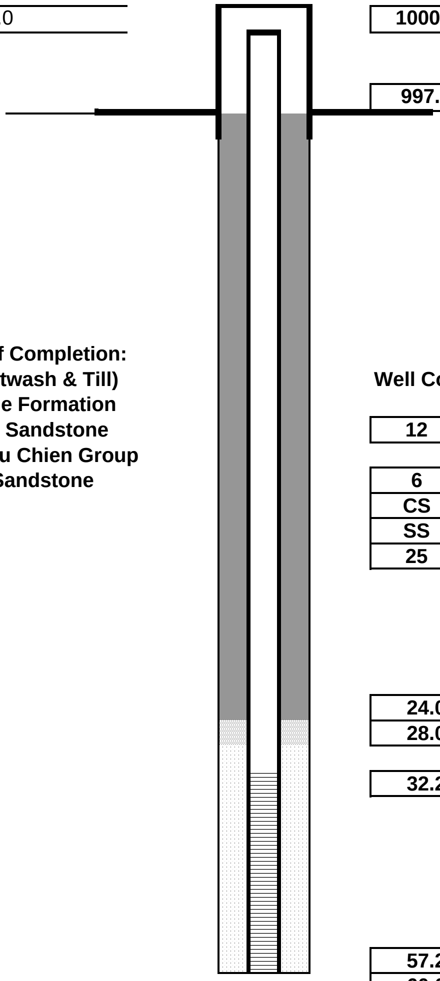
Site ID: RW-23

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 2-Apr-08
DEPTH TO WATER (TOC): 6.34

Northing: 16346518.2
Easting: 1648422.0



1000.75	**TOC Elevation (fmsl)**
997.44	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- ( ) Platteville Formation
- ( ) St. Peter Sandstone
- ( ) Prairie du Chien Group
- ( ) Jordan Sandstone
- ( ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
25	**Screen Length (ft)**

24.00	**Top of Fine-grained Sand**
28.00	**Top of Coarse-grained Sand**
32.20	**Top of Screen** 10 **Screen Slot**
57.20	**Bottom of Screen**
60.00	**Total Boring Depth**

Lithologic Contact Depths (fbgs)

0	to	60	**Glacial Drift (Outwash Gravels / Till)**
	to		**Platteville Formation**
	to		**Glenwood Formation**
	to		**St. Peter Sandstone**
	to		**Prairie du Chien Formation**
	to		**Jordan Sandstone**

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WESTON®
MANAGERS DESIGNERS CONSULTANTS

WELL CONSTRUCTION LOG

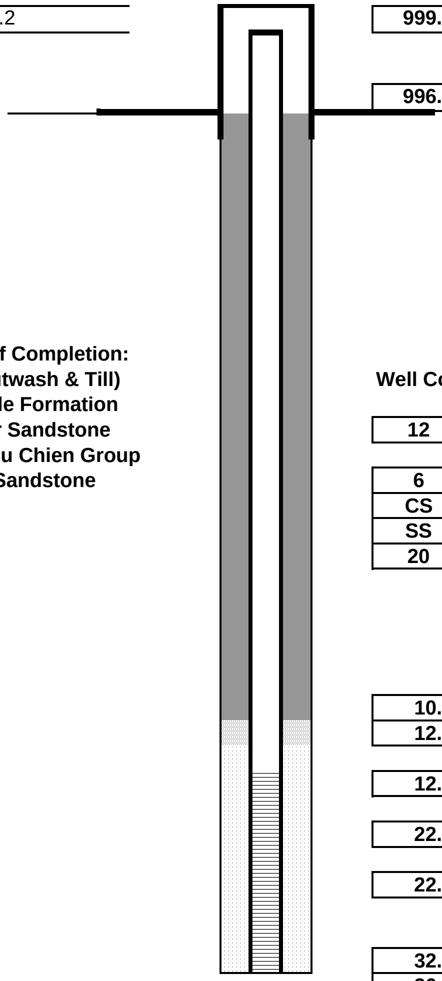
Site ID: **RW-24**

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: J. Hunter

DATE OF WELL CONSTRUCTION: 8-Apr-08
DEPTH TO WATER (TOC): 4.08

Northing: 16346525.1
Easting: 1648259.2



999.42	**TOC Elevation (fmsl)**
996.44	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
(x) Drift (Outwash & Till)
(   ) Platteville Formation
(   ) St. Peter Sandstone
(   ) Prairie du Chien Group
(   ) Jordan Sandstone
(   ) Other:

Well Construction:

12	**Boring Diameter (in)**
6	**Well Diameter (in)**
CS	**Riser Material**
SS	**Screen Material**
20	**Screen Length (ft)**

10.0	**Top of Fine-grained Sand**		
12.0	**Top of Coarse-grained Sand**		
12.7	**Top of Screen**	5	**Screen Slot**
22.7	**Screen Bottom**	5	**Screen Slot**
22.7	**Top of Screen**	10	**Screen Slot**
32.7	**Screen Bottom**	10	**Screen Slot**
36.0	**Total Boring Depth**		

Lithologic Contact Depths (fbgs)

0	to	60	**Glacial Drift (Outwash Gravels / Till)**
	to		**Platteville Formation**
	to		**Glenwood Formation**
	to		**St. Peter Sandstone**
	to		**Prairie du Chien Formation**
	to		**Jordan Sandstone**

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

WELL CONSTRUCTION LOG

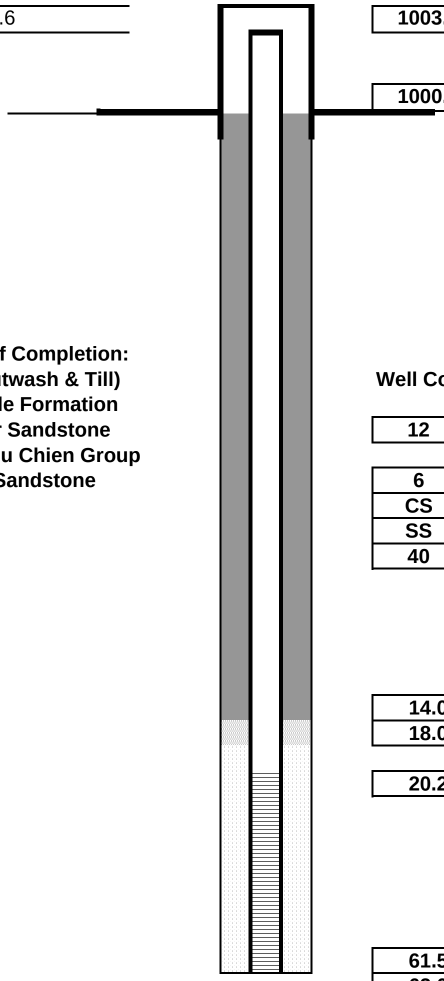
Site ID: **RW-25**

Page 1 of 1

CLIENT: Confidential
SITE NAME: Oakdale Disposal Site, Oakdale, MN
PROJECT NO.: 02181-202-006-0001
DRILLING CO.: Boart-Longyear Drilling Co.
LOGGED BY: D. Cairns

DATE OF WELL CONSTRUCTION: 12-Apr-08
DEPTH TO WATER (TOC): 9.93

Northing: 16345867.2
Easting: 1649111.6



1003.21	**TOC Elevation (fmsl)**
1000.19	**GND Elevation (fmsl)**

Lithologic Unit of Completion:
- (x) Drift (Outwash & Till)
- ( ) Platteville Formation
- ( ) St. Peter Sandstone
- ( ) Prairie du Chien Group
- ( ) Jordan Sandstone
- ( ) Other:

Well Construction:

12	Boring Diameter (in)
6	Well Diameter (in)
CS	Riser Material
SS	Screen Material
40	Screen Length (ft)

14.05	Top of Fine-grained Sand
18.05	Top of Coarse-grained Sand
20.20	Top of Screen; 10 Screen Slot
61.50	Bottom of Screen
62.00	Total Boring Depth

Lithologic Contact Depths (fbgs)

0	to	62	Glacial Drift (Outwash Gravels / Till)
	to		Platteville Formation
	to		Glenwood Formation
	to		St. Peter Sandstone
	to		Prairie du Chien Formation
	to		Jordan Sandstone

CS	Carbon Steel	gal.	Gallons
SS	Stainless Steel	TOC	Top of casing

Depths are presented as feet below ground surface unless otherwise indicated.

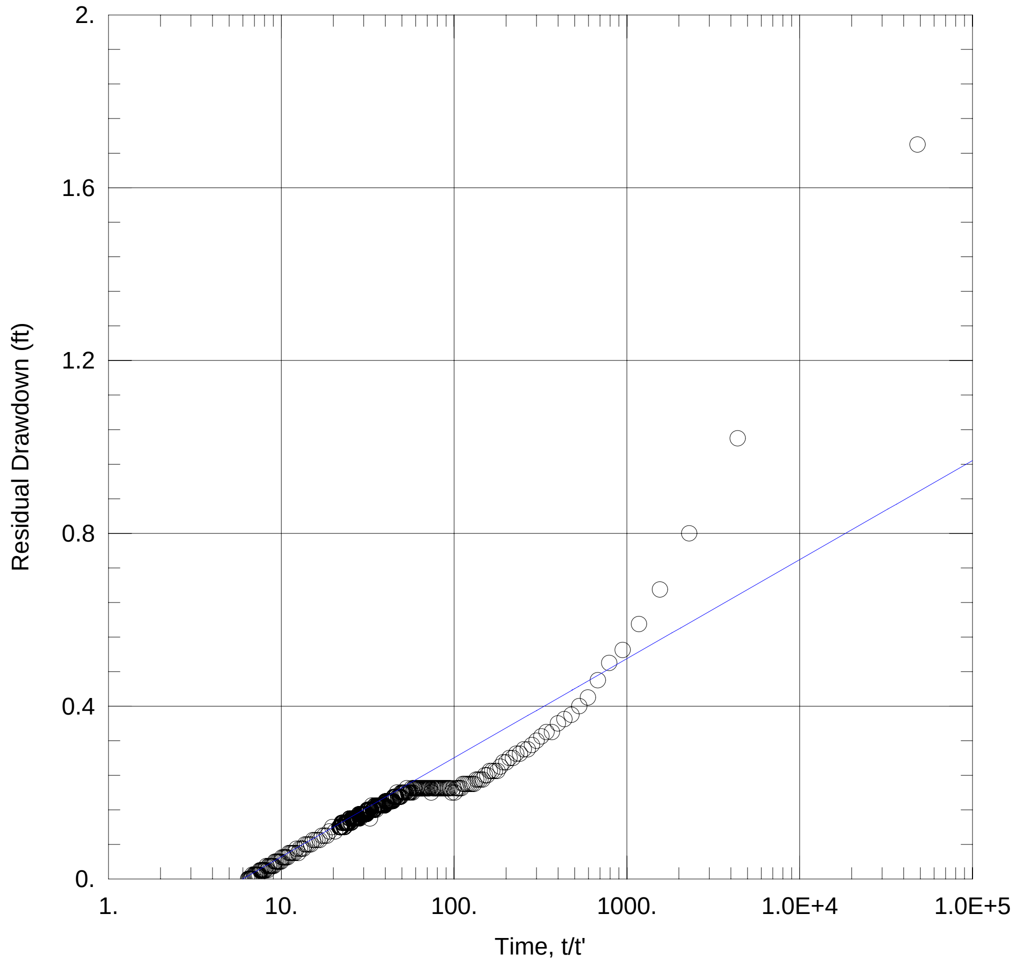
WESTON®
MANAGERS DESIGNERS CONSULTANTS

APPENDIX B

PUMP TEST DATA ANALYSES

RW16 Pump Test

Data Analysis



RW-16 PUMP TEST (RW-16 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW16
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 39. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW16	1649267	16346329

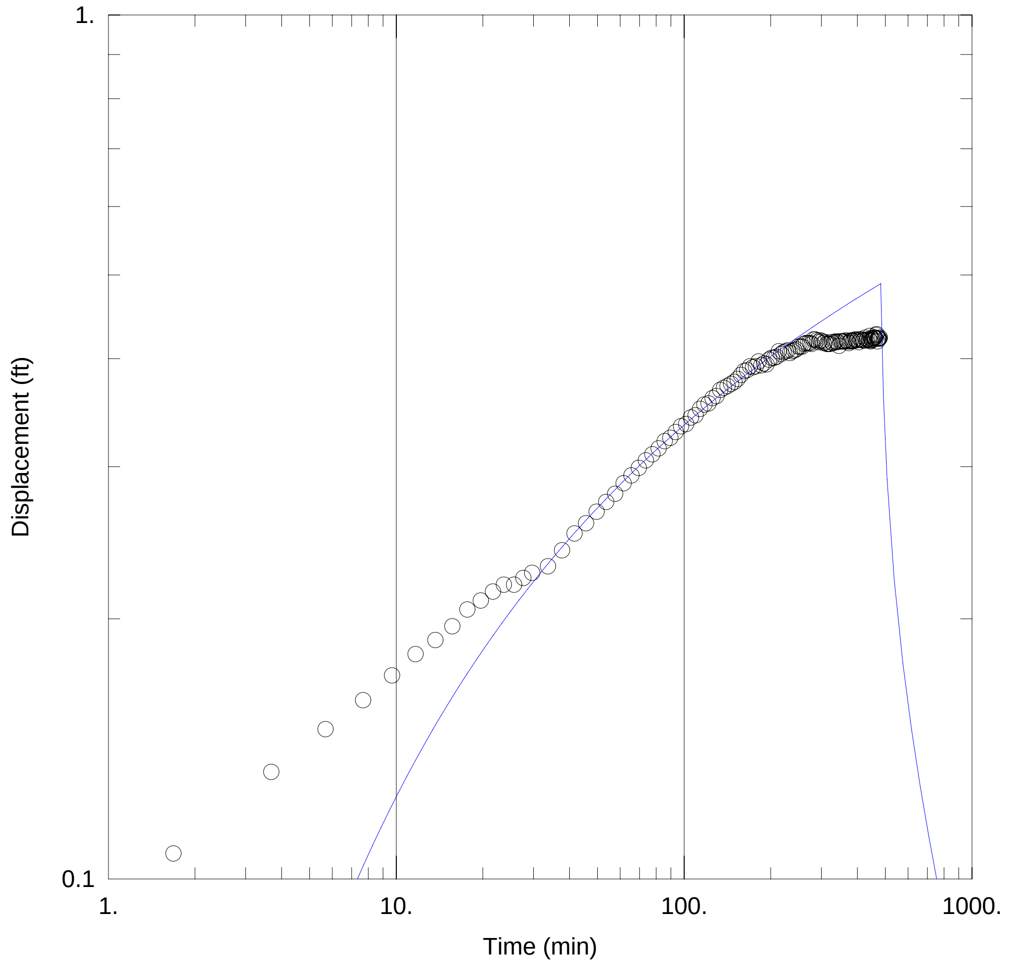
Observation Wells

Well Name	X (ft)	Y (ft)
○ RW16	1649267	16346329

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Recovery)

T = 1307.6 ft^2/day
S/S' = 5.992



RW-16 PUMP TEST (RW-17 THEIS-DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW16
Test Date: April 2008

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW16	1649267	16346329

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW17	1649141	16346185

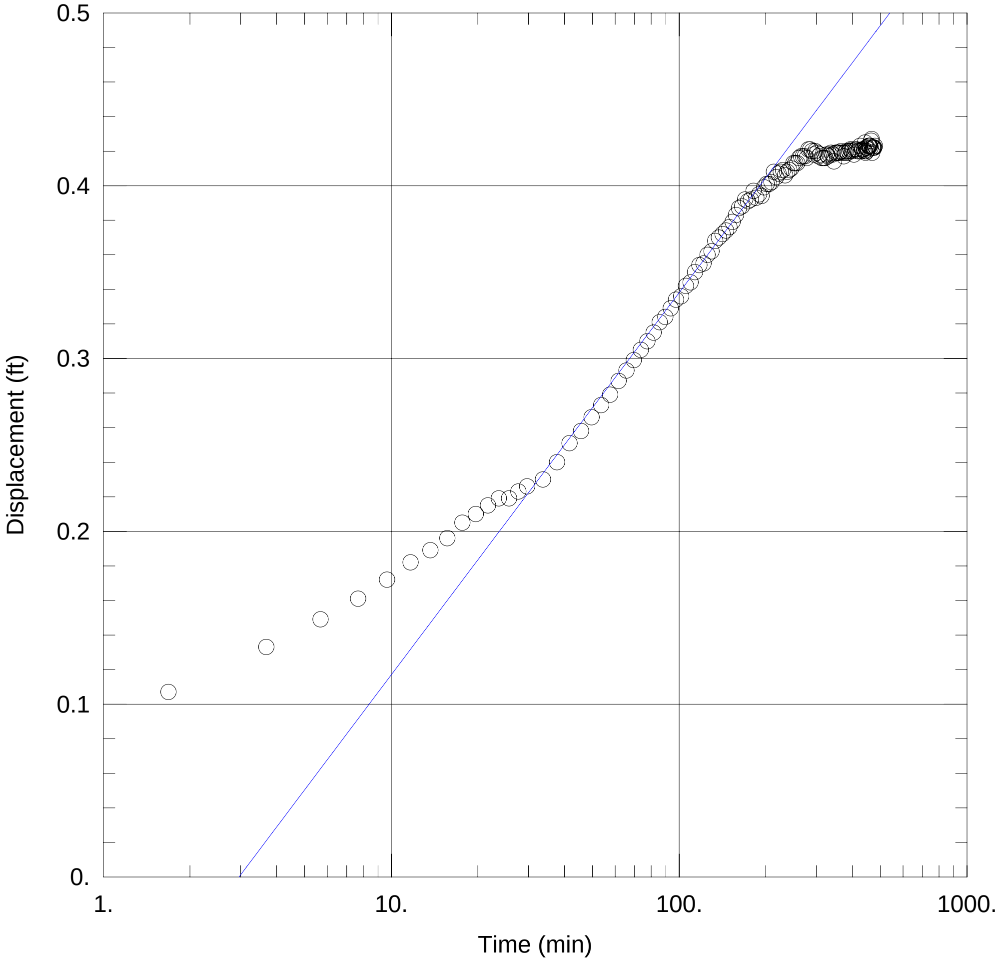
SOLUTION

Aquifer Model: Confined

Solution Method: Theis

T = 1322.2 ft^2/day
Kz/Kr = 1.

S = 0.0001908
b = 39. ft



RW-16 PUMP TEST (RW-17 COOPER-JACOB DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW16
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 39. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW16	1649267	16346329

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW17	1649141	16346185

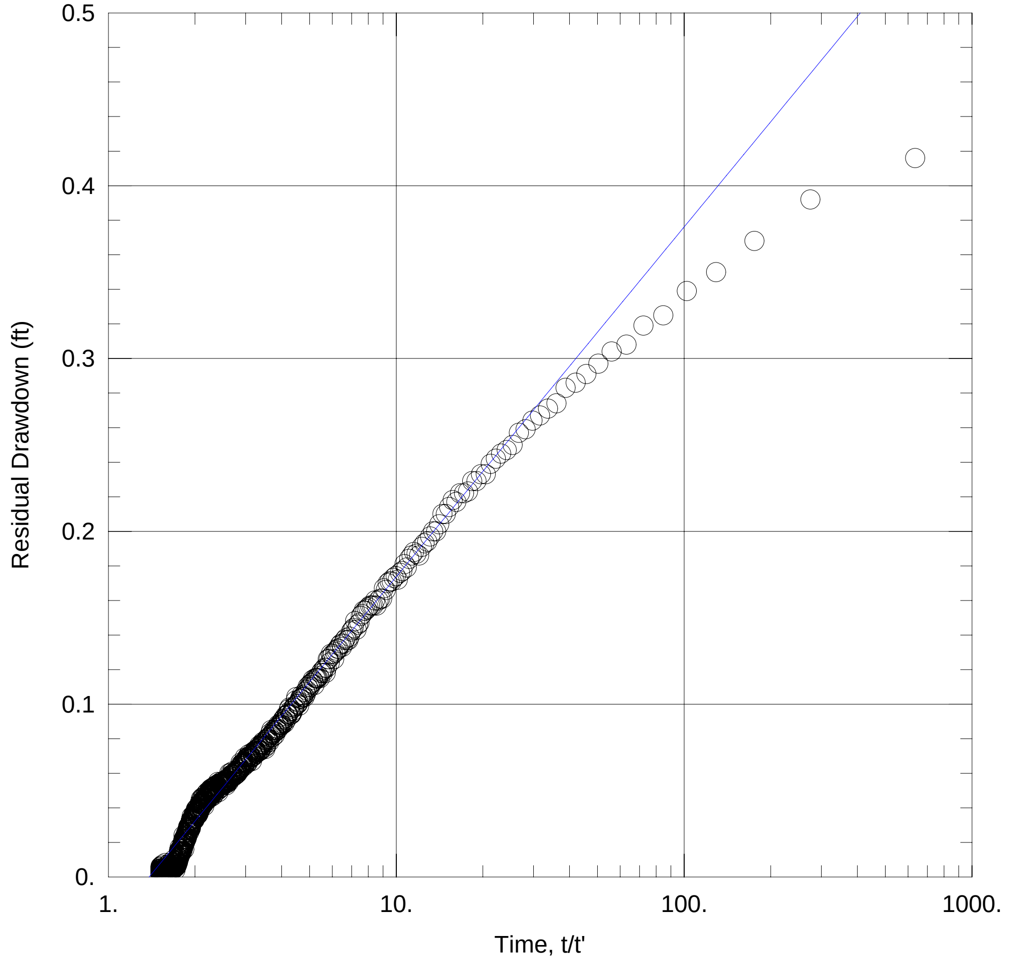
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 1355.7 ft^2/day

S = 0.0001709



RW-16 PUMP TEST (RW-17 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW16
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 39. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW16	1649267	16346329

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW17	1649141	16346185

SOLUTION

Aquifer Model: Confined

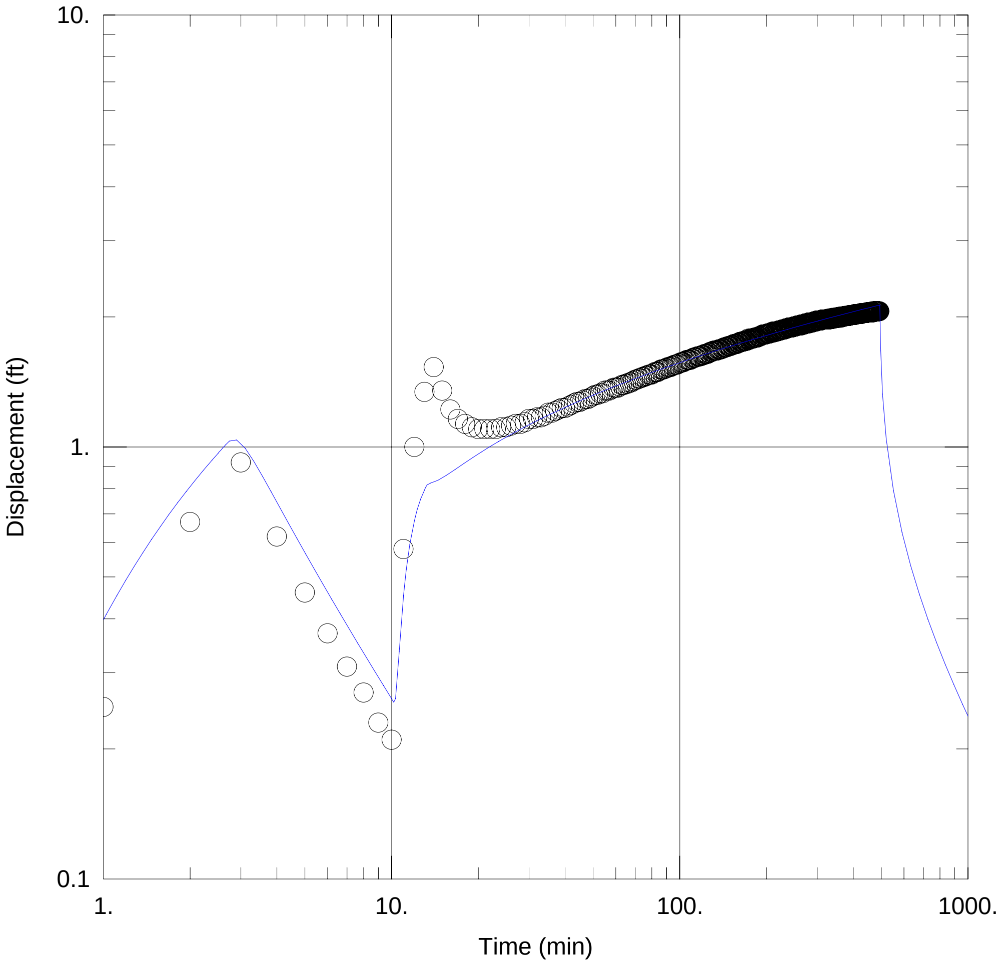
Solution Method: Theis (Recovery)

T = 1481.7 ft^2/day

S/S' = 1.385

RW19 Pump Test

Data Analysis



RW-19 PUMP TEST (RW-18 THEIS DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346198

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW18	1648944	16346249

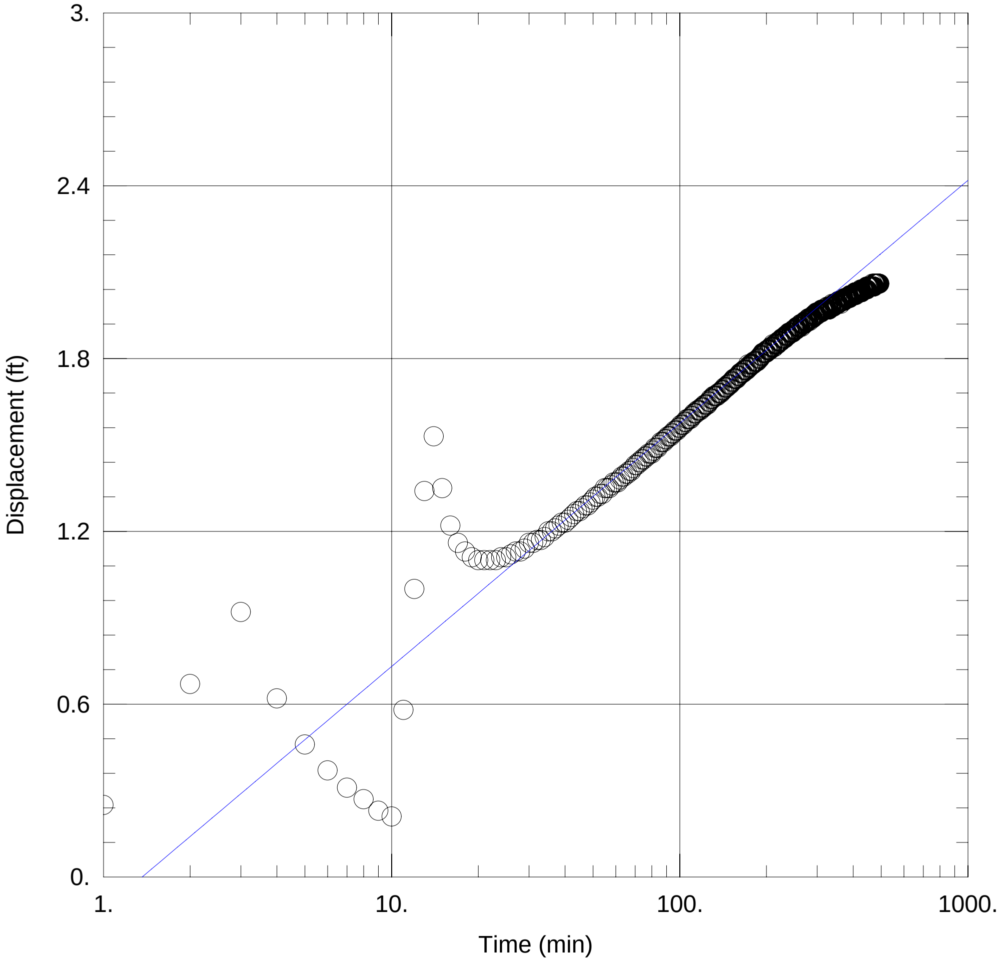
SOLUTION

Aquifer Model: Confined

Solution Method: Theis

T = 1312.2 ft^2/day
Kz/Kr = 1.

S = 0.0001414
b = 40. ft



RW-19 PUMP TEST (RW-18 COOPER-JACOB DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW18	1648944	16346249

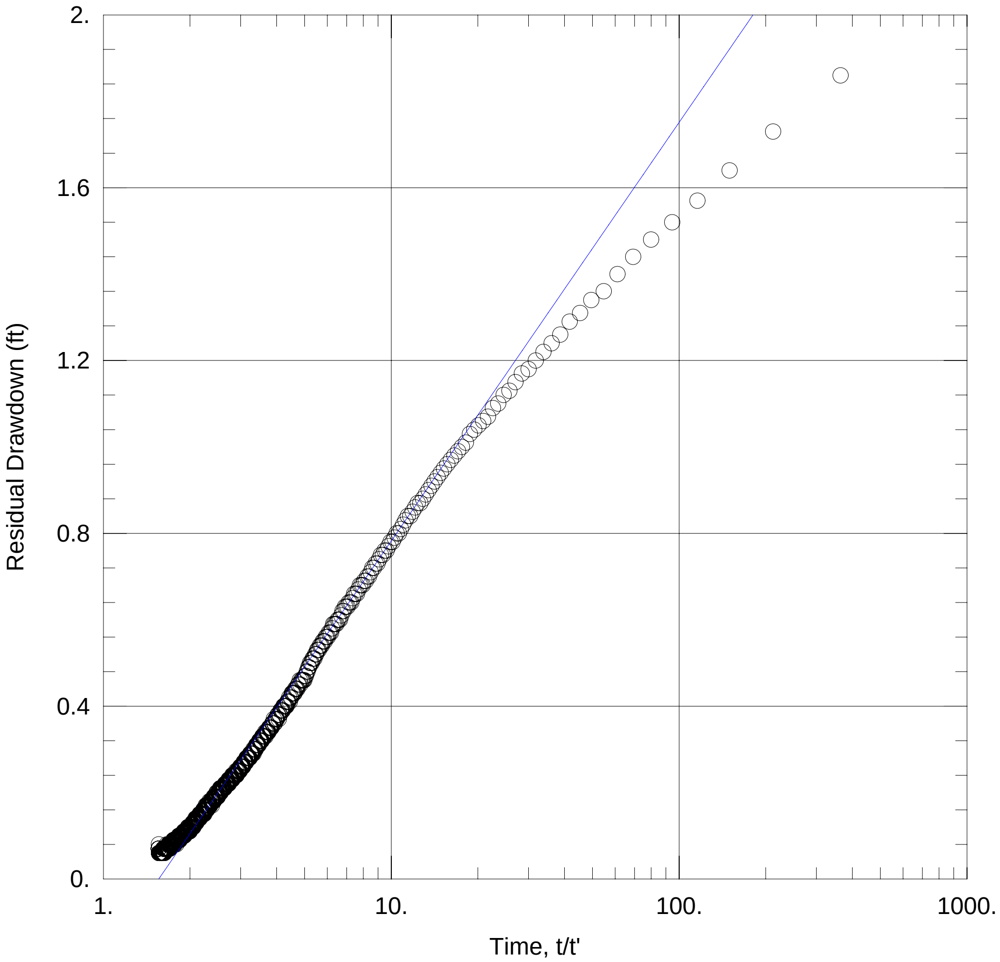
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 1253.6 ft^2/day

S = 0.0001625



RW-19 PUMP TEST (RW-18 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW18	1648944	16346249

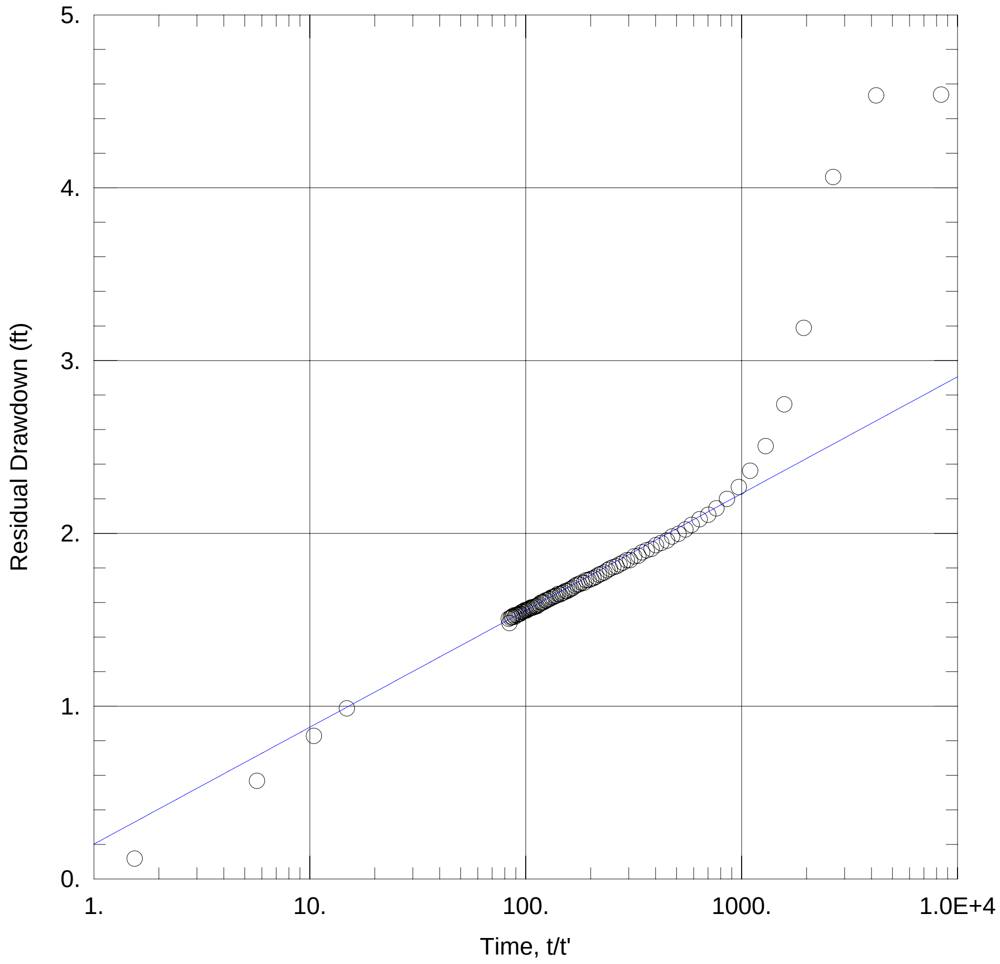
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1092.2 ft^2/day

S/S' = 1.558



RW-19 PUMP TEST (RW-19 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

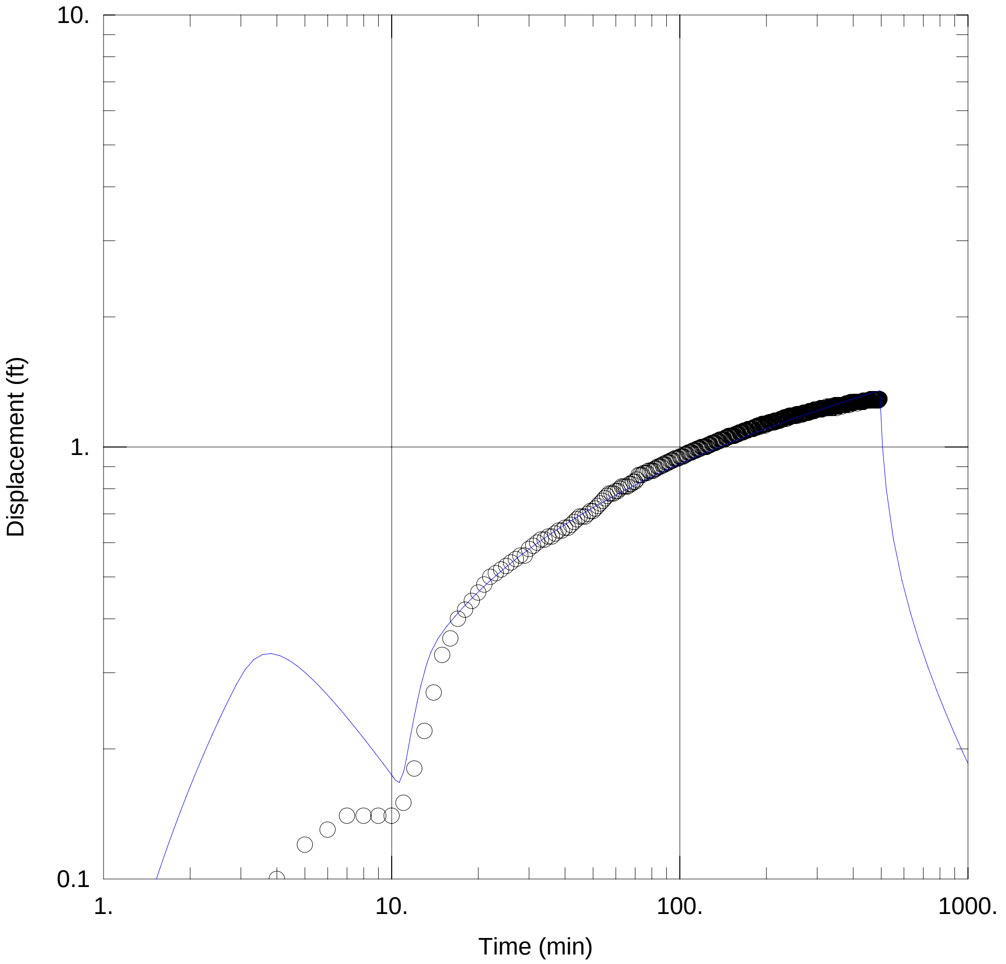
Observation Wells

Well Name	X (ft)	Y (ft)
○ RW19	1648827	16346197

SOLUTION

Aquifer Model: Confined
Solution Method: Theis (Recovery)

T = 1565.6 ft^2/day
S/S' = 0.5036



RW-19 PUMP TEST (RW-20 THEIS-DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW20	1648697	16346217

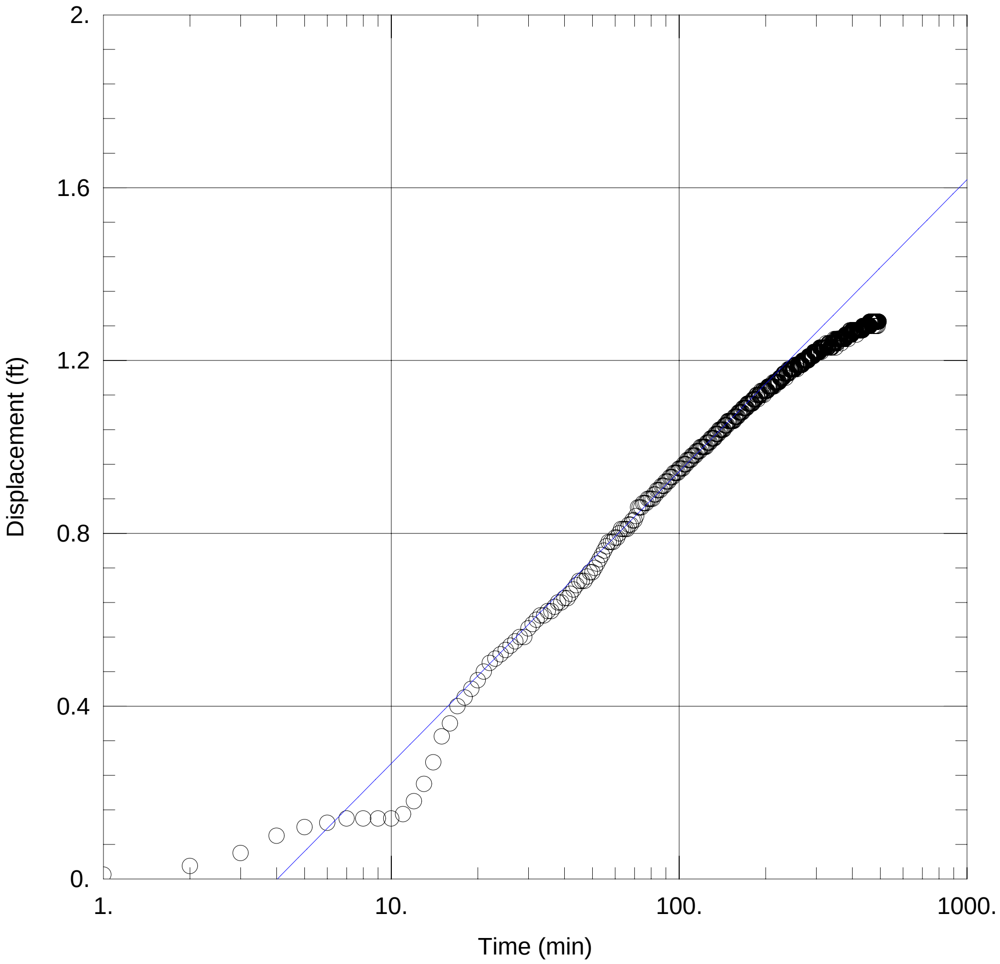
SOLUTION

Aquifer Model: Confined

Solution Method: Theis

T = 1685.4 ft^2/day
Kz/Kr = 1.

S = 0.0005327
b = 40. ft



RW-19 PUMP TEST (RW-20 COOPER-JACOB DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

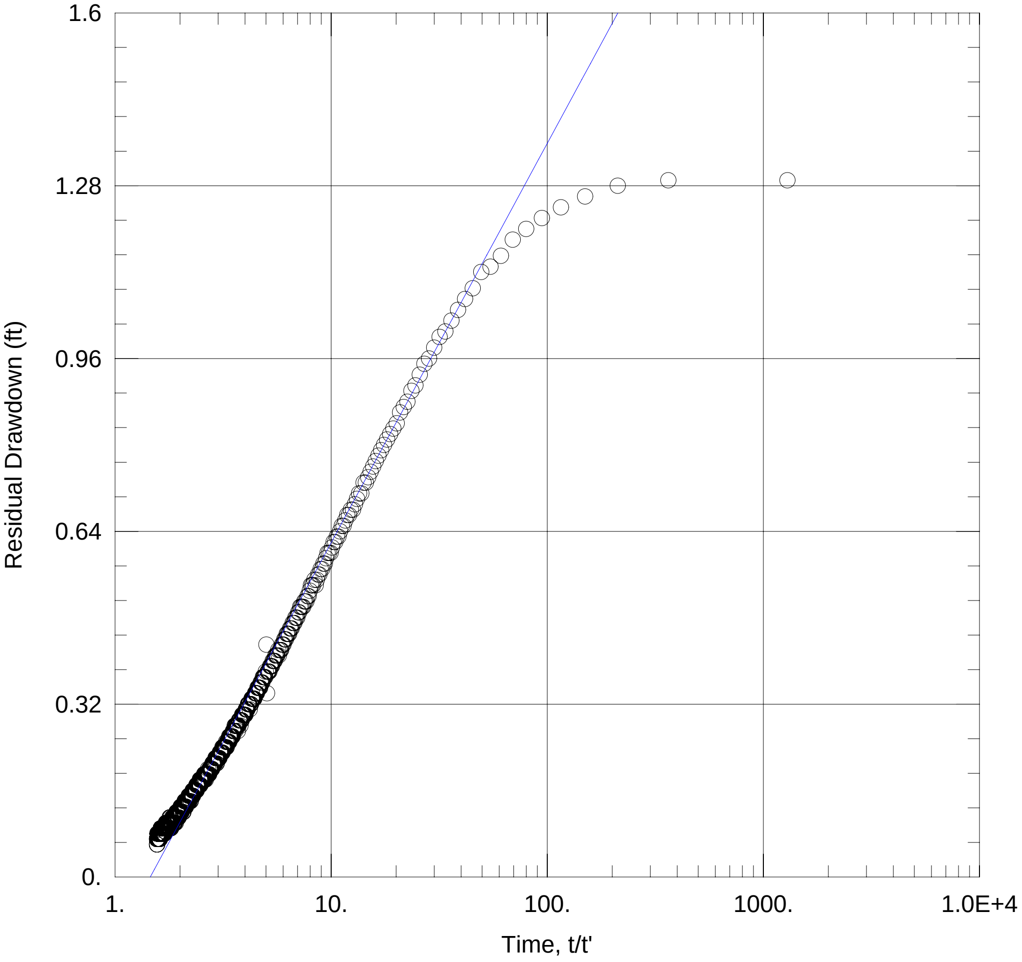
Observation Wells

Well Name	X (ft)	Y (ft)
○ RW20	1648697	16346217

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Jacob

T = 1566.1 ft^2/day
S = 0.0005679



RW-19 PUMP TEST (RW-20 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW20	1648697	16346217

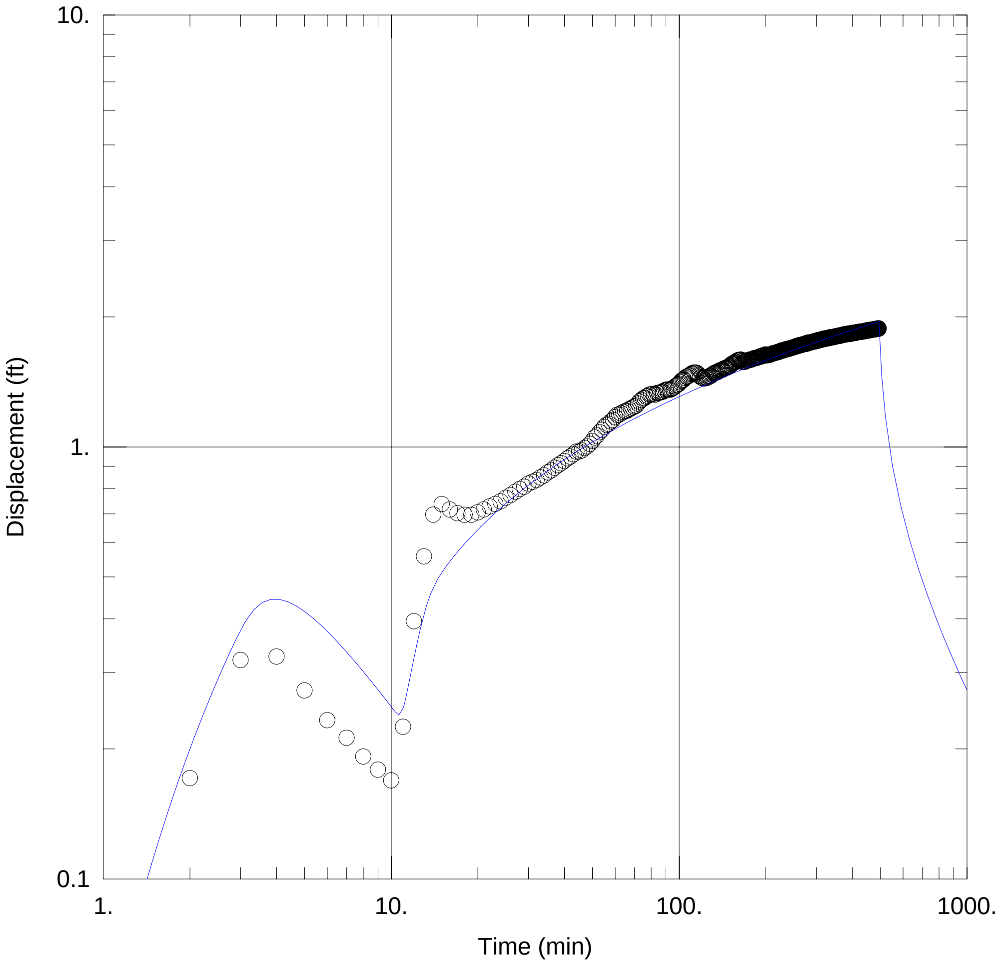
SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1431.4 ft^2/day

S/S' = 1.457



RW-19 PUMP TEST (RW-21 THEIS-DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW21	1648626	16346037

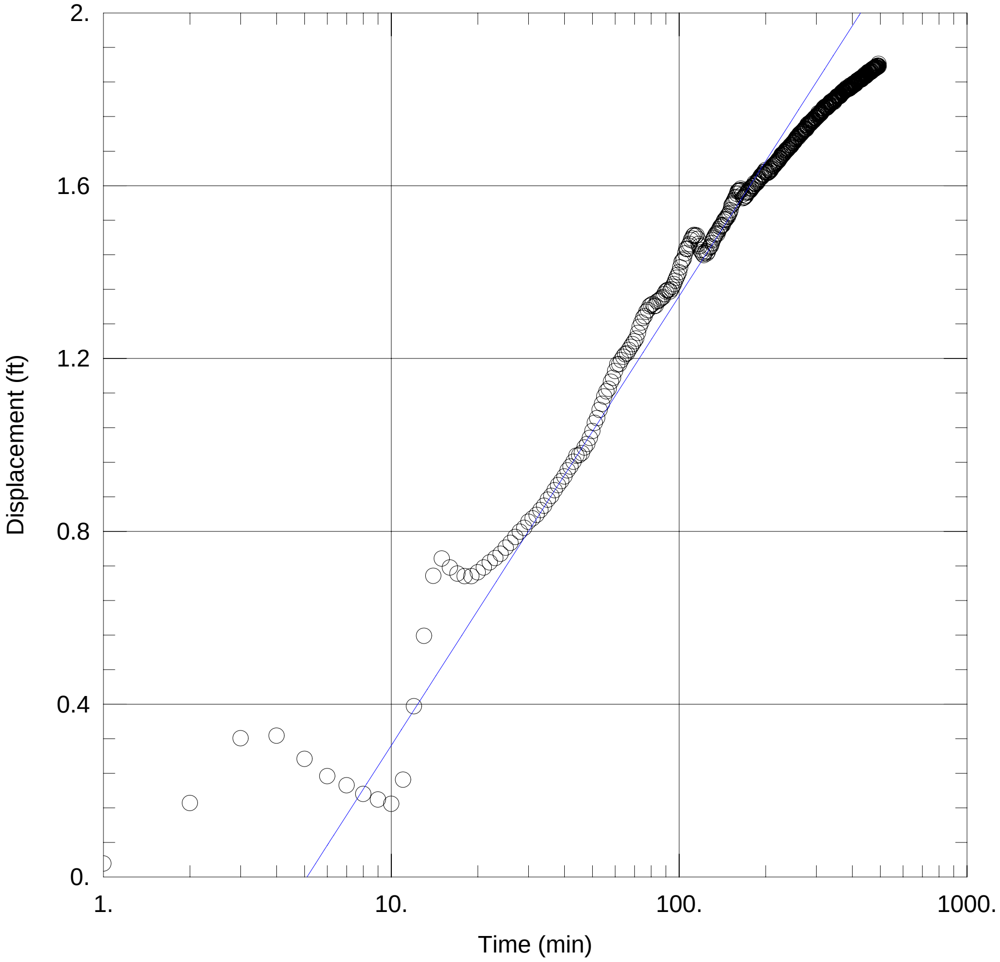
SOLUTION

Aquifer Model: Confined

Solution Method: Theis

T = 1140.6 ft^2/day
Kz/Kr = 1.

S = 0.0001055
b = 40. ft



RW-19 PUMP TEST (RW-21 COOPER-JACOB DRAWDOWN METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW21	1648626	16346037

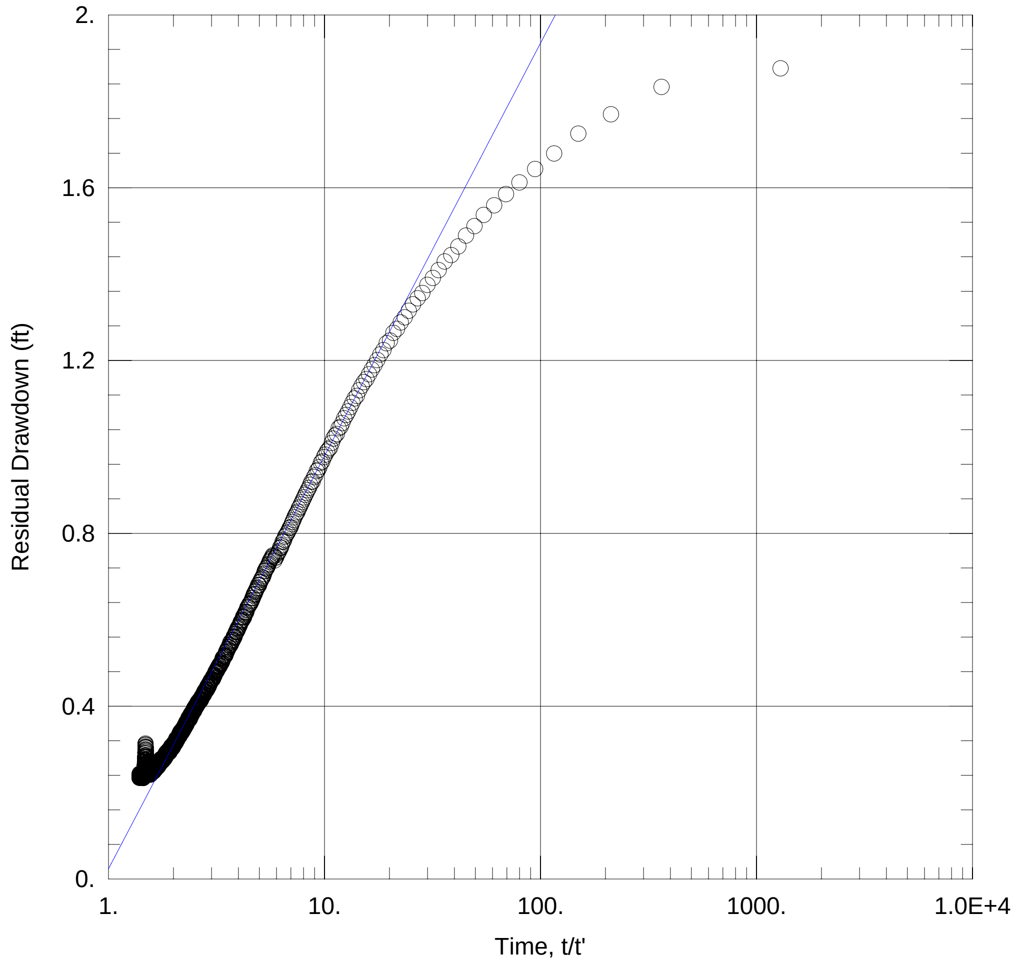
SOLUTION

Aquifer Model: Confined

Solution Method: Cooper-Jacob

T = 1017.5 ft^2/day

S = 0.0001226



RW-19 PUMP TEST (RW-21 THEIS RECOVERY METHOD)

PROJECT INFORMATION

Company: Weston Solutions, Inc.
Client: Confidential
Location: Oakdale, MN
Test Well: RW19
Test Date: April 2008

AQUIFER DATA

Saturated Thickness: 40. ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
RW19	1648827	16346197

Observation Wells

Well Name	X (ft)	Y (ft)
○ RW21	1648626	16346037

SOLUTION

Aquifer Model: Confined

Solution Method: Theis (Recovery)

T = 1107.7 ft^2/day

S/S' = 0.946

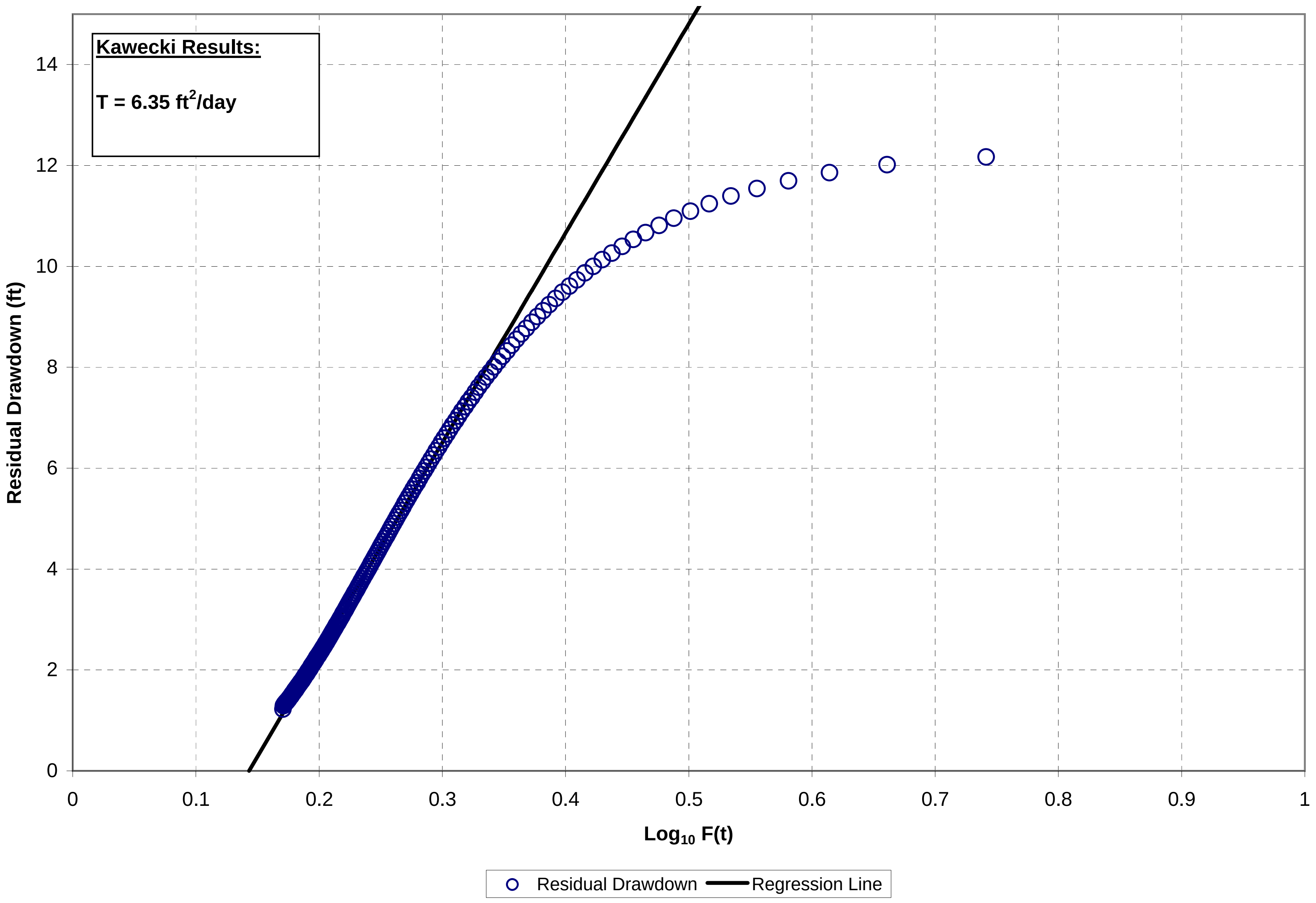
Short-Term Pumping Tests

RW14 Short-term Pump Test

Data Analysis

RW14 Short-Term Pump Test - Recovery Data

Kawecki Recovery Method

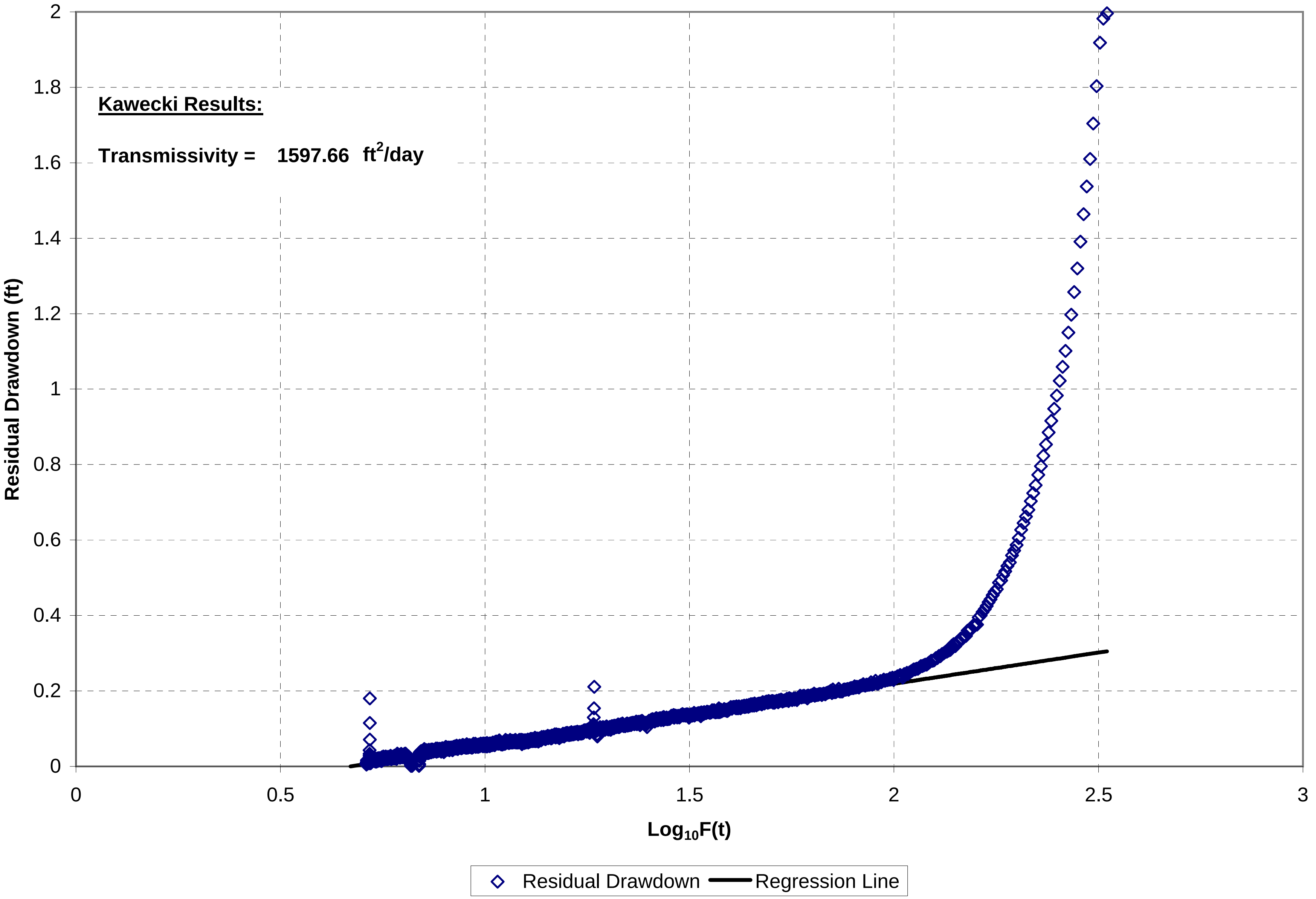


RW17 Short-term Pump Test

Data Analysis

RW17 Short-Term Pump Test - Recovery Data

Kawecki Recovery Method

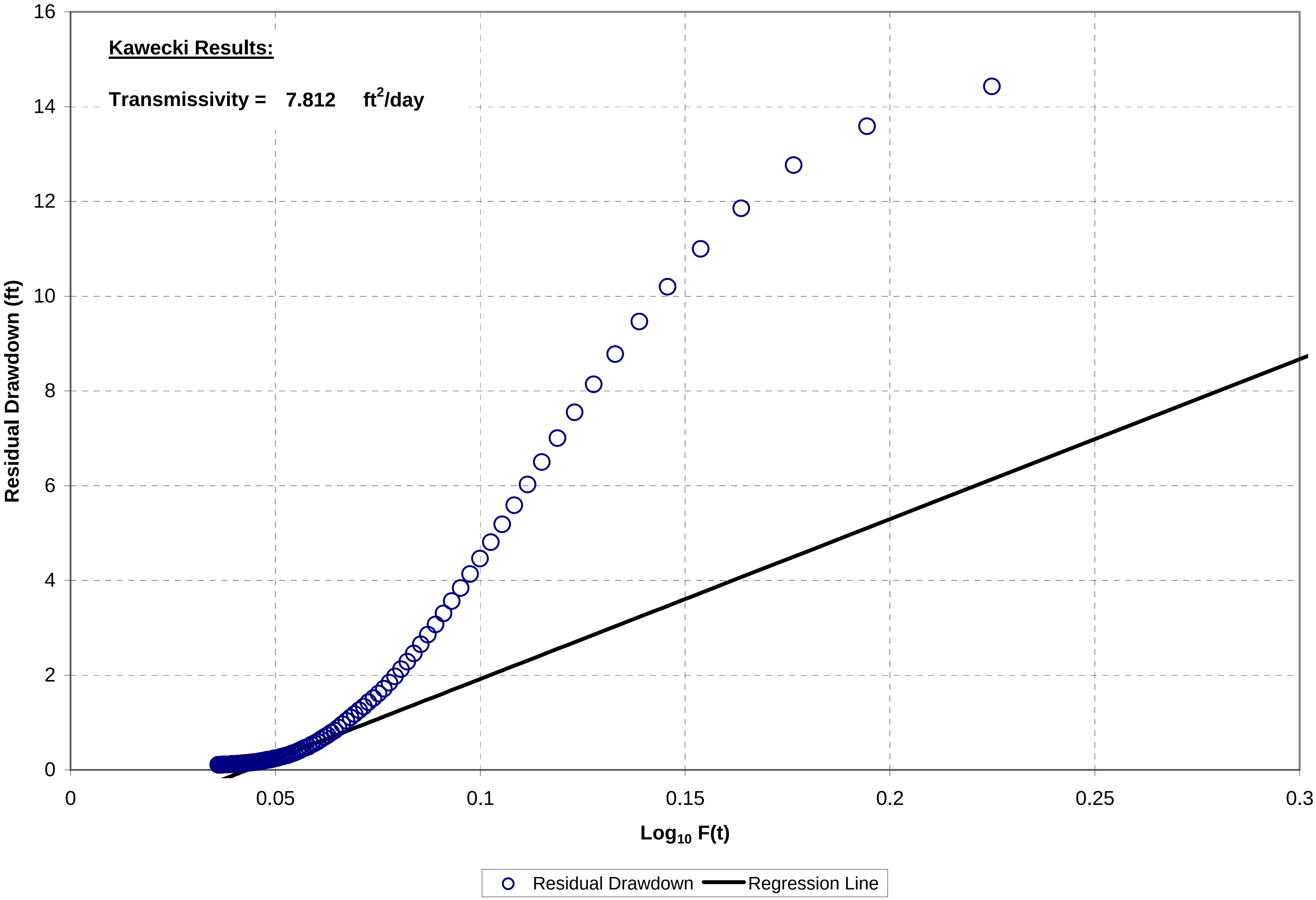


RW22 Short-term Pump Test

Data Analysis

RW22 Short-Term Pump Test-Recovery Data

Kawecki Recovery Method



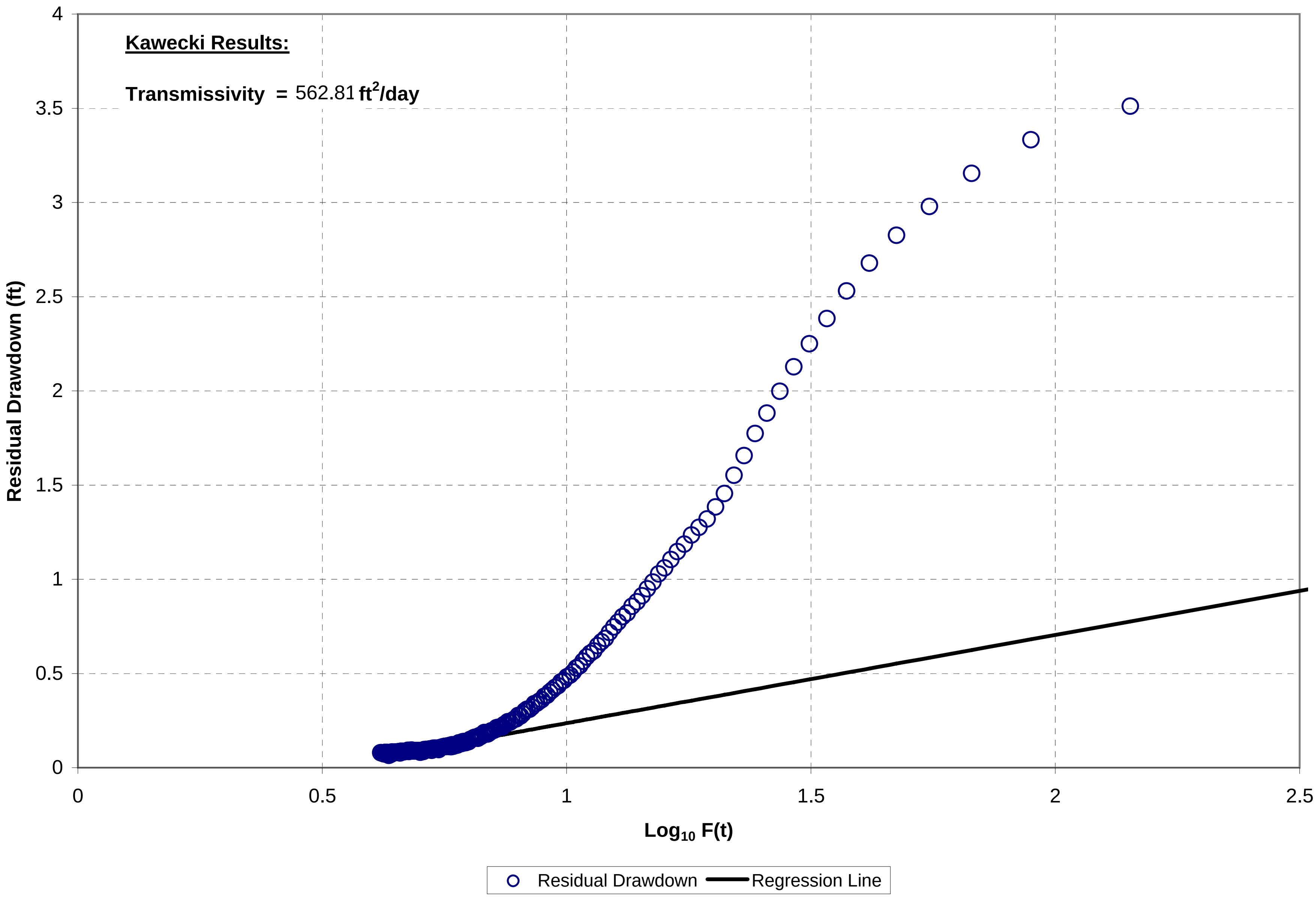
RW22_kaweckiKaw_RW14_CHT

RW25 Short-term Pump Test

Data Analysis

RW25 Short-Term Pump Test - Recovery Data

Kawecki Recovery Method



APPENDIX C

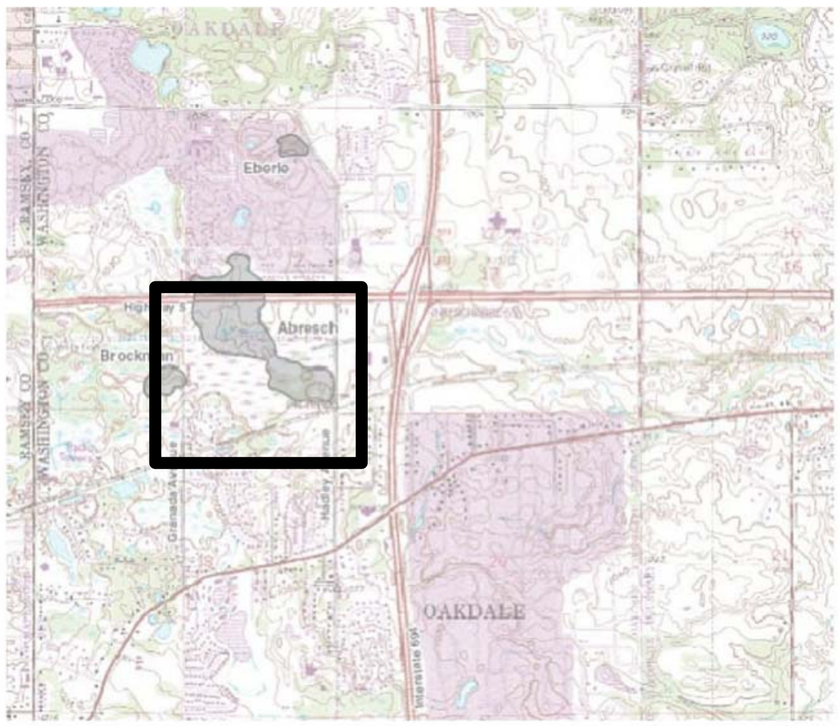
AS-BUILT DRAWINGS

3M COMPANY
GROUNDWATER EXTRACTION SYSTEM
OAKDALE SITE
OAKDALE, MINNESOTA

AS-BUILT
02/16/2009

SHEET INDEX

TITLE	SHEET NO.
TITLE SHEET	C-01
MECHANICAL - SITE PLAN	C-02
PIPE LAYOUT AT CONTROL BUILDING	C-03
PIPING DETAILS	C-04
ELECTRICAL - SITE PLAN	C-05
ELECTRICAL PLAN	C-06
WIRING DIAGRAM - 1	C-07



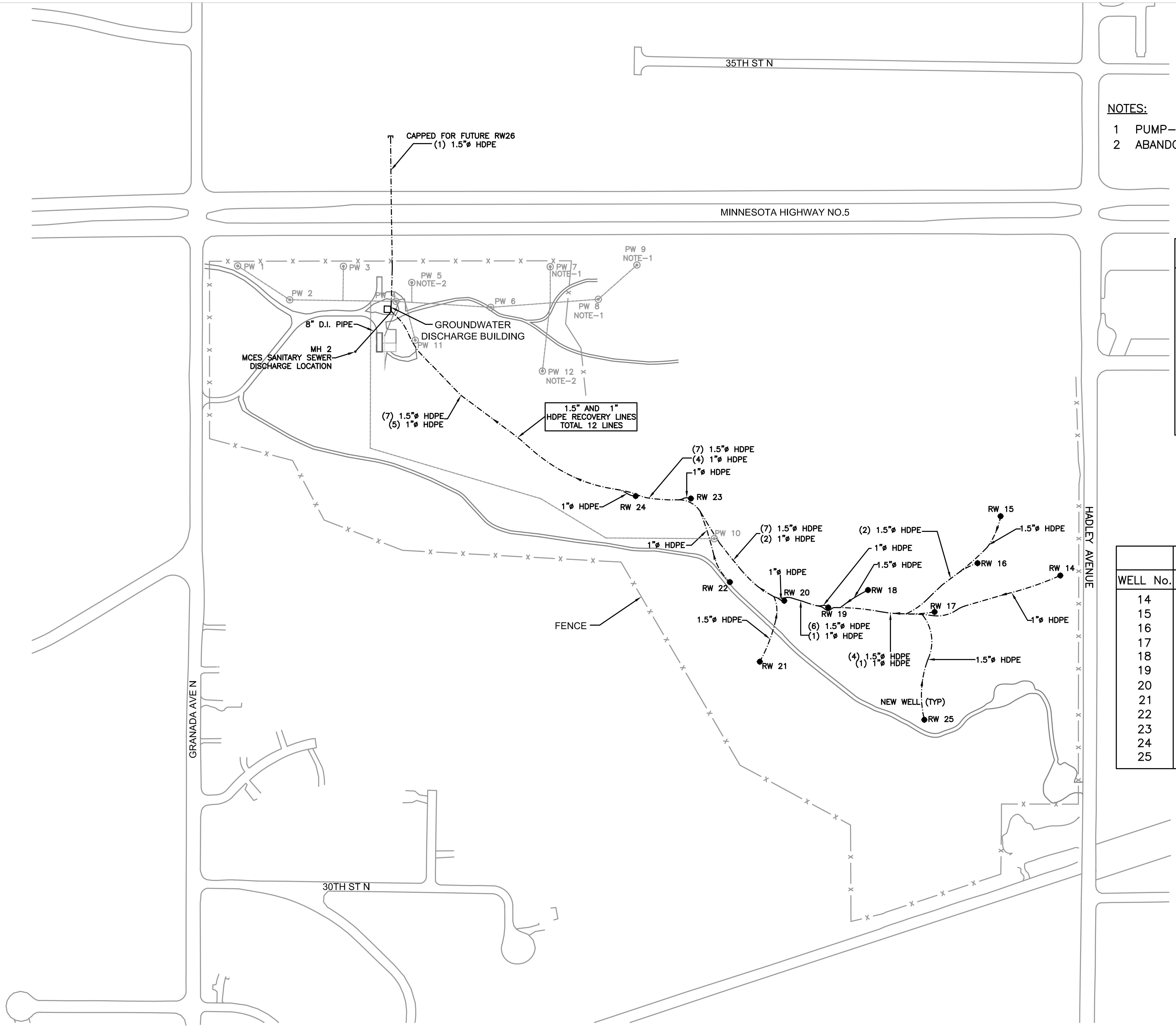
NOTE :-

1 : PUMP-OUT WELL CONVERTED TO MONITORING WELL.
2 : ABANDONED.

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM
TITLE SHEET
C-01



N

NOTES:

1 PUMP-OUT WELL CONVERTED TO MONITORING WELL.
2 ABANDONED.

LEGEND

◎	EXTRACTION WELLS INSTALLED IN 1985
----	UNDERGROUND CONVEYANCE PIPING INSTALLED IN 1985
●	EXTRACTION WELLS INSTALLED IN 2008
—·—▸—	UNDERGROUND CONVEYANCE PIPING INSTALLED IN 2008
═	ROADS
—x—	ACCESS CONTROL FENCE

	ELEVATIONS(MSL)		COORDINATES	
WELL No.	TOC	GROUND	X	Y
14	995.4	992.08	465999.2329	190764.333
15	995.6	992.30	465822.9806	190939.3348
16	996.18	993.12	465755.0946	190800.7585
17	996.75	994.19	465628.3426	190656.897
18	996.86	993.8	465432.0412	190721.5266
19	1000.53	997.25	465314.6086	190670.2253
20	–	996.93	465184.9995	190689.8992
21	998.41	995.29	465112.8099	190510.1468
22	–	995.56	465024.7032	190744.8862
23	–	997.44	464909.6289	190991.5395
24	–	996.44	464746.8128	190998.8075
25	1003.21	1000.19	465598.183	190388.8516

AS-BUILT
02/16/2009

-150' 0' 150' 300'

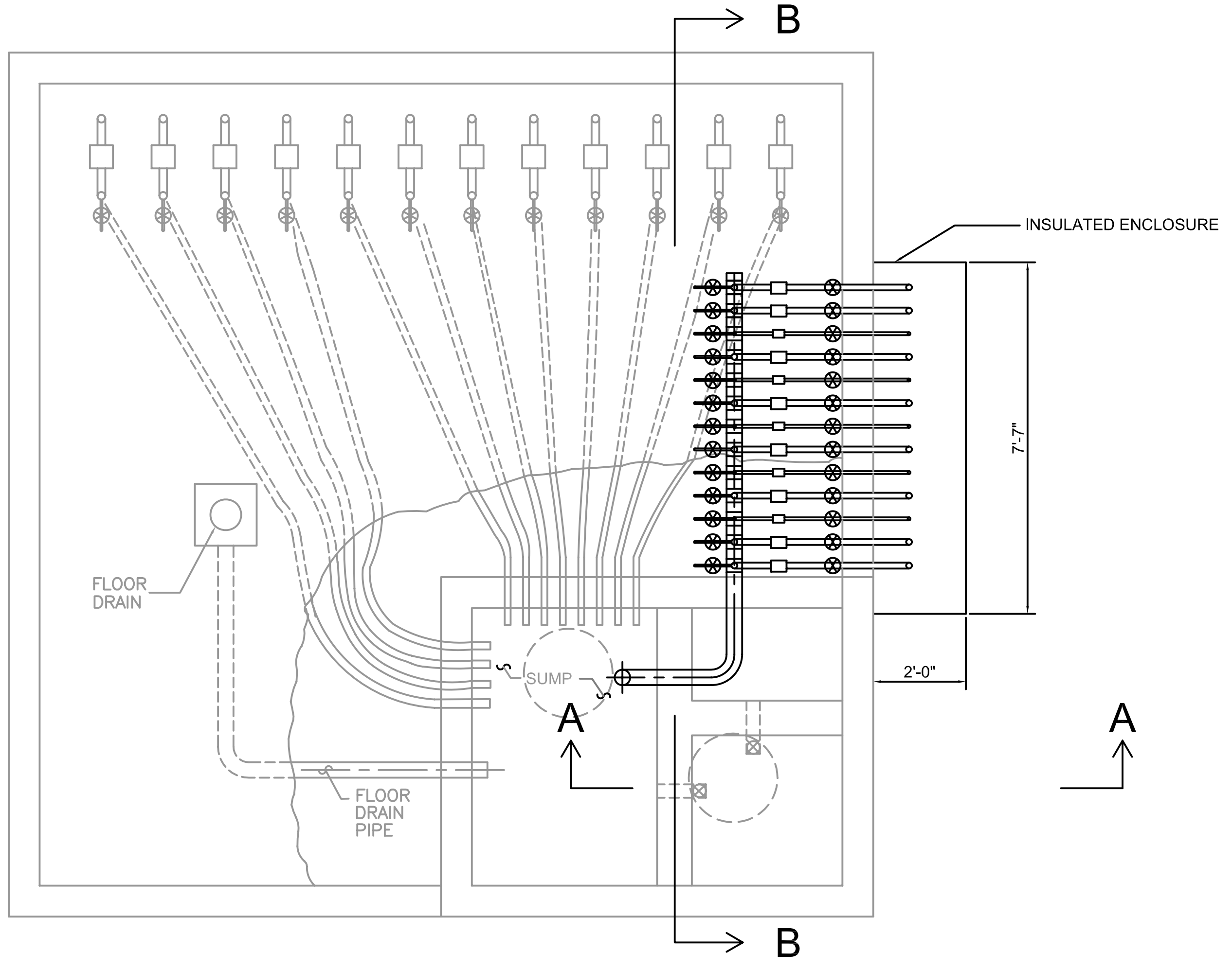
WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

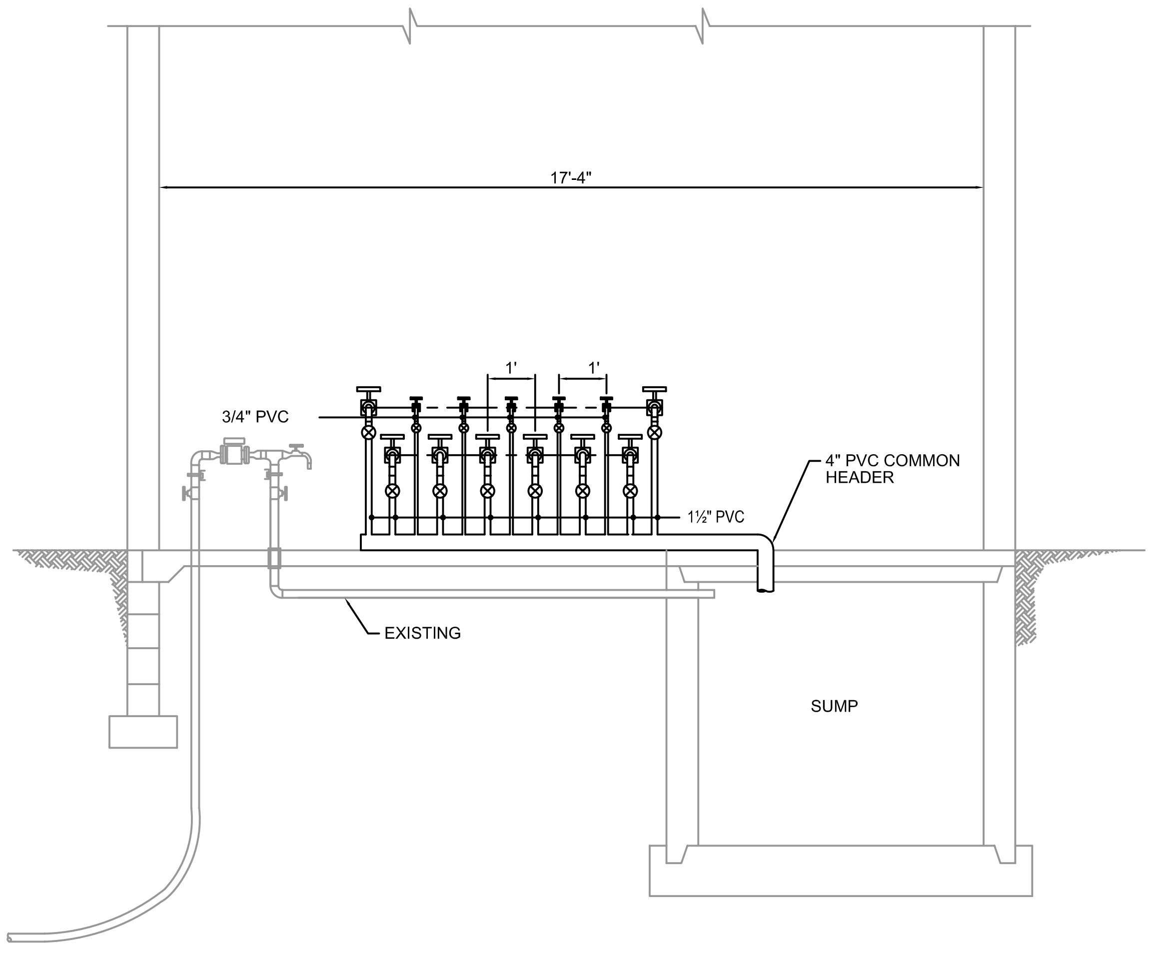
GROUNDWATER EXTRACTION SYSTEM

MECHANICAL SITE PLAN

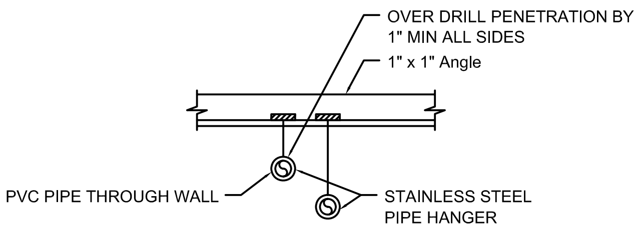
C-02



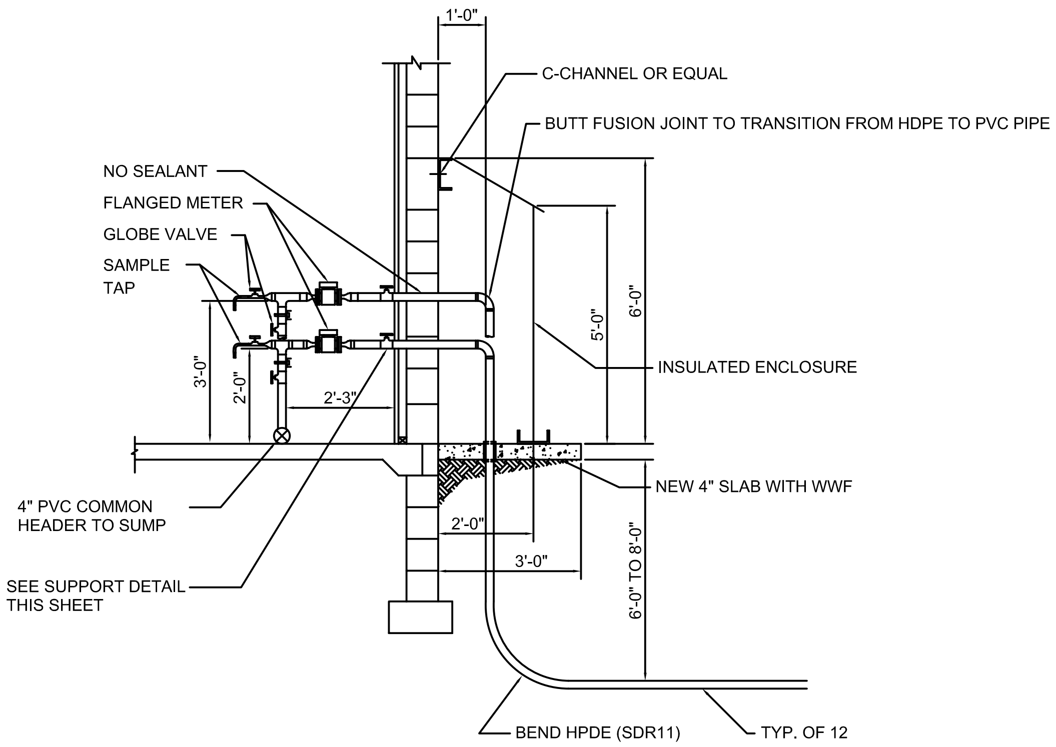
PIPE LAYOUT AT GROUNDWATER CONTROL BUILDING



SECTION B-B



TYPICAL PIPE SUPPORT DETAIL FOR WALL PENETRATION



SECTION A-A

AS-BUILT
02/16/2009

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM
PIPE LAYOUT
AT CONTROL BUILDING
C-03

TABLE 1

Well #	Total Depth In Feet (1)	Approx. Depth to Water In Feet (1)	Pump Motor	Drop Wire Size (2)
14	31	27.23	FR2W13230E	10
15	52	48.65	FR2W12230E	12
16	42	38.25	FR2W12230E	12
17	38	33.8	FR2W12230E	12
18	60	55.74	FR2W12230E	12
19	55	47.12	FR2W12230E	12
20	56	48.45	FR2W13230E	10
21	58	52.29	FR2W12230E	10
22	26	20.49	FR2W12230E	10
23	56	48.86	FR2W12230E	10
24	35	30.25	FR2W13230E	12
25	65	54.68	FR2W12230E	10

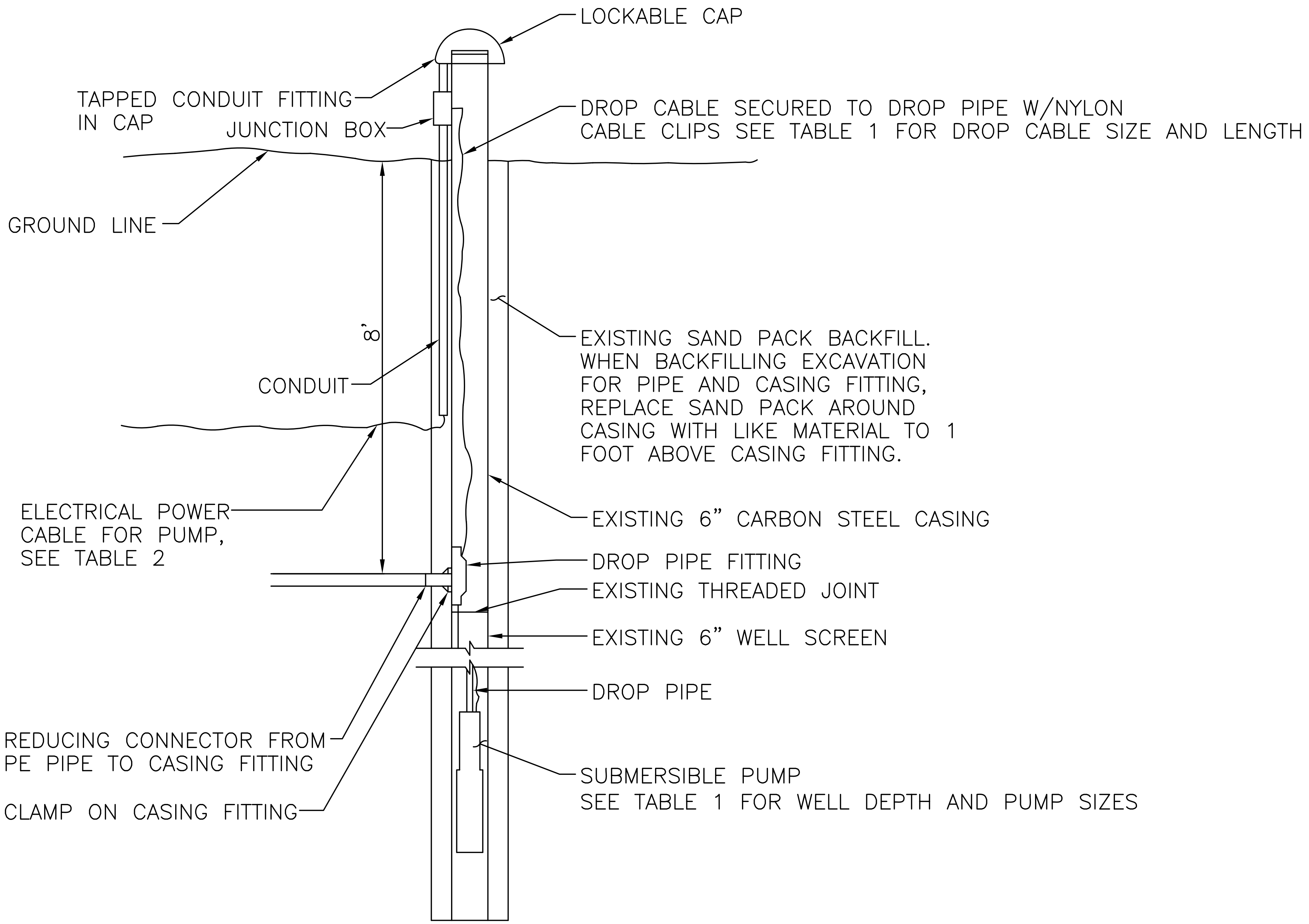
(1) – Depths are from top of existing casing. Casings typically extend approximately 2 feet above the ground surface.

(2) – Drop wire length to be equal to total depth of well plus 10 feet. Drop wire to be provided by pump manufacturer

TABLE 2

Well #	Approx. Length In Feet	Cable Size
14	2820	2#4AWG W/1#6AWG GND.
15	2750	2#4AWG W/1#6AWG GND.
16	2550	2#4AWG W/1#6AWG GND.
17	2360	2#6AWG W/1#8AWG GND.
18	2240	2#6AWG W/1#8AWG GND.
19	2025	2#6AWG W/1#8AWG GND.
20	1890	2#6AWG W/1#8AWG GND.
21	1960	2#6AWG W/1#8AWG GND.
22	1740	2#6AWG W/1#8AWG GND.
23	1280	2#8AWG W/1#10AWG GND.
24	1100	2#8AWG W/1#10AWG GND.
25	2500	2#4AWG W/1#6AWG GND.

(1) – ALL CABLES TO BE DIRECT BURY. CABLE SHALL BE INSTALLED W/ DETECTABLE WARNING TAPE ABOVE.



SECTION: WELL HEAD (TYP.)

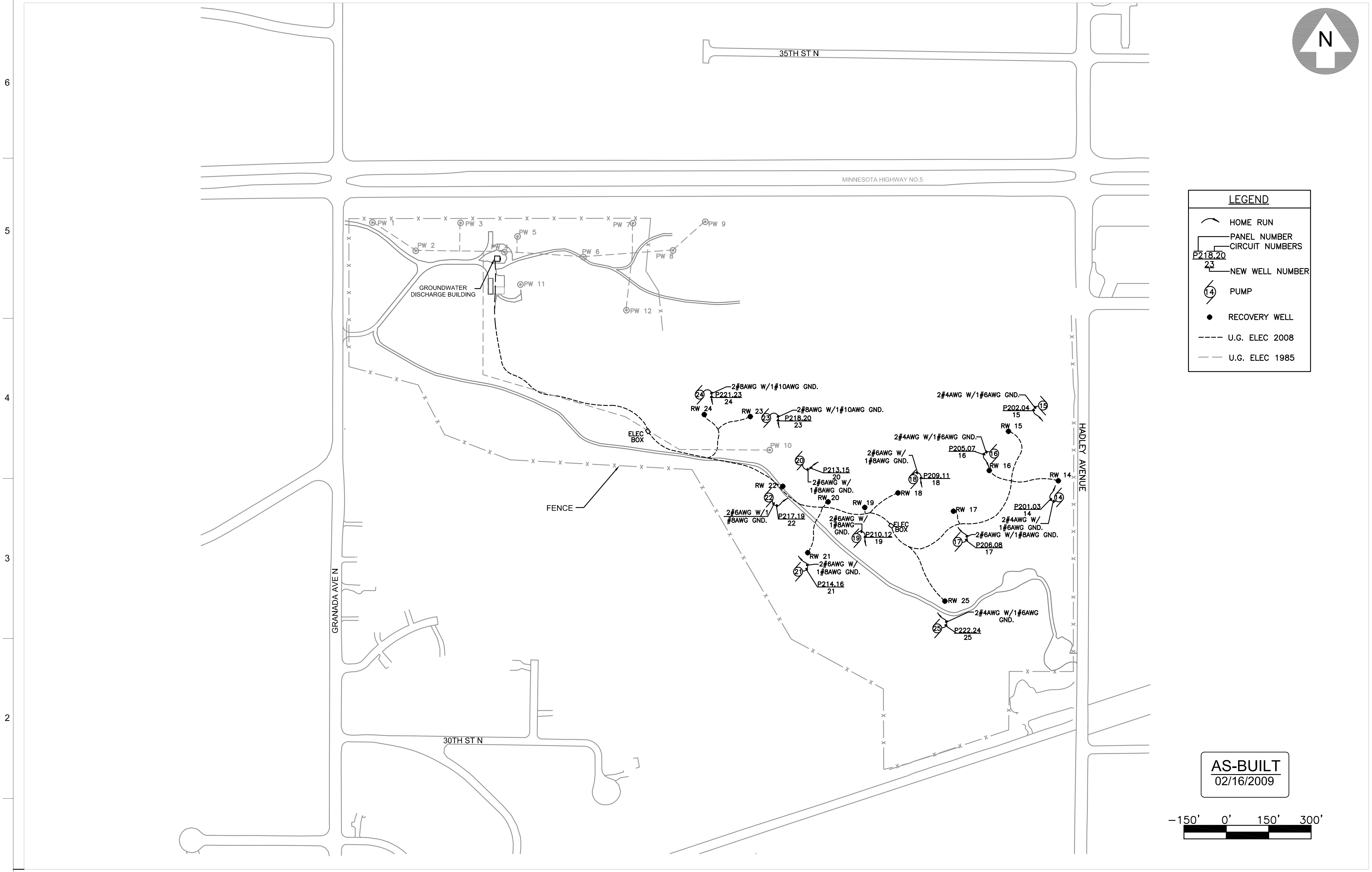
AS-BUILT
02/16/2009

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM

PIPING DETAILS

C-04

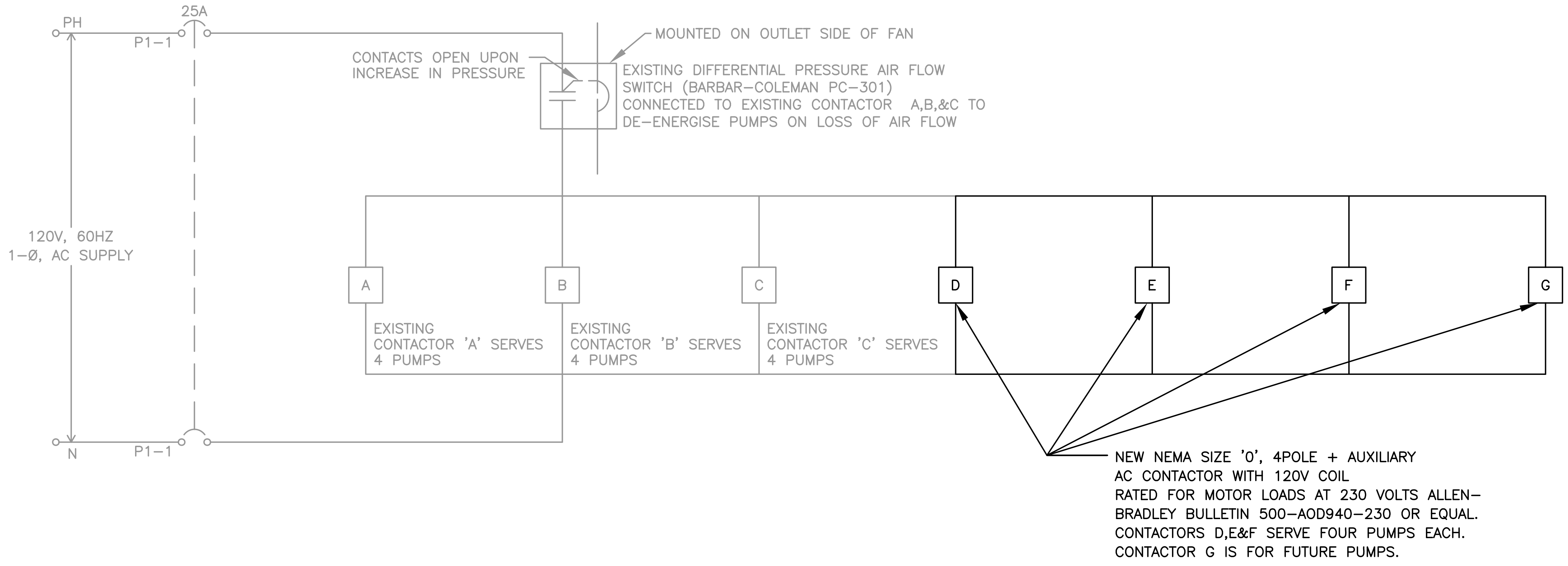


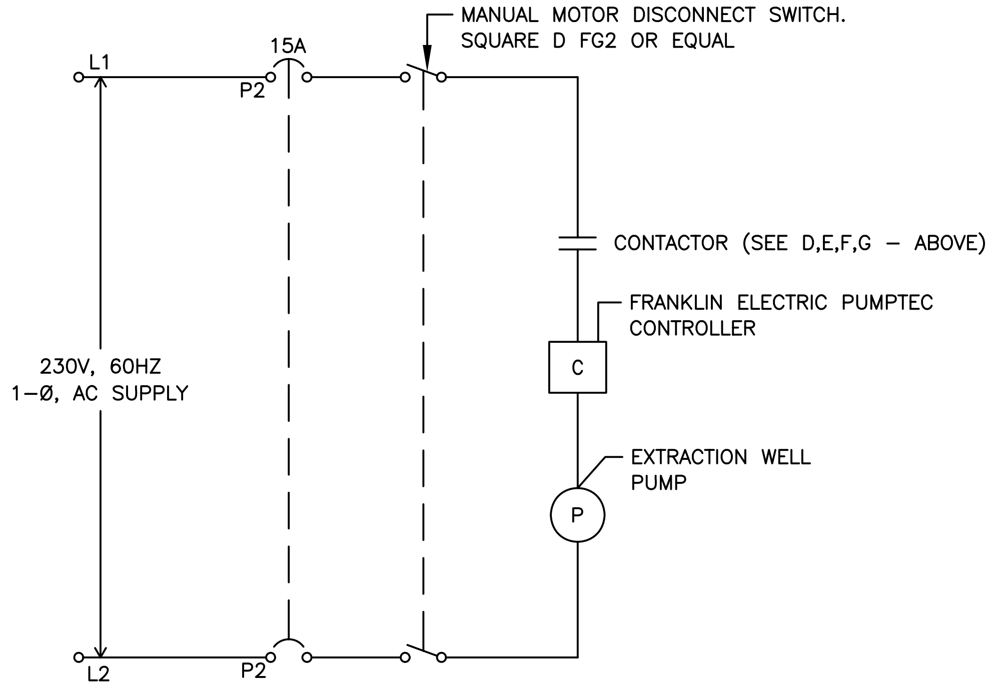
AS-BUILT
02/16/2009

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM
ELECTRICAL SITE PLAN
C-05





TYPICAL PUMP CONTROL CIRCUIT

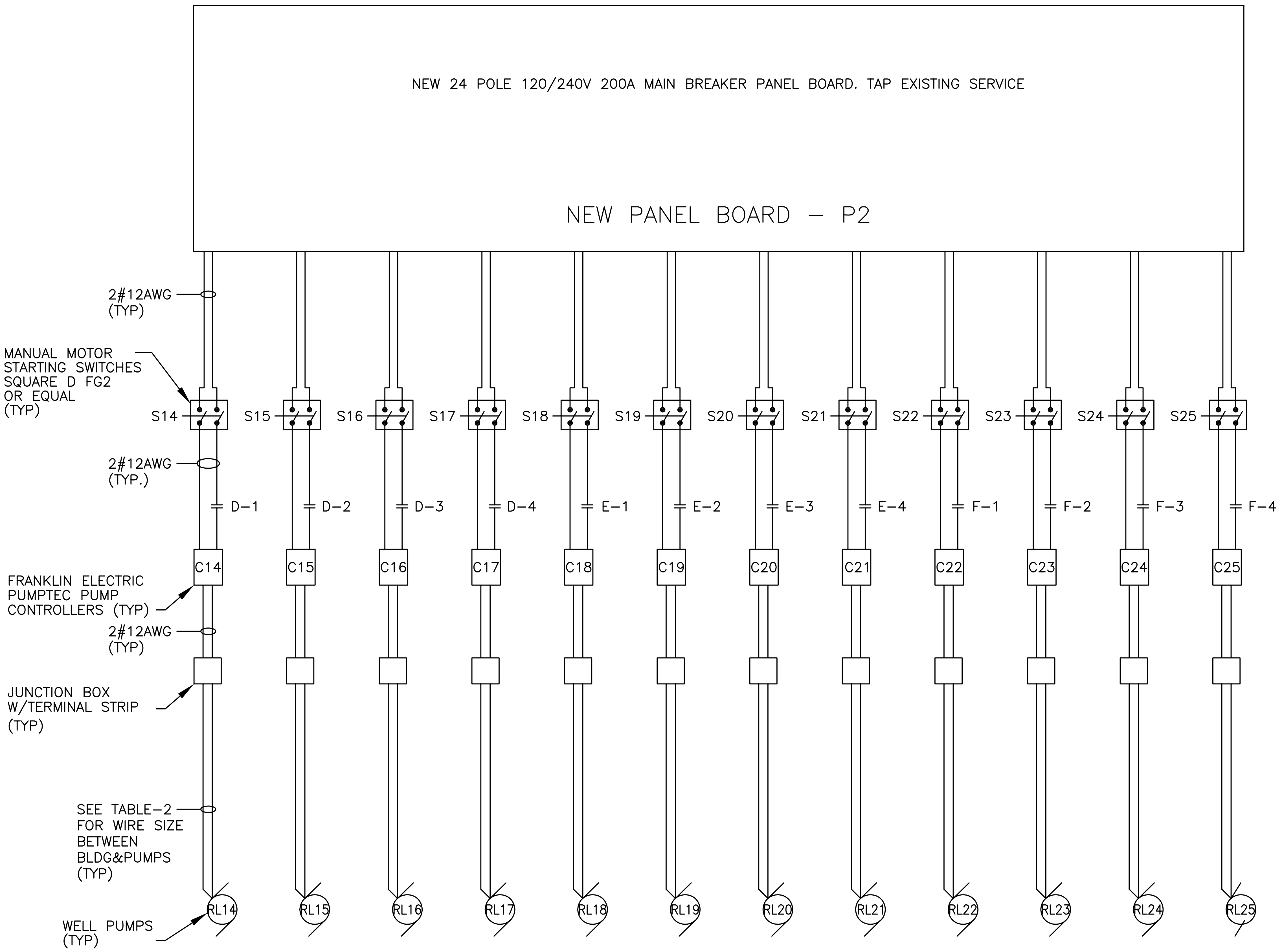
AS-BUILT
02/16/2009

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM

ELECTRICAL PLAN
C-06



NOTE:–
GROUND WIRE NOT SHOWN

WIRING DIAGRAM

AS-BUILT
02/16/2009

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

GROUNDWATER EXTRACTION SYSTEM
WIRING DIAGRAM
C–07

APPENDIX D

SVE VENT LOGS

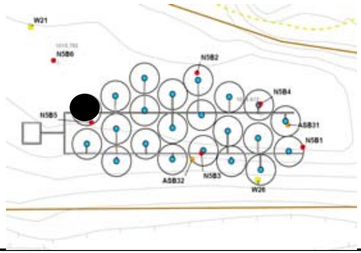
SVE POINT CONSTRUCTION LOG

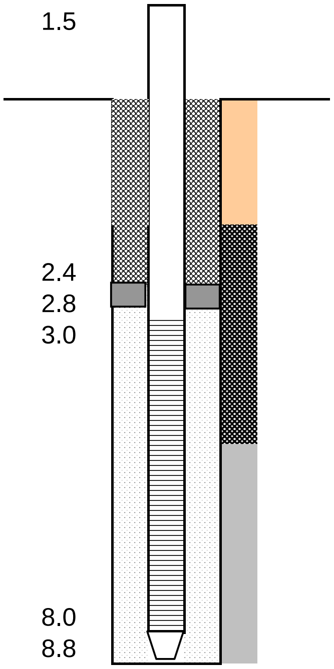
SVE VENT: A1

Date Constructed **25 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.8 fbgs
Maximum PID Reading: 3132 ppm

0-2	Light brown silty f.g. to m.g. sand
2-5	Dark brown silty sand to clayey silty sand with some debris, solvent odor
5-8.8	Dark brown silty sand to clayey silty sand





Stickup: 1.5
Top-of-Seal: 2.4
Bottom-of-Seal: 2.8
Top-of-Screen: 3.0
Bottom-of-Screen: 8.0
Boring Depth: 8.8

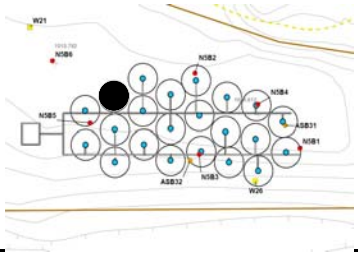
Depths provided as feet below grade

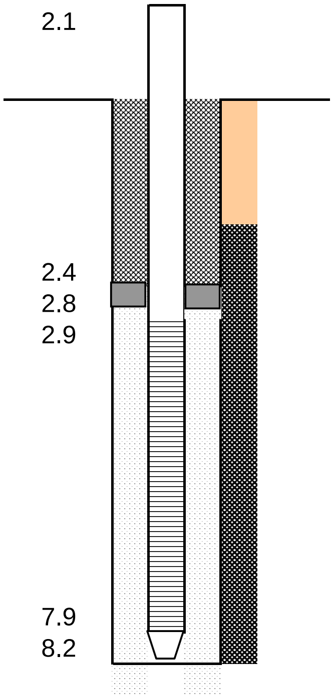
SVE VENT: A2

Date Constructed **25 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.2 fbgs
Maximum PID Reading: 2872 ppm

0-2	Light brown silty sand
2-8.2	Dark brown clayey silty sand with debris strong odor





Stickup: 2.1
Top-of-Seal: 2.4
Bottom-of-Seal: 2.8
Top-of-Screen: 2.9
Bottom-of-Screen: 7.9
Boring Depth: 8.2

Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

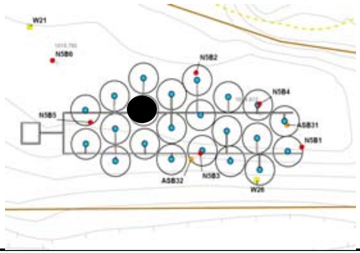
SVE POINT CONSTRUCTION LOG

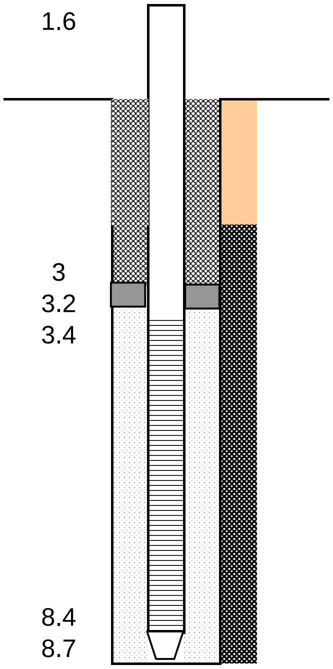
SVE VENT: A3

Date Constructed **26 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 3458 ppm

0-2	Light brown silty sand
2-5	Brown silty sand with some debris, glass, plastic
5-8.7	Dark brown clayey silty sand, ~15% debris, primarily mineral soil





Stickup: 1.6
Top-of-Seal: 3
Bottom-of-Seal: 3.2
Top-of-Screen: 3.4
Bottom-of-Screen: 8.4
Boring Depth: 8.7

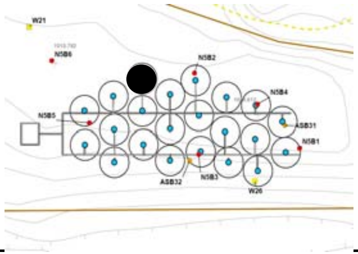
Depths provided as feet below grade

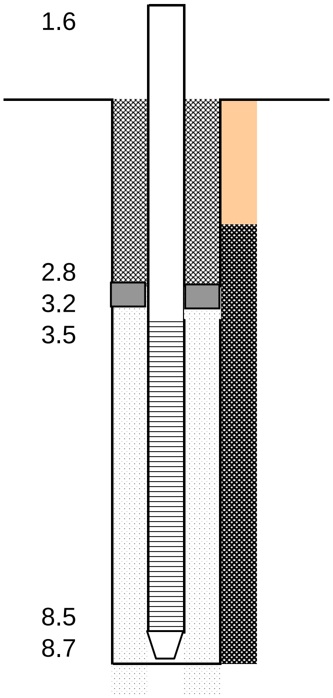
SVE VENT: A4

Date Constructed **26 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 1947 ppm

0-2.5	Light silty sand
2.5-4.5	Brown to dark brown silty sand, odor, wood debris (~10%)
4.5-6	Brown to dark brown silty sand, odor, increased clay content
6-8.7	Brown silty sand with clay, ~10% debris (plastic sheeting, yellow paint, no obvious soil staining





Stickup: 1.6
Top-of-Seal: 2.8
Bottom-of-Seal: 3.2
Top-of-Screen: 3.5
Bottom-of-Screen: 8.5
Boring Depth: 8.7

Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ▒ Impacted Soil 🟫 Soil (undisturbed?)

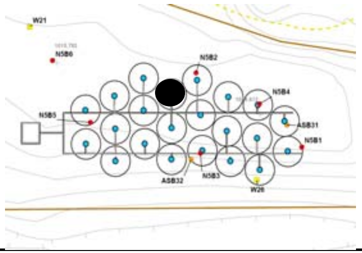
SVE POINT CONSTRUCTION LOG

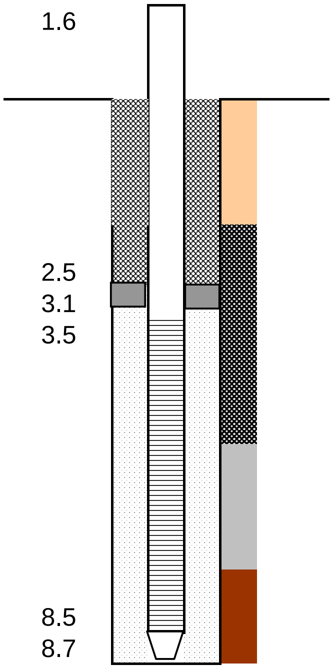
SVE VENT: A5

Date Constructed 26 August 2008

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 2973 ppm

0-~3	Light brown silty f.g. sand
3-5	Brown to dark brown silty sand with abundant glass
5-7	Brown silty clayey sand (6-60-19-15) with plastic film/sheeting
7-8.7	Sandy silt to silty sand ~10% clay, 5% debris, solvent odor, no staining





Stickup: 1.6
Top-of-Seal: 2.5
Bottom-of-Seal: 3.1
Top-of-Screen: 3.5
Bottom-of-Screen: 8.5
Boring Depth: 8.7

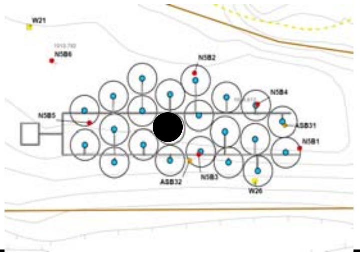
Depths provided as feet below grade

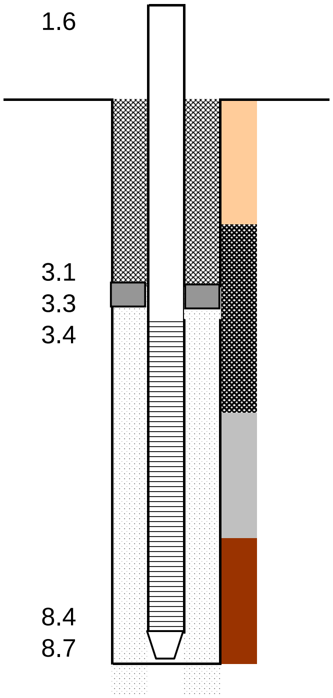
SVE VENT: A6

Date Constructed 26 August 2008

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 1667 ppm

0-2	Light brown silty sand
2-5	Brown to dark brown silty sand with glass and plastic debris
5-7	Dark brown clayey sand to clayey silty sand, some staining, odors, 10-15% debris
7-8.7	Reddish brown clayey silty sand





Stickup: 1.6
Top-of-Seal: 3.1
Bottom-of-Seal: 3.3
Top-of-Screen: 3.4
Bottom-of-Screen: 8.4
Boring Depth: 8.7

Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

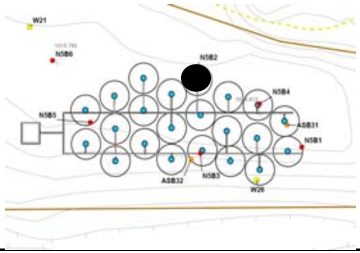
SVE POINT CONSTRUCTION LOG

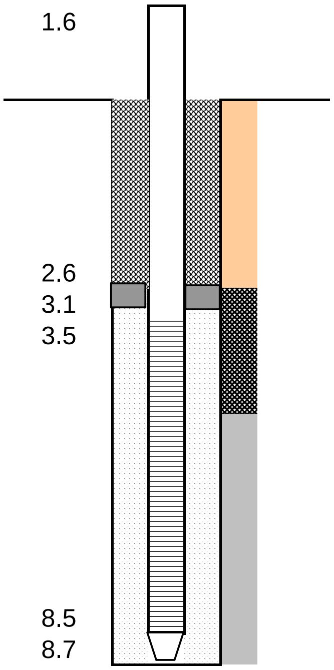
SVE VENT: A7

Date Constructed 26 August 2008

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 1542 ppm

0-~3	Light brown silty f.g. sand
3-5	Brown to dark brown silty sand with abundant plastic film/sheeting, glass
5-8.7	Dark brown to brown silty sand with clay (5-60-25-10) with glass and plastic debris no apparent staining, solvent odor





Stickup: 1.6
Top-of-Seal: 2.6
Bottom-of-Seal: 3.1
Top-of-Screen: 3.5
Bottom-of-Screen: 8.5
Boring Depth: 8.7

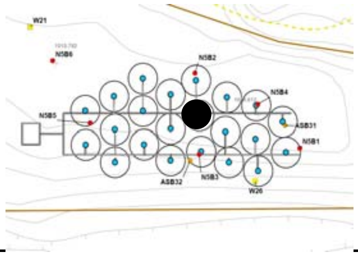
Depths provided as feet below grade

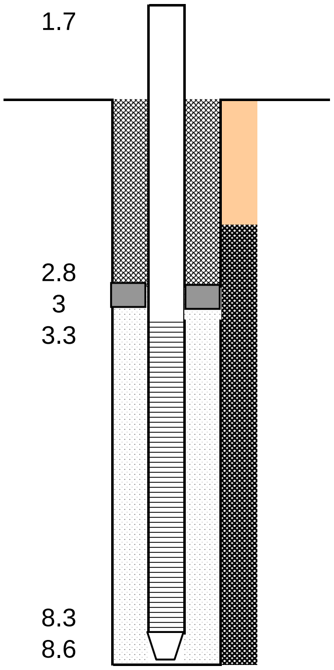
SVE VENT: A8

Date Constructed 26 August 2008

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.6 fbgs
Maximum PID Reading: 2607 ppm

0-2	Light brown silty sand
2-5	Brown silty sand (10-65-20-5), 5% debris plastic
5-8.6	As above, with plastic sheeting (10-15%) No staining, solvent odor





Stickup: 1.7
Top-of-Seal: 2.8
Bottom-of-Seal: 3
Top-of-Screen: 3.3
Bottom-of-Screen: 8.3
Boring Depth: 8.6

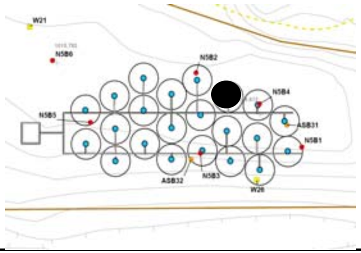
Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

SVE VENT: A-9

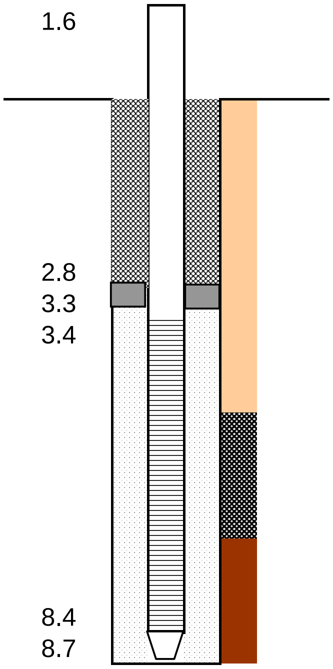
Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 3752 ppm

0-2	Light Brown silty sand
2-5	Brown silty sand with some gravel
5-7	Dark brown silty sand with clay and abundant debris (30-40%), plastic, wood, glass, staining
7-8.7	Brown ssil sand, odor



Date Constructed 27 August 2008

Stickup: 1.6
Top-of-Seal: 2.8
Bottom-of-Seal: 3.3
Top-of-Screen: 3.4
Bottom-of-Screen: 8.4
Boring Depth: 8.7

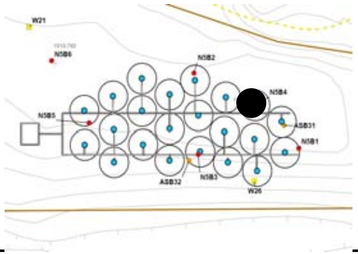


Depths provided as feet below grade

SVE VENT: A-10

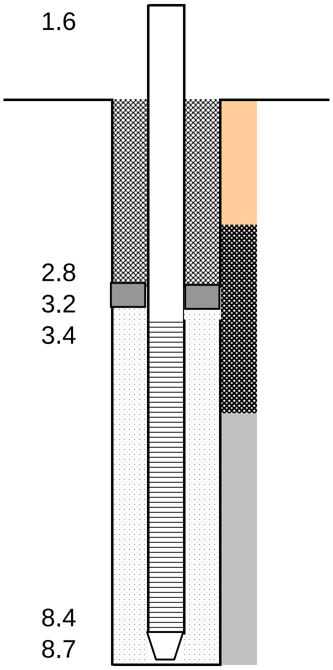
Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 3609 ppm

0-2	Light brown to brown silty sand
2-4	Dark brown to dark grayish brown silty sand with gravel, odor
4-5	As above with debris
5-8.7	Reddish brown ilty sand with clay some debris, strong odor



Date Constructed 27 August 2008

Stickup: 1.6
Top-of-Seal: 2.8
Bottom-of-Seal: 3.2
Top-of-Screen: 3.4
Bottom-of-Screen: 8.4
Boring Depth: 8.7



Depths provided as feet below grade

🟧 Capping Soil ▨ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

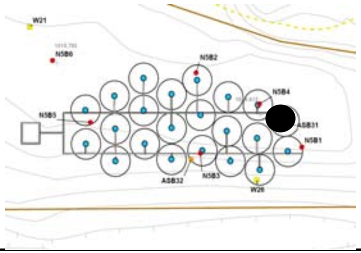
SVE POINT CONSTRUCTION LOG

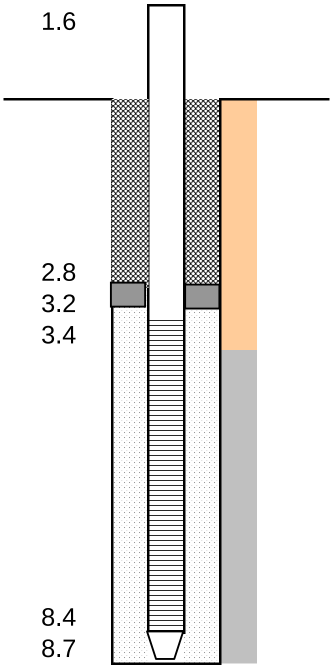
SVE VENT: A-11

Date Constructed 27 August 2008

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 3410 ppm

0-2	Light brown silty sand
2-4	Brown silty sand with gravel
4-5	Dark brown to grayish brown silty sand
5-8.7	Dark grayyi brown silty sand with clay to clayey silty sand, staining





Stickup:	1.6
Top-of-Seal:	2.8
Bottom-of-Seal:	3.2
Top-of-Screen:	3.4
Bottom-of-Screen:	8.4
Boring Depth:	8.7

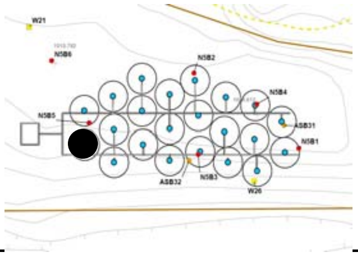
Depths provided as feet below grade

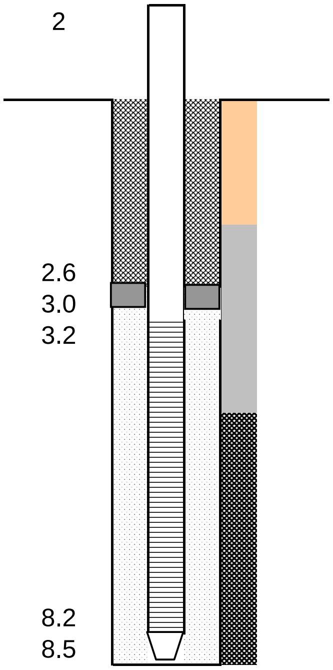
SVE VENT: B1

Date Constructed 25 August 2008

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.5 fbgs
Maximum PID Reading: 2845 ppm

0-2	Brown silty sand f.g. to m.g. (5-70-20-5)
2-5	Dark Brown clayey silty sand, solvent odor
5-8.5	Dark Brown to Black clayey silty sand with abundant debris, solvent odor





Stickup:	2
Top-of-Seal:	2.6
Bottom-of-Seal:	3.0
Top-of-Screen:	3.2
Bottom-of-Screen:	8.2
Boring Depth:	8.5

Depths provided as feet below grade

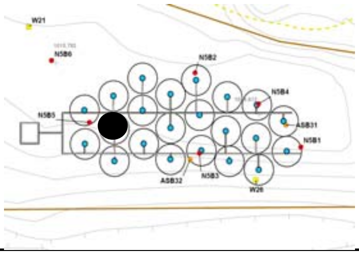
🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

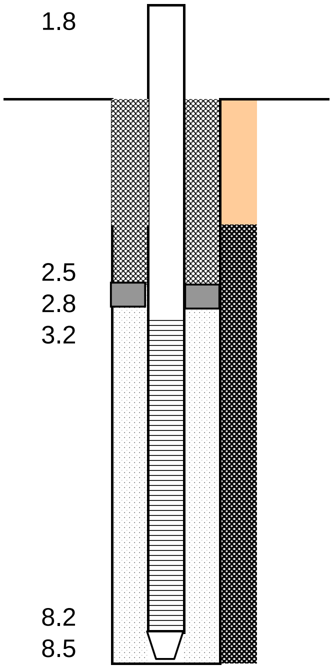
SVE VENT: B2

Date Constructed **25 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.5 fbgs
Maximum PID Reading: 2258 ppm

0-2	Light brown silty f.g. sand
2-6	Dark brown clayey silty sand, abundant debris, paint chips, plastic
6-8.5	As above, locally saturated with a clear viscous liquid, strong solvent odor





Stickup: 1.8
Top-of-Seal: 2.5
Bottom-of-Seal: 2.8
Top-of-Screen: 3.2
Bottom-of-Screen: 8.2
Boring Depth: 8.5

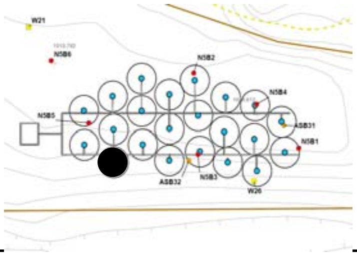
Depths provided as feet below grade

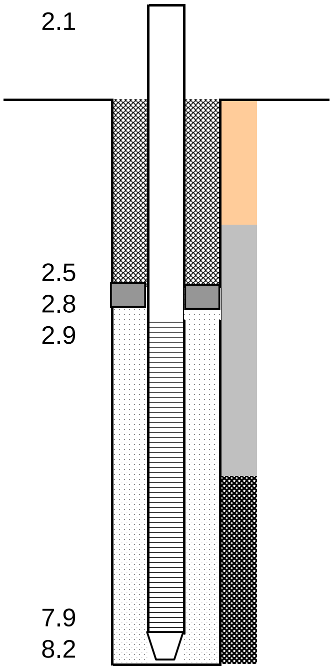
SVE VENT: B3

Date Constructed **26 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.2 fbgs
Maximum PID Reading: 1522 ppm

0-2	Light brown silty f.g. sand
2-6	Dark Brown to black silty m.g. sand
6-8.2	Dark Brown clayey silty sand with abundant plastic sheeting and green felt locally wet (perch) and locally saturated with resin, strong odors





Stickup: 2.1
Top-of-Seal: 2.5
Bottom-of-Seal: 2.8
Top-of-Screen: 2.9
Bottom-of-Screen: 7.9
Boring Depth: 8.2

Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

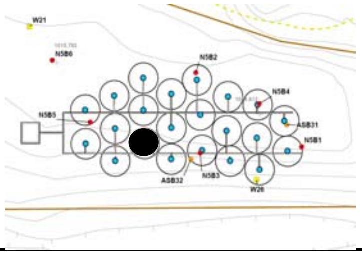
SVE POINT CONSTRUCTION LOG

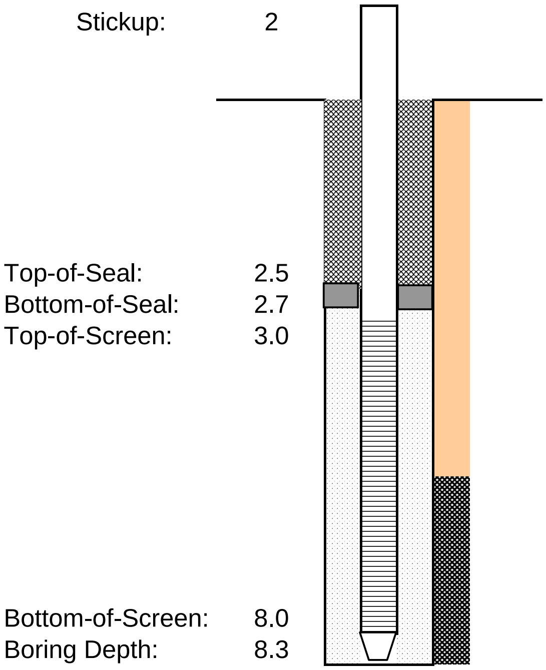
SVE VENT: B4

Date Constructed **25 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.3 fbgs
Maximum PID Reading: 2925 ppm

0-2	Light brown silty sand, cuttings loose
2-4	Brown silty sand with gravel, resistant drilling at 3.5 fbgs
4-6	Brown silty sand with clay (3-70-20-7)
6-8.3	Brown silty sand with clay, increased debris (wood, paint/platic) ~10-15% No apparent staining




Stickup: 2
Top-of-Seal: 2.5
Bottom-of-Seal: 2.7
Top-of-Screen: 3.0
Bottom-of-Screen: 8.0
Boring Depth: 8.3

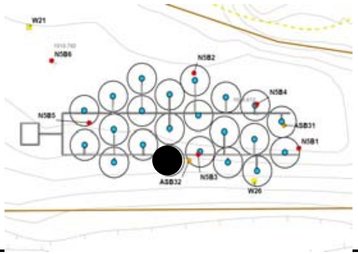
Depths provided as feet below grade

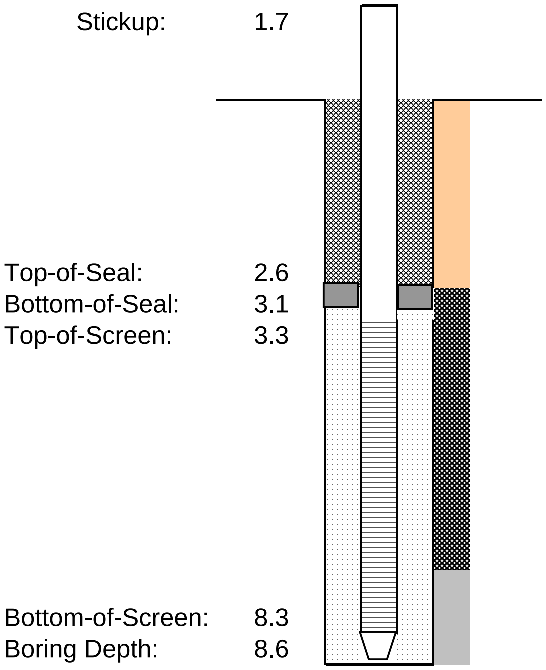
SVE VENT: B5

Date Constructed **26 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.6 fbgs
Maximum PID Reading: 1030 ppm

0-3	Light brown silty sand
3-6	Dark brown silty sand with clay, some glass and plastic debris
6-7	Reddish brown clayey silty sand, metal and plastic debris (10%)
7-8.6	Dark grayish brown clayey silty sand Staining or gleying??, odor, no debris




Stickup: 1.7
Top-of-Seal: 2.6
Bottom-of-Seal: 3.1
Top-of-Screen: 3.3
Bottom-of-Screen: 8.3
Boring Depth: 8.6

Depths provided as feet below grade

🟧 Capping Soil	▩ Waste to heavily impacted soil	⬜ Impacted Soil	🟫 Soil (undisturbed?)

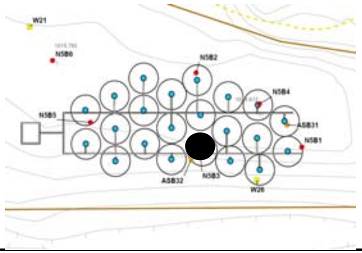
SVE POINT CONSTRUCTION LOG

SVE VENT: B6

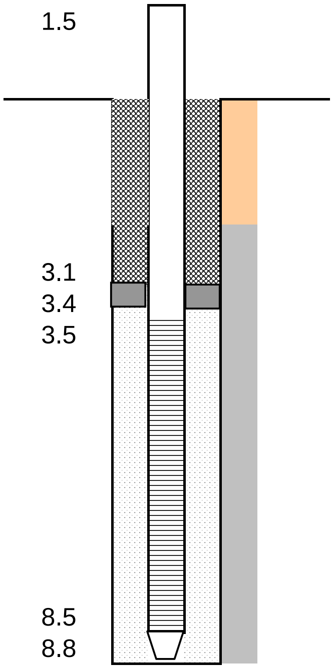
Date Constructed **26 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 8-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.8 fbgs
Maximum PID Reading: 1957 ppm

0-2	Light brown silty sand
2-8.8	Brown silty sand with some debris transitioning to yellowish brown silty sand with some clay, some plastic and glass, no staining, solvent odor



Stickup: 1.5
Top-of-Seal: 3.1
Bottom-of-Seal: 3.4
Top-of-Screen: 3.5
Bottom-of-Screen: 8.5
Boring Depth: 8.8



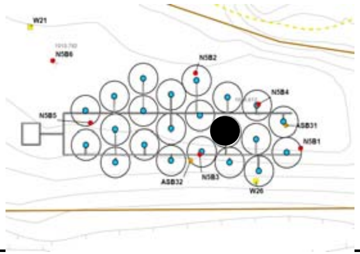
Depths provided as feet below grade

SVE VENT: B-7

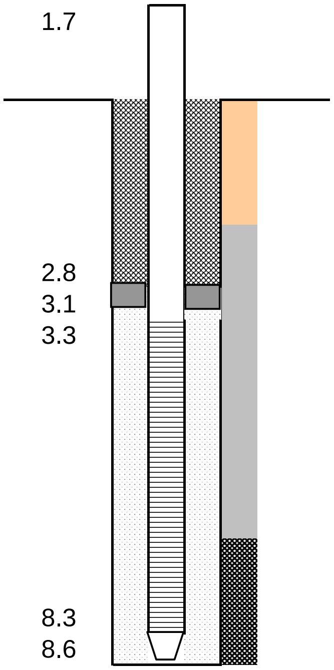
Date Constructed **27 August 2008**

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.6 fbgs
Maximum PID Reading: 3347 ppm

0-2	Light brown sandy silt
2-7	Brown to yellowish brown silty sand with clay increasing with depth to ~10%, little debris, no staining, solvent odor
7-8.6	Brown to dark brown silty sand, staining, debris



Stickup: 1.7
Top-of-Seal: 2.8
Bottom-of-Seal: 3.1
Top-of-Screen: 3.3
Bottom-of-Screen: 8.3
Boring Depth: 8.6



Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ⬜ Impacted Soil 🟫 Soil (undisturbed?)

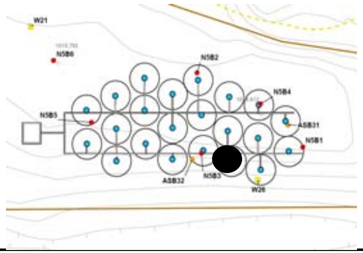
SVE POINT CONSTRUCTION LOG

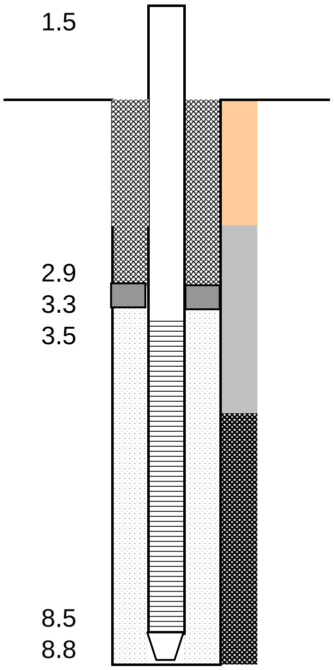
SVE VENT: B8

Date Constructed **26 August 2008**

Point Diameter:	2-Inch
Boring Diameter:	8-Inch
Material:	PVC
Screen Length:	Five Feet
Screen Slot:	0.01-Inch
Sand Pack:	1/4-inch Pea Gravel
Seal:	Bentonite Slurry
Total Depth:	8.8 fbgs
Maximum PID Reading:	1952 ppm

0-2	Light brown silty sand
2-5	Brown silty sand, resistant drilling at 3 fbgs
5-8.8	Dark brown clayey silty sand, some staining, odors, Debris (paper, plastic)





Stickup:	1.5
Top-of-Seal:	2.9
Bottom-of-Seal:	3.3
Top-of-Screen:	3.5
Bottom-of-Screen:	8.5
Boring Depth:	8.8

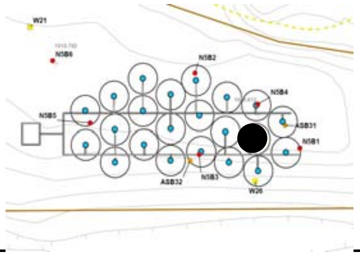
Depths provided as feet below grade

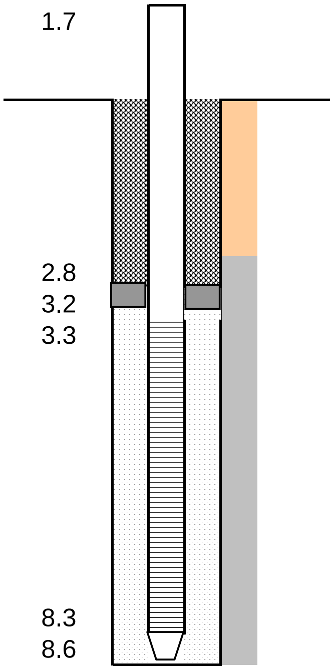
SVE VENT: B-9

Date Constructed **27 August 2008**

Point Diameter:	2-Inch
Boring Diameter:	6-Inch
Material:	PVC
Screen Length:	Five Feet
Screen Slot:	0.01-Inch
Sand Pack:	1/4-inch Pea Gravel
Seal:	Bentonite Slurry
Total Depth:	8.6 fbgs
Maximum PID Reading:	3792 ppm

0-2.5	Light brown silty v.f.g. to f.g. sand
2.5-4	Dark brown gravelly silty sand, some debris
4-8.6	Reddish brown silty sand with clay, abundant debris, wood, rope, glass, odor, no staining





Stickup:	1.7
Top-of-Seal:	2.8
Bottom-of-Seal:	3.2
Top-of-Screen:	3.3
Bottom-of-Screen:	8.3
Boring Depth:	8.6

Depths provided as feet below grade

🟧 Capping Soil ▩ Waste to heavily impacted soil ▒ Impacted Soil 🟫 Soil (undisturbed?)

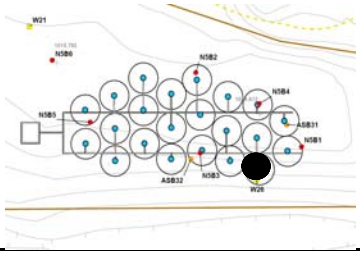
SVE POINT CONSTRUCTION LOG

SVE VENT: B-10

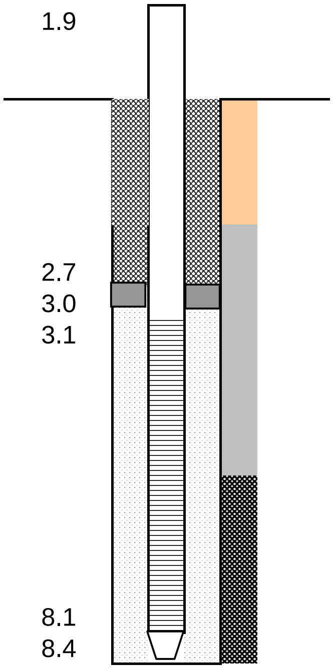
Date Constructed 27 August 2008

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.4 fbgs
Maximum PID Reading: 2369 ppm

0-2	Light brown silty sand
2-6	Brown silty sand with some gravel and debris
6-8.4	Grayish brown to dark brown clayey silty sand stained and odor



Stickup: 1.9
Top-of-Seal: 2.7
Bottom-of-Seal: 3.0
Top-of-Screen: 3.1
Bottom-of-Screen: 8.1
Boring Depth: 8.4



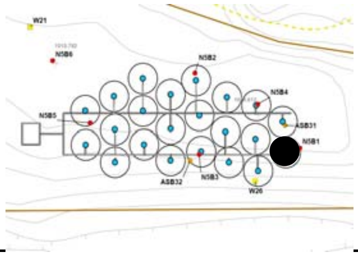
Depths provided as feet below grade

SVE VENT: B-11

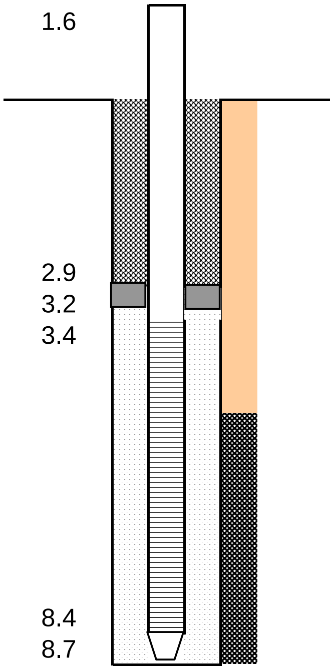
Date Constructed 27 August 2008

Point Diameter: 2-Inch
Boring Diameter: 6-Inch
Material: PVC
Screen Length: Five Feet
Screen Slot: 0.01-Inch
Sand Pack: 1/4-inch Pea Gravel
Seal: Bentonite Slurry
Total Depth: 8.7 fbgs
Maximum PID Reading: 2766 ppm

0-5	Light brown to brown silty sand
5-8.7	Dark brown to grayish brown clayey silty sand to silty sand with clay, stained, odors, with debris (15 to 20%)



Stickup: 1.6
Top-of-Seal: 2.9
Bottom-of-Seal: 3.2
Top-of-Screen: 3.4
Bottom-of-Screen: 8.4
Boring Depth: 8.7

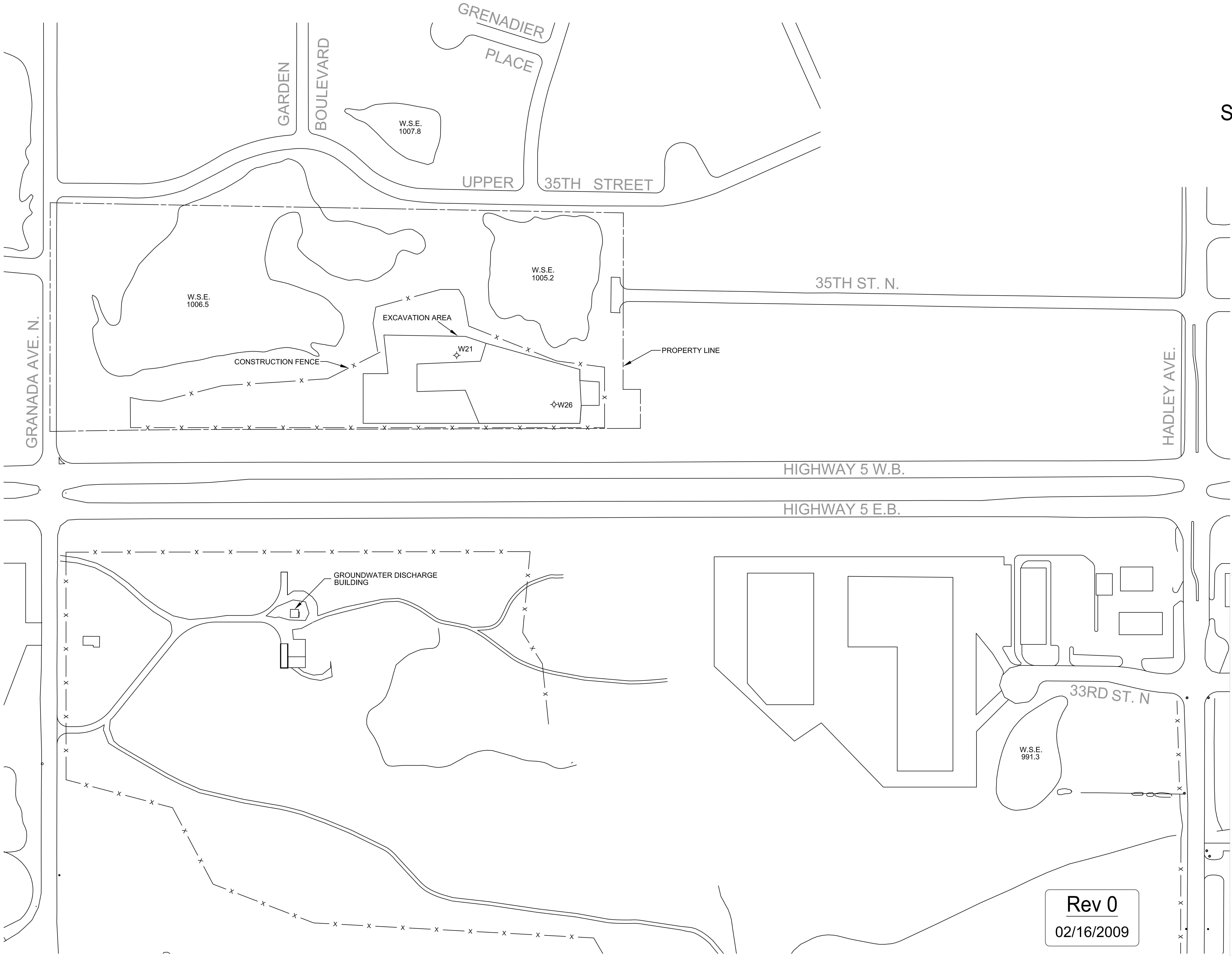


Depths provided as feet below grade

🟧	Capping Soil
▩	Waste to heavily impacted soil
⬜	Impacted Soil
🟫	Soil (undisturbed?)

APPENDIX E

CONSTRUCTION DRAWINGS



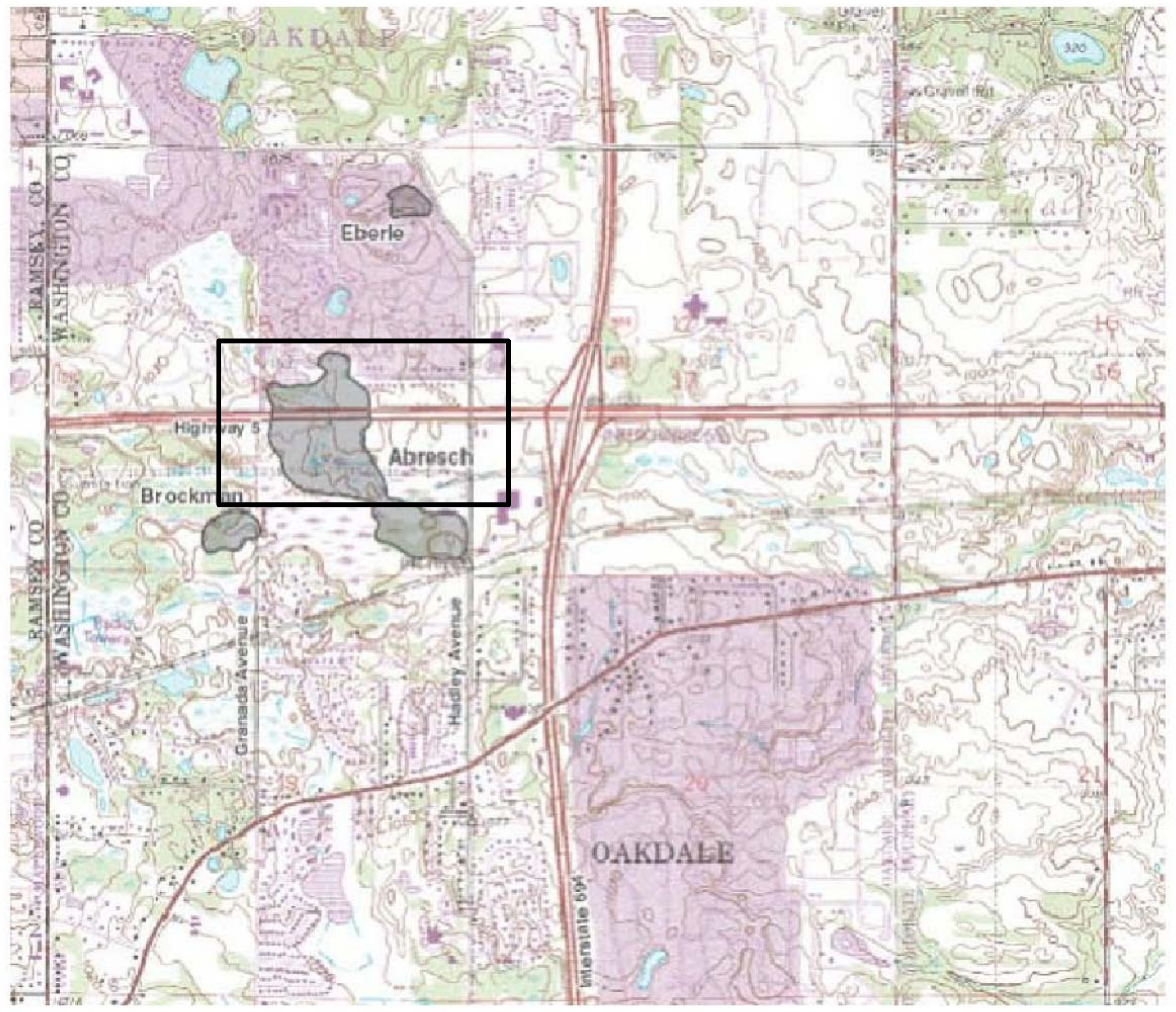
3M COMPANY

SOIL EXCAVATION CONSTRUCTION DRAWINGS

OAKDALE
MINNESOTA

SHEET INDEX

TITLE	SHEET NO.
TITLE SHEET	E-01
EXISTING CONDITIONS	E-02
SOIL EXCAVATION AND REMOVAL LIMITS	E-03
SITE ACCESS ROAD IMPROVEMENTS	E-04
EXCAVATION AREA	E-05
EAST-WEST CROSS SECTIONS	E-06
NORTH-SOUTH CROSS SECTIONS	E-07
E & S CONTROLS	E-08
FINAL GRADING PLAN	E-09
TYPICAL DETAILS	E-10



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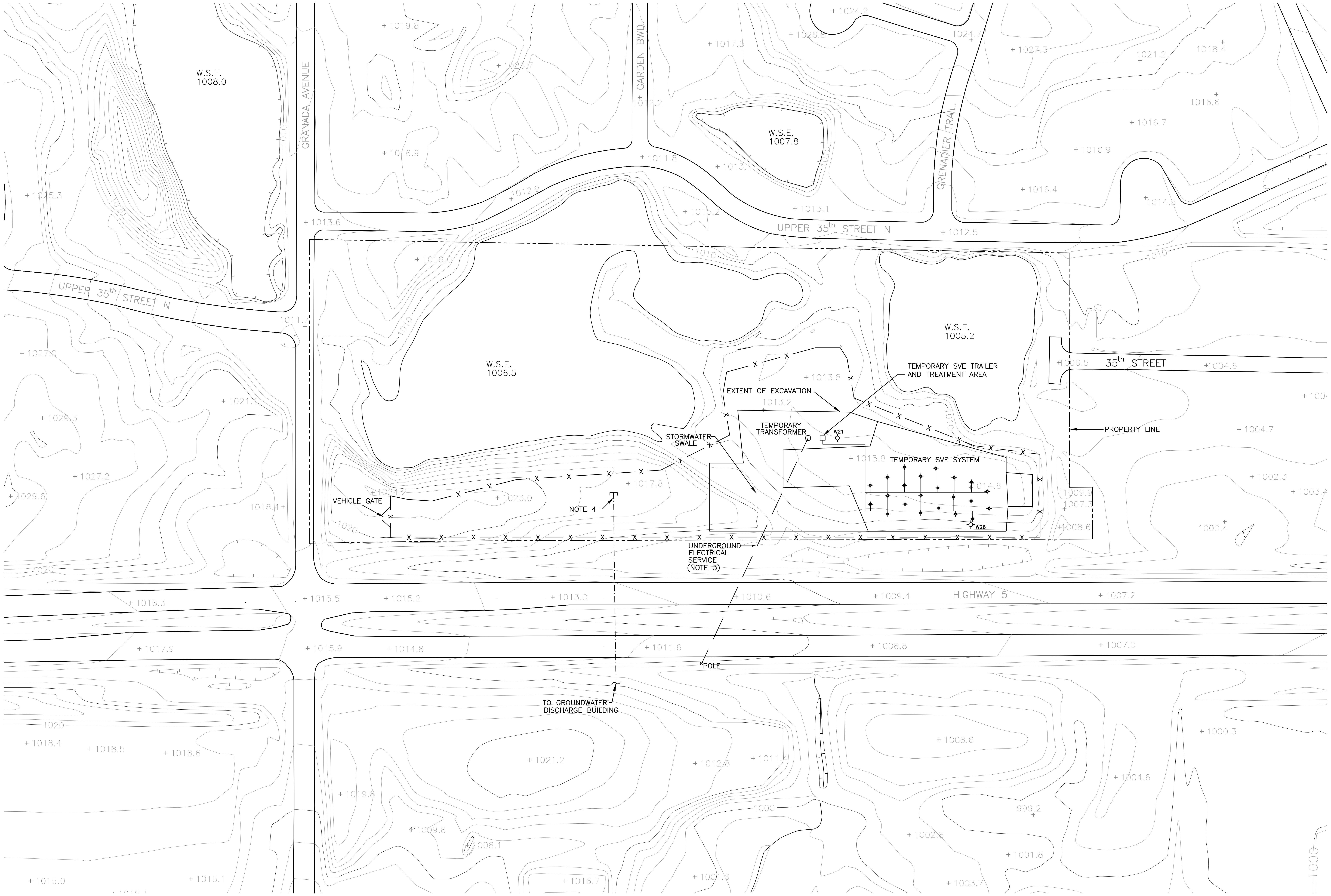
WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

TITLE SHEET
E-01



NOTES:

1. TOPOGRAPHY PROVIDED BY WASHINGTON COUNTY DEPARTMENT OF TRANSPORTATION & PHYSICAL DEVELOPMENT, SURVEY AND LAND MANAGEMENT DIVISION.
2. ALL DATA IS IN WASHINGTON COUNTY COORDINATE SYSTEM NAD83 COORDINATES.
3. CONTRACTOR TO FIELD VERIFY LOCATIONS.
4. TERMINATION OF UNDERGROUND GROUNDWATER TRANSFER PIPE,TO BE CONNECTED TO FUTURE GROUNDWATER EXTRACTION WELL RW–26.

LEGEND

—x—x—	CONSTRUCTION FENCE
—·—·—	PROPERTY LINE
——	EXISTING CONTOUR (MAJOR)
——	EXISTING CONTOUR (MINOR)
+ 1009.4	EXISTING SPOT ELEVATION
⌖ W26	GROUNDWATER MONITORING WELL
◎	SVE VENT LOCATION
— —	UNDERGROUND ELECTRICAL SERVICE
-·-·-	UNDERGROUND CONVEYANCE PIPING

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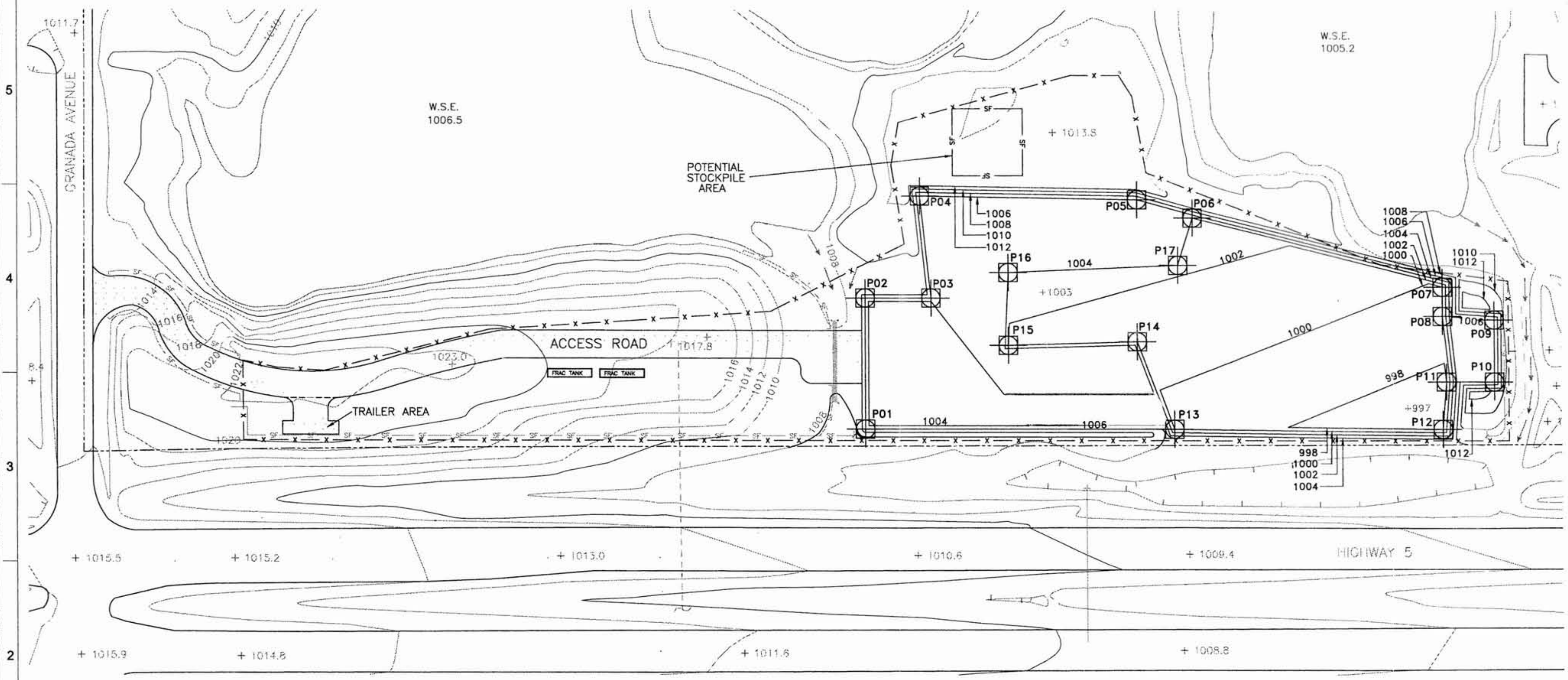
100' 0 100' 200'
SCALE: 1"=100'–0"

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

EXISTING CONDITIONS
E-02



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2. ALL DATA IS IN WASHINGTON COUNTY COORDINATE SYSTEM NAD83 COORDINATES.

LEGEND

—x—	CONSTRUCTION FENCE
—·—·—	PROPERTY LINE
——	FINAL EXCAVATION CONTOUR
——	EXISTING CONTOUR
· 1009.4	EXISTING SPOT ELEVATION
→	DRAINAGE FLOW
⌖	SURVEY POINTS

SURVEY POINTS DEFINE TOE OF SLOPE

LOC_ID	X_COORD	Y_COORD
P01	502207	4982732
P02	502207	4982768
P03	502225	4982768
P04	502222	4982796
P05	502281	4982795
P06	502296	4982790
P07	502364	4982771
P08	502364	4982763
P09	502378	4982762
P10	502378	4982745
P11	502365	4982745
P12	502364	4982732
P13	502291	4982732
P14	502281	4982756
P15	502246	4982755
P16	502246	4982775
P17	502292	4982777

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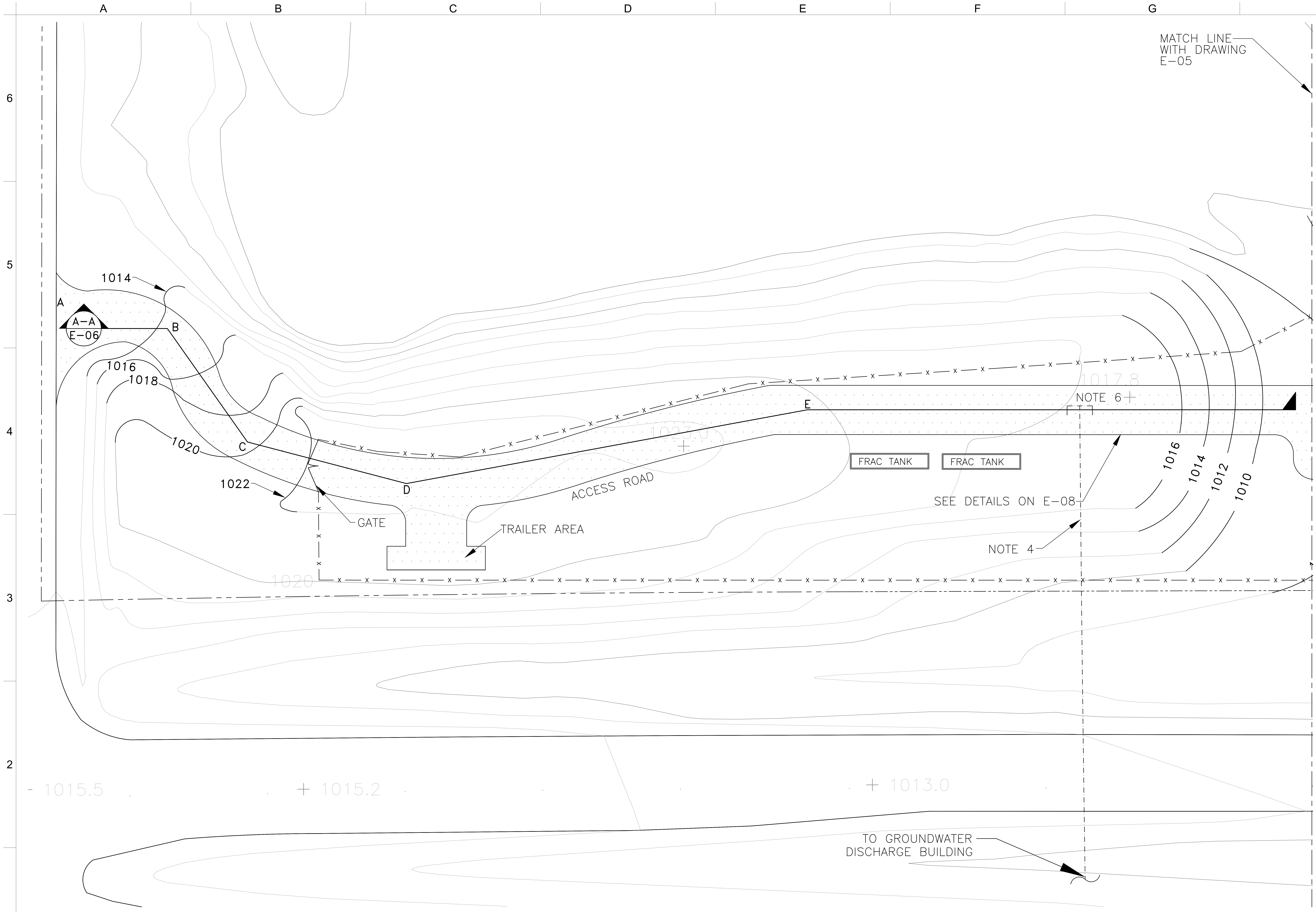
50' 0 50' 100'
SCALE: 1'=50'-0"

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS
SOIL EXCAVATION & REMOVAL LIMITS
E-03



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2. ALL DATA IS IN WASHINGTON COUNTY COORDINATE SYSTEM NAD83 COORDINATES.
3. CONTRACTOR SHALL COMPLETE EXCAVATION IN ACCORDANCE WITH 29 CFR 1926 SUBPART P, AND ALL OTHER APPLICABLE STATE AND FEDERAL REGULATIONS.
4. CONTRACTOR TO EXPOSE U.G. HDPE LINE FOR CONNECTION TO FRAC TANK DISCHARGE PUMP. FRAC TANKS ARE USED FOR COLLECTION OF CONSTRUCTION WATER.
5. E & S CONTROLS SHOWN ON DRAWING E–08.
6. LOCATION APPROXIMATE

LEGEND

—— x ——	CONSTRUCTION FENCE
— - - — - - —	PROPERTY LINE
————	FINAL EXCAVATION CONTOUR
————	EXISTING CONTOUR
+ 1009.4	EXISTING SPOT ELEVATION
⟶	DRAINAGE FLOW
— - — - —	UNDERGROUND CONVEYANCE PIPING

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25' 0 25' 50'
SCALE: 1'=25'–0"

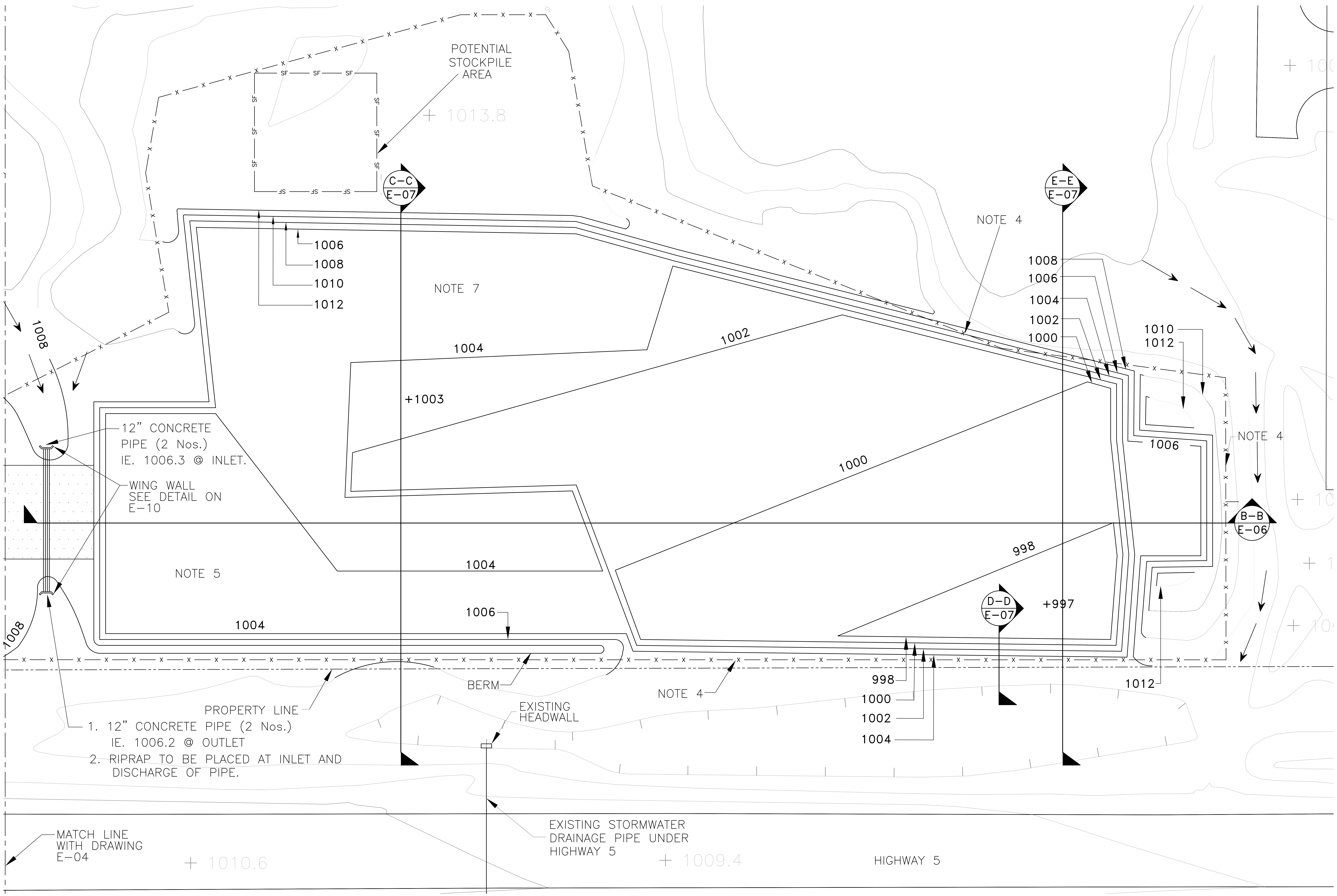
WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

SITE ACCESS ROAD IMPROVEMENTS

E-04



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2. ALL DATA IS IN WASHINGTON COUNTY COORDINATE SYSTEM NAD83 COORDINATES.
3. CONTRACTOR SHALL COMPLETE EXCAVATION IN ACCORDANCE WITH 29 CFR 1926 SUBPART P, AND ALL OTHER APPLICABLE STATE AND FEDERAL REGULATIONS.
4. SECURE AND/OR RELOCATE SITE ACCESS FENCE AS REQUIRED FOR SLOPE STABILITY OF EXCAVATION AND SUPPORT OF FENCE.
5. EXCAVATION IS DEEPER IN LOCALIZED AREA OF FORMER SWALE AND WILL BE 4' BELOW EXISTING GROUND SURFACE.
6. E & S CONTROLS SHOWN ON DRAWING E–08.
7. ELEVATIONS ARE FOR GUIDANCE MINIMUM EXCAVATION WILL BE 4' IN THIS AREA.

LEGEND

— x —	CONSTRUCTION FENCE
—·—·—	PROPERTY LINE
———	FINAL EXCAVATION CONTOUR
———	EXISTING CONTOUR
· 1009.4	EXISTING SPOT ELEVATION
→	DRAINAGE FLOW

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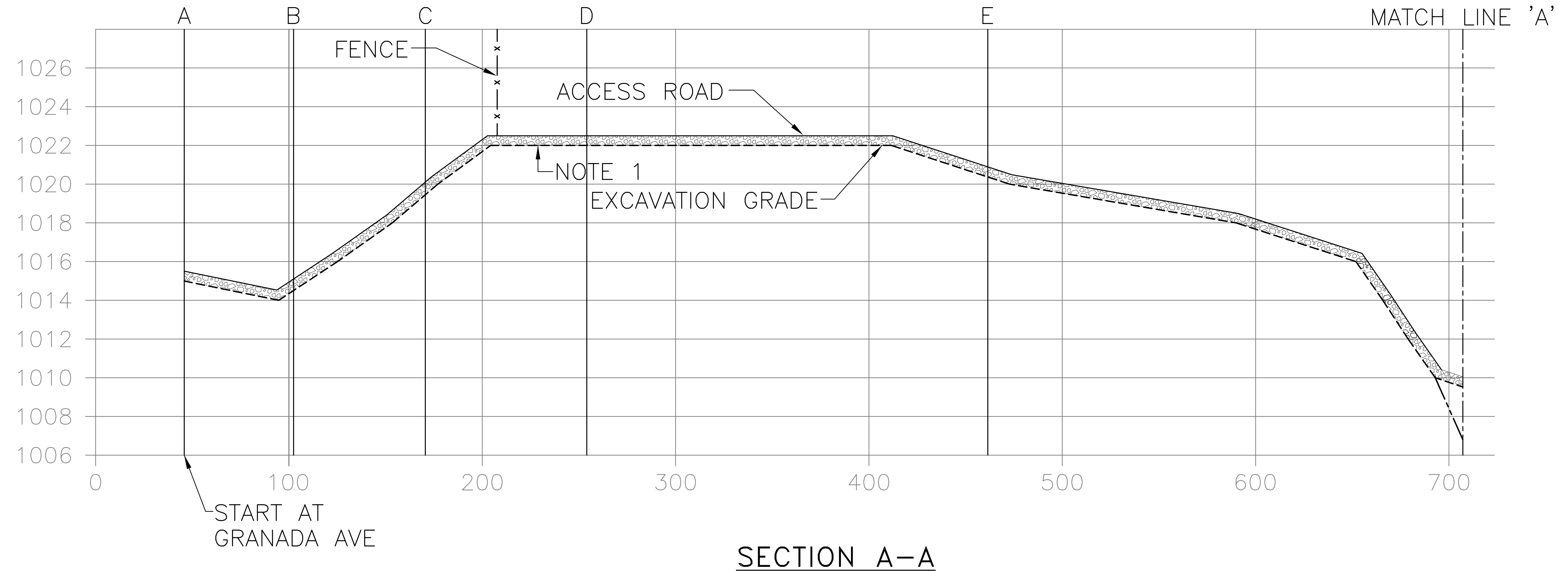
25' 0 25' 50'
SCALE: 1'=25'–0"

WESTON SOLUTIONS

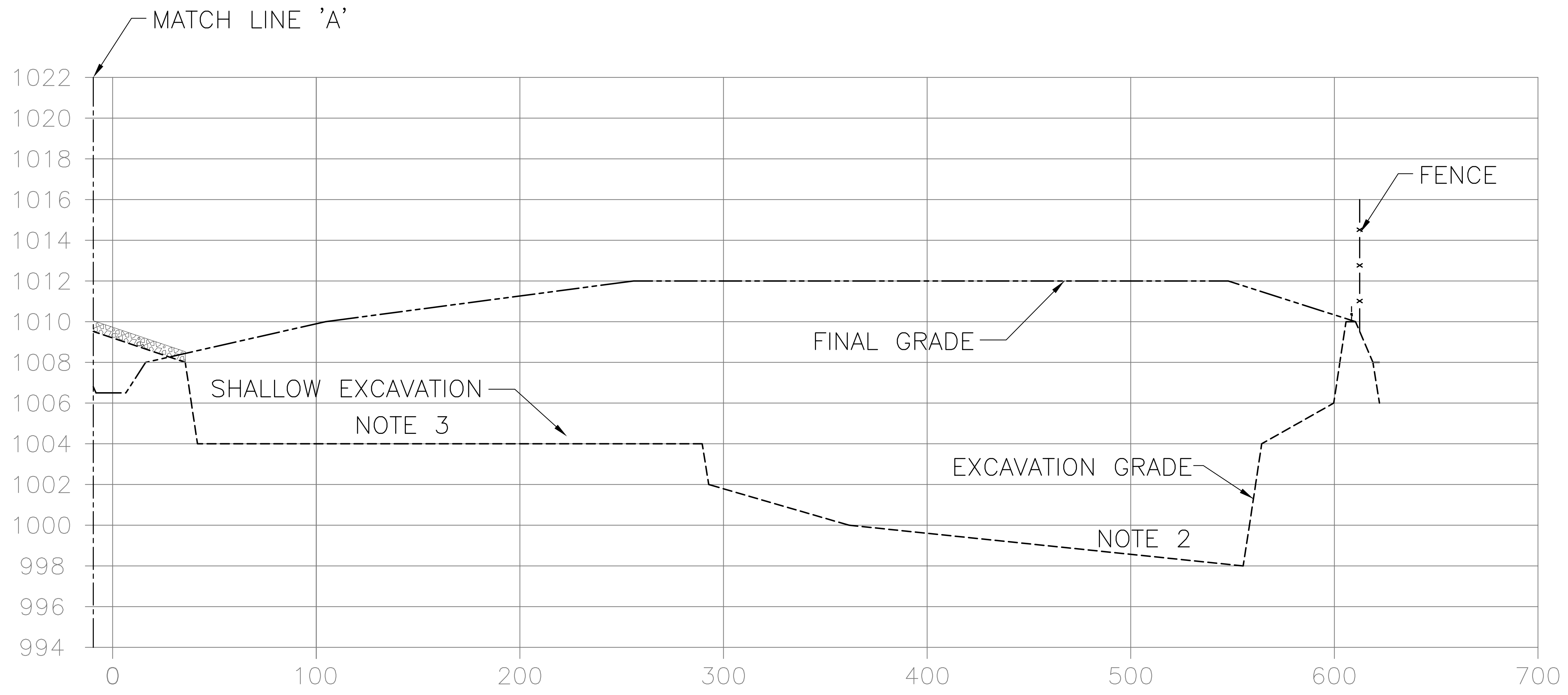
OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

EXCAVATION AREA
E-05



SECTION A–A
Scale: Hor: 1"=50'
Ver: 1"=5'



SECTION B–B
Scale: Hor: 1"=50'
Ver: 1"=5'

NOTES:

1. ACCESS ROAD TO BE REMOVED FROM THIS POINT EASTWARD. EXCAVATION GRADE WILL BECOME FINAL GRADE.
2. EXCAVATION WILL BE TO GROUNDWATER. GRADES SHOWN ARE BASED ON WATER TABLE DATA.
3. MAXIMUM EXCAVATION WILL BE TO ELEVATION 1004. EXCAVATION MAY TERMINATE AT A HIGHER ELEVATION IF A MINIMUM EXCAVATION DEPTH OF 4 FT IS REACHED.

LEGEND

--------	EXCAVATION GRADE
—·—·—	FINAL GRADE

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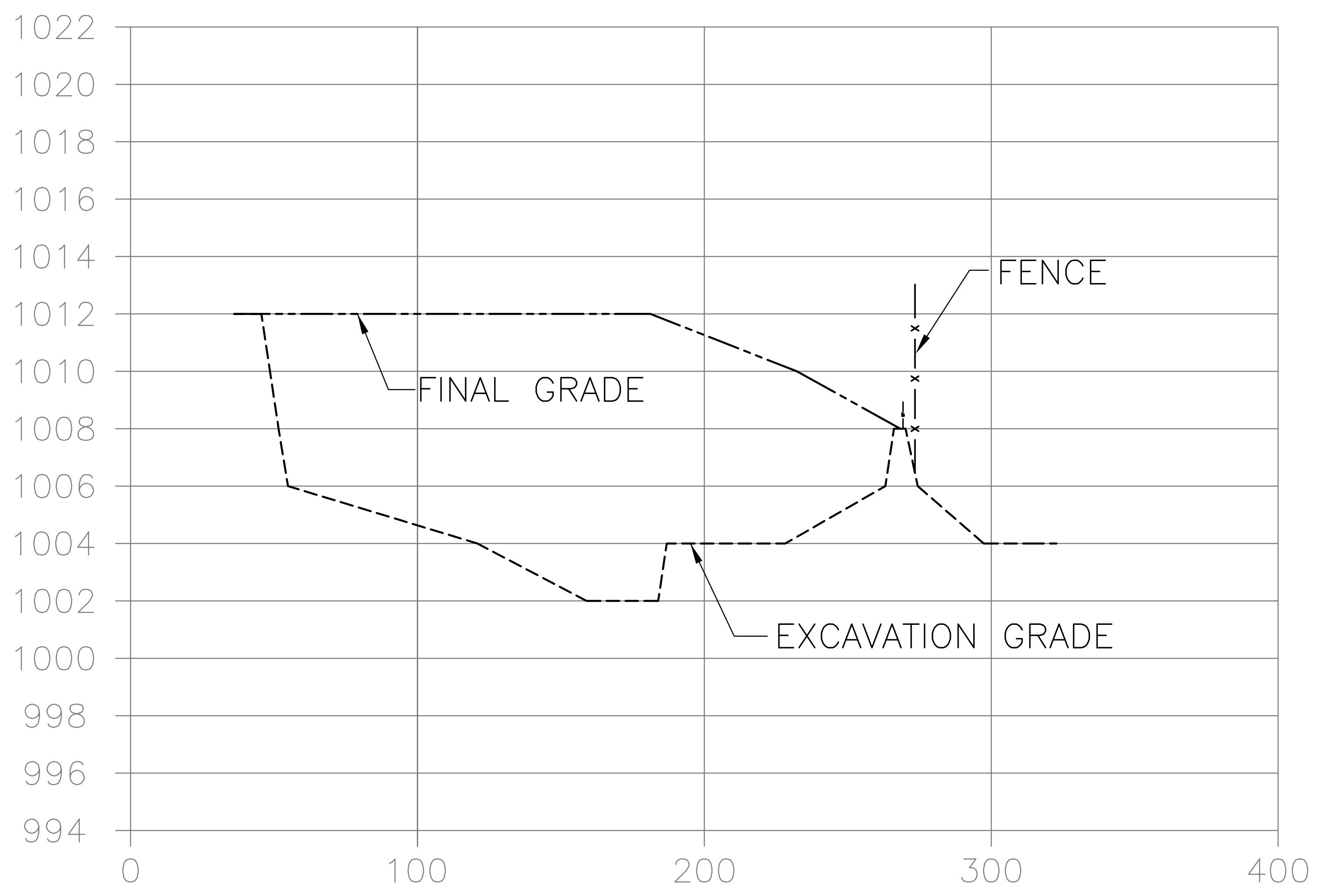
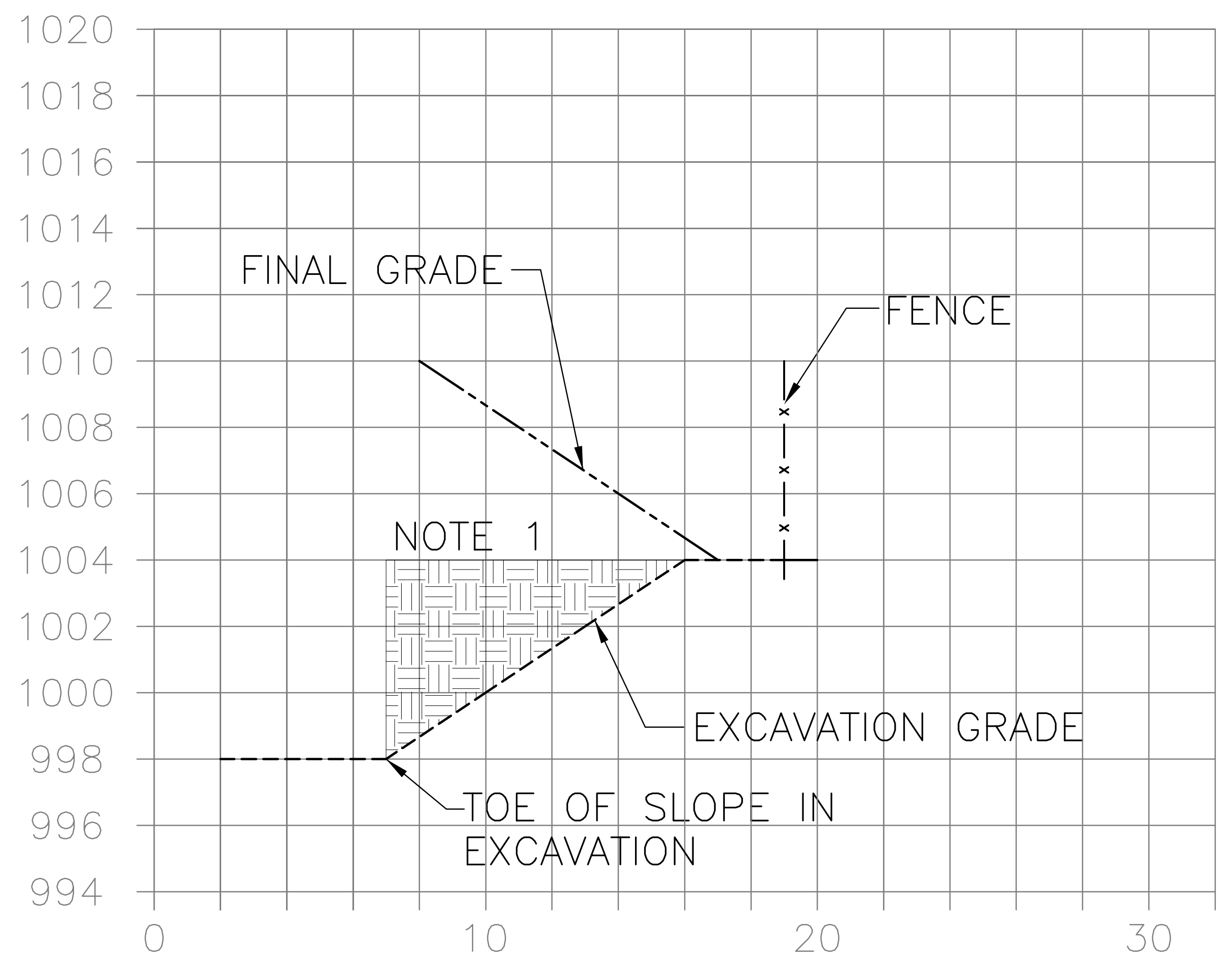
WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS
EAST-WEST
CROSS SECTIONS
E-06



SECTION C–C
Scale: Hor: 1"=50'
Ver: 1"=5'



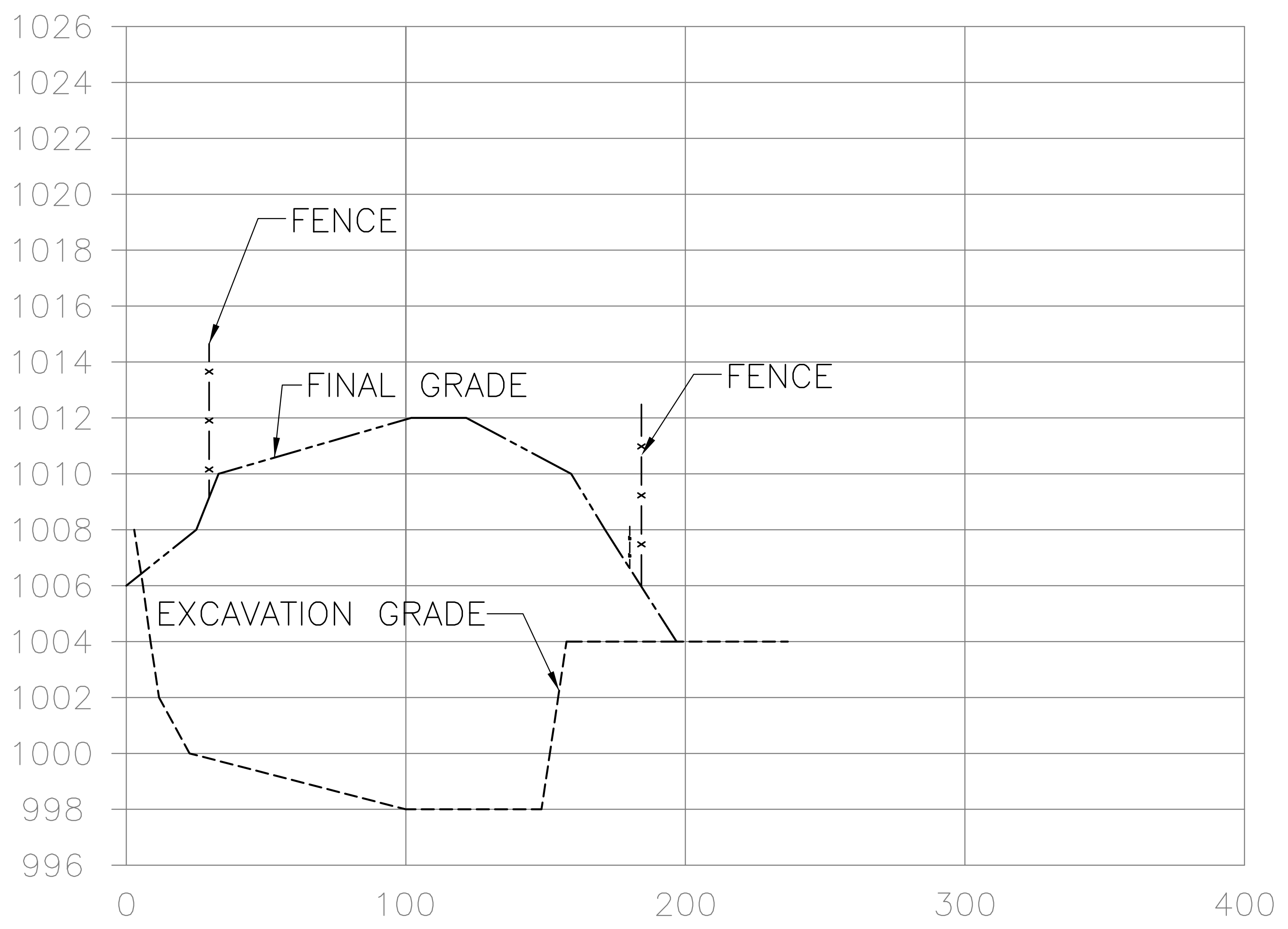
SECTION D–D
Scale: Hor: 1"=5'
Ver: 1"=5'

NOTES:

1. THE SOIL THAT IS REMOVED TO CONSTRUCT A SIDE SLOPE (SHADED AREA) MAY BE USED AS BACKFILL MATERIAL WITHIN THE EXCAVATION.

LEGEND

--------	EXCAVATION GRADE
———	FINAL GRADE



SECTION E–E
Scale: Hor: 1"=50'
Ver: 1"=5'

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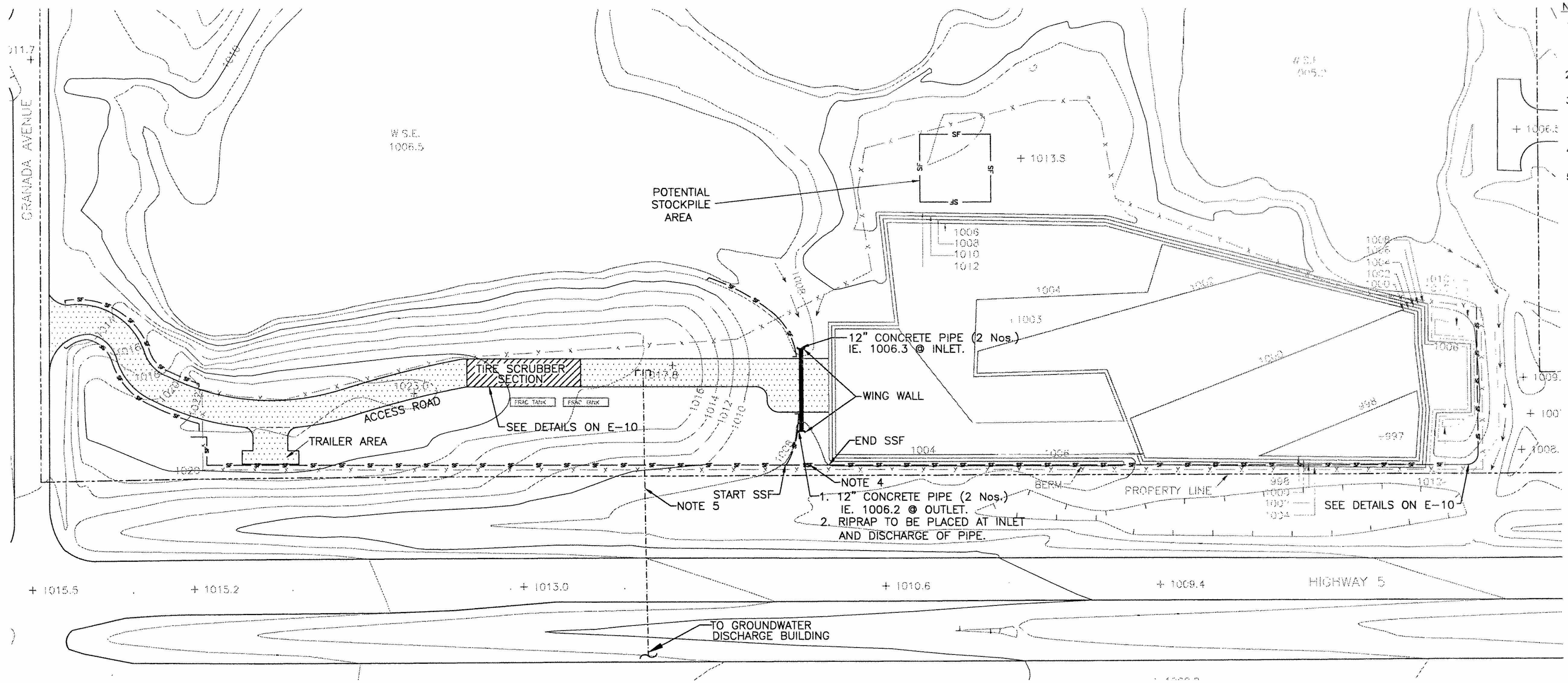
WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS
NORTH-SOUTH
CROSS SECTIONS
E-07



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3. CONTRACTOR SHALL COMPLETE EXCAVATION IN ACCORDANCE WITH 29 CFR 1926 SUBPART P, AND ALL OTHER APPLICABLE STATE AND FEDERAL REGULATIONS.
4. SUPER SILT FENCE WILL BE INSTALLED BETWEEN THE 1008 CONTOURS.
5. TERMINATION OF UNDERGROUND GROUNDWATER TRANSFER PIPE,TO BE CONNECTED TO FUTURE GROUNDWATER EXTRACTION WELL RW-26.

LEGEND

—x—x—	CONSTRUCTION FENCE
—·—·—	PROPERTY LINE
······	FINAL EXCAVATION CONTOUR
——	EXISTING CONTOUR
+ 1009.4	EXISTING SPOT ELEVATION
→	DRAINAGE FLOW
— SF —	SILT FENCE
— SSF —	SUPER SILT FENCE

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50' 0 50' 100'
SCALE: 1"=50'-0"

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

E & S CONTROLS
E-08

NOTES:

1. TOPOGRAPHY PROVIDED BY WASHINGTON COUNTY DEPARTMENT OF TRANSPORTATION & PHYSICAL DEVELOPMENT, SURVEY AND LAND MANAGEMENT DIVISION.
2. ALL DATA IS IN WASHINGTON COUNTY COORDINATE SYSTEM NAD83 COORDINATES.
3. SILT FENCE (DWG C-03) WILL BE MAINTAINED UNTIL VEGETATION IS ESTABLISHED.
4. DISTURBED AREAS TO BE SEEDED.
5. BACKFILLED MATERIAL TO BE COMPACTED IN 8-12 INCH LIFTS.
6. TOP 6 INCHES OF BACKFILL TO BE TOPSOIL.
7. EROSION CONTROL BLANKETS TO BE USED IN SWALE UNTIL VEGETATION IS ESTABLISHED.

LEGEND

—·—·—	PROPERTY LINE
——	FINAL GRADING CONTOUR
——	EXISTING CONTOUR
· 1009.4	EXISTING SPOT ELEVATION
→	DRAINAGE FLOW
– – –	EXCAVATION AREA
—SF—SF—	SILT FENCE
—SSF—	SUPER SILT FENCE

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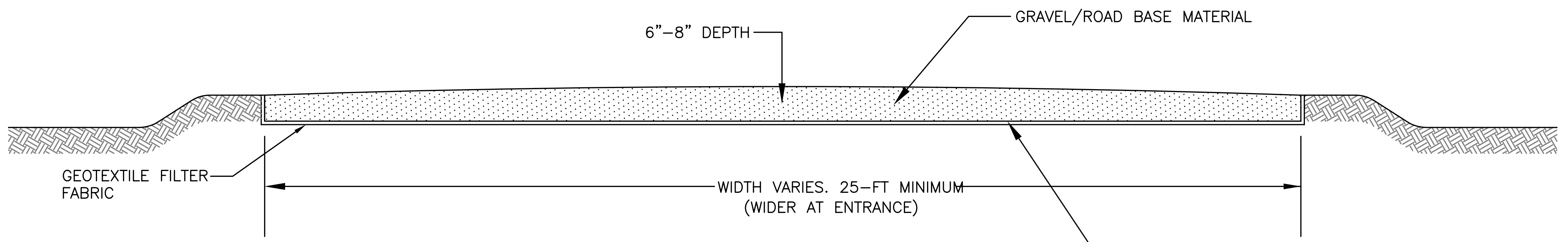
50' 0 50' 100'
SCALE: 1"=50'-0"

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

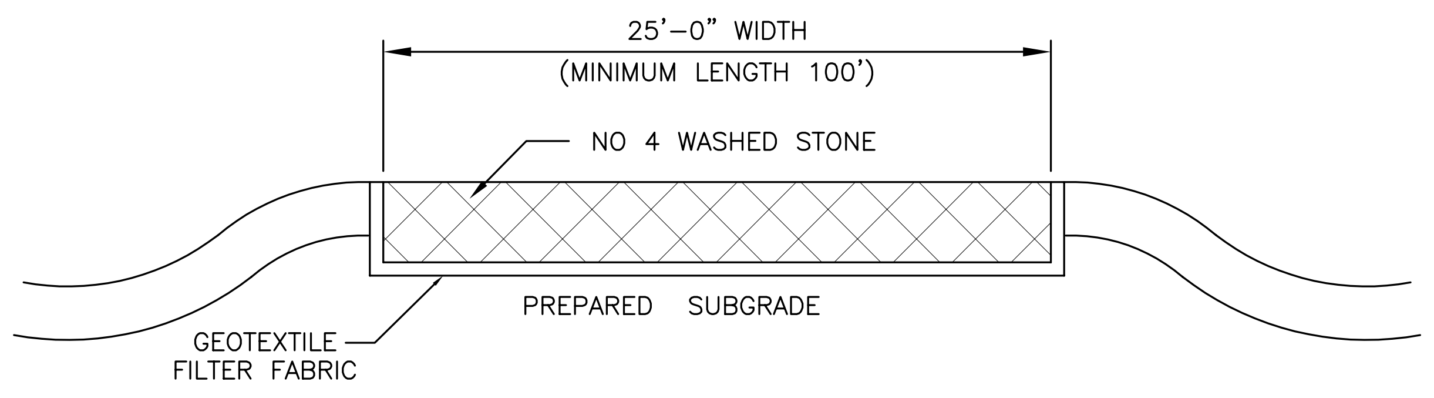
SOIL EXCAVATION CONSTRUCTION DRAWINGS

FINAL GRADING PLAN
E-09



ROAD CROSS SECTION DETAILS

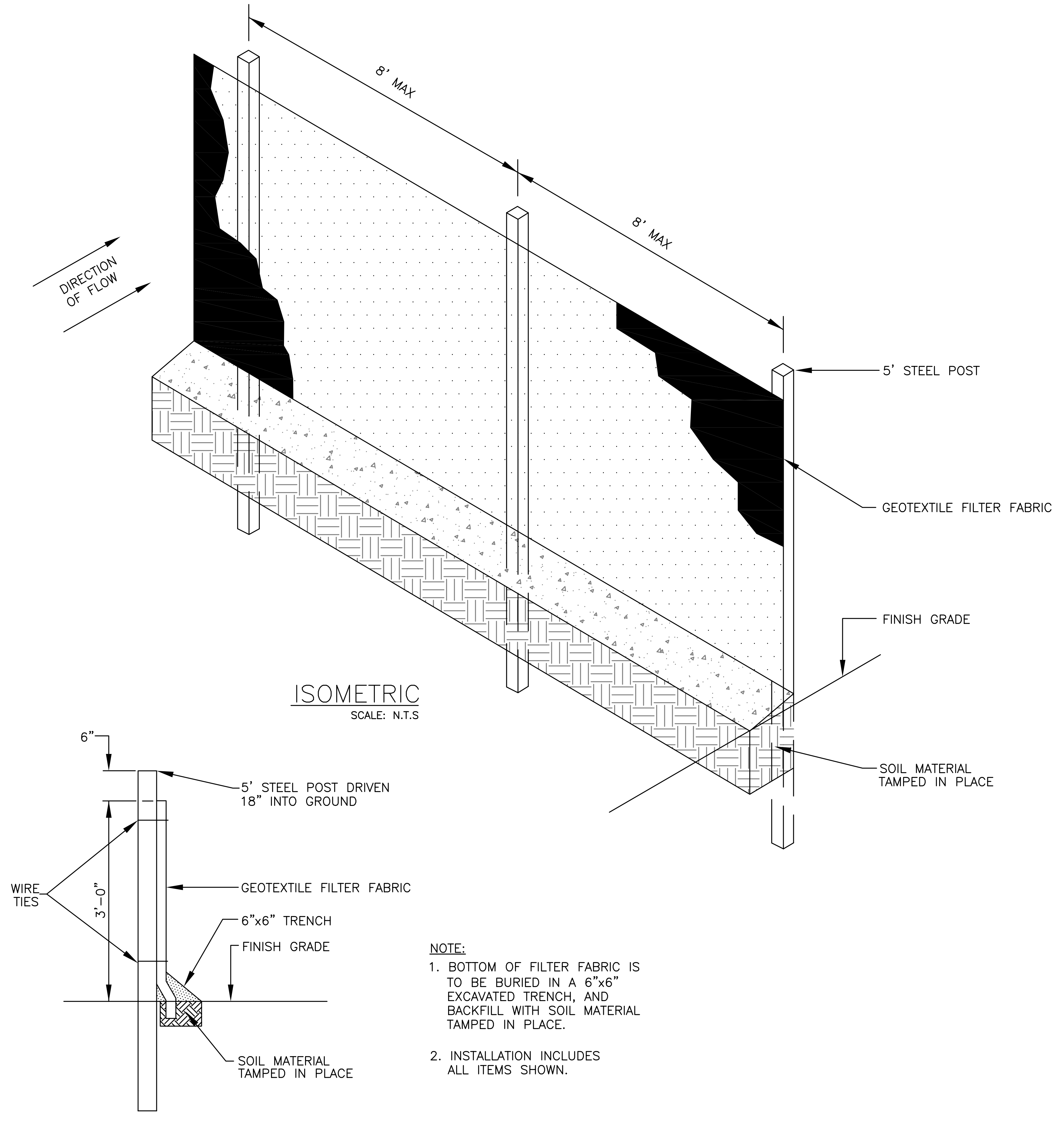
SCALE: N.T.S



TIRE SCRUBBER SECTION

SCALE: N.T.S

NOTES:
1. STONE TO BE REPLACED IF SOIL ACCUMULATES ON SURFACE.
2. STONE THAT IS REPLACED TO BE USED AS BACKFILL MATERIAL IN EXCAVATION OR DISPOSED



ISOMETRIC

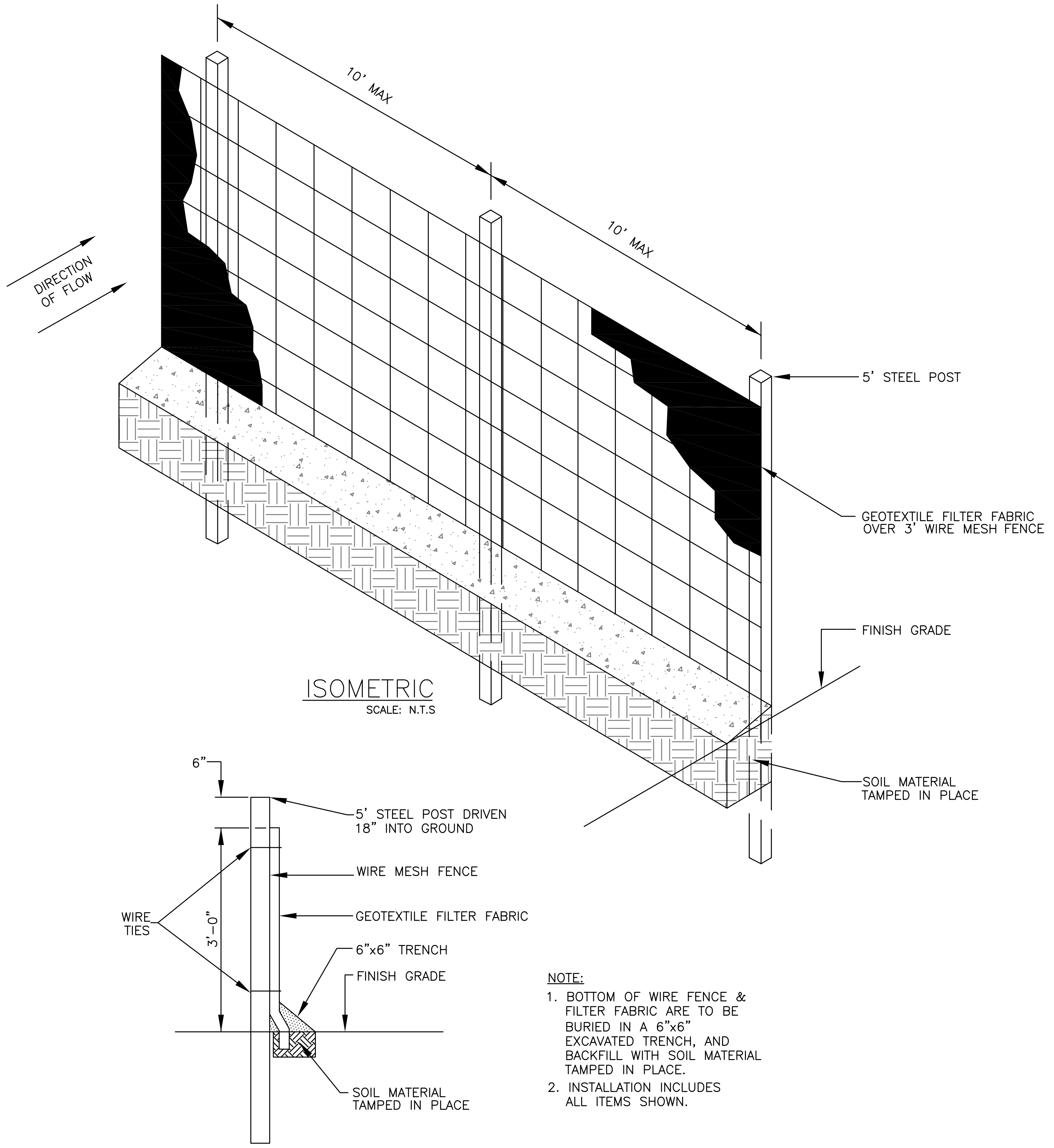
SCALE: N.T.S

NOTE:
1. BOTTOM OF FILTER FABRIC IS TO BE BURIED IN A 6"x6" EXCAVATED TRENCH, AND BACKFILL WITH SOIL MATERIAL TAMPED IN PLACE.
2. INSTALLATION INCLUDES ALL ITEMS SHOWN.

SECTION

CONVENTIONAL SILTATION FENCE

SCALE: N.T.S



ISOMETRIC

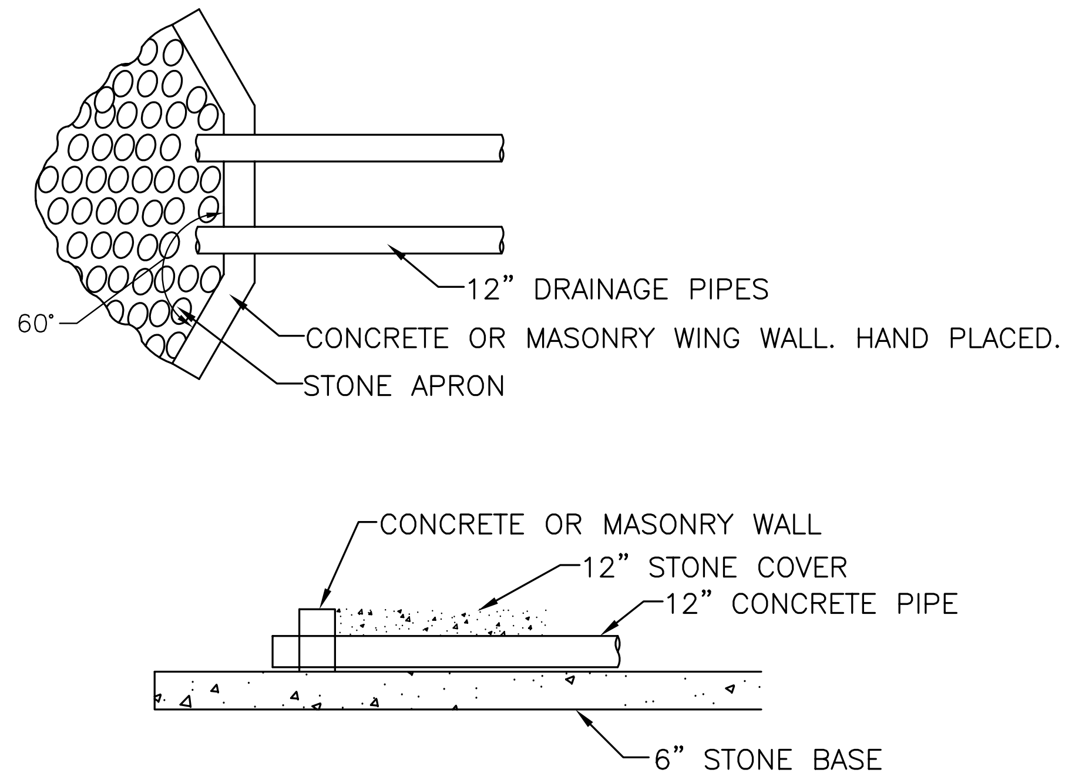
SCALE: N.T.S

NOTE:
1. BOTTOM OF WIRE FENCE & FILTER FABRIC ARE TO BE BURIED IN A 6"x6" EXCAVATED TRENCH, AND BACKFILL WITH SOIL MATERIAL TAMPED IN PLACE.
2. INSTALLATION INCLUDES ALL ITEMS SHOWN.

SECTION

SUPER SILTATION FENCE

SCALE: N.T.S



SECTION

CONCRETE DRAINAGE PIPES

SCALE: N.T.S

Rev 0
02/16/2009

WESTON SOLUTIONS

OAKDALE SITE
OAKDALE, MINNESOTA

SOIL EXCAVATION CONSTRUCTION DRAWINGS

TYPICAL DETAILS
E-10

ATTACHMENT 1

STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT PLAN

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

Weston Solutions, Inc.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

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LIST OF TABLES

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LIST OF ACRONYMS

3M	3M Company
BMPs	best management practices
EAW	environmental assessment worksheet
EIS	environmental impact statement
MCES	Metropolitan Council of Environmental Services
MPCA	Minnesota Pollution Control Agency
O&M	operation and maintenance
PFCs	perfluorochemicals
POTW	publicly owned treatment works
RD/RA	Remedial Design/Response Action
SMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan

1. INTRODUCTION

This Stormwater Management Plan (SMP) is a supporting document to the Remedial Design/Response Action (RD/RA) Plan that has been prepared by the 3M Company (3M) for the Oakdale Site in Oakdale, Minnesota, to address the presence of perfluorochemicals (PFCs) in soil and groundwater. The primary focus of the SMP is the soil excavation area north of Highway 5, since the work south of Highway 5 involves only minor handling of PFC-containing material during construction. However, elements of this plan may be applicable to the construction and operation and maintenance (O&M) activities for the groundwater treatment system.

This plan presents the overall procedures and steps that will be taken for managing stormwater at the Site. Minor modifications and additions may be made to this plan before and during implementation that will not involve regulatory review and approval.

1.1 OVERVIEW

This SMP has been prepared to detail the procedures for the management of stormwater runoff associated with the excavation of soils at the 3M Oakdale Site.

This SMP and the attached Stormwater Pollution Prevention Plan (SWPPP) are required for excavation activities to be in compliance with Minnesota permit number MN R100001: General Permit – Authorization to Discharge Stormwater Associated with Construction Activity under the National Pollutant Discharge Elimination System/State Disposal System Permit Program (MN R100001), issued August 1, 2008 (Exhibit A).

1.2 BACKGROUND

As specified in the RD/RA Plan, soil removal will be conducted at the site to prevent contact with accessible surface soil within the defined area and to reduce the mass of PFCs in the soil, thereby accelerating the removal of PFCs from the groundwater. Throughout this area, the upper 4 feet of soil will be removed and transported to a permitted off-site landfill to provide engineered isolation and containment of PFCs.

Additional soils below the 4-foot zone have also been delineated and will be removed. This SMP outlines how stormwater and sediments will be managed during excavation activities to protect the surrounding environment and community.

1.3 APPLICABILITY

Stormwater General Permit MN R100001 will cover the stormwater discharges associated with the construction activities at the Site. The total area of disturbance during these activities is approximately 5.5 acres (3.5 acres north of Highway 5 and 2 acres south of Highway 5). This classifies the excavation as a “construction activity” under MN R10001.

Coverage under General Permit MN R10001 will begin 2 days after the completion of the online application or 7 days after the postmarked date of the application form.

2. STORMWATER GENERAL PERMIT

2.1 CONSTRUCTION SITE

The primary soil removal construction activities will take place in the portion of the Site north of Highway 5. This area is enclosed by a fence for access control, and construction activities will take place within the perimeter of the fence. The construction site is presented in the construction drawings provided in Appendix E of the RD/RA Report. The disturbed construction area north of Highway 5 is approximately 3.5 acres, and the disturbed area south of Highway 5 is 2 acres.

Construction phasing will be finalized once an excavation contractor has been selected. However, it is anticipated that excavation will proceed along an east/west orientation. The excavation may be backfilled in stages; however, this will depend on the logistics of transporting soil to the site and placing/compacting it in the excavation.

2.2 ENVIRONMENTAL REVIEW

The upcoming excavation activities on-site do not meet or exceed the thresholds of the environmental assessment worksheet (EAW) or environmental impact statement (EIS) categories listed in the Minnesota Administrative Rules, Chapter 4410.

2.3 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

As required by Stormwater General Permit MN R100001, an SWPPP was developed and is included as Exhibit B to this plan. The SWPPP addresses site information, including owner, location and construction details, as well as best management practices (BMPs) to be implemented during construction activities to prevent the discharge of sediment and/or potential pollutants from the site. Proposed BMPs to be implemented on-site include:

- <u>Stockpiles:</u> Operational and temporary controls will be utilized to manage stockpiles when soil is not being actively added or removed, including nights and weekends. These controls may include wetting of the stockpile when needed to prevent dust emissions and use of silt fences or berming set up around the stockpiles to control sediment transport. Tarps may also be used to cover stockpiles and control sediment transport.

- Sedimentation Tanks: 20,000-gallon frac tanks will be used to collect construction water prior to pumping to the publicly owned treatment works (POTW). These tanks will be set up in a controlled area outside of the exclusion zone. The tanks will be emptied via pumping to the POTW discharge manhole on the south side of Highway 5. Water in the tanks will be discharged through the existing 2-inch pipeline beneath Highway 5 to the Metropolitan Council of Environmental Services (MCES) sanitary sewer. All discharges will be in accordance with the MCES permit.

- Water Accumulation: During excavation and soil removal, precipitation that falls into the excavation will be allowed to drain into the soil. However, if the quantity of stormwater is such that excess water accumulates, this construction water will be pumped into the on-site frac tanks, and then discharged into the POTW. Pumping will be completed in a manner to minimize sediment suspension in the pumped water. No water that is pumped from the excavation will be discharged to surface water. Any decontamination water may also be handled using this method, if permissible under the MCES permit.

- Excavation and Loading: Excavation and truck loading will be performed so that the haul trucks remain on designated stone-surfaced roads. Any soil that spills from a truck during loading operations will be cleared. During loading operations, trucks will not be filled to a height that exceeds the sidewalls. Free water will not be permitted in the haul trucks. If free water is present in excavated soil, the soil will be stockpiled or otherwise stored until it has dried to the point that free water is no longer present. The trucks will be covered with tarps at all times during off-site transport.

- Silt Fences: A temporary barrier of geotextile and support posts will be placed downgradient of the disturbed area as well as around temporary stockpiles. This will help to filter sediment out of any stormwater runoff as shown on the drawings. The silt fences will be repaired or replaced when they become nonfunctional, or when sediment reaches 1/3 of the height of the fence.

- Diversion Berms: Diversion berms will be constructed as needed to direct stormwater run-on around the excavation, disturbed areas and stockpile areas. Accumulated debris next to the berms and accumulated sediment within the berms will be cleared on a regular basis to allow free flow of diverted water.

- Diversion Swales and Ditches: Diversion swales or ditches will be used to control stormwater runoff. Accumulated debris and sediment will be removed on a regular basis to allow flow.

- Roads/Parking Areas/Loading Areas: Stone-surfaced roads will be constructed to prevent haul trucks from coming in contact with soils. The stone surfaces will be maintained to prevent soil and mud from being carried out of the exclusion zone and off-site onto local roadways. The stone base will be renewed as needed to support the loaded trucks and to maintain a clean surface and drain water.

- Seeding: Temporary seeding (i.e., rye grass) during construction and final seeding during restoration will be used to control erosion. Mulch will be applied as needed to promote grass growth and prevent washing of seed or to control erosion. The seed area will be watered as needed during extended drought periods to establish growth of 6 inches. Areas that do not germinate will be reseeded.

- Diesel Fuel Tank: If a fuel tank is set up on-site for construction equipment fueling, it will be kept securely locked. The tank will have secondary containment in case of any leaks or spills. Precipitation will be prevented from entering the secondary containment.

For planning purposes, Table 2-1 provides approximate quantities of erosion prevention and sediment control BMPs. These quantities will be better defined as the construction plans are completed.

2.4 STORMWATER DISCHARGE RECEIVING WATERS

There are three waters that have the potential to receive a discharge of stormwater runoff from the Oakdale construction site:

1. North of Highway 5, drainage ditch south of the construction area.
2. South of Highway 5, drainage ditch through the construction area.
3. South of Highway 5, Raleigh Creek (intermittent stream) originating at Hadley Avenue.

None of these waters is considered “special waters” or “impaired waters” by the MPCA. No “special” or “impaired waters” are located within 1 mile of the construction site. Discharge into the above-listed waters does not have the potential to impact protected resources, including calcareous fens.

Table 2-1 Approximate Quantities of Erosion Prevention and Sediment Control Best Management Practices

Best Management Practice	Quantity
Stockpile Area	2,500 sq. ft.
Construction Stormwater Frac Tanks (two)	20,000 gal. each
Silt Fence	2,000 LF
Super Silt Fence	50 LF
Diversion Berms	130 LF
Diversion Swales and Ditches	200 LF
Stone Roads	17,000 sq. ft.(a)
Tire Scrubber	2,500 sq. ft.
Seeding	3 acres
Secondary Containment (Diesel Fuel Tank)	<500 gal

(a) Does not include additional stone-surfaced haul roads located within the exclusion zone.

3. ONGOING COMPLIANCE WITH PERMIT

3.1 TRAINING

Personnel charged with the task(s) of implementing, revising and/or amending the SWPPP and/or performing site inspections will undergo task-specific training. Training will be conducted by a qualified trainer. All training records will be kept on-site.

3.2 INSPECTIONS

During active construction, routine inspections of the construction site will take place once a week. Inspections will also be conducted within 24 hours after a rainfall event greater than 0.5 inch in 24 hours. Routine inspections after a rainfall event inspection will resume within 7 days, in accordance with Stormwater General Permit MN R100001.

All inspections will be recorded on a Stormwater Management Inspection Log (see Exhibit C). During inspections the following will be noted:

- Inspector name.
- Date and time of inspection.
- Type of inspection.
- Area inspected.
- Findings at each area inspected.
- Corrective actions (if any) at each area inspected.

All Stormwater Management Inspection Logs will be kept on-site.

3.3 RECORD RETENTION

The following will be kept in a field trailer on-site during construction activities:

- A copy of the SWPPP.
- Training records for all personnel.

- Stormwater Management Inspection Logs.

- All permits required for the construction activities.

All of the above records will be kept on file for 3 years after submittal of a Notice of Termination to the MPCA.

4. TERMINATION OF COVERAGE

A Notice of Termination will be submitted to the MPCA within 30 days of final stabilization. Final stabilization requires that soil-disturbing activities have been completed, at least 70% of the disturbed area is covered by perennial vegetation, and all temporary BMPs have been removed from the Site. In accordance with the permit, termination of coverage under MN R100001 begins at midnight on the postmark date of the Notice of Termination or on the date of an online submittal of the Notice of Termination to the MPCA.

EXHIBIT A

MINNESOTA CONSTRUCTION ACTIVITY STORMWATER GENERAL PERMIT (MN R100001)

GENERAL PERMIT
AUTHORIZATION TO DISCHARGE
STORMWATER ASSOCIATED WITH CONSTRUCTION ACTIVITY UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM/STATE DISPOSAL SYSTEM PERMIT PROGRAM

ISSUANCE DATE: **August 1, 2008** **EXPIRATION DATE:** **August 1, 2013**

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et seq.), 40 CFR 122, 123, and 124, as amended, et seq.; Minn. Stat. chs. 115 and 116, as amended, Minn. R. chs. 7001 and 7090:

This permit regulates the discharges of **stormwater** to the **waters of the state** of Minnesota associated with **construction activity**. This permit covers the **stormwater** discharges identified in Part I.A. of this permit. The limitations on permit coverage are identified in Part I.B. of this permit.

This permit requires the development and implementation of a **Storm Water Pollution Prevention Plan (SWPPP)**. No person shall commence **construction activity** covered by Part I.A. until permit coverage under this permit is effective or, if applicable, until the Minnesota Pollution Control Agency (MPCA) has issued an individual **National Pollutant Discharge Elimination System (NPDES)**/State Disposal System (SDS) construction **stormwater** permit for the project. The **SWPPP** must be completed prior to submitting any permit application and prior to conducting any **construction activity** by any required **Permittee**.

Unless notified by the MPCA to the contrary, applicants who submit a complete and accurate application (including permit fee) in accordance with the requirements of this permit are authorized to discharge **stormwater** from construction sites under the terms and conditions of this permit as described in Part II.B.

*Signature:*______________________________

Brad Moore
Commissioner
Minnesota Pollution Control Agency

If you have questions on this permit, including the specific permit requirements, permit reporting or permit compliance status, please contact the appropriate MPCA offices.

Minnesota Pollution Control Agency
Municipal Division
Construction Stormwater Program
520 Lafayette Road North
St. Paul, MN 55155-4194
Telephone: 651-296-6300
Toll free in MN 800-657-3864

All boldfaced terms are defined in "Definitions," Pages 23 through 26
TDD (for hearing and speech impaired only): (651)282-5332
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PART I. PERMIT COVERAGE AND LIMITATIONS

A. PERMIT COVERAGE

1. This permit is required for **construction activity** and **small construction activity** as defined in 40 CFR pt. 122.26(b)(14)(x) and (b)(15), respectively.

2. This permit authorizes, subject to the terms and conditions of this permit, the discharge of **stormwater** associated with **construction activity** and **small construction activity.**

   Construction activity includes clearing, grading and excavation, that disturbs land of equal to or greater than five (5) acres and includes the disturbance of less than five (5) acres of total land area that is a part of a larger **common plan of development or sale** if the larger common plan will ultimately disturb five (5) acres or more.

   Small construction activity includes clearing, grading and excavation, that disturbs land of equal to or greater than one (1) acre, and includes the disturbance of less than one (1) acre of total land area that is part of a larger **common plan of development or sale** if the larger common plan will ultimately disturb equal to or greater than one and less than five (5) acres. **Small construction activity** does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the facility.

3. This permit covers all areas of the State of Minnesota.

4. For Parts I.B through Appendix A of this permit, all reference to **construction activity** includes both **small construction activity** and **construction activity**.

5. Coverage under this permit is not required when all runoff from **construction activity** or **small construction activity** is routed directly to and treated by a “treatment works”, as defined in Minn. Stat. § 115.01, subd. 21, that is operated under an individual NPDES/SDS permit with a Total Suspended Solids effluent limit for all treated runoff.

6. Previously Permitted Ongoing Projects. **Permittee(s)** of ongoing projects covered initially under the previous MPCA-issued NPDES/SDS Construction Stormwater General Permit (issuance date August 1, 2003) must continue coverage under this reissued permit. The **Permittee(s)** of those ongoing projects shall amend the **SWPPP** for the project to meet the requirements of this reissued permit no later than 18 months after the issuance date of this reissued permit if the termination-of-coverage requirements in Part II.C. will not be met within 18 months of the issuance date of this reissued permit. Any additional permanent treatment in Appendix A. Part C.2 is not required for previously permitted projects that have discharges to impaired waters or if the project is located between 2000 feet and one mile of, and discharges to, a special water.

   a. If the previously permitted ongoing project will meet the termination-of-coverage requirements in Part II.C within 18 months of the issuance date of this reissued permit, the **Permittee(s)** shall comply with the 2003 construction general permit until the project is complete and a **Notice of Termination** consistent with Part II.C. of this reissued permit is submitted.

   b. If the previously permitted ongoing project will not be able to meet the terms and conditions of this reissued permit, an individual permit will be required in accordance with Minn. R. ch. 7001.

B. LIMITATIONS OF COVERAGE

This permit does not cover the following activities:

1. Discharges or releases that are not **stormwater** except those non-**stormwater** discharges authorized under Part IV.D.

2. The placement of fill into **waters of the state** requiring local, state, or federal authorizations (such as U.S. Army Corps of Engineers Section 404 permits, Minnesota Department of Natural Resources Public Waters Work Permits or Local Governmental Unit Wetland Conservation Act replacement plans or determinations).

3. **Stormwater** discharges associated with industrial activity that originate from the site after construction activities have been completed and the site has undergone **Final Stabilization**. Post-construction, industrial **stormwater** discharges may need to be covered by a separate NPDES/SDS permit.

4. Non-point source agricultural and silvicultural discharges excluded from **NPDES** permit requirements under 40 CFR pt. 122.3(e).

5. Discharges to the waters identified below unless the requirements of Appendix A. are complied with:

    a. Discharges into **outstanding resource value waters** as listed in Minn. R. 7050.0180, subp. 3, 4, 5, 6 and 6a, except calcareous fens listed in Minn. R. 7050.0180, subp. 6b.

    b. Discharges into Trout waters as listed in Minn. R. 6264.0050, subp. 2 and 4.

    c. Discharges into **wetlands** as defined in Minn. R. 7050.0130, item F.

    d. Discharges from projects that have not met applicable Environmental Review requirements under state or federal laws.

    e. Discharges that adversely impact or contribute to adverse impacts on a state or federal listed endangered or threatened species or adversely modify a designated critical habitat.

    f. Discharges which adversely affect properties listed or eligible for listing in the National Register of Historic Places or affecting known or discovered archeological sites.

6. Discharges to calcareous fens listed in Minn. R. 7050.0180, subp. 6b, without a letter of approval from the Minnesota Department of Natural Resources (DNR). If the DNR does not respond to the permittee’s request for approval within 30 calendar days, the application can be submitted.

7. Discharges to waters identified as impaired pursuant to section 303 (d) of the federal Clean Water Act (33 U.S.C. § 303(d)) where the identified pollutant(s) or stressor(s) are phosphorus (nutrient eutrophication biological indicators), turbidity, dissolved oxygen, or biotic impairment (fish bioassessment, aquatic plant bioassessment and aquatic macroinvertebrate bioassessment), and with or without a U.S. Environmental Protection Agency (USEPA) approved Total Maximum Daily Load (TMDL) for any of these identified pollutant(s) or stressor(s), unless the applicable requirements of Part III.A.9 are met.

PART II. SUBMITTING THE APPLICATION

A. PREREQUISITE FOR SUBMITTING A PERMIT APPLICATION

The **owner** must develop a **SWPPP** in accordance with Part III (Storm Water Discharge Design Requirements) of this permit. The plans are not to be submitted to the MPCA (unless the project size is 50 acres or more and will discharge to certain waters as described in Part II.B.1.b.) but are to be retained by the **owner** in accordance with Part III.D (Record Retention). The applicants' failure to complete the **SWPPP** prior to submitting the application will result in the application being returned and the **stormwater** discharges associated with **construction activity** will not be authorized by this permit.

B. APPLICATION AND DURATION OF COVERAGE

1. Application Required.

   a. The **owner** and **operator** shall submit a complete and accurate application form (or a photocopy thereof) with the appropriate fee for project size (see application form) to the MPCA for each project which disturbs one (1) or more acres of land. The **owner** and **operator** of a **common plan of development or sale** that will ultimately disturb one (1) or more acres must submit a complete and accurate application to the MPCA.

   b. For certain projects or **common plans of development or sale** disturbing 50 acres or more, the application must be submitted at least 30 days before the start of construction activity. This requirement pertains to projects that have a discharge point on the project that is within one mile of, and flows to, a special water listed in Appendix A, Part B. or waters listed as impaired under section 303(d) of the federal Clean Water Act (see the MPCA's web site) where the identified pollutant(s) or stressor(s) are phosphorus (nutrient eutrophication biological indicators), turbidity, dissolved oxygen, or biotic impairment (fish bioassessment, aquatic plant bioassessment and aquatic macroinvertebrate bioassessment). Applicants must submit a complete and accurate application form and **SWPPP** including all calculations for the Permanent **Stormwater** Management System (see Part III.A – C).

2. The **Owner** and **Operator** are **Permittee(s)**. The **owner** who signs the application is a **Permittee** and is responsible for compliance with all terms and conditions of this permit. The **operator** (usually the **general contractor**) who signs the application is a **Permittee** for Parts II.B., Part II.C., Part IV. and applicable construction activity requirements found in Appendix A. Part C. of this permit and is jointly responsible with the **owner** for compliance with those portions of the permit.

3. Permit Coverage. The commencement of any **construction activity** (e.g., land disturbing activities) covered under Part I.A. of this permit is prohibited until permit coverage under this permit is effective or, if applicable, until the MPCA has issued an individual NPDES/SDS construction **stormwater** permit for the project.

   a. Except as provided in subp. 3.b., 3.c. and 3.d below, permit coverage will become effective seven (7) calendar days after the postmarked date of the completed application form.

b. For projects disturbing 50 acres or more, that have a discharge point on the project that is within one mile of, and flows to, a special water listed in Appendix A, Part B. or waters listed as impaired under section 303(d) of the federal Clean Water Act, the applicants must submit a complete application and **SWPPP** to the MPCA at least thirty (30) calendar days prior to the commencement of **construction activity**. MPCA staff will review the **SWPPP** submitted with the complete application and permit coverage will become effective 30 calendar days after the postmarked date or MPCA date stamp (whichever is first) of the complete application or on the effective date identified within a permit coverage letter issued by the MPCA. For incomplete applications (e.g. lack of fees or signature) or incomplete **SWPPPs** (e.g. missing calculations, **Best Management Practice (BMP)** specifications or timing of **BMP** installation narrative), the 30 calendar day review period begins on the date that all required information is submitted.

c. For proposals to use Alternative Method(s) for the Permanent Stormwater Management System under Part III.C.5, the applicants must submit a complete application and **SWPPP**, including the Alternative Method documentation under Part III.C.5, to MPCA for review and approval at least 90 days prior to the proposed starting date of **construction activity**.

    i. The MPCA will notify the applicant within the 90-day period, in writing, whether the alternative method is approved or not approved and, if applicable, the basis for denial.

    ii. The applicant may re-submit the alternative method after addressing the MPCA's basis for denial. The MPCA will respond within 30 days.

    iii. Permit coverage will become effective upon receipt of an alternative treatment method approval letter from MPCA. Any **construction activity** on the project is not covered under this permit until receiving the alternative treatment approval letter.

d. Except as provided in parts 3.b. and 3.c., for, projects that apply online, permit coverage will become effective two (2) calendar days after the online application process is complete.

4. Coverage Letter. For projects under subpart 3.a. of this part, the **Permittee(s)** will receive a permit letter and certificate acknowledging permit coverage, usually within 30 days of the postmarked date of the complete application.

5. Change of Coverage. For construction projects where the **owner** or **operator** changes, (e.g., an original developer sells portions of the property to various homebuilders or sells the entire site to a new owner):

    a. The original/current **owner** shall provide a copy of the complete notice of termination/permit modification form (as required in Part II.C.2.b) to the new **owner**. The original/current **owner** shall provide a **SWPPP** to the new **owner** and **operator** that specifically addresses the remaining **construction activity**. Note: The notice of termination/permit modification form replaces the subdivision registration, permit transfer/modification and notice of termination forms.

    b. The new **owner** or **operator** shall submit a complete and signed permit modification portion (permit modifications include subdivision registration or permit transfer) of the notice of termination/permit modification form to the MPCA prior to commencing **construction activity** on site or in no case later than seven (7) days after taking ownership of the property. The new **Permittee(s)** are responsible for compliance with all terms and conditions of this permit as described in Part II.B.2.

c. If an **operator** or **general contractor** has completed their portion of work on the site, is no longer in operational control of the project, and all contractual obligations between the **owner** and **operator** or **general contractor** relating to compliance with the terms and conditions of this permit have been met, the **operator** or **general contractor**, may transfer permit coverage back to the **owner** or to a new **operator** using the notice of termination/permit modification form. A signature from both the owner and operator is required.

C. TERMINATION OF COVERAGE

1. **Permittee(s)** wishing to terminate coverage under this permit must submit a **Notice of Termination (NOT)** to the MPCA. Compliance with this permit is required until a **NOT** is submitted. The **Permittee(s)** coverage under this permit terminates at midnight on the postmark date of the **NOT**, or on the date an online **NOT** is submitted to the MPCA.

2. Termination of coverage scenarios:

   a. Termination of coverage for the entire project.

      i. All **Permittee(s)** must submit a **NOT** within 30 days after **Final Stabilization** (see Part IV.G.) has been completed on all portions of the site for which the **Permittee** is responsible and all **construction activity** has been completed. If the site includes permanent stormwater management systems, the requirements for final cleanout/maintenance must be performed as required in **Final Stabilization**, Part IV.G.2.

      ii. **Permittee(s)** must submit a **NOT** within 30 days after selling the entire site including roads and stormwater infrastructure, and coverage is transferred to another owner as described in Part II.B.5.

   b. Termination of coverage for a portion of the entire project.

      All **Permittee(s)** must submit a **NOT** within seven (7) days after selling or otherwise legally transferring portions of the site to another party and they are no longer the **owner** or **operator**. The portions of the site being sold to another party must be in compliance with the permit (e.g. all **temporary erosion protection** and **sediment control** measures must be in place). The form must include signatures from the original **Permittee(s)** and contact information for the new **owner** of the property.

   c. Termination of coverage obtained using a subdivision registration.

      If permit coverage was obtained using the subdivision registration process, **Permittee(s)** are required to submit a **NOT** within 30 days after achieving **Final Stabilization** (see Part IV.G.).

3. **Permittee(s)** that use an alternative method for the Permanent **Stormwater** Management System as described in Part III.C.5, are prohibited from terminating this permit until **Final Stabilization** has been achieved on site and either:

a. The two years of monitoring data required in Part III.C.5 has been submitted to the MPCA and the MPCA has determined that the required treatment has been achieved. The **Permittee** will be notified in writing within 30 days after the monitoring data has been submitted. If the **Permittee** has not heard from the MPCA within 30 days after submitting the required data, the Permittee can submit a **NOT**.

b. The Permittee can submit a **NOT**, even if the timeframe is less than two years, if the MPCA determines that the alternative method is achieving the required treatment.

During the monitoring and evaluation of the alternative method, the **Permittee** is not responsible for other permit requirements that have been transferred as described in Part II.B.5.

PART III. STORMWATER DISCHARGE DESIGN REQUIREMENTS

A. STORM WATER POLLUTION PREVENTION PLAN

The **owner** must develop a Storm Water Pollution Prevention Plan (**SWPPP).** The **SWPPP** shall be completed prior to submitting any permit application and prior to conducting any **construction activity** by any required **Permittee(s)**. The plan must be a combination of narrative, plan sheets and if appropriate standard detail sheets that address the foreseeable conditions, at any stage in the construction or post construction activities. The plan must include a description of the nature of the **construction activity**. The plan must address the potential for discharge of sediment and/or other potential pollutants from the site. For **stormwater** discharges from **construction activity** where the **owner** or **operator** changes, the new **owner** or **operator** can implement the original **SWPPP** created for the project, modify the original SWPPP, or develop and implement their own **SWPPP**. **Permittee(s)** shall ensure either directly or through coordination with other **Permittee(s)** that their **SWPPP** meets all terms and conditions of this permit and that their activities do not render another party’s **erosion prevention** and **sediment control BMPs** ineffective.

1. As part of the **SWPPP** the **owner** must identify a person knowledgeable and experienced in the application of **erosion prevention** and **sediment control BMPs** who will oversee the implementation of the **SWPPP**, and the installation, inspection and maintenance of the **erosion prevention** and **sediment control BMPs** before and during construction. The **owner** must identify who will have the responsibility for long term operation and maintenance of the Permanent **Stormwater** Management System (see Part III.C.). The **owner** shall develop a chain of responsibility with all **operators** on the site to ensure that the **SWPPP** will be implemented and stay in effect until the construction project is complete, the entire site has undergone **Final Stabilization**, and a **NOT** has been submitted to the MPCA.

2. Training requirements. **Permittee(s)** must comply with these training requirements no later than 18 months after the issuance date of this permit. The **Permittee(s)** shall ensure the individuals identified in this part have been trained in accordance with this Permit’s training requirements. The **Permittee(s)** shall ensure the training is recorded in or with the **SWPPP** before the start of construction or as soon as the personnel for the project have been determined.

   a. Who must be trained:

      i. Individual(s) preparing the **SWPPP** for the project.

      ii. Individual(s) overseeing implementation of, revising, and amending the **SWPPP** and individual(s) performing inspections as required in Part IV.E. One of these individual(s) must be available for an on site inspection within 72 hours upon request by the MPCA.

        iii. Individual(s) performing or supervising the installation, maintenance and repair of **BMPs**. At least one individual on a project must be trained in these job duties.

    b. Training content. The content and extent of training must be commensurate with the individual's job duties and responsibilities with regard to activities covered under this permit for the project. At least one individual present on the permitted project site (or available to the project site in 72 hours) must be trained in the job duties described in Part III.A.2.a.ii and Part III.A.2.a.iii.

    c. Training documentation.

        i. Documentation must be in or with the **SWPPP** or be available within 72 hours upon request.

        ii. Names of the personnel associated with this project that are required to be trained per Part III.A.2.a. of this permit.

        iii. Dates of training and name of instructor(s) and entity providing training.

        iv. Content of training course or workshop (including number of hours of training).

    d. The **Permittee(s)** shall ensure that the individuals are trained by local, state, federal agencies, professional organizations, or other entities with expertise in **erosion prevention**, **sediment control** or permanent **stormwater** management such as the University of Minnesota, Minnesota Erosion Control Association, Soil and Water Conservation Districts or the MPCA.

3. The **SWPPP** must incorporate the requirements of Part III (Stormwater Discharge Design Requirements), Part IV (Construction Activity Requirements) and Appendix A for the project. A narrative describing the timing for installation of all **erosion prevention** and **sediment control BMPs** required in Part III, Part IV and Appendix A must also be included in the **SWPPP**.

4. The **SWPPP** requirements must be incorporated into the project's final plans and specifications and/or project documentation, as appropriate, and must include:

    a. Location and type of all temporary and permanent **erosion prevention** and **sediment control BMPs** along with procedures to be used to establish additional temporary **BMPs** as necessary for the site conditions during construction. **Standard plates** and/or specifications for the **BMPs** used on the project must be included in the final plans and specifications for the project.

    b. Estimated preliminary quantities tabulation anticipated at the start of the project for the life of the project must be included for all **erosion prevention** and **sediment control BMPs** in the **SWPPP**.

    c. The **SWPPP** must include the number of acres of impervious surface for both pre- and post-construction.

   d. A site map with existing and final grades, including dividing lines and direction of flow for all pre-and post-construction **stormwater** runoff drainage areas located within the project limits. The site map must also include **impervious surfaces** and soil types.

   e. Locations of areas not to be disturbed. Buffer zones, if required in Appendix A. Part C.3, must be described and identified on plan sheets or project maps in the **SWPPP**.

   f. Location of areas where construction will be phased to minimize duration of exposed soil areas.

   g. All **surface waters** and existing **wetlands**, which can be identified on maps such as United States Geological Survey 7.5 minute quadrangle maps or equivalent maps within one mile from the project boundaries, which will receive **stormwater** runoff from the construction site, during or after construction. Where **surface waters** receiving runoff associated with **construction activity** will not fit on the plan sheet, they must be identified with an arrow, indicating both direction and distance to the **surface water**. The **SWPPP** must identify if the **surface water** is a special or impaired water.

   h. Methods to be used for **Final Stabilization** of all exposed soil areas.

5. The **Permittee(s)** must amend the **SWPPP** as necessary to include additional requirements, such as additional or modified **BMPs**, designed to correct problems identified or address situations whenever:

   a. There is a change in design, construction, operation, maintenance, weather or seasonal conditions that has a significant effect on the discharge of pollutants to **surface waters** or **underground waters**;

   b. Inspections or investigations by site **operators**, local, state or federal officials indicate the **SWPPP** is not effective in eliminating or significantly minimizing the discharge of pollutants to **surface waters** or **underground waters** or that the discharges are causing water quality standard exceedances (e.g. nuisance conditions as defined in Minn. R. 7050.0210, subp. 2); or

   c. The **SWPPP** is not achieving the general objectives of minimizing pollutants in **stormwater** discharges associated with **construction activity**, or the **SWPPP** is not consistent with the terms and conditions of this permit.

   d. At any time after permit coverage is effective, the MPCA may determine that the project's **stormwater** discharges may cause, have reasonable potential to cause, or contribute to non-attainment of any applicable water quality standard, or that the **SWPPP** does not incorporate the applicable requirements in Part III.A.9, Discharges to Impaired Waters and TMDLs. If MPCA makes such determination(s) or any of the determinations in Parts III.A.5.a.-.c., MPCA will notify the **Permittee(s)** in writing. In response, the **Permittee(s)** must develop a supplemental **BMP** action plan or appropriate **SWPPP** amendments describing **SWPPP** modifications to address the identified concerns and submit information requested by MPCA, which may include an individual permit application. If MPCA's written notification requires a response, failure to respond within the specified timeframe constitutes a permit violation.

6. The **SWPPP** must factor in any findings of and include any **stormwater** mitigation measures required as the result of any environmental, archeological or other required local, state or federal review conducted for the project. For the purposes of this permit provision, mitigation measures mean avoiding, minimizing, rectifying (e.g., repairing, rehabilitating, restoring), reducing, eliminating or compensating for impacts related to: (1) **stormwater** discharges associated with the project's **construction activity**; and (2) **erosion prevention**, **sediment control** and the Permanent **Stormwater** Management System for the project.

7. The **SWPPP** must provide additional measures as necessary to assure compliance with **surface and ground water** standards in Minn. R. chs. 7050 and 7060 in karst areas and to ensure protection of drinking water supply management areas (see Minn. R. 4725.4450).

8. If runoff from the site discharges to a calcareous fen listed in Minn. R. 7050.0180, subp. 6b, and a letter of approval from the Minnesota Department of Natural Resources (DNR) has been obtained, this must be documented in the **SWPPP** for the project. Any additional **stormwater** mitigation measures contained in the DNR approval letter must be incorporated into the **SWPPP** for the project. If the DNR does not respond to the request for a letter of approval within 30 calendar days, this must be documented in the SWPPP for the project.

9. <u>Discharges to Impaired Waters and TMDLs</u>

   This part describes the requirements for projects that have a discharge point on the project that is within one mile of, and flows to, an impaired water that is identified on the most recent USEPA approved list of impaired waters. Impaired waters for the purposes of this permit are those waters identified as impaired pursuant to section 303(d) of the Clean Water Act where the identified pollutant(s) or stressor(s) are phosphorus (nutrient eutrophication biological indicators), turbidity, dissolved oxygen, or biotic impairment (fish bioassessment, aquatic plant bioassessment and aquatic macroinvertebrate bioassessment), and a TMDL is either required, or complete and USEPA approved, for any of the identified pollutant(s) or stressor(s).

   a. <u>Requirements for Discharges to Impaired Waters</u>

      For projects that have a discharge point on the project that is within one mile of, and flows to, an impaired water, the **Permittee(s)** must identify the impaired water(s) in the **SWPPP**, and whether there is a USEPA approved TMDL for the pollutant(s) or stressor(s) identified in this part. Unless otherwise notified by the MPCA in writing, the **Permittee(s)** identification of impaired waters must be based on the most recent USEPA approved section 303(d) Clean Water Act list of impaired waters and USEPA approved TMDLs at the time a complete permit application is submitted. The **Permittee(s)** identification must include those TMDLs applicable to the project's **stormwater** discharge that were approved at any time prior to permit application submittal and are still in effect.

   b. <u>Impaired Water Without an Approved TMDL or With an Approved TMDL and No Waste Load Allocation</u>

      If runoff from the site discharges to an impaired water, and a TMDL has not been approved by USEPA or there is a USEPA approved TMDL that does not establish a Waste Load Allocation (WLA) for construction **stormwater**, the **Permittee(s)** must incorporate into their **SWPPP**, and implement, the additional **BMPs** in Appendix A, Part C.1 and C.2.

c. Impaired Water With an Approved TMDL and WLA

If runoff from the site discharges to an impaired water for which there is a USEPA approved TMDL that establishes a WLA for construction **stormwater**, and the TMDL does not identify any specific implementation activities that would apply to the site discharges, the **Permittee(s)** must incorporate into their **SWPPP**, and implement, the additional BMPs in Appendix A, Part C.1 and C.2. If the TMDL identifies specific implementation activities regarding construction stormwater that would apply to the site discharges, the Permittee(s) must include the following in the **SWPPP**:

i. Identify the receiving water, the areas of the site discharging to it, and the pollutant(s) identified in the TMDL; and

ii. **BMPs** identified in the TMDL and any other specific construction stormwater related implementation activities identified in the TMDL.

B. TEMPORARY SEDIMENT BASINS

Where ten (10) or more acres of disturbed soil drain to a common location, a temporary (or permanent) sediment basin must be provided prior to the runoff leaving the construction site or entering **surface waters**. The **Permittee** is encouraged, but not required, to install temporary sediment basins where appropriate in areas with steep slopes or highly erodible soils even if less than ten (10) acres drains to one area. The basins must be designed and constructed according to the following requirements:

1. The basins must provide storage below the outlet pipe for a calculated volume of runoff from a two (2) year, 24 hour storm from each acre drained to the basin, except that in no case shall the basin provide less than 1800 cubic feet of storage below the outlet pipe from each acre drained to the basin.

2. Where no such calculation has been performed, a temporary (or permanent) sediment basin providing 3,600 cubic feet of storage below the outlet pipe per acre drained to the basin, shall be provided where attainable until **permanent cover** is established for the entire drainage area of the temporary basin.

3. Temporary basin outlets must be designed to prevent short-circuiting and the discharge of floating debris. The basin must be designed with the ability to allow complete basin drawdown (e.g., perforated riser pipe wrapped with filter fabric and covered with crushed gravel, pumps or other means, see Part IV.D.) for maintenance activities, and provide a **stabilized** emergency overflow to prevent failure of pond integrity. **Energy dissipation** must be provided for the basin outlet (see Part IV.B.4).

4. The temporary (or permanent) basins must be constructed and made operational concurrent with the start of soil disturbance that is upgradient of the area and contributes runoff to the pond.

5. Where the temporary sediment basin is not attainable due to site limitations, equivalent **sediment controls** such as smaller sediment basins, and/or sediment traps, silt fences, vegetative buffer strips, or any appropriate combination of measures are required for all down slope boundaries of the construction area and for those side slope boundaries deemed appropriate as dictated by

individual site conditions. In determining whether installing a sediment basin is attainable, the **Permittee** must consider public safety and may consider factors such as site soils, slope, and available area on site. This determination must be documented in the **SWPPP**.

C. PERMANENT STORMWATER MANAGEMENT SYSTEM

All **stormwater** must be discharged in a manner that does not cause nuisance conditions, erosion in receiving channels or on downslope properties, or inundation in **wetlands** causing a significant adverse impact to the **wetlands**.

Where a project's ultimate development replaces vegetation and/or other pervious surfaces with one or more acres of cumulative **impervious surface**, a **water quality volume** of ½ inch of runoff from the new **impervious surfaces** created by the project must be treated by one of the methods outlined in Part III.C.1 through Part III.C.5 prior to the runoff leaving the construction site or entering **surface waters** (excluding man made drainage systems that convey **stormwater** to a constructed permanent **stormwater** management facility designed to treat the **water quality volume** from the project).

For those areas of a project where there is no feasible way to meet the treatment requirement for the **water quality volume**, other treatment such as grassed swales, smaller ponds or grit chambers is required prior to discharge to **surface waters**. A cumulative maximum of three (3) acres or 1% of project size whichever is larger can be treated in this manner.

Where the proximity to bedrock precludes the installation of any of the permanent **stormwater** management practices outlined in Part III.C., other treatment, such as grassed swales, smaller ponds, or grit chambers, is required prior to discharge to **surface waters**.

For work on linear projects where the lack of right of way precludes the installation of any of the permanent **stormwater** management practices outlined in Part III.C., other treatment such as grassed swales, smaller ponds, or grit chambers, is required prior to discharge to **surface waters**. A reasonable attempt must be made to obtain right of way during the project planning process. Documentation of these attempts must be in the **SWPPP** for the project or made available upon request within 72 hours.

1. Wet Sedimentation Basin

    a. The basin must have a permanent volume of 1800 cubic feet of storage below the outlet pipe for each acre that drains to the basin. The basin's permanent volume must reach a minimum depth of at least 3 feet and must have no depth greater than 10 feet. The basin must be configured such that scour or resuspension of solids is minimized.

    b. The basin's **water quality volume** is calculated as ½ inch of runoff from the new **impervious surfaces** created by the project.

    c. Basin outlets shall be designed such that the **water quality volume** is discharged at no more than 5.66 cubic feet per second (cfs) per acre of surface area of the pond.

    d. Basin outlets must be designed to prevent short-circuiting and the discharge of floating debris. Basin outlets must have **energy dissipation**.

e. The basin must provide a **stabilized** emergency overflow to accommodate storm events in excess of the basin's hydraulic design.

f. Adequate maintenance access must be provided (typically 8 ft. wide) along with a maintenance plan identifying whom will be performing future maintenance of the basin.

2. Infiltration/Filtration

Infiltration/Filtration options include but are not limited to: infiltration basins, infiltration trenches, rainwater gardens, sand filters, organic filters, bioretention areas, enhanced swales, dry storage ponds with underdrain discharge, off-line retention areas, and natural depressions. Infiltration must be used only as appropriate to the site and land uses. Settleable solids, floating materials, oils and grease should be removed from the runoff to the maximum extent practicable before runoff enters the infiltration/filtration system. Filtration systems must have a reasonable chance of achieving approximately 80% removal of total suspended solids. The **Permittee(s)** must evaluate the impact of constructing an infiltration practice on existing hydrologic features (e.g., existing **wetlands**) and try to maintain pre-existing conditions (e.g., do not breach a perched water table which is supporting a **wetland**). For a discussion of potential stormwater hotspots, ground water warnings, design measures, maintenance considerations or other retention, detention, and treatment devices, see the **Minnesota Stormwater Manual** or MPCA's **Protecting Water Quality in Urban Areas** found on the MPCA's web-site.

a. Infiltration systems should not be excavated to final grade until the contributing drainage area has been constructed and fully **stabilized**.

b. During construction of an infiltration system, rigorous **erosion prevention** and **sediment controls** (e.g., diversion berms) should be used to keep sediment and runoff completely away from the infiltration area. The area must be staked off and marked so that heavy construction equipment will not compact the soil in the proposed infiltration area.

c. To prevent clogging of the infiltration or filtration system, a pretreatment device such as a vegetated filter strip, small sedimentation basin, or water quality inlet (e.g., grit chamber) must be used to settle particulates before the **storm water** discharges into the infiltration or filtration system.

d. Infiltration or filtration systems shall be sufficient to infiltrate or filter a **water quality volume** of ½ inch of runoff from the new **impervious surfaces** created by the project.

e. The **water quality volume** shall discharge through the soil surface or filter media in 48 hours or less. Additional flows that cannot be infiltrated or filtered in 48 hours should be routed to bypass the system through a **stabilized** discharge point. A way to visually verify that the system is operating as designed must be provided.

f. Appropriate on-site testing consistent with the recommendations found in the **Minnesota Stormwater Manual** shall be conducted to ensure a minimum of 3 feet of separation from the seasonally **saturated soils** (or from bedrock) and the bottom of the proposed infiltration system. Calculations or computer model results that demonstrate the design adequacy of the infiltration system must be included as part of the **SWPPP**.

g. Adequate maintenance access must be provided (typically 8 ft. wide) along with a maintenance plan identifying whom will be performing future maintenance of the infiltration or filtration system.

h. Use of designed infiltration systems receiving runoff from vehicle fueling and maintenance areas is prohibited.

3. Regional Ponds

Regional ponds can be used provided that they are constructed ponds, not a natural **wetland** or water body, (**wetlands** used as regional ponds must be mitigated for, see Appendix A) and designed in accordance with this permit's design requirements (see Part III.C.1) for all water from **impervious surfaces** that reach the pond. **Permittee(s)** shall not construct regional ponds in **wetlands**, regardless of their condition, quality or designation by local plans, unless the mitigative sequence in Appendix A. D. of this permit has been completed. There must be no significant degradation of the waterways between the project and the regional pond. The **owner** must obtain written authorization from the applicable local governmental unit (LGU) or private entity that owns and maintains the regional pond. The LGU's or private entity's written authorization must identify that the regional pond will discharge the **water quality volume** (½ inch of runoff from the impervious watershed area) at no more than 5.66 cfs per acre of surface area of the pond. The **owner** must include the LGU's or private entities' written authorization in the **SWPPP**. The LGU's or private entity's written authorization must be obtained before the **owner** finalizes the **SWPPP** and before any application for this permit is made to the MPCA.

4. Combination of Practices

A combination of practices, including those required by a LGU, which meet the requirements of Part III.C.1, 2 and 3 respectively, (i.e., wet sedimentation basins, infiltration/filtration, and regional ponds) may be used such that the **water quality volume** of ½ inch of runoff from the new **impervious surfaces** created by the project is accounted for in the **owner's** permanent **storm water** management system (e.g., ¼ inch infiltrated and ¼ inch treated through a wet sedimentation basin). If any combination of these practices is used, the **SWPPP** must contain documentation (e.g., LGU or private entity's authorization, infiltration computer model results or calculations, etc.) identifying the volume that each practice addresses.

5. Alternative Method

Where an alternative, innovative treatment system is proposed and demonstrated by calculation, design or other independent methods to achieve approximately 80% removal of total suspended solids on an annual average basis, the **Commissioner** will approve the method if the process outlined in Part II.B.3.c. is completed, and the following information is submitted:

a. All calculations, drainage areas, plans, and specifications for the proposed alternative method and a graphic representation of the area to be served by the method. These items must be included in the **SWPPP** and submitted to the MPCA at least 90 days prior to the proposed starting date of the **construction activity**.

b. A two (2) year monitoring plan to sample runoff from the proposed method. The plan must include a discussion of the methods used to collect samples, location where samples will be taken (upstream and downstream of the proposed method), frequency of samples (minimum of six runoff events sampled), identify lab used to analyze the samples and quality assurance and quality control methods to be used. The plan must include a schedule for submitting the monitoring data annually.

c. A mitigation plan that addresses how the **water quality volume** will be treated in the event that the monitoring data shows the proposed alternative treatment method does not function as designed.

d. The alternative method must achieve approximately 80% removal of total suspended solids on an average annual basis for the conditions expected at the site. The design must also consider public safety, health and water quality concerns. Proprietary information on effectiveness will not be considered for alternative treatment method review and approval.

No **construction activity** on the project is covered under this permit until the applicant receives an alternative treatment approval letter from the MPCA as described in Part II.B.3.c.

D. RECORD RETENTION

The **SWPPP** (original or copies) including, all changes to it, and inspections and maintenance records must be kept at the site during construction by the **Permittee** who has operational control of that portion of the site. The **SWPPP** can be kept in either the field office or in an on site vehicle during normal working hours.

All **owner(s)** must keep the **SWPPP**, along with the following additional records, on file for three (3) years after submittal of the **NOT** as outlined in Part II.C. This does not include any records after submittal of the **NOT**.

1. Any other permits required for the project;

2. Records of all inspection and maintenance conducted during construction (see Part IV.E. Inspections and Maintenance);

3. All permanent operation and maintenance agreements that have been implemented, including all right of way, contracts, covenants and other binding requirements regarding perpetual maintenance; and

4. All required calculations for design of the temporary and Permanent **Stormwater** Management Systems.

PART IV. CONSTRUCTION ACTIVITY REQUIREMENTS

A. STORM WATER POLLUTION PREVENTION PLAN

The **Permittee(s)** must implement the **SWPPP** and the requirements of this part. The **BMPs** identified in the **SWPPP** and in this permit must be selected, installed, and maintained in an appropriate and functional manner that is in accordance with relevant manufacturer specifications and accepted engineering practices.

B. EROSION PREVENTION PRACTICES

1. The **Permittee(s)** must plan for and implement appropriate construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices that minimize erosion, so that the inspection and maintenance requirements of Part IV.E. are complied with. The location of areas not to be disturbed must be delineated (e.g. with flags, stakes, signs, silt fence etc.) on the development site before work begins.

2. All exposed soil areas must be **stabilized** as soon as possible to limit soil erosion but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. Temporary stockpiles without significant silt, clay or organic components (e.g., clean aggregate stockpiles, demolition concrete stockpiles, sand stockpiles) and the constructed base components of roads, parking lots and similar surfaces are exempt from this requirement but must comply with Part IV.C.5.

3. The **normal wetted perimeter** of any temporary or permanent drainage ditch or swale that drains water from any portion of the construction site, or diverts water around the site, must be **stabilized** within 200 lineal feet from the property edge, or from the point of discharge into any **surface water**. Stabilization of the last 200 lineal feet must be completed within 24 hours after connecting to a **surface water**.

   Stabilization of the remaining portions of any temporary or permanent ditches or swales must be complete within 14 days after connecting to a **surface** water and construction in that portion of the ditch has temporarily or permanently ceased.

   Temporary or permanent ditches or swales that are being used as a sediment containment system (with properly designed rock ditch checks, bio rolls, silt dikes etc.) do not need to be **stabilized**. These areas must be **stabilized** within 24 hours after no longer being used as a sediment containment system.

4. Pipe outlets must be provided with temporary or permanent **energy dissipation** within 24 hours after connection to a **surface water**.

C. SEDIMENT CONTROL PRACTICES

1. **Sediment control** practices must minimize sediment from entering **surface waters**, including curb and gutter systems and storm sewer inlets.

   a. Temporary or permanent drainage ditches and sediment basins that are designed as part of a sediment containment system (e.g., ditches with rock check dams) require **sediment control** practices only as appropriate for site conditions.

   b. If the down gradient treatment system is overloaded, additional upgradient **sediment control** practices or redundant BMPs must be installed to eliminate the overloading, and the **SWPPP** must be amended to identify these additional practices as required in Part III.A.4, a. through c.

   c. In order to maintain sheet flow and minimize rills and/or gullies, there shall be no unbroken slope length of greater than 75 feet for slopes with a grade of 3:1 or steeper.

2. **Sediment control** practices must be established on all down gradient perimeters before any upgradient land disturbing activities begin. These practices shall remain in place until **Final Stabilization** has been established in accordance with Part IV.G.

3. The timing of the installation of **sediment control** practices may be adjusted to accommodate short-term activities such as clearing or grubbing, or passage of vehicles. Any short-term activity must be completed as quickly as possible and the **sediment control** practices must be installed immediately after the activity is completed. However, **sediment control** practices must be installed before the next precipitation event even if the activity is not complete.

4. All storm drain inlets must be protected by appropriate **BMPs** during construction until all sources with potential for discharging to the inlet have been **stabilized**. Inlet protection may be removed for a particular inlet if a specific safety concern (street flooding/freezing) has been identified and the **Permittee(s)** have received written correspondence from the jurisdictional authority (e.g. city/county/township/MnDOT engineer) verifying the need for removal. The written correspondence must be documented in the **SWPPP** or available within 72 hours upon request. When written correspondence can not be obtained in a timely manner, the specific inlet protection can be removed to alleviate the immediate safety concern. However, efforts to obtain written correspondence must be documented in the SWPPP and available within 72 hours upon request. Permission to remove inlet protection based on a specific safety concern must still be obtained from the jurisdictional authority within 30 days of removal.

5. Temporary soil stockpiles must have silt fence or other effective **sediment controls**, and cannot be placed in **surface waters**, including **stormwater** conveyances such as curb and gutter systems, or conduits and ditches unless there is a bypass in place for the stormwater**.**

6. Vehicle tracking of sediment from the construction site (or onto streets within the site) must be minimized by **BMPs** such as stone pads, concrete or steel wash racks, or equivalent systems. Street sweeping must be used if such **BMPs** are not adequate to prevent sediment from being tracked onto the street (see Part IV.E.4.d.).

7. The **Permittee** must install temporary sedimentation basins as required in Part III.B. of this permit.

D. DEWATERING AND BASIN DRAINING

1. **Dewatering** or basin draining (e.g., pumped discharges, trench/ditch cuts for drainage) related to the **construction activity** that may have turbid or sediment laden discharge water must be discharged to a temporary or permanent sedimentation basin on the project site whenever possible. Discharge from the temporary or permanent sedimentation basin must be visually checked to ensure adequate treatment is obtained in the basin and that nuisance conditions (see Minn. R. 7050.0210, subp. 2) will not result from the discharge. If the water cannot be discharged to a sedimentation basin prior to entering the **surface water**, it must be treated with the appropriate **BMPs**, such that the discharge does not adversely affect the receiving water or downstream landowners. The **Permittee(s)** must ensure that discharge points are adequately protected from erosion and scour. The discharge must be dispersed over natural rock riprap, sand bags, plastic sheeting, or other accepted **energy dissipation** measures. Adequate sedimentation control measures are required for discharge water that contains suspended solids.

2. All water from **dewatering** or basin draining activities must be discharged in a manner that does not cause nuisance conditions, erosion in receiving channels or on downslope properties, or inundation in **wetlands** causing significant adverse impact to the **wetland.**

E. INSPECTIONS AND MAINTENANCE

1. The **Permittee(s)** (either the **owner** or **operator**, whoever is identified in the **SWPPP**) must routinely inspect the entire construction site at least once every seven (7) days during active construction and within 24 hours after a rainfall event greater than 0.5 inches in 24 hours. Following an inspection which occurs within 24 hours after a rainfall event, the next inspection must be conducted within seven (7) days after that.

2. All inspections and maintenance conducted during construction must be recorded in writing and these records must be retained with the **SWPPP** in accordance with Part III.D. Records of each inspection and maintenance activity shall include:

   a. Date and time of inspections;

   b. Name of person(s) conducting inspections;

   c. Findings of inspections, including recommendations for corrective actions;

   d. Corrective actions taken (including dates, times, and party completing maintenance activities);

   e. Date and amount of all rainfall events greater than 1/2 inch (0.5 inches) in 24 hours;

   f. Documentation of changes made to the **SWPPP** as required in Part III.A.4; and

3. Where parts of the construction site have **permanent cover**, but work remains on other parts of the site, inspections of the areas with **permanent cover** may be reduced to once per month. Where construction sites have **permanent cover** on all exposed soil areas and no construction activity is occurring anywhere on the site, the site must be inspected for a period of twelve (12) months (the inspections may be ceased during frozen ground conditions). Following the twelfth month of **permanent cover** and no **construction activity**, inspections may be terminated until construction activity is once again initiated or sooner if notified in writing by the MPCA. Where work has been suspended due to frozen ground conditions, the required inspections and maintenance schedule must begin within 24 hours after runoff occurs at the site or prior to resuming construction, whichever comes first.

4. All **erosion prevention** and **sediment control BMPs** must be inspected to ensure integrity and effectiveness. All nonfunctional **BMPs** must be repaired, replaced, or supplemented with functional **BMPs** within 24 hours after discovery, or as soon as field conditions allow access unless another time frame is specified below. The **Permittee(s)** must investigate and comply with the following inspection and maintenance requirements:

   a. All silt fences must be repaired, replaced, or supplemented when they become nonfunctional or the sediment reaches 1/3 of the height of the fence. These repairs must be made within 24 hours of discovery, or as soon as field conditions allow access.

   b. Temporary and permanent sedimentation basins must be drained and the sediment removed when the depth of sediment collected in the basin reaches 1/2 the storage volume. Drainage and removal must be completed within 72 hours of discovery, or as soon as field conditions allow access (see Part IV.D.).

   c. **Surface waters**, including drainage ditches and conveyance systems, must be inspected for evidence of erosion and sediment deposition. The **Permittee(s)** must remove all deltas and sediment deposited in **surface waters**, including drainage ways, catch basins, and other drainage systems, and restabilize the areas where sediment removal results in exposed soil. The removal and stabilization must take place within seven (7) days of discovery unless precluded by legal, regulatory, or physical access constraints. The **Permittee** shall use all reasonable efforts to obtain access. If precluded, removal and stabilization must take place within seven (7) calendar days of obtaining access. The **Permittee** is responsible for contacting all local, regional, state and federal authorities and receiving any applicable permits, prior to conducting any work.

d. Construction site vehicle exit locations must be inspected for evidence of off-site sediment tracking onto paved surfaces. Tracked sediment must be removed from all paved surfaces, within 24 hours of discovery, or if applicable, within a shorter time to comply with Part IV.C.6.

e. The **Permittee(s)** are responsible for the operation and maintenance of temporary and permanent water quality management **BMPs**, as well as all **erosion prevention** and **sediment control BMPs**, for the duration of the construction work at the site. The **Permittee(s)** are responsible until another **Permittee** has assumed control according to Part II.B.5 over all areas of the site that have not been finally **stabilized** or the site has undergone **Final Stabilization**, and a **NOT** has been submitted to the MPCA.

f. If sediment escapes the construction site, off-site accumulations of sediment must be removed in a manner and at a frequency sufficient to minimize off-site impacts (e.g., fugitive sediment in streets could be washed into storm sewers by the next rain and/or pose a safety hazard to users of public streets).

5. All infiltration areas must be inspected to ensure that no sediment from ongoing **construction activity** is reaching the infiltration area and these areas are protected from compaction due to construction equipment driving across the infiltration area.

F. POLLUTION PREVENTION MANAGEMENT MEASURES

The **Permittee(s)** shall implement the following pollution prevention management measures on the site:

1. Solid Waste: Collected sediment, asphalt and concrete millings, floating debris, paper, plastic, fabric, construction and demolition debris and other wastes must be disposed of properly and must comply with MPCA disposal requirements.

2. Hazardous Materials: Oil, gasoline, paint and any hazardous substances must be properly stored, including secondary containment, to prevent spills, leaks or other discharge. Restricted access to storage areas must be provided to prevent vandalism. Storage and disposal of hazardous waste must be in compliance with MPCA regulations.
3. External washing of trucks and other construction vehicles must be limited to a defined area of the site. Runoff must be contained and waste properly disposed of. No engine degreasing is allowed on site.

4. Concrete washout onsite: All liquid and solid wastes generated by concrete washout operations must be contained in a leak-proof containment facility or impermeable liner. A compacted clay liner that does not allow washout liquids to enter ground water is considered an impermeable liner. The liquid and solid wastes must not contact the ground, and there must not be runoff from the concrete washout operations or areas. Liquid and solid wastes must be disposed of properly and in compliance with MPCA regulations. A sign must be installed adjacent to each washout facility to inform concrete equipment operators to utilize the proper facilities.

G. FINAL STABILIZATION

The **Permittee(s)** must ensure **Final Stabilization** of the site. **Final Stabilization** requires all of Parts IV.G.1-5 or Part IV.G.6:

1. **Final Stabilization** requires that all soil disturbing activities at the site have been completed and all soils must be **stabilized** by a uniform perennial vegetative cover with a density of 70% over the entire pervious surface area, or other equivalent means necessary to prevent soil failure under erosive conditions.

2. The **Permittee(s)** must ensure that the permanent **stormwater** treatment system meets all requirements in Part III, C. This includes but is not limited to, a final clean out of temporary or permanent sedimentation basins that are to be used as permanent water quality management basins and final construction or maintenance of infiltration basins. All sediment must be removed from conveyance systems and ditches must be **stabilized** with **permanent cover**.

3. Prior to submission of the **NOT**, all temporary synthetic and structural **erosion prevention** and **sediment control BMPs** (such as silt fence) must be removed on the portions of the site for which the **Permittee** is responsible. **BMPs** designed to decompose on site (such as some compost logs) may be left in place.

4. For residential construction only, individual lots are considered finally **stabilized** if the structure(s) are finished & **temporary erosion protection** and downgradient perimeter control has been completed and the residence has been sold to the homeowner. Additionally, the **Permittee** must distribute the MPCA's "**Homeowner Fact Sheet"** to the homeowner to inform the homeowner of the need for, and benefits of, **permanent cover**.

5. For construction projects on land used for agricultural purposes (e.g., pipelines across crop or range land) **Final Stabilization** may be accomplished by returning the disturbed land to its preconstruction agricultural use.

6. A **Permittee** may terminate permit coverage prior to completion of all **construction activity** if all of the following conditions are met in addition to Part IV.G.2 through Part IV.G.3 and where applicable, Part IV.G.4 or Part IV.G.5.

    a. **Construction activity** has ceased for at least 90 days.

    b. At least 90% (by area) of all originally proposed **construction activity** has been completed and **permanent cover** established on those areas.

    c. On areas where **construction activity** is not complete, **permanent cover** has been established.

PART V. GENERAL PROVISIONS

A. APPLICABILITY CRITERIA

1. If the **Commissioner** determines that **stormwater** discharges associated with a **construction activity** are contributing to a violation of a water quality standard or would be more appropriately regulated by an individual permit, the **Commissioner** may require the **owner** to be covered by an individual **stormwater** discharge permit. The **Commissioner** may require the **owner** to develop and implement specific **BMPs** and monitor the discharge from the site. If applicable, upon issuance of an individual permit, this general permit would no longer apply.

2. If the terms and conditions of this general permit cannot be met, an **owner** may request an individual permit, in accordance with Minn. R. 7001.

3. Any interested person may petition the MPCA to require an individual NPDES/SDS permit in accordance with 40 CFR 122.28(b)(3).

B. RESPONSE

The **SWPPP**, including all certificates, reports, records, or other information required by this permit, must be made available to federal, state, and local officials within 72 hours upon request for the duration of the permit and for three years following the **NOT**. This does not include any records after submittal of the **NOT**.

C. PROHIBITIONS

This permit prohibits discharges of any material other than **stormwater,** and discharges from **dewatering** or basin draining activities in accordance with Part IV.D.1 and 2. For example, prohibited discharges include but are not limited to vehicle and equipment washing, maintenance spills, wash water, and discharges of oil and other hazardous substances.

D. TRANSFER OF OWNERSHIP OR CONTROL

This permit may not be assigned or transferred by the permit holder except when transfer occurs in accordance with the applicable requirements of Part II.B.5.

E. CIVIL AND CRIMINAL LIABILITY

Nothing in this permit must be construed to relieve the **Permittee(s)** from civil or criminal penalties for noncompliance with the terms and conditions provided herein. Nothing in this permit must be construed to preclude the initiation of any legal action or relieve the **Permittee(s)** from any responsibilities, liabilities, or penalties to which the **Permittee(s)** is or may be subject to under Section 311 of the Act and Minn. Stat. chs. 115 and 116, as amended. The **Permittee(s)** are not liable for permit requirements for activities occurring on those portions of a site where another party has submitted a notice of termination/permit modification form as described in Part II. B.5.b or the permittee has submitted the notice of termination/permit modification form as described in Part II.C.2.b except for monitoring responsibilities listed under Part III.C.5 if applicable.

F. SEVERABILITY

The provisions of this permit are severable. If any provision of this permit, or the application of any provision of this permit to any circumstances, is held invalid, the application of such provision to other circumstances, and the remainder of this permit must not be affected thereby.

G. NPDES/SDS RULE STANDARD CONDITIONS

The **Permittee(s)** must comply with the provisions of Minn. R. 7001.0150, subp. 3 and Minn. R. 7001.1090, subp. 1(A), 1(B), 1(C), 1(H), and 1(I). This permit does not require the submittal of a data monitoring report, except where monitoring is required in Part III.C.5.

H. INSPECTION AND ENTRY

The **Permittee(s)** must comply with the provisions of 40 CFR 122.41(i), Minn. Stat. ch. 115.04 and Minn. Stat. ch. 115B.17. The **Permittee(s)** shall allow representatives of the MPCA or any member, employee or agent thereof, when authorized by it, upon presentation of credentials, to enter upon any property, public or private, for the purpose of obtaining information or examination of records or conducting surveys or investigations.

APPENDIX A

A. GENERAL REQUIREMENTS

All requirements in this Appendix are in addition to **BMPs** already specified in the permit. Where provisions of Appendix A conflict with requirements elsewhere in the permit, the provisions in Appendix A take precedence. All **BMPs** used to comply with this Appendix must be documented in the **SWPPP** for the project. If the terms and conditions of this Appendix cannot be met, an individual permit will be required in accordance with Minn. R. ch. 7001.

B. REQUIREMENTS FOR DISCHARGES TO SPECIAL WATERS AND IMPAIRED WATERS

Additional **BMPs** together with enhanced runoff controls are required for discharges to the following special waters (part B.1 through B.8 of Appendix A) and impaired waters (part B.9 of Appendix A). The **BMPs** identified for each special or impaired water are required for those areas of the project draining to a discharge point on the project that is within one mile of a special or impaired water and flows to that special or impaired water.

1. **Wilderness areas:** Boundary Waters Canoe Area Wilderness; Voyageurs National Park; Kettle River from the site of the former dam at Sandstone to its confluence with the Saint Croix River; Rum River from Ogechie Lake spillway to the northernmost confluence with Lake Onamia. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2, C.3 and C.4 of this Appendix.

2. **Mississippi River:** Those portions from Lake Itasca to the southerly boundary of Morrison County that are included in the Mississippi Headwaters Board comprehensive plan dated February 12, 1981. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2 and C.3 of this Appendix.

3. **Scenic or recreational river segments:** Saint Croix river, entire length; Cannon River from northern city limits of Faribault to its confluence with the Mississippi River; North Fork of the Crow River from Lake Koronis outlet to the Meeker-Wright county line; Kettle River from north Pine County line to the site of the former dam at Sandstone; Minnesota River from Lac qui Parle dam to Redwood County state aid highway 11; Mississippi River from county state aid highway 7 bridge in Saint Cloud to northwestern city limits of Anoka; and Rum River from state aid Highway 27 bridge in Onamia to Madison and Rice streets in Anoka. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2 and C.3 of this Appendix.

4. **Lake Superior:** (Prohibited and restricted.) Discharges to Lake Superior must incorporate the **BMPs** outlined in C.1, C.2 and C.3 of this Appendix.

5. **Lake Trout Lakes:** Identified in Minn. R. 7050.0470, including those inside the boundaries of the Boundary Waters Canoe Area Wilderness and Voyageurs National Park. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2, C.3 and C.4 of this Appendix.

6. **Trout Lakes:** Identified in Minn. R. 6264.0050, subp. 2. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2, C.3, and C.4 of this Appendix.

7. **Scientific and natural areas:** Boot Lake, Anoka County; Kettle River in sections 15, 22, 23, T 41 N, R 20, Pine County; Pennington Bog, Beltrami County; Purvis Lake-Ober Foundation, Saint Louis County; Waters within the borders of Itasca Wilderness Sanctuary, Clearwater County; Iron Springs Bog, Clearwater County; Wolsfeld Woods, Hennepin County; Green Water Lake, Becker County; Blackdog Preserve, Dakota County; Prairie Bush Clover, Jackson County; Black Lake Bog, Pine County; Pembina Trail Preserve, Polk County; and Falls Creek, Washington County. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2, C.3 and C.4 of this Appendix.

8. **Trout Streams:** Listed in Minn. R. 6264.0050, subp. 4. Discharges to these waters must incorporate the **BMPs** outlined in C.1, C.2, C.3, and C.5 of this Appendix.

9. **Impaired Waters**: waters identified as impaired under section 303 (d) of the federal Clean Water Act for phosphorus (nutrient eutrophication biological indicators), turbidity, dissolved oxygen or aquatic biota (fish bioassessment, aquatic plant bioassessment and aquatic macroinvertebrate bioassessment). Discharges to these waters must incorporate the **BMPs** outlined in C.1 and C.2 of this Appendix.

Note on impaired waters listing terminology: The terms in parenthesis in Appendix A Part B.9 above are the most current terminology used to list waters as impaired at the time of permit issuance. These terms are subject to change. For example, at one time waters were listed as impaired for phosphorus and now those same waters are listed as impaired for nutrient eutrophication biological indicators. If the terminology changes for one of the pollutant(s) or stressor(s) identified in the permit, the MPCA will keep a list of the new terms on its construction **stormwater** web site.

C. ADDITIONAL BMPS FOR SPECIAL WATERS AND IMPAIRED WATERS

For the BMPs described in C.2, C.4 and C.5 of this Appendix:

Where the proximity to bedrock precludes the installation of any of the permanent **stormwater** management practices outlined in Appendix A, other treatment such as grassed swales, smaller ponds, or grit chambers is required prior to discharge to **surface waters**.

For work on linear projects where the lack of right of way precludes the installation of any of the permanent **stormwater** management practices outlined in Appendix A, other treatment such as grassed swales, smaller ponds, or grit chambers is required prior to discharge to **surface waters**.

1. During construction.

    a. All exposed soil areas must be **stabilized** as soon as possible to limit soil erosion but in no case later than seven (7) days after the **construction activity** in that portion of the site has temporarily or permanently ceased.

    b. Temporary sediment basin requirements described in Part III.B.1-5 must be used for common drainage locations that serve an area with five (5) or more acres disturbed at one time.

2. Post construction. The **water quality volume** that must be treated by the project's permanent **stormwater** management system described in Part III.C. shall be one (1) inch of runoff from the new **impervious surfaces** created by the project. Where site conditions allow, at least ½ inch of the **water quality volume** must be infiltrated. See Part III.C.2 for more information on infiltration design and appropriate site conditions. If it is determined that site conditions are not appropriate for infiltration (e.g. lack of 3 ft. of separation to seasonally saturated ground water, proximity to bedrock, contaminated soils) the reasons should be documented in the **SWPPP** for the project. Infiltration is not required in Hydrologic Soil Group D soils.

3. Buffer zone. An undisturbed buffer zone of not less than 100 linear feet from the special water (not including tributaries) shall be maintained at all times. Exceptions from this requirement for areas, such as water crossings, limited water access and restoration of the buffer are allowed if the **Permittee** fully documents in the **SWPPP** the circumstances and reasons that the buffer encroachment is necessary. Replacement of existing impervious surface within the buffer is allowed under this permit. All potential water quality, scenic and other environmental impacts of these exceptions must be minimized by the use of additional or redundant **BMPs** and documented in the **SWPPP** for the project.

4. Enhanced runoff controls. The Permanent **Stormwater** Management System must be designed such that the pre-and post-project runoff rate and volume from the 1 and 2-year 24-hour precipitation events remain the same or are reduced.

5. Temperature Controls. The Permanent **Stormwater** Management System must be designed such that the discharge from the project will minimize any increase in the temperature of trout stream receiving waters resulting from the 1-and 2-year 24-hour precipitation events. This includes all tributaries of designated trout streams within the section that the trout stream is located. Projects that discharge to trout streams must minimize the impact using one or more of the following measures, in order of preference:

    a. Minimize new **impervious surfaces**.

    b. Minimize the discharge from connected **impervious surfaces** by discharging to vegetated areas, or grass swales, and through the use of other non-structural controls.

    c. Infiltration or evapotranspiration of runoff in excess of pre-project conditions (up to the 2-year 24-hour precipitation event).

d. If ponding is used, the design must include an appropriate combination of measures such as shading, filtered bottom withdrawal, vegetated swale discharges or constructed **wetland** treatment cells that will limit temperature increases. The pond should be designed to draw down in 24 hours or less.

e. Other methods that will minimize any increase in the temperature of the trout stream.

D. REQUIREMENTS FOR DISCHARGING TO WETLANDS

If the project has any **stormwater** discharges with the potential for significant adverse impacts to a **wetland** (e.g., conversion of a natural **wetland** to a **stormwater** pond) , the **Permittee(s)** must demonstrate that the **wetland** mitigative sequence has been followed in accordance with D.1 or D.2 of this appendix.

1. If the potential adverse impacts to a **wetland** on a specific project site have been addressed by permits or other approvals from an official statewide program (U.S. Army Corps of Engineers 404 program, Minnesota DNR, or the State of Minnesota Wetland Conservation Act) that are issued specifically for the project and project site, the **Permittee** may use the permit or other determination issued by these agencies to show that the potential adverse impacts have been addressed. For the purposes of this permit, deminimus actions are determinations by the permitting agency that address the project impacts, whereas a non-jurisdictional determination does not address project impacts.

2. If there are impacts from the project that are not addressed in one of the permits or other determinations discussed in Appendix A, Part D.1 (e.g., permanent inundation or flooding of the **wetland**, significant degradation of water quality, excavation, filling, draining), the **Permittee** must minimize all adverse impacts to **wetlands** by utilizing appropriate measures. Measures used must be based on the nature of the **wetland**, its vegetative community types and the established hydrology. These measures include in order of preference:

   a. Avoid all significant adverse impacts to **wetlands** from the project and post-project discharge.

   b. Minimize any unavoidable impacts from the project and post-project discharge.

   c. Provide compensatory mitigation when the **Permittee** determines that there is no reasonable and practicable alternative to having a significant adverse impact on a **wetland**. For compensatory mitigation, **wetland** restoration or creation shall be of the same type, size and whenever reasonable and practicable in the same watershed as the impacted **wetland**.

E. DISCHARGES REQUIRING ENVIRONMENTAL REVIEW

This permit does not replace or satisfy any environmental review requirements, including those under the Minnesota Environmental Policy Act or the National Environmental Policy Act. The **owner** must verify that any environmental review required by law, including any required Environmental Assessment Work Sheets or Environmental Impact Statements, Federal environmental review, or other required review is complete, and the **owner** must incorporate any **stormwater** mitigation measures required as the result of any environmental review into the **SWPPP** for the project. If any part of your common plan of development or sale requires environmental review, coverage under this permit can not be obtained until such environmental review is complete.

F. DISCHARGES AFFECTING ENDANGERED OR THREATENED SPECIES

This permit does not replace or satisfy any review requirements for endangered or threatened species, from new or expanded discharges that adversely impact or contribute to adverse impacts on a listed endangered or threatened species, or adversely modify a designated critical habitat. The **owner** must conduct any required review and coordinate with appropriate agencies for any project with the potential of affecting threatened or endangered species, or their critical habitat.

G. DISCHARGES AFFECTING HISTORIC PLACES OR ARCHEOLOGICAL SITES

This permit does not replace or satisfy any review requirements for historic places or archeological sites, from new or expanded discharges which adversely affect properties listed or eligible for listing in the National Register of Historic Places or affecting known or discovered archeological sites. The **owner** must be in compliance with National Historic Preservation Act and conduct all required review and coordination related to historic preservation, including significant anthropological sites and any burial sites, with the Minnesota Historic Preservation Officer.

APPENDIX B. - DEFINITIONS

1. "**Best Management Practices (BMPs)**" means **erosion prevention** and **sediment control,** and water quality management practices that are the most effective and practicable means of controlling, preventing, and minimizing degradation of **surface water**, including avoidance of impacts, construction-phasing, minimizing the length of time soil areas are exposed, prohibitions, and other management practices published by state or designated area-wide planning agencies.

   Individual **BMPs** found in this permit are described in the current version of **Protecting Water Quality in Urban Areas**, Minnesota Pollution Control Agency 2000. **BMPs** must be adapted to the site and can be adopted from other sources. However, they must be similar in purpose and at least as effective and stringent as MPCA's **BMPs**. (Other sources include manufacturers specifications, **Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices**, U.S. Environmental Protection Agency 1992, and **Erosion Control Design Manual**, Minnesota Department of Transportation, et al, 1993).

2. **"Commissioner"** means the **Commissioner** of the MPCA or the **Commissioner's** designee.

3. **"Common Plan of Development or Sale"** means a contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, but under one proposed plan. One plan is broadly defined to include design, permit application, advertisement or physical demarcation indicating that land-disturbing activities may occur.

4. "**Construction Activity**" includes **construction activity** as defined in 40 C.F.R. pt. 122.26(b)(14)(x) and **small construction activity** as defined in 40 C.F.R. pt. 122.26(b)(15). This includes a disturbance to the land that results in a change in the topography, existing soil cover (both vegetative and non-vegetative), or the existing soil topography that may result in accelerated **stormwater** runoff, leading to soil erosion and movement of sediment into **surface waters** or drainage systems. Examples of **construction activity** may include clearing, grading, filling, and excavating. **Construction activity** includes the disturbance of less than one acre of total land area that is a part of a larger **common plan of development or sale** if the larger common plan will ultimately disturb one (1) acre or more.

5. **“Dewatering**” means the removal of water for **construction activity**. It can be a discharge of appropriated surface or groundwater to dry and/or solidify a construction site. It may require Minnesota DNR permits to be appropriated and if contaminated may require other MPCA permits to be discharged.

6. "**Energy Dissipation**" means methods employed at pipe outlets to prevent erosion. Examples include, but are not limited to: concrete aprons, riprap, splash pads, and gabions that are designed to prevent erosion.

7. **“Erosion Prevention”** means measures employed to prevent erosion including but not limited to: soil stabilization practices, limited grading, mulch, temporary erosion protection or **permanent cover**, and construction phasing.

8. "**Final Stabilization**" See part IV.G.

9. "**General Contractor**" means the party who signs the construction contract with the **owner** or **operator** to construct the project described in the final plans and specifications. Where the construction project involves more than one contractor, the **general contractor** could be the party responsible for managing the project on behalf of the **owner** or **operator**. In some cases, the **owner** or **operator** may be the **general contractor**. In these cases, the **owner** may contract an individual as the **operator** who would become the Co-**Permittee**.

10. “**Homeowner Fact Sheet”** means a fact sheet developed by the MPCA to be given to homeowners at the time of sale by a builder to inform the homeowner of the need for, and benefits of, **Final Stabilization**.

11. "**Impervious Surface**" means a constructed hard surface that either prevents or retards the entry of water into the soil and causes water to run off the surface in greater quantities and at an increased rate of flow than prior to development. Examples include rooftops, sidewalks, patios, driveways, parking lots, storage areas, and concrete, asphalt, or gravel roads.

12. "**National Pollutant Discharge Elimination System (NPDES)**" means the program for issuing, modifying, revoking, reissuing, terminating, monitoring, and enforcing permits under the Clean Water Act (Sections 301, 318, 402, and 405) and United States Code of Federal Regulations Title 33, Sections 1317, 1328, 1342, and 1345..

13. “**Normal Wetted Perimeter**” means the area of a conveyance, such as a ditch, channel, or pipe that is in contact with water during flow events that are expected to occur once every year.

14. "**Notice of Termination**" means notice to terminate coverage under this permit after construction is complete, the site has undergone **Final Stabilization**, and maintenance agreements for all permanent facilities have been established, in accordance with all applicable conditions of this permit.

15. **“Operator”** means the person (usually the **general contractor**), designated by the **owner**, who has day to day operational control and/or the ability to modify project plans and specifications related to the **SWPPP**. The person must be knowledgeable in those areas of the permit for which the **operator** is responsible, (Part II.B. and Part IV.) and must perform those responsibilities in a workmanlike manner.

16. "**Owner**" means the person or party possessing the title of the land on which the construction activities will occur; or if the **construction activity** is for a lease, easement, or mineral rights license holder, the party or individual identified as the lease, easement or mineral rights license holder; or the contracting government agency responsible for the **construction activity**.

17. "**Permanent Cover**" means surface types that will prevent soil failure under erosive conditions. Examples include: gravel, asphalt, concrete, rip rap, roof tops, perennial cover, or other landscaped material that will permanently arrest soil erosion. A uniform perennial vegetative cover (e.g., evenly distributed, without large bare areas) with a density of 70% of the native background vegetative cover for the area must be established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures. **Permanent cover** does not include the practices listed under temporary erosion protection.

18. "**Permittee**" means a person or persons, firm, or governmental agency or other institution that signs the application submitted to the MPCA and is responsible for compliance with the terms and conditions of this permit.

19. "**Public Waters**" means all water basins and watercourses that are described in Minn. Stat. 103G.005 subd. 15

20. **"Saturated Soil"** means the highest seasonal elevation in the soil that is in a reduced chemical state because of soil voids being filled with water. **Saturated soil** is evidenced by the presence of redoximorphic features or other information.

21. "**Sediment Control**" means methods employed to prevent sediment from leaving the site. **Sediment control** practices include silt fences, sediment traps, earth dikes, drainage swales, check dams, subsurface drains, pipe slope drains, storm drain inlet protection, and temporary or permanent sedimentation basins.

22. "**Small Construction Activity**" means small construction activity as defined in 40 C.F.R. part 122.26(b)(15) . Small construction activities include clearing, grading and excavating that result in land disturbance of equal to or greater than one acre and less than five acres. **Small construction activity** includes the disturbance of less than one (1) acre of total land area that is part of a larger **common plan of development or sale** if the larger common plan will ultimately disturb equal to or greater than one and less than five (5) acres.

23. "**Stabilized**" means the exposed ground surface has been covered by appropriate materials such as mulch, staked sod, riprap, erosion control blanket, mats or other material that prevents erosion from occurring. Applying mulch, hydromulch, tackifier, polyacrylamide or similar **erosion prevention** practices is not acceptable stabilization in temporary or permanent drainage ditches or areas where concentrated overland flow occurs. Grass seeding is not stabilization.

24. "**Standard Plates**" means general drawings having or showing similar characteristics or qualities that are representative of a **construction activity** or practice.

25. "**Stormwater**" is defined under Minn. R. 7077.0105, subp. 41(b), and includes precipitation runoff, **stormwater** runoff, snowmelt runoff, and any other surface runoff and drainage.

26. **“Storm Water Pollution Prevention Plan”** means a plan for **stormwater** discharge that includes **erosion prevention** measures, **sediment controls** and Permanent **Stormwater** Management Systems that, when implemented, will decrease soil erosion on a parcel of land and decrease off-site nonpoint pollution.

27. **“Surface Water or Waters”** means all streams, lakes, ponds, marshes, **wetlands**, reservoirs, springs, rivers, drainage systems, waterways, watercourses, and irrigation systems whether natural or artificial, public or private.

28. "**Temporary Erosion Protection**" means methods employed to prevent erosion. Examples of temporary erosion protection include; straw, wood fiber blanket, wood chips, and erosion netting.

29. “**Underground Waters**” means water contained below the surface of the earth in the saturated zone including, without limitation, all waters whether under confined, unconfined, or perched conditions, in near surface unconsolidated sediment or regolith, or in rock formations deeper underground. The term ground water shall be synonymous with underground water.

30. **“Waters of the State”** (as defined in Minn. Stat. § 115.01, subd. 22) means all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, reservoirs, aquifers, irrigation systems, drainage systems and all other bodies or accumulations of water, surface or underground, natural or artificial, public or private, which are contained within, flow through, or border upon the state or any portion thereof.

31. **“Water Quality Volume”** means ½ inch of runoff from the new **impervious surfaces** created by this project and is the volume of water to be treated in the Permanent **Stormwater** Management System, as required by this permit except as provided in Appendix A.C.2.

32. **“Wetland” or “Wetlands**” is defined in Minn. R. 7050.0130, subp. F and includes those areas that are inundated or saturated by **surface water** or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in **saturated soil** conditions. **Wetlands** generally include swamps, marshes, bogs, and similar areas. Constructed **wetlands** designed for wastewater treatment are not **waters of the state**. **Wetlands** must have the following attributes:

    a. A predominance of hydric soils;

    b. Inundated or saturated by **surface water** or ground water at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in a **saturated soil** condition; and

    c. Under normal circumstances support a prevalence of such vegetation.

EXHIBIT B

STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

Exhibit B: Stormwater Pollution Prevention Plan (SWPPP)

To comply with the
Stormwater General Permit for Construction Activity (MN R100001)

Construction Activity Information

Project Name

3M Oakdale Site – Soil Remediation

Project Location

Briefly describe where construction activity occurs. *Include address if available*
Oakdale, MN. East of Granada Ave. N.; west of Hadley Ave N.; north and south of Highway 5

City or Township **Oakdale**	State, Zip Code **MN**

Latitude and longitude of approximate centroid of project
92°58'14.459"W 44°59'53.708"N

Method of collection of latitude/longitude:
Commercial software (ESRI) and on-line maps

All cities where construction will occur
Oakdale

All counties where construction will occur **Washington**	All townships where construction will occur

Project Size (number of acres to be disturbed)

5.5 acres total (3.5 acres north of Highway 5 and 2 acres south of Highway 5)

Project Type

☐ Residential	☐ Commercial/Industrial	☐ Road Construction
☐ Residential and Road Construction	☒ Other (describe) **Soil remediation**	

Cumulative Impervious Surface

Existing area of impervious surface (to the nearest quarter acre): None .

Post construction area of impervious surface (to the nearest quarter acre): None .

Receiving Waters

Water Body ID*	**Name of Water Body**	**Type** (ditch, pond, wetland, lake, stream, river)	**Special Water?** (See Stormwater Permit Appendix A)	**Impaired Water?**** (See Stormwater Permit Appendix A)
Drainage Ditch north of Highway 5	Unnamed	Undifferentiated ditch	☐ Yes ☒ No	☐ Yes ☒ No
Drainage Ditch south of Highway 5	Unnamed	Undifferentiated ditch	☐ Yes ☒ No	☐ Yes ☒ No
Intermittent stream south of Highway 5	Raleigh Creek	Stream	☐ Yes ☒ No	☐ Yes ☒ No
			☐ Yes ☐ No	☐ Yes ☐ No

*Water Body ID might not be available for all water bodies. Use the Special and Impaired Waters Search Tool at: www.pca.state.mn.us/water/stormwater/stormwater-c.html
** Impaired water for the following pollutant(s) or stressor(s): phosphorus, turbidity, dissolved oxygen, or biotic impairment

Dates of Construction

Construction Start Date **April 2009**	Estimated Completion Date **April 2010**

Contact Information

Owner of the Site

Business of Firm Name **3M Company**		
Last Name First Name Title **Kotsmith, James** **Senior Envir. Supervisor**	E-mail **jrkotsmith@mmm.com**	Telephone **651-737-3635**
Mailing Address **3M Center, Bldg. 224-2E-55**	City **St. Paul**	State Zip Code **MN** **55144-1000**
Alternate Contact Last Name First Name **Junnier, Robert**	E-mail **r.junnier@westonsolutions.com**	Telephone **610-701-3679**

Contractor (Person who will oversee implementation of the SWPPP)

Business of Firm Name **Weston Solutions, Inc.**		
Last Name First Name Title **Hunter, John** **Site Supervisor**	E-mail **john.hunter@westonsolutions.com**	Telephone **651-587-9681 (cell)**
Mailing Address **1748 Juliet Avenue**	City **St. Paul**	State Zip Code **MN, 55101**
Alternate Contact Last Name First Name **Junnier, Robert**	E-mail **r.junnier@westonsolutions.com**	Telephone **610-701-3679**

Party Responsible for Long Term Operation and Maintenance of the Permanent Stormwater Management System

Business of Firm Name **Not applicable - No long term operation required.**		
Last Name First Name Title	E-mail	Telephone
Mailing Address	City	State Zip Code
Alternate Contact	E-mail	Telephone

General Construction Project Information

Describe the construction activity (what will be built, general timeline, etc.)

The 3M Company (3M) will be conducting a site remediation project in Oakdale, MN. This project is executed under the approval of the Minnesota Pollution Control Agency (MPCA). Soil north of Highway 5 will be excavated and transported to a landfill. The excavation will be backfilled with clean soil from an off-site source, and the disturbed area will be revegetated.

The disturbed area, including roads and all re-grading outside the actual excavation area, is approximately 3.5 acres in size. A vapor extraction system is currently being used for in-situ removal of volatile organic compounds from the soil. When this treatment is complete, the soil will be excavated and transported to a landfill. The excavated soil will be loaded directly into trucks, if possible; however, in certain cases, it will first be stockpiled to allow additional sampling.

During rainfall events, stormwater run-on will be diverted from the disturbed area (excavation).

Generally, there will be no runoff from the excavation, because the bottom of the excavation will be lower than the surrounding ground. However, some runoff from disturbed areas can occur during initial excavation and after the site has been restored (i.e., after backfilling). Soil that is brought on-site may be placed directly into the excavation or it may be first placed in temporary stockpiles.

Stormwater that falls into the excavation will be allowed to drain into the soil. However, if the quantity of stormwater is such that excess water accumulates, this water will be pumped into on-site sedimentation tanks, and then discharged into the municipal sewer. There is currently a 2-inch HDPE pipe that runs under Highway 5 and connects to a municipal sewer on the south side of the highway. The water from the sedimentation tanks will be discharged into this pipe. No water that is pumped from the excavation will be discharged to surface water. Any decontamination water may also be handled using this method, if permissible under the MCES permit.

As a housekeeping measure, the trucks that are used to haul the soils off-site will be confined to stone haul roads. These trucks will not be cleaned at the site.

On the south side of Highway 5, soils will be disturbed during the construction of a groundwater treatment facility. All disturbed soil will remain on-site and be re-graded upon completion of construction. The disturbed area will be revegetated.

The disturbed area, including roads and all re-grading outside the construction area, is approximately 2 acres in size. During rainfall events, stormwater run-on will be diverted from the disturbed area. Stormwater that falls onto the disturbed area will be allowed to drain into the soil. However, if excess water accumulates, this water will be pumped into on-site sedimentation tank(s), and then discharged to the sewer. No water from the tank(s) will be discharged to surface water.

Describe soil types found at the project.

The surface soil is fill material, overlying alluvial deposits.

General site information (III.A)

Describe the location and type of all temporary and permanent erosion prevention and sediment control BMPs. Include the timing for installation and procedures used to establish additional temporary BMPs as necessary. (III.A.4.a)

Stockpiles
Sedimentation Tanks
Water Accumulation BMPs
Excavation and Loading BMPs
Silt Fences
Diversion Berms, Swales and Ditches
Road/Parking Area/Loading Area BMPs
Seeding
Diesel Tank BMPs

Note: Locations of erosion prevention/sediment control BMPs are provided in the attached construction drawings. Descriptions of the erosion prevention/sediment control BMPs are provided in the Stormwater Management Plan.

Attach to this SWPPP a table with the anticipated quantities for the life of the project for all erosion prevention and sediment control BMPs (III. A. 4.b)

The schedule and quantity of BMPs in use are provided in the Stormwater Management Plan.

Attach to this SWPPP a site map that includes the following features (III.A.3.b – f):

- Existing and final grades, including dividing lines and direction of flow for all pre and post-construction stormwater runoff drainage areas located within the project limits.
- Locations of impervious surfaces and soil types.
- Locations of areas not to be disturbed.
- Location of areas of phased construction
- All surface waters and existing wetlands within 1mile from the project boundaries that will receive stormwater runoff from the site (identifiable on maps such as USGS 7.5 minute quadrangle maps or equivalent). Where surface waters receiving runoff associated with construction activity will not fit on the plan sheet, they must be identified with an arrow, indicating both direction and distance to the surface water.
- Methods to be used for final stabilization of all exposed soil areas.

See attached drawings and aerial map.

Were stormwater mitigation measures required as the result of an environmental, archaeological, or other required local, state, or federal review of the project? If yes, describe how these measures were addressed in the SWPPP. (III.A.6.)

This project involves environmental soil remediation and construction of a groundwater treatment facility, and is being conducted under review and consent from the MPCA. As such, a work plan is being prepared for all site activities, including stormwater management.

Is the project located in a karst area such that additional measures would be necessary to protect drinking water supply management areas as described in Minn. R. chapters 7050 and 7060? If yes, describe the additional measures to be used. (III.A.7.)

The project is not located in a karst area.

Does the site discharge to a calcareous fen listed in Minn. R. 7050.0180, subp. 6.b.? If yes, a letter of approval from the Minnesota Department of Natural Resources must be obtained prior to application for this permit. (Part I B.6 and Part III.A.8)

No, a review of calcareous fen locations shows that the site does not discharge to an area listed in the Minn R. 7050.0180, subp. 6.b.

Does the site discharge to a water that is listed as impaired for the following pollutant(s) or stressor(s): phosphorus, turbidity, dissolved oxygen or biotic impairment? Use the Special and Impaired Waters Search Tool at: www.pca.state.mn.us/water/stormwater/stormwater-c.html. If no, skip to next box.

No

Does the Impaired water have an approved TMDL with an Approved Waste Load Allocation for construction activity? If yes:

a. List the receiving water, the areas of the site discharging to it, and the pollutant(s) identified in the TMDL

b. List the BMPs and any other specific construction stormwater related implementation activities identified in the TMDL.

If the site has a discharge point within one mile of the impaired water and the water flows to the impaired water but no specific BMPs for construction are identified in the TMDL, the additional BMPs in Appendix A (C.1 and C.2) must be added to the SWPPP and implemented. (III.A.7). The additional BMPs only apply to those portions of the project that drain to one of the identified discharge points.

Training (III.A)

Training is required for all permitted projects after February 1, 2010. It must be provided by entities with expertise in erosion prevention, sediment control or permanent stormwater management. Training must be focused on the individual's job duties as they relate to the permit requirements (Part III.A.2). Who must be trained?

- ✓ Individual(s) preparing the SWPPP for the project
- ✓ Individual(s) overseeing the implementation of, revising and amending the SWPPP and individuals performing inspections required by the permit
- ✓ Individuals performing or supervising the installation, maintenance or repair of BMPs

Attach to this SWPPP:
Names of the personnel trained; dates of training; name of instructor(s) and entity providing training; content of training course or workshop (including number of hours of training)

The project will be completed prior to February 2010. However, training has nonetheless been provided to the following personnel:
John Hunter - Site Supervisor
Robert Junnier, P.E. - Project Manager
Contractors on-site will be required to provide proper certification.

Selection of a Permanent Stormwater Management System (III.C)

Will the project create a new cumulative impervious surface greater than or equal to one acre?
☐ Yes ☒ No
If yes, a water quality volume of ½ inch of runoff from this area must be treated before leaving the site or entering surface waters (1 inch if discharging to special waters).

Describe which method will be used to treat runoff from the new impervious surfaces created by the project (III.C):

- Wet sedimentation basin
- Infiltration/Filtration
- Regional ponds
- Combination of practices

Include all calculations and design information for the method selected. See Part III.C of the permit for specific requirements associated with each method.

Not Applicable

If it is not feasible to meet the treatment requirement for the water quality volume, describe why. This can include proximity to bedrock or road projects where the lack of right of way precludes the installation of any permanent stormwater management practices. Describe what other treatment, such as grasses swales, smaller ponds, or grit chambers, will be implemented to treat runoff prior to discharge to surface waters. (III.C)

Not Applicable

If proposing an alternative method to treat runoff from the new impervious surfaces, describe how this alternative will achieve approximately 80% removal of total suspended solids on an annual average basis (III.C.5). NOTE: If proposing an alternative method, you must submit your SWPPP to MPCA at least 90 days prior to the starting date of the construction activity.

Not Applicable

Erosion Prevention Practices (IV.B)

Describe construction phasing, vegetative buffer strips, horizontal slope grading, and other construction practices to minimize erosion. Delineate areas not to be disturbed (e.g., with flags, stakes, signs, silt fence, etc.) before work begins.

Refer to drawings provided in Appendix E of RD/RA Plan. Erosion and sedimentation control measures will be installed prior excavation. Construction phasing will be finalized once an excavation contractor has been selected. However, it is anticipated that excavation will proceed along an east/west orientation. The excavation may be backfilled in stages; however, this will depend on the logistics of transporting soil to the site and placing/compacting it in the excavation. Once the soil has been excavated, no runoff from the excavation can occur, because all stormwater will remain in the excavation. Therefore, there is no necessity for staged restoration.

Describe temporary erosion protection or permanent cover used for exposed soil. All exposed soil areas must be stabilized as soon as possible but in no case later than 14 days after the construction activity in that portion of the site has temporarily or permanently (part IV.B.2)

See Stormwater Management Plan and construction drawings.

For drainage or diversion ditches, describe practices to stabilize the normal wetted perimeter within 200 lineal feet of the property edge or point of discharge to surface water. The remaining portions of the temporary or permanent ditch or swale must be stabilized within 14 days after connecting to surface waters and construction in that portion of the ditch has temporarily or permanently ceased.

See Stormwater Management Plan and construction drawings.

Describe other erosion prevention practices (list and describe).

Sediment Control Practices (IV.C)

Describe sediment control practices used to minimize sediments from entering surface waters, including curb and gutter systems and storm drain inlets. At a minimum, these sediment control practices must include:

- Sediment controls for temporary or permanent drainage ditches and sediment basins that are designed as part of a treatment system
- Installation of check dams or other grade control practice to ensure sheet flow and prevent rills (for slope lengths greater than 75 feet with a grade of 3:1 or steeper).
- Sediment control practices on all down gradient perimeters prior to land disturbing activities.
- Storm drain inlet protection for all inlets.

- Silt fencing or other sediment control surrounding temporary soil stockpiles.
- Minimize vehicle tracking of sediments (e.g., stone pads, concrete or steel wash racks, or equivalent systems).
- Street sweeping of tracked sediment.
- Temporary sedimentation basins (see Part III.B).

Sediment control will consist of the following:

- **Silt fences will be used for the portions of the site that convey drainage from disturbed areas. These areas are small, because the excavation will hold water and will not be a source of sediment transport. Silt fencing will also be installed around the stockpile.**

- **Sedimentation tanks will be used to remove sediment from the water pumped from the excavation (if necessary); no water from the excavation will discharge to surface water. Following sedimentation, all water will be discharged to the municipal sewer (under an approved Industrial Discharge Permit).**

- **All entrance and haul roads will be covered with geotextile and a minimum of 6 inches of stone. In addition, while on-site, the trucks will be confined to the haul roads and not allowed on unpaved areas without prior approval from 3M. The contractor will be required to immediately clean Granada Ave. if any soil is carried onto the street.**

Dewatering and Basin Draining (IV.D)

Will the project include dewatering or basin draining? ☐ Yes ☒ No

If yes, describe BMPs used so the discharge does not adversely affect the receiving water or downstream landowners.

Additional BMPs for Special Waters and Discharges to Wetlands (Appendix A, Parts C and D)

Special Waters. Does your project discharge to special waters? ☐ Yes ☒ No If no, skip to Wetlands section below.

If proximity to bedrock or road projects where the lack of right of way precludes the installation of any of the permanent stormwater management practices, then other treatment such as grassed swales, smaller ponds, or grit chambers is required prior to discharge to surface waters. Describe what other treatment will be provided.

Describe erosion and sediment controls for exposed soil areas with a continuous positive slope to a special waters, and temporary sediment basins for areas that drain 5 or more acres disturbed at one time.

Describe the undisturbed buffer zone to be used (not less than 100 linear feet from the special water).

Describe how the permanent stormwater management system will ensure that the pre and post project runoff rate and volume from the 1, and 2-year 24-hour precipitation events remains the same.

Describe how the permanent stormwater management system will minimize any increase in the temperature of trout stream receiving waters resulting in the 1, and 2-year 24-hour precipitation events.

Wetlands. Does your project discharge stormwater with the potential for significant adverse impacts to a wetland (e.g., conversion of a natural wetland to a stormwater pond)? ☐ Yes ☒ No

If Yes, describe the wetland mitigation sequence that will be followed in accordance with Part D of Appendix A.

Inspections and Maintenance (IV.E)

Describe procedures to routinely inspect the construction site:

- Once every seven (7) days during active construction and,
- Within 24 hours after a rainfall event greater than 0.5 inches in 24 hours, and within seven (7) days after that.

Inspections must include stabilized areas, erosion prevention and sediment control BMPs, and infiltration areas.

The contractor will informally inspect the site on a daily basis when construction activity is taking place. At least once a week, and within 24 hours of a rainfall event of 0.5 inch or more in 24 hours, a formal, written inspection will be conducted. The inspection form that will be used is included herein as Exhibit C.

Pollution Prevention Management Measures (IV.F)

Describe practices to properly manage and dispose of solid waste, including trash (IV.F.1)

The contractor will supply a covered dumpster to accumulate solid waste, including construction debris and trash. All woody vegetation that is cleared from the site will be chipped and transported to a landfill.

Described practices to properly manage hazardous materials (IV.F.2).

There are no hazardous wastes on-site. The excavated soil will be characterized prior to disposal as discussed in the RD/RA Plan. Soil will be transported in trucks in compliance with Department of Transportation regulations. No soil will be loaded higher than the sides of the truck bed, and a tarp will be in place during transport.

Describe practices for external washing of trucks and other construction vehicles (IV.F.3)

It is not anticipated that any washing will be required for haul-trucks. Equipment or construction vehicles will be decontaminated on a decontamination pad in accordance with the Decontamination Plan (see Attachment 6 to the RD/RA Plan).

Describe how are you going to provide a safe, lake proof, concrete washout on site (IV.F.4):

Not Applicable

Describe your spill prevention plan.

There will be a portable diesel fuel tank for the trucks and construction equipment. This will be an engineered, packaged system, complete with double-walled tanks and provision for leak detection. Automatic shut-off nozzles will be used during transfer operations. Personnel will be present at all times during fueling operations to observe and respond to any spills.

Describe measures to address sanitary and septic waste.

A portable toilet will be maintained by the contractor.

Final Stabilization (IV.G)

Describe how you will achieve final stabilization of the site (IV.G).

See construction drawings.

Records Retention (III.D)

Describe your record retention procedures (must be kept at the site) (III.D). Records must include:

- Copy of SWPPP and any changes
- Training documentation (III.A.2.)
- Inspection and maintenance records
- Permanent operation and maintenance agreements
- Calculations for the design of temporary and permanent stormwater management systems.

EXHIBIT C

STORMWATER MANAGEMENT INSPECTION LOG

Exhibit C: Stormwater Management Inspection Log

Oakdale, MN Facility

Inspector: ____ **Date:** _____________________

Type of Inspection: **Time:** _____________________

☐ Routine Weekly

☐ 24-hrs After Rainfall Event > 0.5 inches
Rainfall (inches): ______________

Area(s) Inspected

☐ **Stockpiles**
Findings:

Corrective Actions:

☐ **Sedimentation Tanks**
Findings:

Corrective Actions:

☐ **Excavation & Loading Procedures**
Findings:

Corrective Actions:

☐ **Silt Fences**
Findings:

Corrective Actions:

☐ **Diversion Berms & Swales**
Findings:

Corrective Actions:

☐ **Roads**
Findings:

Corrective Actions:

☐ **Seeding**
Findings:

Corrective Actions:

☐ **Diesel Fuel Tank**
Findings:

Corrective Actions:

☐ **Drainage Swale/Piping**
Findings:

Corrective Actions:

ATTACHMENT 2

CONSTRUCTION SAMPLING PLAN (WASTE MANAGEMENT PLAN)

CONSTRUCTION SAMPLING PLAN
(WASTE MANAGEMENT PLAN)

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

Weston Solutions, Inc.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

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LIST OF FIGURES

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LIST OF ACRONYMS

3M	3M Company
ASTM	American Society for Testing and Materials
bgs	below ground surface
CSP	Construction Sampling Plan
DOT	U.S. Department of Transportation
E&S	erosion and sedimentation
GPS	Global Positioning System
MCES	Metropolitan Council of Environmental Services
MPCA	Minnesota Pollution Control Agency
NAAQS	National Ambient Air Quality Standard
NACs	noise area classifications
O&M	operation and maintenance
PCBs	polychlorinated biphenyls
PCFs	perfluorochemicals
pDR	personalDataRAM
PEL	permissible exposure limit
PID	photoionization detector
ppm	parts per million
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Response Action
RI	Remedial Investigation
SRV	Soil Reference Value
STEL	short-term exposure limit
SVE	soil vapor extraction
SWPPP	Stormwater Pollution Prevention Plan
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TWA	time-weighted average
UV	ultraviolet
VOCs	volatile organic compounds

1. INTRODUCTION

This Construction Sampling Plan (CSP) is a supporting document to the Remedial Design/Response Action (RD/RA) Plan that has been prepared by the 3M Company (3M) for the Oakdale Site in Oakdale, Minnesota, to address the presence of perfluorochemicals (PFCs) in soil and groundwater. The primary focus of the CSP is the soil excavation area north of Highway 5, since the work south of Highway 5 involves only minor handling of PFC-containing material during construction. However, elements of this plan may be applicable to the construction and operation and maintenance (O&M) activities for the groundwater treatment system.

This plan presents the overall procedures and steps that will be taken to complete monitoring and sampling prior to and during the RA activities. Minor modifications and additions may be made to this plan before and during implementation that will not involve regulatory review and approval.

This plan also presents the majority of the information that would be considered as a Waste Management Plan. Waste characterization information is presented within this document. Additional waste management information can also be found in other supporting documents to the RD/RA Plan, including the Quality Assurance Project Plan (Attachment 3), the Soil Transportation Plan (Attachment 4), and the Decontamination Plan (Attachment 6).

1.1 OVERVIEW

This CSP has been prepared to detail the sampling procedures for the execution of the response actions associated with the excavation of soils at the 3M Oakdale Site.

As specified in the RD/RA Plan, soil removal will be conducted to prevent contact with accessible surface soil in the defined excavation area and to reduce the migration of PFCs from the soil into the groundwater. Throughout the area defined in the RD/RA Plan, the upper 4 feet of soil will be removed and transported to an existing permitted off-site landfill to provide engineered isolation and containment of PFCs. Additional soils below the 4-foot zone have also been defined and will be removed from the designated area in the eastern portion of the excavation footprint. The soil excavation locations and depths are provided in Figure 1-1. Soil from the designated excavation footprint will be collected and analyzed for some or all the following constituents for disposal profiling:

- Volatile organic compounds (VOCs) – target compound list (TCL)
- Total polychlorinated biphenyls (PCBs)
- Resource Conservation and Recovery Act (RCRA) hazardous parameters, including:
    - Toxicity Characteristic Leaching Procedure (TCLP) VOCs
    - TCLP metals
    - Ignitability
    - Reactivity
- Paint filter test (ex situ only)

These objectives will be accomplished by conducting an environmental sampling program. Upon completion of the disposal profile sampling, excavated soils will be sent to appropriate waste disposal facilities.

In addition to soil disposal profiling, this CSP also includes the protocols for:

- Verification sampling of backfill material
- Construction water sampling
- Perimeter air monitoring
- Perimeter noise monitoring

1.2 CONSTRUCTION SAMPLING PLAN OBJECTIVES

This CSP outlines the sampling methodology for media to be sampled/monitored (soils, construction water, air and noise) at the Site including:

- Field procedures associated with determining sampling locations, methods of sample collection and sample handling.

- Documentation of samples, sample locations and results.
- Frequency and parameters for analysis per media and type of sample (e.g., soil disposal profiling, backfill verification) including laboratory analytical methods and specified criteria to be met, as specified in the Quality Assurance Project Plan (QAPP) associated with this Site.

Please note that the project QAPP applies to chemical analysis of environmental samples. Therefore, discussion of analytical sampling in this CSP will reference the QAPP.

All sampling will be performed by trained and qualified personnel, as applicable. To provide continuity of the text, all tables and figures referenced in the text can be found at the end of each respective section of this CSP.

File: \\Fsfed01\TIG\Oakdale\mxd\soil excavation area.mxd, 12-Feb-09 14:59, ricksc

WESTON SOLUTIONS

Legend

🟨	Water Table Monitoring Well
—	Fenceline
🟧	Potential Stockpile Area
🟩	Excavate to 4 Feet Below Grade
▭	Area of Soil (PFOS > 1.0 ppm)
🟦	Excavation to Groundwater Table

N
W E
S

0 100 200
Feet

Figure 1-1
Excavation Area

Oakdale Site
Oakdale, Minnesota

2. SOILS

Soils addressed in this section are as follows:

- Soils requiring profiling for off-site disposal.
- Soils obtained from off-site sources for backfill.

2.1 SOIL DISPOSAL PROFILING

Activities addressed in this section include the in situ sampling of soil within the defined excavation area footprint prior to excavation and ex situ sampling of excavated soil in stockpiles.

In situ soil sampling will take place within the defined excavation area. These soil samples will be analyzed for VOCs and PCBs. One in every 10 soil samples will also be analyzed to determine the RCRA hazardous waste classification, including TCLP VOCs, TCLP metals, ignitability and reactivity. The results of these analyses will be used for soil disposal profiling. 3M may elect to perform additional sampling (at a frequency of more than one in 10 samples) for RCRA classification.

Three disposal categories of soil materials are possible: non-hazardous waste, soils that meet hazardous waste criteria, and wastes with a PCB concentration greater than 50 parts per million (ppm). Areas classified as non-hazardous will be excavated and direct-loaded for non-hazardous disposal at the SKB Landfill. Other areas will be excavated and the soils staged in a designated on-site area for further profiling and subsequent off-site disposal.

The purpose of this sampling effort is to develop a waste stream profile for subsequent off-site disposal. This profile will be used to ensure that the material is transported in accordance with U.S. Department of Transportation (DOT) regulations to an appropriate permitted facility for final disposition. Quality assurance/quality control (QA/QC) samples will be collected as discussed in the project QAPP.

2.1.1 Field Procedures

2.1.1.1 In Situ Sampling

The following are procedures that will be performed in the field associated with collecting in situ soil samples from the defined excavation area:

1. Soil samples will be collected within the defined excavation area using direct push technology.

2. Each boring location will have a unique identification that will be used for the sample identification and documentation. Samples from each boring will be identified by boring location number and sample depth below ground surface (bgs) (see Section 6 for nomenclature).

3. A 75-foot sampling grid will be established in the designated area where soils are being excavated to 4 feet bgs. It should be noted that due to variations in surface elevation, the final depth of excavation may exceed 4 feet in some locations within this designated area. One vertical sample will be collected at the center of the 75-foot grid area over the 4-foot depth. At some locations where the depth of excavation may extend to greater than 6 feet due to localized topography, an additional sample may be collected. A 50-foot sampling grid will be established in the area where soils are being excavated to the water table. Within this footprint area, vertical samples will be collected at the center of each grid to represent the 0 to 4 foot bgs range and the 4 to 8 foot bgs range. If the depth of excavation extends to greater than 10 feet because of the location of the water table, an additional sample may be collected.

   There will be a total of 28 boring locations; the approximate boring locations are shown in Figure 2-1. Samples will be collected from the borings using the following methodology :

   a. All samples will be collected by persons wearing nitrile (or equivalent) disposable gloves. Gloves will be changed between samples.

   b. The boring will be visually inspected by the sample collector and a photoionization detector (PID) will be used to determine the most conservative (i.e., the location of the highest PID reading) points to collect a grab sample of soil for VOC analysis.

   c. The soil boring will be composited every sampling interval for PCB, TCLP VOCs, TCLP metals, ignitability and reactivity analyses. Each sampling interval will be homogenized in a disposable paint tray liner to obtain a representative sample.

   d. Soil samples will be placed in clean sample containers provided by the analytical laboratory.

4. All sample containers will be labeled with the following information:
   a. Unique sample identification (see Section 6 for nomenclature)
   b. Date of collection
   c. Time of collection
   d. Preservation
   e. Analysis to be performed
   f. Grab or composite
   g. Initials of collector
5. All samples will be recorded onto a chain-of-custody form, and sampling activities will be documented in a logbook.
6. All samples will be immediately placed into a cooler containing ice to maintain an interior temperature of 4° C.
7. All samples will be transported to the laboratory within 48 hours after collection for extraction.

2.1.1.2 Ex Situ Sampling

The following procedures will be performed in the field associated with collecting soil samples from stockpiles for disposal profiling:

1. Soil to be sampled will be staged in stockpiles of approximately 100 cubic yards (volume may be adjusted to facilitate operations). It is important to note that soil cuttings from the soil vapor extraction (SVE) vent installation and extraction well installation are stored in drums on the south side of Highway 5. The drums from SVE vent installation (north of Highway 5, and within the footprint of the excavation area) will be brought to the north side of Highway 5 and emptied to form one separate stockpile for profiling or will be included in an existing stockpile. The drums of cuttings from the extraction well installation (south of Highway 5) will be profiled based on existing boring data collected during the Remedial Investigation (RI). Based on this review, the cuttings for each drum will either be spread on the ground or further profiling of the drum contents will be conducted to determine the final disposition.
2. Analyses selected for each ex situ sampling of excavated soil will depend upon the parameter(s) that exceeded the non-hazardous criteria in the in situ sampling. For

example, if a soil sample collected from an in situ grid point indicated a concentration(s) of a VOC greater than its Soil Reference Value (SRV) but below the TCLP and PCB hazardous criteria, then the excavated soil from that location would be placed in approximately 100 cubic yard stockpiles. The stockpiles would be sampled for VOCs, but not TCLP VOCs and metals or PCBs.

3. Each stockpile will have a unique identification that will be used for the sample identification (see Section 6 for nomenclature) and documentation. Stockpile identification will be recorded on the logbook.

4. One composite sample will be collected from approximately every 100 cubic yards of excavated soil using the following methodology:

    a. All samples will be collected by persons wearing nitrile (or equivalent) disposable gloves, and gloves will be changed between samples. Gloves will not be changed between discrete points of the same composite sample.

    b. Each composite sample will be comprised of two equal discrete samples collected from locations (points) representative (i.e., from each half) of the soil stockpile.

    c. The stockpile will be visually inspected by the sample collector and a PID will be used to determine the most conservative (i.e., locations of highest PID readings) points to collect soil for the sample.

    d. An equal amount of soil will be collected from each of the two discrete points using a pre-cleaned, disposable scoop. Enough volume will be collected so that the total composite volume is adequate for laboratory analyses.

    e. Soil from each point will be placed in a clean, disposable aluminum pan for homogenization for chemical analyses.

    f. The homogenized sample will be transferred into the respective sample containers, with the exception of VOC samples (as discussed below).

5. A discrete sample will be collected for VOC analyses at each of the two sample points (if this is the target parameter based on in situ analytical results). These samples will be collected after the portion of soil has been removed for the composite sample.

6. Activities will then proceed as outlined in Subsection 2.1.1.1, Procedures 4 through 7. 3M may choose to collect more than two discrete samples from each 100-cubic yard stockpile of soil or to modify the 100-cubic yard stockpile size for ex situ profiling, depending on the sampling results variability or as required by the disposal facility. This will be documented in the field record.

2.1.2 Documentation

Documentation for the soil boring and stockpile locations will be conducted in the following manner:

1. In situ soil sampling
    a. All sampling activities will be recorded in a logbook. The logbook entry will include:
        i. A field sketch depicting the soil boring locations in relation to a reference point and a north arrow.
        ii. The depths from which the samples were collected at each boring will be noted.
        iii. The date, time, and parameters for the sample will be noted along with the sample identification.
    b. Soil borings will be located using Global Positioning System (GPS) instrumentation. This information will be added to the notebook for reference.
    c. The soil boring will be marked with a survey lathe stating the sample identification.
    d. The sample(s) will be recorded on a chain-of-custody form. The information provided will include:
        i. Project location and information for reporting purposes
        ii. The unique sample identification (see Section 6 for nomenclature)
        iii. The date and time of sample collection
        iv. The matrix of the sample
        v. The number of containers
        vi. Preservation
        vii. Parameters for analysis
        viii. Turnaround time for result reporting
        ix. Comments regarding the samples and specific notes to the laboratory regarding analyses
        x. A release signature at the time of custody transfer

2. Ex situ soil sampling

   a. All sampling activities will be recorded in a logbook. The logbook entry will include:

      i. A field sketch depicting approximate dimensions and location of stockpiles in relation to a point of reference and include locations of the two points for the composite sample and a north arrow.

      ii. The location from which the samples were collected will be noted.

      iii. The date, time, and parameters for the sample will be noted along with the sample identification.

      iv. A reference about where the stockpiled material originated.

   b. The stockpile will be located using GPS instrumentation. This information will be added to the notebook for reference.

   c. The sample(s) will be recorded on a chain-of-custody form. The information provided will include the same items as identified above in Items 1.d.i through 1.d.x for in situ soil sampling.

2.1.3 Sampling Frequency, Parameters, and Laboratory Methods

Sampling for disposal profiling will occur as discussed in Subsection 2.1.1. Samples may be collected more frequently if the soil exhibits an obvious change in characteristics (i.e. discoloration, elevated PID readings, change in odor).

Samples will be collected and submitted for laboratory analysis for one or more of the following parameters:

- VOCs – target compound list (TCL)
- Total PCBs
- TCLP VOCs (every 10 in situ samples)
- TCLP metals (every 10 in situ samples)
- Ignitability (every 10 in situ samples)
- Reactivity (every 10 in situ samples)
- Paint filter test (ex situ only – based on field observations)

These samples will be submitted to Pace Laboratories, Inc. (Pace) for analysis. Table 2-1 of this CSP lists the parameters, containers, and laboratory methods associated with the above parameters.

2.2 IMPORTED SOILS AND MATERIALS

The soils addressed in this section include those imported for fill. Most, if not all, backfill will be obtained at the SKB site. The borrow location at SKB will be inspected, and soil samples will be collected for verification as clean backfill. There may be other potential sources of clean fill, and these will be sampled and verified in a manner similar to that discussed for the SKB site. Imported materials such as rock and sand obtained from a quarry and used for site roads, drainage, erosion and sedimentation (E&S) control, etc., will not be sampled for laboratory analysis.

The purpose of this sampling effort is to confirm that imported materials meet chemical and physical requirements. QA/QC field sampling is warranted for samples collected for chemical analysis and will be performed as specified in the project QAPP. The analytical laboratory will conduct its internal QA/QC samples and qualify all reported results, as discussed in the project QAPP.

QA/QC sampling is not warranted for samples collected for physical/geotechnical testing (laboratory and in-place). The frequency and representativeness of these samples will provide adequate information to assure and control the quality for construction purposes.

2.2.1 Field Procedures

Samples of borrow soil for chemical analyses will be collected at the place of origin. Geotechnical analyses will be performed in-place and/or at the testing laboratory prior to delivery. Analyses may include grain size distribution, moisture content, and Proctor tests for compaction.

2.2.1.1 Chemical Analysis

The following are sampling procedures that will be performed in situ at the point of origin for chemical analyses:

1. One or more composite samples will be collected from every borrow source. More samples will be collected at SKB, which is the primary source, whereas fewer samples will be collected from other smaller sources. Samples will typically be collected using the following methodology:
   a. All samples will be collected by persons wearing nitrile (or equivalent) disposable gloves. All gloves will be changed between samples. Gloves will not be changed between discrete points of the same composite sample.
   b. Each composite sample will be comprised of four equal discrete samples collected from locations (points) representative of the material.
   c. The stockpile/area will be visually inspected by the sample collector to determine the most representative points to collect soil for the sample.
   d. The top 2 to 6 inches of overburden or surficial materials will be removed from the sample point locations using a hand shovel. It will not be necessary to perform more than a gross decontamination of this shovel (i.e., clear the surface of large amounts of overburden that may stick to it during digging) between points since the shovel will not come into contact with the material to be sampled.
   e. An equal amount of soil will be collected from each of the four discrete points using a pre-cleaned, disposable scoop. Enough volume will be collected so that the total composite volume is adequate for laboratory analyses.
   f. Soil from each point will be placed in a clean, disposable aluminum pan for homogenization, with the exception of the soil volume for VOC analysis.
   g. At one of the four sample points, a discrete sample will be collected for VOC analysis. This sample will be collected after the portion of soil has been removed for the composite.
   h. Soil from the four sample points will be homogenized in the aluminum pan to obtain a representative sample.
   i. The homogenized sample will be transferred into the respective sample containers, with the exception of VOC samples (as discussed above).
2. Activities will commence as outlined in Subsection 2.1.1.1, Procedures 4 through 7.

2.2.1.2 Visual Inspection and Geotechnical Analysis

The borrow source will be visually inspected to ensure that it contains none of the following:

- Roots, debris, organic material or waste
- Free liquid or sludge
- Large rocks
- Noncompactable material

If these physical criteria are not met, the potential borrow source for import material will not be approved.

Sampling for geotechnical parameters to establish material compaction and gradation will be performed by trained personnel. Geotechnical sampling will be conducted on imported soils, and samples will be collected as specified in the respective American Society for Testing and Materials (ASTM) procedures. Procedures for this sampling are provided on a case-by-case basis depending on the borrow site.

2.2.2 Documentation

Documentation will be recorded for off-site sampling (including laboratory analysis and in-place testing) as outlined below.

1. All sampling activities will be recorded in a logbook. The logbook entry will include:
    a. A field sketch depicting the dimensions and location of the stockpile or borrow and the address (or nearest crossroads) and include locations of the four points for the composite sample and a north arrow.
    b. The location from which the VOC discrete sample is collected will be noted.
    c. The date, time and parameters for the samples will be noted along with the sample identification (see Section 6 for nomenclature).
2. The sample(s) will be recorded on a chain-of-custody form. The information provided will include the same items as identified in Subsection 2.1.2, Items 1.d.i through 1.d.x.

2.2.3 Sampling Frequency, Parameters, and Laboratory Methods

Table 2-1 of this CSP lists the parameters, containers and laboratory methods associated with the parameters listed below.

Chemical sampling for imported materials will typically occur at a minimum of one per borrow source of material. More samples will be collected at the SKB site, which is the primary borrow source, whereas fewer samples will be collected from other smaller sources. Samples may be collected more frequently if the material exhibits an obvious change in physical properties.

Chemical samples will be collected and submitted for laboratory analysis for the following parameters:

- VOCs – TCL
- Total PCBs

In lieu of conducting sampling and analysis for the TCLP parameters, the total concentration results will be compared to 20 times the TCLP regulatory limits. The required 20:1 dilution performed as part of the TCLP procedure would cause the extract concentration to always be at least 20 times less than the chemical concentration in the original sample. Therefore, if a total chemical concentration is found at less than 20 times the TCLP regulatory limits, the soil cannot leach enough of that constituent to exceed the TCLP limit, even if the entire constituent concentration dissolved into the extract. If the individual chemical concentrations are found at levels in excess of the 20 times TCLP concentration limits, this source may be disqualified as a potential source of borrow material or the material tested for TCLP extraction.

Table 2-1 Soil Sample Methods, Volumes, Containers and Preservatives

Oakdale Site

Analysis	Container	Method	Preservative
VOCs	Terra Core Kit	SW846 5035	*See Note*
		SW846 8260B	
TCLP VOCs	4-oz glass	SW846 1311	Cool, 4 °C ± 2 °C
		SW846 8260B	
Total PCBs	4-oz glass	SW846 8082	Cool, 4 °C ± 2 °C
TCLP Metals	4-oz glass	SW846 1311	Cool, 4 °C ± 2 °C
		SW846 6010B / 7470	
Ignitability	8-oz glass	ASTM D92-77	NA
Reactivity	100-g glass	SW846, Ch. 7.3	Cool, 4 °C ± 2 °C
Paint Filter Test	250-mL plastic	SW846 9095	Cool, 4 °C ± 2 °C

NOTE: Terra Core Kit contains one 40-mL vial with 5 mL of methanol, two 40-mL vials with 5 mL of sodium bisulfate and a stir bar, one 60-mL amber bottle and one 5-gram terra core. Kit will be kept cool at 4 °C.

NA - Not Applicable

Figure 2-1
In Situ Soil Profiling Plan

Oakdale Site
Oakdale, Minnesota

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3. CONSTRUCTION WATER

Construction water addressed in this section refers to contact water collected within the excavation and managed during the excavation activities. Also included is the decontamination water generated during the RA. Construction water will be discharged to the Metropolitan Council of Environmental Services (MCES) sewer south of Highway 5.

The purpose of this sampling effort is to screen the construction water to ensure that the discharge of the water meets the MCES industrial discharge permit requirement. Due to the nature of this sampling, no field QA/QC samples are warranted, with the exception of trip blanks. The analytical laboratory will conduct its internal QA/QC samples and qualify all reported results, as discussed in the project QAPP. The Stormwater Pollution Prevention Plan (SWPPP) outlines procedures for minimizing stormwater runoff.

3.1 FIELD PROCEDURES

The following are the procedures that will be performed in the field associated with collecting water samples:

1. Grab samples will be collected from construction water holding tanks.
2. Each batch or volume (specified by MCES approval or permit requirement) will have a unique identification that will be used for the sample identification (see Section 6 for nomenclature) and documentation.
3. Grab samples will be collected using the following methodology:
    a. All samples will be collected by persons wearing nitrile (or equivalent) disposable gloves. All gloves will be changed between samples.
    b. Water will be decanted directly into the sample containers from a clean sample bottle that has no preservative in it.
    c. The sample containers will be prepared by the laboratory with the appropriate preservatives prior to sample collection.
    d. Sample containers will be filled to their appropriate fill volumes and sealed as appropriate.

    e. For samples collected in 40-mL vials with septum caps, the sample will be checked by inverting the bottle after it is sealed and tapping on the inverted bottom to ensure no air bubbles exist in the volume collected.

    f. If air bubbles are found, additional volume will be added to the container, and it will be rechecked following the same procedure.

4. Activities will commence as outlined in Subsection 2.1.1.1, Procedures 4 through 7.

3.2 DOCUMENTATION

Documentation for this sampling will be conducted in the following manner:

1. All sampling activities will be recorded in a logbook. The logbook entry will include:

    a. A description of the construction water source including the batch number and volume of water.

    b. The date, time and parameters for the sample will be noted along with the sample identification.

2. The sample(s) will be recorded on a chain-of-custody form. The information provided on the chain of custody will include the same items as identified in Subsection 2.1.2, Items 1.d.i through 1.d.x.

3.3 SAMPLING FREQUENCY, PARAMETERS, AND LABORATORY METHODS

Sampling associated with construction water will typically occur at a minimum of one sample per batch or at a frequency required by the MCES discharge approval. Samples will be collected and submitted for laboratory analysis, which include the following parameters:

- VOCs – TCL
- Total PCBs

Table 3-1 of this CSP lists the parameters, containers and laboratory methods associated with the above parameters.

Table 3-1 Construction Water Sample Methods, Volumes, Containers and Preservatives

Oakdale Site

Analysis	Container	Method	Preservative
VOCs	3 x 40-mL glass VOA vials	SW846 8260B	HCl & Cool, 4°C ± 2°C
		EPA 624	
Total PCBs	1L glass amber	SW846 8082	Cool, 4°C ± 2°C

4. PERIMETER AIR MONITORING PROGRAM

4.1 PERIMETER AIR MONITORING PLAN OBJECTIVES

As part of the excavation activities, WESTON will perform perimeter ambient air monitoring to ensure that off-site migration of fugitive emissions from excavation activities does not adversely affect neighboring areas. WESTON will provide and operate a minimum of two perimeter air monitors generally stationed upwind and downwind of the Site to provide real-time monitoring for VOC and PM_{10} emissions during active construction periods of the excavation activities. Actual monitoring locations may vary and will depend on the area accessibility during monitoring activities, site operations and weather conditions. Monitoring will not be needed when construction activities are shut down (i.e., weekends, nights or holidays) or when excavation is not actively occurring.

This section describes the design, installation and operation of the ambient air quality monitoring system at and beyond the fenceline of the remediation site. The Site-Specific Security, Health and Safety Plan for this project will cover the monitoring protocols for the work area inside the construction fence, particularly in the excavation area. Ambient monitoring will be performed using PID and aerosol monitors to document air quality during excavation operations.

4.2 AMBIENT AIR MONITORING

Ambient air monitoring will be conducted to monitor VOC and PM_{10} concentrations along the perimeter of the Site during active excavation periods. PM_{10} will also be monitored during backfill operations. The instruments that will be used are designed to detect short-term excursions of high levels of fugitive emissions. This section provides a description of the equipment, procedures, number of monitoring locations and the quality assurance (QA) procedures for the ambient air VOC and PM_{10} monitoring program. Minor modifications may be made to this program after work startup based on site operations to improve the results or render them more representative.

4.2.1 Perimeter Monitoring Site Selection

Air monitoring will be conducted at a minimum of two stations generally located upwind and downwind of the Site. Each station will have a unique identification number that will be used in all data recording. The sites will be positioned to provide data representative of potential off-site migration of pollutants in the directions of nearby sensitive receptors.

Potential air monitoring locations will be as follows:

- Station 1 – On the western border.
- Station 2 – On the southern border.
- Station 3 – On the eastern site border.
- Station 4 – On the northern site border.

Figure 4-1 shows the general parameter air monitoring locations. Locations were chosen with consideration of the relative locations of nearby buildings, the terrain and the excavation activities. These general locations are designed to primarily provide coverage of the site perimeter. At a minimum, the stations selected for monitoring will include one that is representative of upwind conditions and one that is representative of downwind conditions. The perimeter monitoring equipment will be portable, which will allow the monitoring network to be adjusted if needed to adapt to changes in activities or meteorological conditions. The stations may also be moved short distances to facilitate construction access.

A meteorological monitoring component of the perimeter monitoring program will be set up and consist of equipment with data logging designed to continuously record wind speed, wind direction, precipitation and air temperature from a central location. The meteorological monitoring will be conducted for the duration of the perimeter air monitoring program.

4.2.2 VOC Monitoring

The equipment selected to monitor VOCs will be the RAE Systems MultiRAE PID or equivalent. The MultiRAE PID uses an ultraviolet (UV) light source to ionize VOC molecules, and a detector to sense the electric current generated by the ions. The MultiRAE uses ionization to detect VOCs in the sampled air. The sample stream flows through the detector's reaction chamber where it is continuously irradiated with high energy ultraviolet light. When compounds are present that have a lower ionization potential than that of the irradiation energy, some of their electrons are stripped away and the compounds become ionized. The flow then enters the detector of the instrument, which measures the electric current produced by the ions. The current is proportional to the compound concentration, and is amplified and scaled into concentration units of parts per million (ppm) relative to the electrical response of the unit to a known concentration of calibration gas.

The MultiRAE PID is contained in a single, compact housing equipped with an inlet tube. Sampled air is drawn into the monitor through the inlet tube, which has a small filter pack attached to its tip. The filter pack is designed to protect the sensor from water (rain or condensation) and dust. The modules will be mounted in the enclosures such that the inlet tubes will extend several inches from the top of the enclosure.

PID measurements for each monitoring station may be recorded manually in the site field logbook or automatically datalogged for daily download to a computer in the site trailer.

4.2.3 PM_{10} Monitoring

PM_{10} monitoring is the measurement of fine liquid or solid particles such as dust, smoke, mist, fumes or smog found in the air. The particle size is less than 10 microns. During excavation and backfill activities and truck hauling, the generation of dust particles will need to be monitored. The equipment selected to monitor PM_{10} will be the Met One Instruments, Inc. (Met One) E-BAM, Thermo Electron Corporation personalDataRAM (pDR), or equivalent. The E-BAM is a beta-attenuation monitor, whereas the pDR is a light-scattering monitor, for measuring airborne particulates such as aerosols and dusts. The units are portable and measure the concentration of airborne particulate matter (up to 10 µm in size) continuously and in real time, with results expressed in milligrams per cubic meter (mg/m^3; 1 mg/m^3 = 1,000 $\mu g/m^3$). Particulate concentrations can be measured over the following ranges: 0.01 – 10 mg/m^3 and 0.1 – 100 mg/m^3. The units are equipped with dataloggers which would be downloaded to a computer in the site trailer at a minimum frequency of once per day.

4.3 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance (QA) includes the planned and systematic actions necessary to provide adequate confidence that a measurement of a process will satisfy a given requirement for accuracy. Quality control (QC) is the operational techniques and activities that are used to fulfill requirements for quality. The QC procedures for the ambient air monitoring component of the program include establishment of baseline levels, planned calibrations, audits and preventive maintenance. All independent audits will be carried out by personnel not involved in the calibration of the equipment being audited.

4.3.1 Calibrations

Calibration of instruments will be performed prior to the start of excavation activities each day. Additional calibrations will be performed as needed or whenever maintenance is performed involving the functional elements of the unit.

4.4 DATA REPORTING

The data collected during the monitoring program will be primarily used for real-time data display and triggering notification to on-site personnel when action levels are exceeded (action levels are discussed in Section 4.5). All air monitoring data will be recorded in the site field logbook or logged into the site computer.

4.5 ACTION LEVELS

Perimeter action levels will be established and will be used as indicators of when excessive off-site migration of VOCs and PM_{10} may be occurring. Monitored ambient concentrations above the action levels will result in actions being taken to more stringently control emissions or trigger more parameter-specific quantitative sampling.

Considering soil profiling data for VOCs, the perimeter action level will be determined based on the constituents detected in the soils with the lowest exposure limits and background PID readings. For example, of the VOCs detected in soil at the Site, benzene may be the constituent with the lowest exposure limits. As a conservative measure, the benzene limits are compared to any detectable concentration measured by the MultiRAE. Benzene has a permissible exposure limit (PEL) of 1 ppm as an 8-hour time-weighted average (TWA) and a short-term exposure limit (STEL) of 5 ppm over a 15-minute period. When using a MultiRAE calibrated to isobutylene, benzene measurements require a 50% correction factor; therefore, site action levels would be:

- 0.5 ppm above background as an 8-hr TWA.
- 2.5 ppm above background as a 15-minute TWA.

The National and Minnesota Ambient Air Quality Standard (NAAQS) for PM_{10} is 150 µg/m^3 as a 24-hour average concentration. An action level of 100 µg/m^3 above background would be appropriate at the commencement of excavation operations. This level could be adjusted based on site conditions to ensure that the 24-hour average concentration remains below 150 µg/m^3.

4.5.1 Operational Responses

When the perimeter monitors detect concentrations above the action level, on-site supervisory personnel will be notified. Notifications will be sent to the WESTON Site Manager and the Site Health and Safety Officer. Upon receiving the notification message, the supervisor will assess the situation and initiate appropriate administrative and/or engineering controls to mitigate the off-site migration of emissions.

If any established action levels are exceeded, site work will stop in the area producing fugitive emissions, and corrective actions will be implemented to reduce emissions to meet specific action levels. The possible corrective actions are discussed in the RD/RA Plan.

WESTON SOLUTIONS

Legend

🟨	Water Table Monitoring Well
—	Fenceline
🟩	Excavate to 4 Feet Below Grade
▯	Area of Soil (PFOS > 1.0 ppm)
▨	Excavation to Groundwater Table
●	Potential Air Monitoring Location

Figure 4-1
Potential Air Monitoring Locations

Oakdale Site
Oakdale, Minnesota

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5. NOISE CONTROL

As part of the heavy construction (excavation and backfill) activities, WESTON will perform perimeter noise monitoring to ensure that neighboring areas are not adversely affected by the noise caused by heavy construction activities. WESTON will monitor noise production during active heavy construction periods. Potential noise monitoring locations are provided in Figure 5-1. Actual monitoring locations will depend on the area accessibility during the monitoring activities. Noise monitoring will not be needed when construction activities are shut down, i.e., on weekends, nights or holidays, or do not involve operation of heavy earthmoving equipment.

5.1 SOUND MONITORING SITE SELECTION

A total of two sound monitoring stations will be set up around the perimeter of the Site (Figure 5-1). Each station will have a unique identification number that will be used in all data recording. The sites will be positioned to provide a location near the closest household unit and a location near a recreational activity area.

The general locations will be as follows:

- Station 1 – On the western site border, near the closest household unit.
- Station 2 – On the southern site border near the Highway 5 right-of-way.

These general locations are designed to primarily provide coverage of nearby noise area classifications (NACs). The monitoring equipment will be portable, which will allow the monitoring network to be adjusted, if needed, to adapt to changes in activities. The stations may also be moved short distances to facilitate construction access.

5.2 NOISE AREA CLASSIFICATIONS

NACs are used to limit sound levels for the preservation of public health and welfare. There are four different NACs defined in the *Minnesota Noise Pollution Control Rules*. Land use activities near the area of excavation can be classified as NAC 1 (household units) and NAC 3 (highway and street right-of-way). The noise standards during daytime hours in NAC 1 and NAC 3 locations are defined as:

NAC 1 - Daytime*	
L50	**L10**
60 dB	65 dB
NAC 3 - Daytime*	
L50	**L10**
75 dB	80 dB

*Daytime hours are those between 7:00 am and 10:00 pm.

L10 – The sound level, expressed in dB, which is exceeded 10% of the time for a 1-hour survey.

L50 – The sound level, expressed in dB, which is exceeded 50% of the time for a 1-hour survey.

Baseline conditions will be established at each location before excavation activities start to account for other noise factors in the area (i.e., vehicle traffic, wind). Backup signals on heavy equipment will be included in the baseline condition as these are necessary for safety.

5.3 NOISE MONITORING EQUIPMENT

A Simpson Sound Level Meter (Model 884-2) or equivalent is a general purpose sound level instrument that will be used to measure the noise due to excavation activities. The 884-2 can be hand-held for rapid testing or mounted on a tripod for measurements over extended periods of time. The meter case is constructed of high-impact molded plastic, especially contoured at the microphone end to minimize reflections of the sound energy field being measured. The range for the 884-2 sound level meter is 40 to 140 dB.

Noise measurements will be recorded in the site field logbook or datalogged when equipment is being operated at the Site.

5.4 DATA REPORTING

The data collected during the monitoring program will be primarily used for real-time data display and initiating on-site evaluation when L10 levels are exceeded. All noise monitoring data will be recorded in the site field logbook or logged into the site computer.

5.5 OPERATIONAL RESPONSES

When the noise monitors detect concentrations above the L10, on-site supervisory personnel will be notified. Notifications will be sent to the WESTON Site Manager and the Site Health and Safety Officer. Upon receiving the notification message, the supervisor will assess the situation and, if necessary, initiate appropriate administrative and/or engineering controls to mitigate the noise caused by construction activities.

Figure 5-1
Potential Sound Level
Monitoring Locations

Oakdale Site
Oakdale, Minnesota

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6. NOMENCLATURE

A unique numbering system will be set up for the Site to identify impacted stockpile samples, soil boring samples and other samples collected in support of excavation activities. Table 6-1 provides a potential nomenclature system for the samples.

Table 6-1 Field Sample Identifiers

Oakdale Site

Soil Samples

Site Location	Sample Type	Sample Location	QC Type	Depth/Location
OKMN - Oakdale, MN	SBC - Soil Boring Composite	SB## - Soil Boring #	0 - Primary Sample	#### - Depth at Top of Sample
	ES - Excavated Soil	SP## - Stockpile #	DB - Duplicate Sample	LOC - A through Z
	ESC - Excavated Soil Composite		RB - Rinsate	LOC - Mult. Location Letters for Composite

Example ID: OKMN-SBC-SB01-0-0040

Primary composite soil sample collected from soil boring #1 at 4.0 ft bgs

Example ID: OKMN-ESC-SP03-DB-LOCAB

Duplicate composite soil sample collected from stock pile #3 locations A & B

Water Samples

Site Location	Sample Type	Sample Location	QC Type	Depth/Location
OKMN - Oakdale, MN	SW - Surface Water	LOC## - GPS Located Sample Point	0 - Primary Sample	#### - Depth of Grab Water Sample
	CW - Construction Water	BAT## - Batch Number	DB - Duplicate Sample	
			RB - Rinsate	

Example ID: OKMN-SW-LOC02-0-0000

Primary surface water collected from location #2 at top of water surface

ATTACHMENT 3

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

Weston Solutions, Inc.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

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LIST OF ACRONYMS

3M	3M Company
AL	action level
ASTM	American Society for Testing and Materials
BS	field blank spike
BSD	blank spike duplicate
CAR	Corrective Action Report
CGI	combustible gas indicator
COC	chain-of-custody
CPR	cardiopulmonary resuscitation
DQI	data quality indicator
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GLP	Good Laboratory Practices
GPR	ground penetrating radar
GPS	global positioning system
ICOC	Internal Chain-of-Custody
ID	identification
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LQM	Laboratory Quality management Program
MDL	method detection limits
MPCA	Minnesota Pollution Control Agency
MS	matrix spike
MSD	matrix spike duplicate
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety and Health Administration
Pace	Pace Analytical Services, Inc.
PCB	polychlorinated biphenyl
PFC	perfluorochemical
PID	photoionization detector
QA	quality assurance
QA/QC	quality assurance/quality control

LIST OF ACRONYMS (CONTINUED)

QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	quality control
RCA	Recommendation for Corrective Action
RD/RA	Remedial Design/Response Action
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
SARM	standard analytical reference materials
SHSC	Site Health and Safety Coordinator
SOP	Standard Operating Procedure
SOW	scope of work
SRM	standard reference material
SRV	soil reference value
SSHASP	Site-Specific, Security, Health and Safety Plan
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TIC	tentatively identified compound
USCS	Unified Soil Classification System
USGS	U.S. Geological Survey
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc., formerly Roy F. Weston, Inc.

1. PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is a supporting document to the Remedial Design/Response Action (RD/RA) Plan that has been prepared by the 3M Company (3M) for the Oakdale Site in Oakdale, Minnesota, to address the presence of perfluorochemicals (PFCs) in soil and groundwater. The primary focus of the Quality Assurance Project Plan is the soil excavation area north of Highway 5, since the work south of Highway 5 does not involve much handling of PFC-containing material during construction. However, elements of this plan may be applicable to the construction and operation and maintenance (O&M) activities for the groundwater treatment system.

This QAPP provides the quality assurance/quality control (QA/QC) procedures for the execution of the response actions associated with the excavation of soils at the Oakdale Site as shown in Figure 1-1. Minor modifications and additions may be made to this plan before and during implementation that will not involve regulatory review and approval.

The purpose of a QA/QC program is to produce analytical measurement data of known quality that satisfy the project data quality objectives (DQOs). DQOs are data quality planning and evaluation tools for all sampling and analysis activities. A consistent and comprehensive approach for developing and using these tools is necessary to ensure that enough data are produced and are of sufficient quality to make decisions for various phases of the RA.

This QAPP has been prepared by Weston Solutions, Inc. (WESTON®), on behalf of 3M. Tables and figures in this QAPP are provided at the end of each section.

1.2 PROJECT OBJECTIVES

As specified in the RD/RA Plan, soil removal will be conducted to prevent contact with all accessible surface soil within the defined excavation area and to reduce migration of perfluorochemicals (PFCs) from the soil into the groundwater, thereby accelerating the removal of PFCs from the groundwater. Throughout the area defined in the RD/RA Plan, the upper 4 feet of soil will be removed and transported to an existing permitted off-site landfill to provide engineered isolation and containment of PFCs. Additional soil below the 4-foot zone has also been defined and will be removed. The soil excavation locations and nominal depths are provided in Figure 1-1. Soil from the excavation area and construction water generated during site activities will be collected and analyzed during the RA for some or all the following constituents for disposal profiling:

- Total volatile organic compounds (VOCs) – target compound list (TCL).
- Total polychlorinated biphenyls (PCBs).
- Toxicity characteristic leaching procedure (TCLP) VOCs.
- TCLP metals.
- Ignitability.
- Reactivity.
- Paint filter test.

These objectives will be accomplished by conducting an environmental sampling program. Upon completion of the soil profile sampling, excavated soils will be sent to appropriate waste disposal facilities.

It is important to note that this QAPP does not cover analyses of samples for PFCs. PFC analyses are addressed by the Good Laboratory Practices (GLP) Protocol P-2561 that has been prepared by 3M and approved by the MPCA for the PFC site assessment activities at all three Minnesota sites. GLP Protocol P-2561 requirements will also be in effect for PFC response action monitoring activities.

1.3 SAMPLE NETWORK

Field sampling activities will involve the collection of soil and construction water samples necessary to complete profiling for soil disposal or water discharge.

Chemical analyses will be conducted to determine the concentration of VOCs and PCBs present in excavated soils and construction water and the concentrations of VOCs and metals in leachate from the soils.

Sampling will be performed on the environmental media in accordance with the Standard Operating Procedures (SOPs) contained in Section 4 of this QAPP.

During excavation activities, quantitative air and noise monitoring will be performed by WESTON. Information regarding air and noise monitoring procedures, locations, and frequencies is provided in the Construction Sampling Plan, which is in Attachment 2 to the RD/RA Plan.

1.4 TRAINING AND CERTIFICATION

Information pertaining to project specific training and certification including medical monitoring, Occupational Safety and Health Administration (OSHA) - related training, first aid/cardiopulmonary resuscitation (CPR), equipment operation, and associated records and documentation can be found in the Site-Specific Security, Health and Safety Plan (SSHASP) provided in Attachment 5 to the RD/RA Plan.

1.5 DISTRIBUTION

At a minimum, this QAPP will be distributed to the following personnel. Additional personnel will be added to the distribution list as required.

Robert Paschke, Manager, Corporate Environmental Programs
Corporate Environmental Programs
3M Environmental, Health and Safety Operations 3M Center
Bldg. 224-2E-55
St. Paul, MN 55144-1000

James R. Kotsmith, Senior Environmental Supervisor
Corporate Environmental Programs
3M Environmental, Health and Safety Operations 3M Center
Bldg. 224-2E-55
St. Paul, MN 55144-1000

Diane J. Anderson, Project Manager
Pace Analytical Services, Inc.
1700 Elm Street
Minneapolis, MN 55414

Robert Junnier, WESTON Project Manager
Weston Solutions, Inc.
1400 Weston Way
P.O. Box 2653
West Chester, PA 19380

WESTON SOLUTIONS

Legend

🟨	Water Table Monitoring Well
—	Fenceline
▨	Potential Stockpile Area
▨	Excavate to 4 Feet Below Grade
▭	Area of Soil (PFOS > 1.0 ppm)
▨	Excavation to Groundwater Table

N
W E
S

0 100 200
Feet

Figure 1-1
Excavation Area

Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\soil_excavation_area.mxd, 12-Feb-09 14:59, ricksc

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

A generalized description of the organization and the responsibilities of key individuals for the project teams are described in this section. This QAPP covers the work of 3M, WESTON, and subcontractors, and position titles. Responsibilities and authority may vary among subcontractors. The following sections give brief descriptions of the primary staff and the responsibilities of the management, QA/QC, and primary task leadership for the field and laboratory tasks. Project activities will be performed within the framework of the organization and functions described in this section.

The organization for the project is designed to provide clear lines of responsibility and authority. This control structure provides for the following:

- Identifying lines of communication and coordination.
- Monitoring project schedules and performance.
- Managing key technical resources.
- Providing periodic progress reports.
- Coordinating support functions such as laboratory analysis and data management.
- Rectifying deficiencies.

Subcontractor and laboratory personnel providing services in support of this program will perform work in strict compliance with the appropriate contract specifications for the activity.

QA personnel will have sufficient authority, organizational freedom, and ability to act as follows:

- Identify QA problems.
- Initiate, recommend, or provide solutions to QA programs through designated channels.
- Ensure that program activities, including processing information deliverables, and installation or use of equipment, are reviewed in accordance with QA objectives.
- Ensure that deficiencies/nonconformances are corrected.

- Ensure that further processing, delivery, or use of data is controlled until the proper disposition of a nonconformance, deficiency, or unsatisfactory condition has occurred.

The organization of the project responsibilities described in this section is illustrated in Figure 2-1, the Project Organization Chart, and Table 2-1, WESTON Project Quality Control Responsibilities. The organizational structure will be reviewed and updated periodically by the WESTON Project Manager. Any necessary staff changes will be filled with qualified personnel and communicated to the 3M Project Manager.

2.1 3M COMPANY PERSONNEL

Mr. Jim Kotsmith, P.E., QEP, will serve as the 3M Project Manager. Mr. Kotsmith will be the primary 3M contact and will be responsible for coordinating clearance for all on-site activities. To the maximum extent possible, communications between 3M and the MPCA concerning the terms and conditions of the Agreement as they apply to response actions for the Site will be directed through the 3M and MPCA-designated Project Managers. The 3M Project Manager will be responsible for assuring that all communications from the MPCA Project Manager are appropriately disseminated and processed.

The 3M Project Manager, as well as the MPCA Project Manager, has the authority to (1) take samples or direct that samples be taken; (2) direct that work at a Site stop for a period not to exceed 72 hours if the Project Manager determines that activities at the Site may create a danger to public health or welfare or the environment; (3) observe, take photographs and make such other reports on the progress of the work as the Project Manager deems appropriate; (4) review records, files and documents relevant to the Agreement; and (5) make or authorize minor field modifications or clarifications during the RA in techniques, procedures or methods utilized in carrying out the RA which are necessary to the completion of those activities. Any field changes that require necessary notification will be approved orally by both the 3M and MPCA Project Managers. If the 3M Project Manager requests a field change, he will, within 72 hours following the change, prepare a memorandum detailing the field change and the reasons therefore and will provide or mail a copy of the memorandum to the MPCA Project Manager. The 3M Project Manager will either be on the Site or available on call by telephone during all hours of work at the Site.

3M will provide a designated representative for all on-site activities. The designated representative will be the on-site point of contact for non-3M personnel and contractors. He will assure that 3M policy, requirements and procedures are being followed.

2.2 WESTON PERSONNEL

2.2.1 Project Manager

Mr. Robert Junnier, P.E., will serve as the WESTON Project Manager. He will be responsible for day-to-day activities on the project and planning, coordinating, integrating, monitoring, and managing project activities, including the activities of subcontractors to WESTON. Mr. Junnier will also be responsible for the identification and ultimate resolution of technical problems and the technical coordination of the field efforts, hydrogeological evaluation, and the subsequent data assessment. Field audits are also the responsibility of the WESTON Project Manager.

2.2.2 Technical Advisors/Quality Assurance Coordinator

Mr. Michael Corbin, P.E., and Mr. Jaisimha Kesari, P.E., will serve as the WESTON Technical Advisors. Messrs. Corbin and Kesari will be responsible for reviewing the accuracy and precision of all sample data and other information generated during the program. Messrs. Corbin and Kesari will have the authority to impose proper procedures or to halt an operation. Their duties include QA review and approval of sampling activities, field documentation, and all technical data.

2.2.3 Quality Assurance Auditor

Mr. Thomas Drew, P.G., of WESTON will serve as the Project Quality Assurance (QA) Auditor. The QA Auditor will be responsible for designing and/or performing QA system and performance audits. Mr. Drew's functions as QA Auditor are presented in detail with a description of the project system and performance audit system in Section 10 of this QAPP.

2.2.4 Field Team Site Manager/Health and Safety Officer

Mr. John Hunter of WESTON will lead the Field Team and serve as Health and Safety Officer and be responsible for oversight of environmental activities in the field. He will be responsible for ensuring that all procedures for the field activities related to soil sampling and disposal profiling are executed in accordance with the approved plans and are documented according to the procedures presented in this QAPP. As Health and Safety Officer, Mr. Hunter will be responsible for: (1) having an up-to-date SSHASP in place; (2) ensuring that all WESTON and subcontractor personnel adhere to the SSHASP; (3) training all personnel involved in health and safety procedures; (4) maintaining control and exercising proper response in emergencies; and (5) keeping a logbook of activities.

2.2.5 Project Engineer/Project Geologist

Ms. Janet Savage, P.E., of WESTON will be the Project Engineer and will be responsible for providing technical support for the field effort, managing the data generated from the field investigation, and preparing data assessment and progress reports. Mr. Timothy R. Frinak, P.G., of WESTON will be the Project Geologist and will have overall responsibility for the performance of the geological and hydrogeological investigations and evaluations required under the RA program. Mr. Frinak also will provide technical oversight, guidance, and QA review of field investigations and sampling activities.

2.3 LABORATORY STAFFING

Analytical work required during the RA program at the 3M Oakdale Site will be performed by Pace Analytical Services, Inc. (Pace). Work will be performed in the Pace laboratory located in Minneapolis, MN. The analytical program for the RA program is detailed in Section 7 of this QAPP. If for any reason another laboratory is needed during the RA program, it will be required to comply with the requirements presented in this QAPP.

A description of the Pace Laboratory Quality Assurance (QA) procedures is summarized in the QA Manual included as Appendix A of this QAPP. The laboratory QA Manual includes a detailed explanation of the staff organization and QA system, as well as personnel responsibilities, qualifications, and training.

It is the individual responsibility of all analysts and technicians to perform their assigned tasks according to this QAPP, applicable standard operating procedures (SOPs), Study Protocols, the scope of work (SOW), and the RD/RA Plan. This includes responsibility for performing QC analyses as specified in the method SOP and for entering the QC data in the appropriate logbook, electronic database, or method control file system. The analyst will report out-of-control results to the Laboratory Supervisor and will indicate corrective action for out-of-control events.

2.3.1 Pace Personnel and Responsibilities

Ms. Sarah Chemey, General Manager, is accountable for the oversight of all laboratory functions and operations. The General Manager’s responsibilities include the oversight of the laboratory’s Quality Systems and ensuring that all tasks performed by the laboratory are conducted in compliance with state, federal and industry standards, as well as the requirements of this QAPP.

Ms. Melanie Oillila, Quality Assurance (QA) Manager, will be responsible for the accuracy and precision of laboratory-generated data and information, and will ensure proper procedures and protocols are being followed so that high-quality data are produced. The QA Manager will maintain a sufficient staff to initiate and oversee audits and corrective action procedures, perform data review, and maintain documentation of training. In addition, the QA Manager has the authority to stop work on projects if QC problems arise that affect the quality of the data produced.

Ms. Chris Bremer, Technical Director, will be responsible for monitoring the standards of performance in QA/QC data; monitoring the legitimacy of analyses performed and data generated; and reviewing tenders, contracts and QAPPs to ensure the laboratory can meet the DQOs for the project.

2.4 SUBCONTRACTORS

The WESTON Project Manager will coordinate with the WESTON Subcontractor Administrator on developing the scope of services to be performed by the subcontractors. The Field Team Manager, in coordination with the Field Team Leader, will direct the subcontractors in the field in accordance with their specific SOW.

Table 2-1 WESTON Project Quality Control Responsibilities
RA Program
Oakdale Site

Position	Responsibility	Authority
Project Manager	• Directs and coordinates project team. • Manages the implementation of all policies and procedures. • Establishes project organization and management procedures. • Serves as point-of-contact for all project activities. • Interfaces with 3M Project Manager. • Ensures that QC program is implemented (including proper custody and documentation procedures). • Ensures that all corrective actions are taken if performance is not acceptable. • Manages data validation tasks, including QC task staffing; and ensuring that QC data evaluation, data validation, and reporting procedures follow approved QAPP. • Notifies the project staff of project nonconformance.	• Defines team resource needs. • Assigns staff and selects team resources.
Project Engineer/ Project Geologist	• Integrates project activities and efforts. • Plans, implements, and tracks QA/QC activities. • Maintains communication with QC and analytical task staff members. • Compiles, reviews, and assembles data, calculations, and project information; checks for accuracy, consistency, and completeness. • Reviews all submittal packages. • Determines usability of data and interprets results for subsequent preparation of analytical reports and investigation report contributions.	• Prepares technical plans. • Documents deficiencies, resolves discrepancies. • Verifies that field activities and analytical data comply with approved plans. • Can recommend stop work orders to the Project Manager against deficient items/ work. • Can recommend rework or replacement of deficient items/work. • Will not allow additional work to be placed over or on deficient items/work.
Field Team Manager	• "Hands on" role in management of project tasks associated with sampling and analysis; involved with field personnel in labels, logs, preservation, and sampling. • Ensures adherence to proper custody and documentation procedures for all sampling activities. • Coordinates with laboratories. • Coordinates with database to compile and present data. • Evaluates soil disposal alternatives.	• Oversees sampling activities in field and is focal point for communication with laboratories. • Verifies compliance of field work with approved plans. • Can recommend stop work orders to the Project Manager against deficient items/work. • Can recommend rework or replacement of deficient items/work. • Will not allow additional work to be placed over or on deficient items/work.

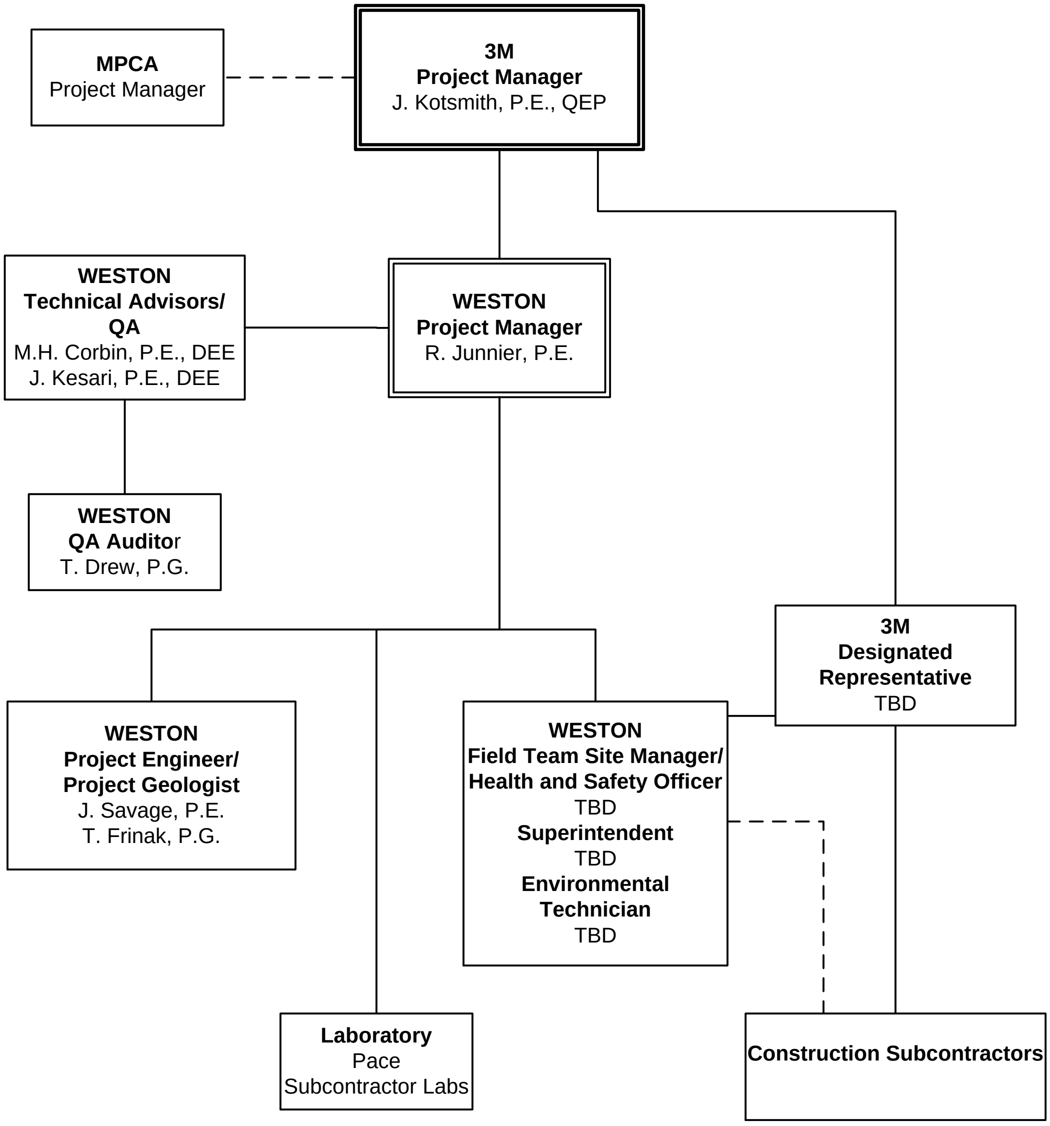

FIGURE 2-1 PROJECT ORGANIZATION CHART
RA PROGRAM
OAKDALE SITE

3. DATA QUALITY OBJECTIVES

The purpose of a QA/QC program is to produce analytical measurement data of known quality that satisfy the project DQOs. DQOs are data quality planning and evaluation tools for all sampling and analysis activities. A consistent and comprehensive approach for developing and using these tools is necessary to ensure that enough data are produced and are of sufficient quality to make decisions for all types of sites and phases of investigation. The DQO process and measurement performance and acceptance criteria for program planning are presented in this section. The procedures of the overall QA/QC program, as described throughout this QAPP, have been developed to ensure that the analytical data collected through implementation of the RA program are of a known and acceptable level of quality.

3.1 THE DATA QUALITY OBJECTIVE PROCESS

The DQO process defines the project objectives in the form of a decision; agreeing upon the criteria used to make a decision and the acceptable level of uncertainty (or error) in making a decision. The DQO process, in general, will be based on information presented in *EPA Guidance for the Data Quality Objectives Process* (U.S. Environmental Protection Agency [EPA]-QA/G-4, 2006), February 2006.

DQOs specify the data type, quality, quantity, and uses needed to make decisions and will be the basis for designing data collection activities. The DQOs developed for the RA program at their broadest level will ensure that the data generated are of a known and acceptable level of quality. Primary DQOs will include the following:

- Sampling of soils for disposal profiling.
- Use of analytical results to determine proper soil disposal locations.
- Sampling of construction water for disposal.

An overview of the RA program is presented in Section 1.4 of this QAPP. Additional information on the study design is contained in the RD/RA Plan. Soils and construction water will be analyzed for some or all of the following parameters:

- Total VOCs (TCL).
- Total PCBs.
- TCLP VOCs.
- TCLP Metals.
- Ignitability.
- Reactivity.
- Paint Filter Test (soils only).

To achieve the DQOs, QA measures will be implemented throughout the project to ensure that the data meet known and suitable data quality criteria such as precision, accuracy, representativeness, comparability, and completeness. The sampling data will be quality-controlled through the collection of field QC samples and the calibration of field and laboratory equipment following established protocols. In addition, replicate samples will be collected and submitted as part of the QA program. Implementation of QA/QC measures to achieve the DQOs will limit the chance of generating inadequate or incomplete data.

The type, quantity, and quality of data needed vary among these uses and with the type of location under investigation; therefore, specifying a single sampling and analysis design or approach for all field activities and locations is not feasible. Instead, anticipated field, sampling, and analytical procedures are included in this QAPP, along with guidance and recommendations for selecting among the alternatives. This approach encourages efficient and cost-effective use of resources and reduces redundancy in the QAPP.

The data collected during the RA program will be reviewed according to the procedures outlined in Section 9.3 of this QAPP. The data will be evaluated for compliance with the specific QC objectives listed in the Tables 7-1 through 7-9 in Section 7 and Appendix A of this QAPP.

3.2 MEASUREMENT PERFORMANCE/ACCEPTANCE CRITERIA

As defined in the *Guidance for Quality Assurance Project Plans* (EPA-QA/G-5, 2002), measurement performance criteria for new data collected in support of the RA activities are stated in terms of the desired (assumed) level of uncertainty in data that will be used to address the study question or support the decision. Measurement acceptance criteria are used in place of performance criteria to assess existing data adequacy and to evaluate uncertainty in the results derived from the use of these data sources. These measurement criteria are often expressed in terms of data quality indicators (DQIs). The measurement criteria established in this QAPP will be used for data quality review. The QA/QC program will provide the following basis for the criteria:

- Provide a mechanism for the ongoing control and evaluation of measurement data quality.
- Provide measures of data quality in terms of precision, accuracy, completeness, representativeness, and comparability to assess whether the data meet the project objectives and can be used for their intended purpose.

The primary objective of the chemical measurement data will be to generate sufficient information to determine the presence or absence of contamination within the environmental media and to determine the nature and extent of concentrations. Data acquired during the sample collection phase must be defensible. The quality objectives for the chemical measurement data will specify the "quality" of the data needed to enable project personnel to make decisions.

The DQOs listed will be accomplished by ensuring that the following analytical objectives are met:

- Collect and analyze samples under controlled situations using standard methods.
- Obtain usable and defensible analytical results.

The following sections discuss the steps that will be taken to ensure the quality of the data acquired during the RA program work. The representativeness of the measurement data is a function of the sampling strategy and will be achieved by following the procedures discussed in the RD/RA Plan and this QAPP. The quality of the analytical results is a function of the analytical system and will be achieved by using standard methods and the QC system discussed in this section. The basis for assessing precision, accuracy, representativeness, comparability, and completeness is discussed in the following sections. Specific calculations for data quality measurements, and the data assessment procedure, are presented in Section 3 of this QAPP.

3.3 DEFINITION OF CRITERIA

This section contains a definition of how the project analytical performance and acceptance measurements will be assessed during the waste characterization program.

3.3.1 Precision

Precision measures the reproducibility of repetitive measurements. Precision is strictly defined as the degree of mutual agreement among independent measurements as the result of the repeated application of the same process under similar conditions. Analytical precision is a measurement of the variability associated with duplicate (2) or replicate (more than 2) analyses of the same analytical sample in the laboratory and, for the purposes of this program, will be determined by analysis of field and laboratory duplicate samples. Field and laboratory duplicates will be used to evaluate total precision, which is a measurement of the variability associated with the entire field sampling and laboratory analysis processes. Precision will be estimated using the relative percent difference (RPD) between field duplicates, matrix spike/matrix spike duplicates (MS/MSDs) (organics) and matrix duplicates (inorganics).

Laboratory precision goals are presented in Tables 7-1 through 7-9 in Section 7 for each method and matrix. Both laboratory and field precision goals will be met if the field normal and duplicate analyses agree within the RSDs specified in Section 7.

3.3.2 Accuracy

Accuracy is a statistical measurement of correctness, and includes components of random error (variability due to imprecision) and systematic error (bias). Therefore, it reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value. Analytical method accuracy is typically measured by determining the percent recovery of known target analytes that are spiked into a field sample (matrix spike [MS]) or reagent water or soil (laboratory control sample [LCS]) before digestion/extraction at known concentrations. Surrogate compound recovery is another spiking technique used to assess method accuracy for each sample analyzed for organic compounds. The stated accuracy objectives apply to spiking levels at concentrations comparable to the estimated method detection limits (MDLs) or higher. Data acceptance criteria for analyses are provided in the individual analytical methods.

Both accuracy and precision will be calculated for specific sampling or analytical activities over the entire study, and the associated sample results must be interpreted considering these specific measures. Application of calculated precision and accuracy to measurement sample results is presented and discussed in Section 8 of this QAPP. An additional consideration in applying accuracy and precision is the concentration level of the samples. A procedure capable of producing the same value within 50% would be considered precise for low-level (near/at the reporting limit) analyses of minor constituents, but would be unacceptable, and possibly useless, for major constituents at high concentrations.

3.3.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Objectives for representativeness are a function of the investigative objectives. Representativeness will be achieved in part through the use of the standard sampling and analytical procedures described in this QAPP and the Construction Sampling Plan. Representativeness is also determined or influenced by appropriate program design, considering elements such as proper well locations, drilling and installation procedures, or sampling locations. The program design, which includes locations and procedures for each of the areas to be sampled, is contained in the RD/RA Plan.

3.3.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to other data sets. The objectives for this QA/QC program are to produce data with the greatest degree of comparability possible. The number of matrices that will be sampled and the range of field conditions encountered must be considered in ultimately determining comparability. Comparability will be achieved by using the applicable methods for sampling and analysis (as presented in Appendices B and A, respectively), reporting data in standard units, and using standard and comprehensive reporting formats.

3.3.5 Completeness

Completeness is a measure of the degree to which the amount of sample data collected meets the scope and a measure of the relative number of analytical data points that meet all the acceptance criteria for accuracy, precision, and other criteria required by the specific method factors. Completeness is calculated from the aggregation of data for each method for any particular sampling event. For each method and each site, the number of valid results, divided by the number of individual analyte results initially planned for, expressed as a percentage, determines the completeness for the data set. The objective for completeness is 90%. If there are any instances of samples that could not be analyzed for any reason (i.e., samples spilled or broken, etc.), the numerator of this calculation will become the number of valid possible results.

Valid results used to meet completeness objectives are those results that provide defensible estimates of the true concentration of an analyte in a sample. These valid results include data that are not qualified and data for which QC results indicate qualification is necessary, but which may still be used to meet project objectives. Invalid results are those data for which there is an indication that the prescribed sampling or analytical protocol was not followed.

3.4 OVERALL DATA QUALITY OBJECTIVE GOAL

The DQO goal for the RA program will be to have all analyses performed on an analytical system that is in control and meets method specifications. Numerically, the goal is to have all individual results traceable to an LCS whose recovery is within the specified limits. Method specifications will be used as tolerance limits for the project. The method-specified limits for the LCS are supplied in Section 7, along with method-specified limits for spike recoveries in natural MSs. Inaccurate or imprecise recovery of the LCS will invalidate results, and the data set will be rejected. The sample will then be re-extracted and re-analyzed. Poor recoveries of spikes in natural-matrix samples indicate the potential for matrix effects. A conclusion of matrix effects must be supported by LCS results within acceptance criteria for the MS performed.

3.5 GEOLOGICAL DATA QUALITY ASSURANCE OBJECTIVES

Geological data are obtained from observations and measurements made during drilling numerous soil borings for the site investigation. While measuring the DQIs of data collected from these activities is more difficult, several steps will be undertaken to ensure that the data are representative and comparable and as accurate as possible. Thus, the geologists will be familiarized with the lithologies that may be encountered and will be provided the opportunity to standardize sample lithologic description methods. After collection, samples will be examined, identified, and described using the appropriate method, which may include the following:

- Unified Soil Classification System (USCS).
- Munsell color charts.
- Standard geological descriptions and field tests, including dilatancy, plasticity, grain size distribution, angularity or roundness, mineral content, organic content, silt-clay-sand percent, and moisture content.

Geologists new to the Oakdale Site will be trained by an experienced geologist to promote comparability and representativeness in procedures and documentation. Standardized lithologic logging, well completion and installation forms, and materials and sample collection forms will be used to document boring or drilling activities and promote information comparability.

Cores and samples to be collected for physical or chemical analysis will be collected and handled according to the procedures presented in this QAPP. Specific sample collection criteria and sampling locations are presented in the RD/RA Plan.

4. SAMPLING PROCEDURES

This section describes the components of the sampling procedures that will be performed to meet the DQOs for the RA program tasks to be performed at the Oakdale Site. Sampling locations, rationale, and analytical methods, as well as the sampling procedures for this project are discussed in detail in the RD/RA Plan and the Construction Sampling Plan.

4.1 SAMPLING PROTOCOLS

This section includes brief descriptions of field procedures used to conduct environmental investigations and characterizations. Criteria or guidelines for choosing among alternatives are also included when more than one procedure can be used. Detailed equipment and sampling protocols are provided in the field sampling SOPs in Appendix of this QAPP:

- Decontamination (Appendix B.1).
- Soil Sampling (Appendix B.2).
- Surface Water Sampling (Appendix B.3).

The sampling SOPs in Appendix B describe the QC specifications, documentation requirements, field logs and forms, stepwise descriptions of the procedure, and any special conditions or precautions that must be considered in the field.

Prior to beginning each sampling event, the Field Team Leader will ensure that the field personnel understand the purpose and objectives of the event. Topics of review and discussion with the team may include schedules, responsibilities, sampling locations, types of samples to be collected (both field samples and QC samples), number of samples and sample volumes to be collected, sample identification numbering schemes, preservation requirements, parameter(s) to be analyzed, sampling procedures, equipment decontamination procedures, and chain-of-custody requirements. Field personnel will read pertinent sections of the QAPP before planning or performing the field work. The

Field Team Leader will ensure that field personnel also have a copy of the complete RD/RA Plan in the field. Field activities must be conducted in accordance with the health and safety procedures described in the SSHASP (Attachment 5 of the RD/RA Plan). Other facility-specific requirements, such as, the Contractor Safety Requirements, must be followed while conducting activities on-site.

Proper site sampling location selection is critical to producing representative data. Locations selected for drilling and/or sampling during the DQO process must represent the location and/or matrix under investigation. The general criteria described here will be considered when selecting drilling and sampling locations. Additional criteria for selection of sampling locations are contained in the RD/RA Plan. Any specific sample collection criteria developed to guide decision making in the field will be documented in the site-specific logbook.

Criteria for selecting soil boring and soil sampling locations are based on sampling grids provided in the Construction Sampling Plan (Attachment 2 of the RD/RA Plan).

Final selection of a site sampling location will depend on securing all necessary clearances and permits from 3M. If necessary, electrical cable and pipe locator instruments will be used with underground utility maps, magnetometer readings, and ground penetrating radar (GPR) to determine if utilities underlie the drilling location. The final locations of all borings must be approved by 3M prior to drilling.

The specific site selection criteria, number of samples to be collected, and parameters of interest are addressed in the RD/RA Plan and Construction Sampling Plan.

4.2 SAMPLING METHOD REQUIREMENTS

Several elements of field and sampling activities are comprehensive and apply to all types of procedures. The standard approach for each element is addressed in the Construction Sampling Plan.

During the project, the Field Team Manager and sampling team members must ensure that all measurement and field procedures are followed as specified herein, and measurements meet the prescribed acceptance criteria. If a problem arises, prompt action to correct the problem is imperative. Corrective action procedures are described in Section 12 of this QAPP.

Field QC sample collection and preparation procedures will follow the requirements presented in this section. A detailed description of the specific QC samples that will be collected as part of the field work is provided in Section 8 of this QAPP.

4.3 SAMPLE HANDLING

The Field Team Manager will be responsible for ensuring that samples are collected with properly decontaminated equipment and containerized in properly cleaned sample bottles. All sample bottles and containers will be obtained directly from the laboratory and will be precleaned according to EPA protocols.

Sampling and preservation procedures will be as mandated by each respective method. In order to preserve the integrity of the sample before it is analyzed, proper sample containment, preservation methods, holding times, and shipping and chain-of-custody procedures must be followed. A summary of the recommended sample containers, sample volumes, preservatives, and holding times for each analytical method and sample matrix is provided in Table 4-1.

4.3.1 Sample Containers

All sample containers provided will be new, precleaned containers that are purchased with traceability of analysis. The types of containers that will be provided for each analyte are listed in Table 4-1.

4.3.2 Sample Preservation

Samples will be preserved as indicated in Table 4-1 or as otherwise specified in the analytical method SOP. All samples will be kept chilled from the time of collection until the time of analysis by the laboratory. Field personnel will keep samples cold using ice and coolers in which samples are to be stored until delivery to the analytical laboratory. A temperature blank will be placed in each cooler prior to shipment and the temperature will be measured and recorded by the laboratory upon receipt. After receipt of the samples, it is the laboratory's responsibility to store the samples at 4° ± 2° C until analysis is begun.

4.3.3 Holding Times

All samples have a finite holding time (the time between sample collection, sample extraction, and sample analysis) to limit the potential for degradation of the analytes. Freezing the samples to extend holding times is not acceptable.

The sample holding times stated in Table 4-1 must be met. The holding times for all required analyses will be measured from the verified time of sample collection. The samples will be hand delivered to Pace by WESTON employees to minimize the time between collection and laboratory processing.

Upon sample receipt at the laboratory, all sample collection dates will be noted by the sample custodian. The required date for completion of analysis (or extraction) will be noted and keyed to the holding time. All analyses that have holding times of 48 hours or less will be identified by the sample custodian, and the appropriate Laboratory Project Manager and analyst will be notified that the samples are in the laboratory. The Laboratory Project Manager will be responsible for ensuring proper execution of all required analyses.

Advance notice must be provided by the Field Team Manager to the laboratory that samples with a short holding time (48 hours or less) are being delivered, so that the laboratory will have time to make necessary arrangements for analysis and instrumentation.

4.3.4 Sample Receipt

The analytical services laboratory will follow procedures for handling, identifying, control, and chain-of-custody procedures to maintain the validity of the samples as discussed in Section 5.2.1 of this QAPP.

4.4 SAMPLING EQUIPMENT DECONTAMINATION

Equipment decontamination is an integral part of the data collection and QA process. The implementation of proper decontamination practices and procedures will begin in the field prior to use of sample collection equipment. Disposable, single use sample collection and sample handling equipment will be used wherever feasible. All non-disposable field sampling equipment will be decontaminated before use and after each sample location according to the procedures contained in the Decontamination SOP (Appendix B.1) and the SOP(s) for the media being sampled. Wash water and other fluids generated during decontamination will be containerized, if required, and managed in accordance with 3M requirements.

Table 4-1 Sample Volumes, Containers, Preservatives and Holding Times

Oakdale Site

Analysis	Container	Preservative	Holding Times
Soil			
VOCs	Terra Core Kit	*See Note*	14 days
TCLP VOCs	4-oz glass	Cool, 4 °C ± 2 °C	14 days
Total PCBs	4-oz glass	Cool, 4 °C ± 2 °C	14 days
TCLP Metals	4-oz glass	Cool, 4 °C ± 2 °C	6 months (except Mercury - 28 days)
Ignitability	8-oz glass	NA	28 days
Reactivity	100-g glass	Cool, 4 °C ± 2 °C	NA
Paint Filter Test	250-mL plastic	Cool, 4 °C ± 2 °C	none
Water			
VOCs	3 x 40-mL glass VOA vials	HCl & Cool, 4 °C ± 2 °C	14 days
Total PCBs	1-L glass amber	Cool, 4 °C ± 2 °C	7 days
TCLP Metals	250-mL plastic	HNO_3 & Cool, 4 °C ± 2 °C	6 months

NOTE: Terra Core Kit contains one 40-mL vial with 5 mL of methanol, two 40-mL vials with 5 mL of sodium bisulfate and a stir bar, one 60-mL amber bottle and one 5-gram terra core. Kit will be kept cool at 4 °C.

NA - Not Applicable

5. SAMPLE CUSTODY

Sample possession during all sampling efforts must be traceable from the time of collection until the results are verified and reported. The sample custody procedures provide a mechanism for documentation of all information related to sample collection and handling to achieve this objective. The sample handling procedures are discussed in Section 4.3. This section contains a general discussion of sampling custody practices. The QC practices in this section are intended to address potential problems with labeling errors, transcription errors, preservation errors, etc. Overall, the QC checks discussed in this section are the mechanisms that detect and correct errors.

Custody is the physical possession of a sample and the storage of a sample in a secure area, and it is typically considered in three parts: sample collection, laboratory files, and final files. All laboratory raw data and other supporting records will be maintained by the laboratory a minimum of 10 years. Field logbooks will be maintained by WESTON.

Sample custody procedures for this program were developed to emphasize careful documentation of sample collection and transfer of data. The WESTON Project Manager and Field Team Manager will be responsible for field team adherence to proper custody and documentation procedures for all sampling operations. To ensure that all of the important information pertaining to each sample is recorded, documentation procedures will be standardized.

Sample custody forms will be used to document the relevant information for each sample taken.

5.1 FIELD OPERATIONS

Each sample collected will immediately be assigned a sample number, which will be put on the label attached to the sample container. Sample labels are given a unique field sample number (see Section 5.1.3), which serves to identify the sample by documenting the sample type, who collected it, where it was collected, when it was collected, the analysis required, and the preservation method(s) used.

Chain-of-custody records will be sequentially numbered to facilitate tracking of the shipment of individual samples. After the sample identification information is entered in the Field logbook, it will be entered on the chain-of-custody form (see Section 5.1.4) and shipped with the samples.

Prior to shipping, a minimum of one custody seal will be affixed to each of the sample coolers sent off-site for sample analysis. The custody seals serve as a tampering indicator and must remain intact until the cooler is opened at the laboratory.

5.1.1 Field Records

Documentation of field sampling will be performed to ensure data validity and facilitate analysis and evaluation. Examples of field documentation are provided in the following sections.

Field personnel are responsible for recording field activities in the appropriate field documentation logbooks in sufficient detail to allow the significant aspects of the event to be reconstructed without relying on memory. It is the responsibility of the Field Team Leader to ensure that all documents are complete and legible. At the end of each day, all documents completed that day will be reviewed by the Field Team Leader for accuracy, completeness, and legibility.

The field documentation forms or equivalent records that will be used during this investigation include the following:

- Soil sampling and borehole log forms.
- Field logbooks.
- Annotation of maps.
- Equipment calibration log.
- Sample chain-of-custody record (discussed in Section 5.1.4)

5.1.1.1 Soil Sampling and Borehole Log Forms

Certain descriptive and sample information will be recorded during the completion of each boring and the collection/logging of soil samples. The information will be recorded on a soil description form, borehole log form, or other appropriate form, as described in the appropriate SOPs. Copies of the forms are provided as part of the field SOPs included as Appendix B of the QAPP.

5.1.1.2 Field Logbooks

Field logbooks will be used to record data collection activities. As such, activities will be described in as much detail as possible so that persons going to the facility can reconstruct a particular situation without relying on memory. After sample collection and before proceeding to the next sampling point, the samplers will complete the following procedures:

- Enter the sample into the chain-of-custody record (per Section 5.1.4).
- Complete appropriate forms or logbook entries.

A bound field logbook will be maintained by the Field Team Manager or another designated field team member at the site to record information pertinent to daily activities, the field sampling program, and the equipment preparation efforts. Field logbooks will be bound, pages numbered, and entries made in permanent, waterproof ink. The Field Team Manager will review field log entries daily. Field logbooks will be transferred to the project files at the end of field activities to provide a record of sampling.

A separate entry will be made for each sample collected. Field logbooks will contain the following types of information, where applicable:

- Name and location of site.
- Date(s) and time(s) of sample collection.
- Name of Field Team Manager and other field team members.
- Field observations, including physical/environmental conditions during the field activity (i.e., weather).
- Summary of equipment preparation/decontamination procedures.
- Number, type, location, depth, and analysis required of samples taken and sample identification codes.

- A description of sampling methodologies or references to the RD/RA Plan/Construction Sampling Plan/SOPs.
- A cross-reference to photographs, if photographs are taken.
- Sample container/preservative.
- A cross-reference of sample identification codes to site sampling points, composites, or grids that may be indicated on annotated site maps or sketches.
- Sample shipping dates and methods.

Comments and other relevant observations such as sampling techniques and any modifications to sampling procedures as well as other technical comments regarding color, odor, texture, and other sample characteristics.

5.1.1.3 Annotation of Maps

Copies of site base maps or sketches will be used by the field teams to record key site conditions and to show approximate locations of soil borings, monitoring wells, buildings and structures, utilities, and other appropriate site location information. The maps or sketches will be maintained by the Field Team Manager during field activities and transferred to the project files for a record of sampling locations.

5.1.1.4 Equipment Calibration Log

Equipment calibration logs will be maintained in the field logbooks to record the calibration measurements and frequencies of site equipment.

5.1.1.5 Corrections to Documentation

All measurements made and samples collected will be recorded. Corrections will be made by drawing a line through the incorrect entry and writing in the correct entry. The person making the correction will date and initial the correction. There will be no erasures or deletions from the field logbooks.

5.1.2 Sample Labels

Each sample container will receive a sample label. Sample labels will identify the sample by documenting the unique sample identification number, the sample type, the parameters to be analyzed, the sampler's initials, the date collected, and the preservation method used. Sample labels will be waterproof and will be completed with a permanent marker and affixed to the sample container.

5.1.3 Sample Identification

A unique sample code, known as a field sample identifier or sample identification (ID), will be assigned to each sample collected. The field collection system will be set up to allow the Field Team Manager, or designated sampling coordinator, to generate field sample identifiers prior to sample collection, if sufficient information is known (i.e., number of sampling locations and depths). Each unique identifier will be printed on the sample jar label, along with the date, time, and location from which the sample was taken. In addition, an alphabetic value will be assigned to the type of sample (i.e., field duplicate, rinse blank) to indicate which samples are to be used for QC analysis and information. This identification is necessary to the nature of the analytical procedures, as discussed in the QA Manual and respective procedures provided in Appendix A of this QAPP.

Field sample identifiers will be generated so that there is no duplication. Each location at a facility will be given a unique, sequential number to ensure that the next sequential number will be used, even when returning to a site that has been sampled previously. The chain-of-custody will be prepared by selecting the field sample identifiers from the list, thereby providing a double-check that the field sample identifier on the sample bottle is consistent with the chain-of-custody form.

The format that will be followed for the field sample identifiers during the characterization activities at the Oakdale Site is presented in Table 5-1.

5.1.4 Chain-of-Custody

An overriding consideration for environmental data is the ability to demonstrate that samples were obtained from the locations stated and that they reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented to accomplish this goal. Documentation will be accomplished through a chain-of-custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt. A standard chain-of-custody form will be provided by the laboratory.

All samples that are collected will be accompanied by a chain-of-custody record. The following information will be recorded to complete the chain-of-custody record:

- Project name and number.
- Initials of sampler.
- Sample number, location, date and time collected, and sample type.
- Analyses requested.
- Any special instructions and/or sample hazards.
- Signature of sampler in the designated blocks, indicating date, time, and company.
- Condition of the sample upon receipt as reported by the analytical laboratory.

The purpose of sample custody procedures is to document the history of sample containers and samples (and sample extracts or digestates) from the time of preparation of sample containers through sample collection, shipment, and analysis. An item is considered to be in one's custody if one or more of the following conditions apply:

- It is in a person's actual possession.
- It is in view after being in physical possession.
- It is locked up so that no one can tamper with it after having been in physical custody.

The following chain-of-custody procedures will be followed for all samples submitted to the laboratory for chemical or physical properties analysis:

- Each individual field sampler is responsible for the care and custody of samples he or she collects until the samples are properly transferred to temporary storage or for shipping.
- A chain-of-custody record will be completed by the sampler for all samples collected and submitted to the laboratory.
- Each time the samples are transferred, the signatures of the persons relinquishing and receiving the samples, as well as the date and time, will be documented.
- A copy of the carrier airbill will be retained as part of the permanent chain-of-custody documentation.
- The laboratory will record the condition of the sample containers upon receipt.
- Changes or corrections to the information documented by the chain-of-custody form (including, but not limited to, field sample ID or requested analyses) must be changed and initialed by the person requesting the change. In situations where the request comes from the contractor, a copy of the chain-of-custody form will be altered, initialed, and forwarded to the laboratory, where it will supersede the original chain-of-custody form.
- A copy of the chain-of-custody form and any documented changes to the original will be returned from the laboratory as part of the final analytical report to the Project Manager. This record will be used to document sample custody transfer from the sampler to the laboratory and will become a permanent part of the project file.

5.1.5 Shipping Procedures

The objective of sample handling procedures is to ensure that samples arrive at the laboratory intact, at the proper temperature, and free of external contamination. Samples will be delivered to Pace via a WESTON employee or a courier service.

5.2 LABORATORY OPERATIONS

The analytical services laboratory will follow the SOPs for handling, identification, control, and chain-of-custody procedures and to maintain the validity of the samples. These SOPs are based on the use of EpicPro Laboratory Information Management System (LIMS) for tracking samples from receipt through reporting of the analytical results. The laboratory custody procedures, summarized in these sections, are presented in Appendix A of this QAPP.

5.2.1 Sample Receipt

A designated sample custodian will be responsible for samples received at each laboratory. The sample custodian will be familiar with custody requirements and the potential hazards of handling environmental samples. In addition to receiving samples, the sample custodian will also be responsible for documenting sample receipt, storage before and after sample analysis, and the proper disposal of samples. Upon sample receipt, the sample custodian will do the following:

1. Sign the chain-of-custody and place it in the project file.
2. Inspect samples for condition upon receipt, type and status of refrigerant, hold times, and turnaround time requirements.
3. Log in samples and assign each with a unique sample number using EpicPro LIMS.
4. Assign each sample a unique barcode label and place in proper storage area until the samples are ready to be prepared/analyzed.

5.2.2 Sample Storage

Samples will be stored in the proper environment as directed by the protocol and analytical methods provided in Appendix A of this QAPP. Sample storage location will be documented using the EpicPro LIMS internal Chain-of-Custody (ICOC) module. To prevent mix-ups and cross-contamination, samples will be stored in areas as designated in the applicable SOP (provided in Appendix A). Room temperature, refrigerator, and freezer temperatures in long-term and short-term sample storage will be monitored.

5.2.3 Sample Tracking

Persons requiring samples from storage initiate a sample transfer request using the EpicPro LIMS. The sample custodian retrieves the samples requested and places them in the short-term, environmentally controlled storage unit or location indicated on the request. Following analysis or at the end of each day, the sample custodian will return the sample to the permanent assigned environmentally controlled storage location.

5.2.4 Recordkeeping

Data related to sample preparation and analysis, as well as observations by laboratory analysts, will be permanently recorded in bound laboratory notebooks or on worksheets, as applicable. All raw data, hard coy or electronic, will undergo a secondary data review process. All hard copy raw data, including, but not limited to, the original chromatograms, worksheets, correspondence, and results shall be included with the data package submitted to the Project Manager.

5.3 SITE SURVEYING

Soil boring and surface soil sampling locations will be located by hand-held global positioning system (GPS) unit. Excavation bottom elevations will be surveyed by a professional Minnesota-certified land surveyor. Vertical survey control will be to 0.01 inch (in.) per EPA standards based on established U.S. Geological Survey (USGS) benchmarks.

5.4 SAMPLE DISPOSAL

The laboratory standard sample/extract/digestate disposal time is 30 days after the final report is submitted. All samples will be labpacked and disposed of by a contracted waste company.

5.5 FINAL FILES

The final file will be the central repository for all documents relevant to sampling and analysis activities described in this QAPP. WESTON is the custodian of the files and maintains the contents of the field files for the sampling activities, including all relevant records, reports, logs, field notes, photographs, drawings, subcontractor reports, and data reviews in a secured, limited access area and under the custody of the WESTON Project Manager.

The final file typically will include the following:

- Field logbooks.
- Field data and data deliverables.

- Photographs.
- Drawings.
- Soil boring logs.
- Laboratory data deliverables.
- Data validation reports.
- Data assessment reports.
- Progress reports, QA reports and interim project reports.
- All custody documentation, including forms and airbills.

Table 5-1 Field Sample Identifiers
Oakdale Site

Soil Samples

Site Location	Sample Type	Sample Location	QC Type	Depth/Location
OKMN - Oakdale, MN	SBC - Soil Boring Composite	SB## - Soil Boring #	0 - Primary Sample	#### - Depth at Top of Sample
	ES - Excavated Soil	SP## - Stock Pile #	DB - Duplicate Sample	LOC - A through Z
	ESC - Excavated Soil Composite		RB - Rinsate	LOC - Mult. Location Letters for Composite

Example ID: OKMN-SBC-SB01-0-0040

Primary composite soil sample collected from soil boring #1 at 4.0 ft bgs

Example ID: OKMN-ESC-SP03-DB-LOCAB

Duplicate composite soil sample collected from stock pile #3 locations A & B

Water Samples

Site Location	Sample Type	Sample Location	QC Type	Depth/Location
OKMN - Oakdale, MN	SW - Surface Water	LOC## - GPS Located Sample Point	0 - Primary Sample	#### - Depth of Grab Water Sample
	CW - Construction Water	BAT## - Batch Number	DB - Duplicate Sample	
			RB - Rinsate	

Example ID: OKMN-SW-LOC02-0-0000

Primary surface water collected from location #2 at top of water surface

6. CALIBRATION PROCEDURES AND FREQUENCY

6.1 FIELD INSTRUMENT CALIBRATION

This section contains brief descriptions of the analytical methods and calibration procedures for the field measurements that will be made during the activities conducted in support of the RD/RA. Field instrumentation will be calibrated to ensure that the instruments are operating properly and produce data that can satisfy the objectives of the sampling program. Specific field instruments that will be used during the waste characterization activities, when appropriate, include the following:

- Photoionization detector (PID).
- Aerosol/dust monitor.
- Sound level meter.

To ensure that the instruments are operating properly and are producing accurate and reliable data, routine calibration must be performed prior to and during use. Factory calibrations should be performed at a frequency recommended by the manufacturer. Calibration procedures are normally included with the equipment. Field calibrations should be performed at the beginning of the day and should be checked throughout the sampling day.

If field calibration reveals that the instrument is outside established accuracy limits, the instrument should be serviced in the field according to the manufacturer's specifications. If necessary, return the instrument to the manufacturer for immediate repair and servicing. A backup instrument should be available for each of the critical real-time instruments used in the field. Calibration records will contain the following information:

- Instrument name and identification number.
- Name of person performing the calibration.
- Date of calibration.
- Calibration points.
- Results of the calibration.
- Manufacturer's lot number of the calibration standards.

- Expiration dates for the field standards, where applicable.

All field equipment will be properly inspected, charged, and in good working condition prior to the beginning of each working day. Prior to the start of each working day, the Field Team Manager or his designee will inspect all equipment to ensure its proper working condition. All field equipment and instruments will be properly protected against inclement weather conditions during the field investigation. At the end of each working day, all field equipment and instruments will be properly decontaminated, taken out of the field, and placed in a cool, dry room for overnight storage and charging.

6.2 LABORATORY INSTRUMENT CALIBRATION

This section provides the requirements for calibration of measuring and test equipment and instruments used in laboratory analysis. This program is designed to ensure that all instruments are calibrated to operate within manufacturers' specifications and that the required traceability, sensitivity, and precision of the equipment/instruments are maintained. Measurements that affect the quality of an item or activity will be taken only with instruments, tools, gauges, or other measuring devices that are accurate, controlled, calibrated, adjusted, and maintained at predetermined intervals to ensure the specified level of precision and accuracy.

Before any instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements will be made within the calibrated range of the instrument. Preparation of all reference materials used for calibration will be documented in a laboratory notebook.

6.2.1 Standards and Traceability

Analytical standards are prepared from pure compounds or are purchased prepared from reputable vendors. These standards provide the stock used to prepare serial dilutions for calibration and spiking standards. Each laboratory section will be responsible for the preparation, storage, and disposal of its standards.

Each standard will be given an internal identification number. The preparation of all stock standards will be documented in a standards notebook, which will be used to record the date of preparation, analyst's initials, source of the reference material, standard components, amounts used, final volume, final concentration(s), solvent used, expiration date of the prepared standard, and the assigned serial reference number (internal identification number) of the stock solution. All standards will be labeled, at a minimum, with the standard serial reference number and expiration date, and, if space permits, the name of the standard, concentration, date of preparation, and initials of the preparer. All diluted working standards not consumed during an analytical session will be labeled fully, including the serial reference number of any stock standard used in its preparation.

If no expiration date has been assigned by the manufacturer, then an expiration date of 1 year from the date of preparation generally will be reported unless degradation prior to this date is observed. The expiration date assigned to a prepared standard will not exceed the expiration date of any individual component in the solution. To help determine if a standard has degraded, any inconsistencies must be noted. For instance, very poor recoveries from newly prepared QC spikes or abnormally low instrument response to a specific standard are indications of possible standard degradation. However, for some standards, degradation is more easily noted. If degradation is observed before the default expiration date, it should be noted in the standards notebook for that standard entry and the standard removed from service.

Reference standards must be traceable to national standards of measurement (e.g., EPA, A2LA, National Institute of Standards and Technology [NIST], or standard analytical reference materials [SARMs]) whenever possible. Standards used for calibration must be traceable, when possible, to national standards of measurement, either directly through supplier documentation or by verification against a second source traceable reference standard.

6.2.2 Balances

Laboratory balances will be calibrated and serviced annually by a factory representative. In addition, the analyst will check the balance before each day's use with more than one mass, with the weight set respective of the balance. A record of calibrations and daily checks will be kept in the balance log. The Class 1 and Class 4 weights used by the analysts for daily balance checks will be calibrated every year by a certified agency for Pace.

6.2.3 Thermometers

An NIST-certified thermometer is maintained for checking the calibration of thermocouples used for electronic temperature monitoring. These devices are calibrated annually against an NIST-traceable thermometer source.

Calibration temperatures and acceptance criteria will be based on the particular temperature requirement of the storage unit (i.e., samples or standards). An inventory of thermometers, their identification, calibration status, and due date of next calibration will be maintained by the QA Department or designated area.

6.3 RECORDS

Records will be maintained as evidence of required calibration frequencies, and equipment will be marked suitably to indicate calibration status. If marking on the equipment is not possible, records traceable to the equipment will be readily available for reference.

7. ANALYTICAL AND MEASUREMENT PROCEDURES

This section presents the field and laboratory analytical and measurement procedures. The objective of this analytical effort is to provide sufficient information to determine soil and construction water/decontamination water disposal profiles.

7.1 FIELD ANALYTICAL AND MEASUREMENT PROCEDURES

The field analytical and measurement tasks are presented in the RD/RA and Construction Sampling Plans. In addition to the procedures presented in this QAPP, field instrument checklists will be available in the field including both calibration and measurement procedures that will be followed during site work. The following section summarizes the process for field-screening for VOCs.

7.1.1 Field Screening for Volatile Organic Constituents

Field screening for volatile organic vapors during sampling and excavation activities will be conducted primarily for two reasons:

- To evaluate ambient air quality as part of health and safety monitoring.
- To preliminarily evaluate volatile organic content in soil samples so that the soil most likely to be contaminated may be preferentially selected for chemical analysis.

Instruments to be used for field screening during intrusive activities may be a PID, oxygen meter, or combustible gas indicator (CGI). Because the instruments are to be used for screening purposes only, there are no specific DQOs. Daily calibration of these instruments according to the manufacturers' specifications, as presented in Section 6.1, will provide for sufficient accuracy in evaluating the potential health risks and for selecting soil samples for laboratory analysis.

7.1.1.1 Health and Safety Evaluation

As required by the SSHASP, a PID or other field instrument may be used to measure the total volatile organics (or other constituents) in the breathing zone as the field team engages in intrusive activities, such as soil sampling and excavation.

If such monitoring is performed, background measurements will be made periodically during each day as conditions require. During intrusive activities, the area will be periodically or continuously monitored as specified in the RD/RA Plan and the Construction Sampling Plan.

Measurements of total organic vapor will be recorded in the field notebook relative to the background reading. All site personnel will be aware of action levels (ALs) that indicate the type of PPE to be worn by participating personnel. Details of the ALs and PPE requirements are presented in the SSHASP (Attachment 5 to the RD/RA Plan).

7.1.1.2 Screening for Sample Selection

Screening of soil samples is performed to select samples for chemical analysis. One typical method is as follows:

1. During collection of the sample at a specific depth interval, a small portion of the soil will be placed in a separate laboratory container for field screening. The containers will be labeled with the appropriate sample number.
2. Aluminum foil will be placed over the top of the container. The container will then be sealed with the lid.
3. At the end of the day or at an appropriate time after sampling, the lids of each screening sample will be removed and the instrument probe extender will be used to puncture the aluminum foil and to obtain a measurement of total VOC concentration in the container headspace. Screening to select one or more samples from among a group of samples will be performed with one instrument (such as a PID).

7.2 LABORATORY ANALYTICAL AND MEASUREMENT PROCEDURES

Laboratory analyses will be performed by Pace in accordance with Minnesota Department of Health (MDH) rules for Certified Environmental Laboratories and the National Environmental Laboratory Accreditation Conference (NELAC). Analytical methods cited in this QAPP for Pace reference *The Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA SW-846), Revision 6, February 2007, *Methods for Chemical Analysis of Water and Wastes* (EPA, 1983); and American Society for Testing and Materials (ASTM) standards. Standards certified by MDH will be referenced where applicable.

Parameters with respective analytical methods selected and the respective reporting limits are presented in Tables 7-1 through 7-9. Tables 7-1 through 7-9 also include the QC limits for each analytical method. In some cases, modification of methods provided in the QA Manual (Appendix A) may be necessary to provide accurate analysis of particularly complex matrices. When modifications to standard analytical methods are made, the specific alterations, as well as the justification for the change, will be communicated to the WESTON Project Manager who will inform the 3M Project Manager. The modifications will also be presented in the case narrative accompanying the analytical report. The choice of method will be determined by the type of sample and the project requirements.

The laboratory will perform a soil moisture test in accordance with ASTM D-2216-71 procedures for determining dry sample weight on each soil sample so that the analytical data will be reported on a dry weight basis.

7.2.1 Common Laboratory Interferences

Certain Target Compound List (TCL) VOCs, such as methylene chloride, acetone, 2-butanone, and toluene, are commonly detected as laboratory contaminants. To ensure that the data reported are not biased by potential laboratory contamination, certain QA procedures, including reagent blank analysis, will be implemented.

For the analysis of volatile TCL compounds, a method blank analysis will be performed once per lot, or with every 20 samples of similar concentrations of target compounds. Blanks must contain less than five times the laboratory reporting limit of methylene chloride, acetone, 2-butanone, and toluene for the reported data to be considered valid. The reporting limits are presented in Tables 7-1 through 7-9.

It is understood that the site may contain some chemical matrices that may cause interferences with organic analyses; therefore, sample cleanup protocols may be implemented to the extent possible to eliminate interferences that reduce the sensitivity of the analyses. The primary cleanup steps that are expected to be employed, when interferences are present, will be gel permeation cleanup by SW-846, Method 3640A, in conjunction with analytical Method 8270C. Cleanups will be employed if deemed necessary by the laboratory.

7.2.2 Method Detection and Quantization Limits

This section presents and defines limits to be used in describing detectable/ quantifiable concentrations.

7.2.2.1 Method Detection Limits (MDLs)

The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The quantitation limit is defined as the reporting limit. Blank concentrations should be below the quantitation limit or corrective action should be taken. Corrective action is not necessary if the concentration in the field samples is greater than 10 times the blank concentration. In some cases, lower quantitation limits may be necessary to evaluate data versus project criteria or ALs. Individual sample reporting limits may vary from the laboratory's routinely reported reporting limits. This may be a result of dilution requirements, variability in sample weight or volume used to perform the analysis, dry weight adjustment for solid samples, the presence of analytical background contaminants, or other sample- or analysis-related conditions.

The performing laboratory will perform MDL studies on an annual basis to demonstrate that it can meet or exceed the method-recommended reporting limits. The EPA procedure used for establishing MDLs is described in Appendix B to Part 136, *Definition and Procedure for the Determination of the Method Detection Limit,* Revision 1.11, 40 CFR 136, 1986. This procedure consists of analyzing (using all sample processing steps specified in the method) seven aliquots of a standard spiked at three to five times the expected MDL. The MDL is defined as three times the standard deviation of the mean value for the seven analyses. In addition, the laboratory may establish reporting limits, which are verified by the MDL studies and included in the laboratory's analytical reports.

7.2.2.2 Reporting Limits (RLs)

RLs are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with an acceptable quantitative error. Specific client requirements, values specified by the EPA methods, and/or other project requirements are also considered in determining the RL. The RL will be equivalent to the lowest calibration standard. Because of the high level of quantitative error associated with determinations at the level of the MDL, RLs will be higher than the MDL. Wherever possible, reporting will be limited to the values approximately three to five times the respective MDLs to ensure confidence in the reported value. For the routine analytical procedures performed by Pace for this project, samples will be flagged (e.g., "J" for organics) if the result is below the RL and greater than the MDL.

Table 7-1 Method Detection Limits, Reporting Limits and Control Limits for VOCs

EPA Method 8260 (Low Level Soils)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	MDL (ug/kg)	RL (ug/kg)	Lower CL	Upper CL	RPD	Lower CL	Upper CL	RPD
1,1,1,2-Tetrachlorethane	2.0	4.0	75	126	20	74	134	30
1,1,1-Trichloroethane	2.0	4.0	75	135	20	73	150	30
1,1,2,2-Tetrachlorethane	2.0	4.0	75	130	20	58	149	30
1,1,2-Trichlorethane	2.0	4.0	75	127	20	71	144	30
1,1,2-Trichlorotrifluoroethane	2.0	4.0	55	150	20	50	150	30
1,1-Dichloroethane	2.0	4.0	75	130	20	70	150	30
1,1-Dichloroethene	2.0	4.0	75	129	20	75	150	30
1,1-Dichloropropene	2.0	4.0	75	133	20	66	150	30
1,2,3-Trichlorobenzene	2.0	4.0	75	136	20	50	150	30
1,2,3-Trichloropropane	2.0	4.0	75	134	20	70	142	30
1,2,4-Trichlorobenzene	2.0	4.0	75	128	20	75	147	30
1,2,4-Trimethylbenzene	2.0	4.0	75	128	20	72	150	30
1,2-Dibromo-3-chloropropane	5.0	10.0	70	130	20	67	136	30
1,2-Dibromoethane (EDB)	2.0	4.0	75	129	20	73	147	30
1,2-Dichlorobenzene	2.0	4.0	75	123	20	75	140	30
1,2-Dichloroethane	2.0	4.0	75	130	20	70	145	30
1,2-Dichloroethene (Total)	4.0	8.0	75	127	20	75	149	30
1,2-Dichloropropane	2.0	4.0	75	131	20	75	147	30
1,3,5-Trimethylbenzene	2.0	4.0	75	128	20	74	150	30
1,3-Dichlorobenzene	2.0	4.0	75	125	20	75	143	30
1,3-Dichloropropane	2.0	4.0	75	126	20	64	140	30
1,4-Dichlorobenzene	2.0	4.0	75	125	20	75	138	30
2,2-Dichloropropane	2.0	4.0	50	150	20	50	150	30
2-Butanone (MEK)	10.0	20.0	50	150	20	50	150	30
2-Chloroethylvinyl ether	10.0	20.0	61	133	20	50	150	30
2-Chlorotoluene	2.0	4.0	75	132	20	52	150	30
2-Hexanone	10.0	20.0	65	148	20	51	150	30
2-Methylnapthalene	10.0	20.0	63	150	20	50	150	30
4-Chlorotoluene	2.0	4.0	75	133	20	54	147	30
4-Methyl-2-pentanone	10.0	20.0	63	150	20	57	150	30
Acetone	10.0	20.0	50	150	20	50	150	30
Acrolein	50.0	100.0	50	150	20	50	150	30
Acrylonitrile	50.0	100.0	75	126	20	56	150	30
Allyl Chloride	5.0	10.0	74	129	20	61	138	30
Benzene	2.0	4.0	75	129	20	69	148	30
Bromobenzene	2.0	4.0	75	127	20	56	140	30
Bromochloromethane	2.0	4.0	75	137	20	65	141	30
Bromodichloromethane	2.0	4.0	73	128	20	71	136	30
Bromoform	10.0	20.0	72	125	20	65	130	30
Bromomethane	10.0	20.0	50	150	20	50	150	30
Carbon disulfide	2.0	4.0	63	125	20	50	150	30
Carbon Tetrachloride	2.0	4.0	67	132	20	67	150	30
Chlorobenzene	2.0	4.0	75	125	20	75	141	30
Chloroethane	5.0	10.0	50	150	20	50	150	30
Chloroform	2.0	4.0	75	134	20	74	150	30
Chloromethane	5.0	10.0	52	141	20	50	150	30
cis-1,2-Dichloroethene	2.0	4.0	75	129	20	75	147	30
cis-1,3-Dichloropropene	2.0	4.0	72	126	20	68	133	30
Cyclohexane	5.0	10.0	67	141	20	50	150	30
Dibromochloromethane	2.0	4.0	75	125	20	71	128	30
Dibromomethane	2.0	4.0	75	131	20	69	137	30
Dichlorodifluoromethane	5.0	10.0	50	150	20	50	150	30
Dichlorofluoromethane	2.0	4.0	50	150	20	50	150	30
Diethyl ether	5.0	10.0	71	139	20	56	145	30
Diisopropyl ether	2.0	4.0	75	134	20	50	150	30
Ethylbenzene	2.0	4.0	75	127	20	74	150	30
Hexachloro-1,3-butadiene	5.0	10.0	75	145	20	54	150	30
Iodomethane	5.0	10.0	56	131	20	50	141	30
Isopropylbenzene (Cumene)	2.0	4.0	75	126	20	75	150	30

Table 7-1 Method Detection Limits, Reporting Limits and Control Limits for VOCs

EPA Method 8260 (Low Level Soils)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/kg)**	**RL (ug/kg)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
m&p-Xylene	4.0	8.0	75	128	20	75	148	30
Methylene Chloride	5.0	10.0	72	128	20	67	144	30
Methyl-tert-butyl ether	2.0	4.0	75	131	20	70	142	30
Naphthalene	5.0	10.0	75	141	20	64	150	30
n-Butylbenzene	2.0	4.0	75	139	20	55	150	30
n-Propylbenzene	2.0	4.0	75	133	20	50	150	30
o-Xylene	2.0	4.0	75	128	20	75	148	30
p-Isopropyltoluene	2.0	4.0	75	132	20	75	138	30
sec-Butylbenzene	2.0	4.0	75	136	20	75	144	30
Styrene	2.0	4.0	75	125	20	75	144	30
tert-Butylbenzene	2.0	4.0	75	133	20	54	150	30
Tetrachloroethane	2.0	4.0	75	130	20	75	150	30
Tetrahydrofuran	20.0	40.0	72	137	20	50	150	30
Toluene	2.0	4.0	75	125	20	73	144	30
trans-1,2-Dichloroethene	2.0	4.0	75	126	20	75	150	30
trans-1,3-Dichloropropene	2.0	4.0	75	125	20	66	127	30
trans-1,4-Dichloro-2-butene	25.0	50.0	74	125	20	50	135	30
Trichloroethene	2.0	4.0	75	133	20	75	150	30
Trichlorofluoromethane	5.0	10.0	50	150	20	50	150	30
Vinyl Acetate	5.0	10.0	50	150	20	50	150	30
Vinyl Chloride	2.0	4.0	64	137	20	50	150	30
Xylene (Total)	6.0	12.0	75	128	20	75	148	30
Surrogates								
1,2-Dichloroethane-d4 (S)	---	---	75	125	---	75	125	---
4-Bromofluorobenzene (S)	---	---	75	125	---	75	125	---
Dibromofluoromethane (S)	---	---	74	125	---	74	125	---
Toluene-d8 (S)	---	---	75	127	---	75	127	---

MDL - Method Detection Limit
RL - Reporting Limit
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

Table 7-2 Method Detection Limits, Reporting Limits and Control Limits for VOCs

EPA Method 8260 (Medium Level Soils)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/kg)**	**RL (ug/kg)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
1,1,1,2-Tetrachloroethane	100	200	75	126	20	74	134	30
1,1,1-Trichloroethane	100	200	75	135	20	73	150	30
1,1,2,2-Tetrachloroethane	100	200	75	130	20	58	149	30
1,1,2-Trichloroethane	100	200	75	127	20	71	144	30
1,1,2-Trichlorotrifluoroethane	100	200	55	150	20	50	150	30
1,1-Dichloroethane	100	200	75	130	20	70	150	30
1,1-Dichloroethene	100	200	75	129	20	75	150	30
1,1-Dichloropropene	100	200	75	133	20	66	150	30
1,2,3-Trichlorobenzene	100	200	75	136	20	50	150	30
1,2,3-Trichloropropane	100	200	75	134	20	70	142	30
1,2,4-Trichlorobenzene	100	200	75	128	20	75	147	30
1,2,4-Trimethylbenzene	100	200	75	128	20	72	150	30
1,2-Dibromo-3-chloropropane	100	200	70	130	20	67	136	30
1,2-Dibromoethane (EDB)	100	200	75	129	20	73	147	30
1,2-Dichlorobenzene	100	200	75	123	20	75	140	30
1,2-Dichloroethane	100	200	75	130	20	70	145	30
1,2-Dichloroethene (Total)	100	200	75	127	20	75	149	30
1,2-Dichloropropane	100	200	75	131	20	75	147	30
1,3,5-Trimethylbenzene	100	200	75	128	20	74	150	30
1,3-Dichlorobenzene	100	200	75	125	20	75	143	30
1,3-Dichloropropane	100	200	75	126	20	64	140	30
1,4-Dichlorobenzene	100	200	75	125	20	75	138	30
2,2-Dichloropropane	100	200	50	150	20	50	150	30
2-Butanone (MEK)	250	500	50	150	20	50	150	30
2-Chloroethylvinyl ether	250	500	61	133	20	50	150	30
2-Chlorotoluene	100	200	75	132	20	52	150	30
2-Hexanone	250	500	65	148	20	51	150	30
2-Methylnaphthalene	100	200	63	150	20	50	150	30
4-Chlorotoluene	100	200	75	133	20	54	147	30
4-Methyl-2-pentanone (MIBK)	250	500	63	150	20	57	150	30
Acetone	250	500	50	150	20	50	150	30
Acrolein	1000	2000	50	150	20	50	150	30
Acrylonitrile	1000	2000	75	126	20	56	150	30
Allyl chloride	100	200	74	129	20	61	138	30
Benzene	25	50	75	129	20	69	148	30
Bromobenzene	100	200	75	127	20	56	140	30
Bromochloromethane	100	200	75	137	20	65	141	30
Bromodichloromethane	100	200	73	128	20	71	136	30
Bromoform	200	400	72	125	20	65	130	30
Bromomethane	250	500	50	150	20	50	150	30
Carbon disulfide	100	200	63	125	20	50	150	30
Carbon tetrachloride	100	200	67	132	20	67	150	30
Chlorobenzene	100	200	75	125	20	75	141	30
Chloroethane	100	200	50	150	20	50	150	30
Chloroform	100	200	75	134	20	74	150	30
Chloromethane	100	200	52	141	20	50	150	30
cis-1,2-Dichloroethene	100	200	75	129	20	75	147	30
cis-1,3-Dichloropropene	100	200	72	126	20	68	133	30
Cyclohexane	100	200	67	141	20	50	150	30
Dibromochloromethane	100	200	75	125	20	71	128	30
Dibromomethane	100	200	75	131	20	69	137	30
Dichlorodifluoromethane	100	200	50	150	20	50	150	30
Dichlorofluoromethane	100	200	50	150	20	50	150	30
Diethyl ether (Ethyl ether)	250	500	71	139	20	56	145	30
Diisopropyl ether	100	200	75	134	20	50	150	30
Ethylbenzene	25	50	75	127	20	74	150	30
Hexachloro-1,3-butadiene	100	200	75	145	20	54	150	30
Iodomethane	100	200	56	131	20	50	141	30

Table 7-2 Method Detection Limits, Reporting Limits and Control Limits for VOCs

EPA Method 8260 (Medium Level Soils)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/kg)**	**RL (ug/kg)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
Isopropylbenzene (Cumene)	100	200	75	126	20	75	150	30
m&p-Xylene	50	100	75	128	20	75	148	30
Methylene Chloride	100	200	72	128	20	67	144	30
Methyl-tert-butyl ether	100	200	75	131	20	70	142	30
Naphthalene	100	200	75	141	20	64	150	30
n-Butylbenzene	100	200	75	139	20	55	150	30
n-Propylbenzene	100	200	75	133	20	50	150	30
o-Xylene	25	50	75	128	20	75	148	30
p-Isopropyltoluene	100	200	75	132	20	75	138	30
sec-Butylbenzene	100	200	75	136	20	75	144	30
Styrene	100	200	75	125	20	75	144	30
tert-Butylbenzene	100	200	75	133	20	54	150	30
Tetrachloroethene	100	200	75	130	20	75	150	30
Tetrahydrofuran	1000	2000	72	137	20	50	150	30
Toluene	25	50	75	125	20	73	144	30
trans-1,2-Dichloroethene	100	200	75	126	20	75	150	30
trans-1,3-Dichloropropene	100	200	75	125	20	66	127	30
trans-1,4-Dichloro-2-butene	250	500	74	125	20	50	135	30
Trichloroethene	100	200	75	133	20	75	150	30
Trichlorofluoromethane	100	200	50	150	20	50	150	30
Vinyl acetate	100	200	50	150	20	50	150	30
Vinyl chloride	25	50	64	137	20	50	150	30
Xylene (Total)	75	150	75	128	20	75	148	30
Surrogates								
1,2-Dichloroethane-d4 (S)	---	---	75	125	---	75	125	---
4-Bromofluorobenzene (S)	---	---	75	125	---	75	125	---
Dibromofluoromethane (S)	---	---	74	125	---	74	125	---
Toluene-d8 (S)	---	---	75	127	---	75	127	---

MDL - Method Detection Limit
RL - Reporting Limit
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

Table 7-3 Method Detection Limits, Reporting Limits and Control Limits for VOCs
EPA Method 8260 (TCLP)
Pace Analytical Laboratory

Analyte	MDL (ug/L)	RL (ug/L)	LCS/LCSD			MS/MSD		
			Lower CL	Upper CL	RPD	Lower CL	Upper CL	RPD
1,1-Dichloroethene	25	50	75	125	20	66	125	30
1,2-Dichloroethane	25	50	75	125	20	73	125	30
1,4-Dichlorobenzene	25	50	75	125	20	75	125	30
2-Butanone (MEK)	125	250	74	126	20	66	130	30
Benzene	25	50	75	125	20	50	150	30
Carbon tetrachloride	25	50	75	125	20	68	128	30
Chlorobenzene	25	50	75	125	20	75	125	30
Tetrachloroethene	25	50	75	125	20	50	150	30
Trichloroethene	25	50	75	125	20	69	125	30
Vinyl chloride	25	50	75	125	20	62	150	30
Surrogate								
1,2-Dichloroethane-d4 (S)	---	---	63	137	---	63	137	---
4-Bromofluorobenzene (S)	---	---	67	133	---	67	133	---
Dibromofluoromethane (S)	---	---	66	134	---	66	134	---
Toluene-d8 (S)	---	---	67	133	---	67	133	---

MDL - Method Detection Limit

RL - Reporting Limit

LCS - Laboratory Control Sample

LCSD - Laboratory Control Sample Duplicate

MS - Matrix Spike

MSD - Matrix Spike Duplicate

CL - Control Limit

RPD - Relative Percent Difference

Table 7-4 Method Detection Limits, Reporting Limits and Control Limits for VOCs

EPA Method 8260 (Water)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	MDL (ug/L)	RL (ug/L)	Lower CL	Upper CL	RPD	Lower CL	Upper CL	RPD
1,1,1,2-Tetrachloroethane	0.50	1.0	75	135	20	75	135	30
1,1,1-Trichloroethane	0.50	1.0	75	132	20	75	140	30
1,1,2,2-Tetrachloroethane	0.50	1.0	75	125	20	75	130	30
1,1,2-Trichloroethane	2.00	4.0	75	125	20	75	125	30
1,1,2-Trichlorotrifluoroethane	0.50	1.0	73	141	20	69	150	30
1,1-Dichloroethane	0.50	1.0	75	125	20	70	140	30
1,1-Dichloroethene	0.50	1.0	75	127	20	75	141	30
1,1-Dichloropropene	0.50	1.0	75	126	20	75	144	30
1,2,3-Trichlorobenzene	0.50	1.0	75	125	20	68	125	30
1,2,3-Trichloropropane	0.50	1.0	75	125	20	74	126	30
1,2,4-Trichlorobenzene	0.50	1.0	75	125	20	70	125	30
1,2,4-Trimethylbenzene	0.50	1.0	75	125	20	61	136	30
1,2-Dibromo-3-chloropropane	2.00	4.0	67	125	20	67	125	30
1,2-Dibromoethane (EDB)	0.50	1.0	75	125	20	75	125	30
1,2-Dichlorobenzene	0.50	1.0	75	125	20	75	125	30
1,2-Dichloroethane	0.50	1.0	75	125	20	75	130	30
1,2-Dichloroethene (Total)	1.00	2.0	75	125	20	75	129	30
1,2-Dichloropropane	0.50	1.0	75	125	20	75	126	30
1,3,5-Trimethylbenzene	0.50	1.0	75	125	20	66	135	30
1,3-Dichlorobenzene	0.50	1.0	75	125	20	75	125	30
1,3-Dichloropropane	0.50	1.0	75	125	20	75	125	30
1,4-Dichlorobenzene	0.50	1.0	75	125	20	75	125	30
1,4-Dioxane (p-Dioxane)	40.00	80.0	70	126	20	63	128	30
2,2-Dichloropropane	0.50	1.0	50	150	20	50	150	30
2-Butanone (MEK)	2.00	4.0	68	127	20	68	127	30
2-Chloroethylvinyl ether	5.00	10.0	50	150	20	50	150	30
2-Chlorotoluene	0.50	1.0	75	125	20	66	148	30
2-Hexanone	2.00	4.0	75	125	20	67	125	30
2-Methylnaphthalene	2.50	5.0	69	150	20	69	150	30
2-Nitropropane	5.00	10.0	50	150	20	50	150	30
2-Propanol	20.00	40.0	69	135	20	50	150	30
3-Pentanone	2.00	4.0	50	150	20	50	150	30
4-Chlorotoluene	0.50	1.0	75	125	20	68	136	30
4-Methyl-2-pentanol	20.00	40.0	59	125	20	50	150	30
4-Methyl-2-pentanone (MIBK)	2.00	4.0	68	133	20	68	133	30
Acetone	5.00	10.0	65	139	20	50	150	30
Acetonitrile	20.00	40.0	71	125	20	70	125	30
Acrolein	20.00	40.0	63	135	20	50	131	30
Acrylonitrile	5.00	10.0	74	128	20	75	125	30
Allyl chloride	2.00	4.0	55	145	20	50	147	30
Benzene	0.50	1.0	75	125	20	75	126	30
Bromobenzene	0.50	1.0	75	125	20	75	125	30
Bromochloromethane	0.50	1.0	75	127	20	75	127	30
Bromodichloromethane	2.00	4.0	75	125	20	72	130	30
Bromoform	4.00	8.0	67	125	20	56	125	30
Bromomethane	2.00	4.0	65	150	20	50	150	30
Carbon disulfide	0.50	1.0	64	134	20	50	147	30
Carbon tetrachloride	0.50	1.0	67	133	20	68	144	30
Chlorobenzene	0.50	1.0	75	125	20	75	125	30
Chloroethane	0.50	1.0	75	129	20	75	142	30
Chloroform	0.50	1.0	75	125	20	75	134	30
Chloromethane	0.50	1.0	67	135	20	61	148	30
Chloroprene	0.50	1.0	71	129	20	50	146	30
cis-1,2-Dichloroethene	0.50	1.0	75	125	20	65	148	30
cis-1,3-Dichloropropene	2.00	4.0	75	125	20	59	132	30
cis-1,4-Dichloro-2-butene	2.00	4.0	50	136	20	50	138	30

Table 7-4 Method Detection Limits, Reporting Limits and Control Limits for VOCs
EPA Method 8260 (Water)
Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/L)**	**RL (ug/L)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
Cyclohexane	0.50	1.0	65	132	20	65	150	30
Dibromochloromethane	0.50	1.0	73	125	20	63	125	30
Dibromomethane	2.00	4.0	75	125	20	75	125	30
Dichlorodifluoromethane	0.50	1.0	55	150	20	50	150	30
Dichlorofluoromethane	0.50	1.0	75	129	20	75	138	30
Diethyl ether (Ethyl ether)	2.00	4.0	75	125	20	74	128	30
Diisopropyl ether	2.00	4.0	57	136	20	57	136	30
Ethanol	200.00	400.0	50	150	20	50	150	30
Ethyl acetate	2.00	4.0	50	150	20	50	150	30
Ethyl acrylate	2.00	4.0	50	150	20	50	150	30
Ethyl methacrylate	2.00	4.0	75	125	20	70	125	30
Ethylbenzene	0.50	1.0	75	125	20	75	126	30
Hexachloro-1,3-butadiene	2.00	4.0	75	132	20	63	146	30
Iodomethane	2.00	4.0	54	139	20	56	150	30
Isobutanol			50	138	20	50	138	30
Isopropylbenzene (Cumene)	0.50	1.0	75	125	20	75	131	30
m&p-Xylene	1.00	2.0	75	125	20	67	137	30
Methacrylonitrile	20.00	40.0	68	136	20	68	136	30
Methyl methacrylate	0.50	1.0	75	125	20	70	125	30
Methylene Chloride	2.00	4.0	63	125	20	62	133	30
Methyl-tert-butyl ether	0.50	1.0	65	140	20	59	140	30
Naphthalene	2.00	4.0	72	128	20	69	129	30
n-Butanol	0.50	1.0	50	138	20	50	150	30
n-Butylbenzene	0.50	1.0	75	125	20	62	141	30
n-Hexane	0.50	1.0	50	150	20	50	150	30
n-Propylbenzene	0.50	1.0	75	125	20	73	139	30
o-Xylene	0.50	1.0	75	125	20	75	126	30
p-Isopropyltoluene	0.50	1.0	75	125	20	70	137	30
Propionitrile	20.00	40.0	75	125	20	75	125	30
sec-Butyl alcohol	20.00	40.0	61	139	20	50	150	30
sec-Butylbenzene	0.50	1.0	75	125	20	73	140	30
Styrene	0.50	1.0	75	125	20	50	144	30
tert-Butyl Alcohol	20.00	40.0	50	150	20	50	150	30
tert-Butylbenzene	0.50	1.0	75	125	20	73	136	30
Tetrachloroethene	0.50	1.0	75	125	20	75	133	30
Tetrahydrofuran	5.00	10.0	60	147	20	67	135	30
Toluene	0.50	1.0	75	125	20	75	125	30
trans-1,2-Dichloroethene	0.50	1.0	75	125	20	75	138	30
trans-1,3-Dichloropropene	2.00	4.0	69	125	20	59	125	30
trans-1,4-Dichloro-2-butene	5.00	10.0	61	128	20	72	135	30
Trichloroethene	0.50	1.0	75	125	20	75	130	30
Trichlorofluoromethane	2.00	4.0	75	135	20	71	150	30
Vinyl acetate	10.00	20.0	50	150	20	50	150	30
Vinyl chloride	0.20	0.4	71	133	20	64	150	30
Xylene (Total)	1.50	3.0	75	125	20	75	125	30
Surrogates								
1,2-Dichloroethane-d4 (S)	---	---	75	125	---	75	125	---
4-Bromofluorobenzene (S)	---	---	75	125	---	75	125	---
Dibromofluoromethane (S)	---	---	74	125	---	74	125	---
Toluene-d8 (S)	---	---	75	127	---	75	127	---

MDL - Method Detection Limit
RL - Reporting Limit
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

Table 7-5 Method Detection Limits, Reporting Limits and Control Limits for PCBs

EPA Method 8082 (Soils)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/L)**	**RL (ug/L)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
PCB-1016 (Aroclor 1016)	0.0165	0.033	50	150	20	50	150	30
PCB-1221 (Aroclor 1221)	0.0165	0.033	---	---	---	---	---	---
PCB-1232 (Aroclor 1232)	0.0165	0.033	---	---	---	---	---	---
PCB-1242 (Aroclor 1242)	0.0165	0.033	---	---	---	---	---	---
PCB-1248 (Aroclor 1248)	0.0165	0.033	---	---	---	---	---	---
PCB-1254 (Aroclor 1254)	0.0165	0.033	---	---	---	---	---	---
PCB-1260 (Aroclor 1260)	0.0165	0.033	50	150	20	50	150	30
PCB-1260 (Aroclor 1262)	0.0165	0.033	---	---	---	---	---	---
PCB-1268 (Aroclor 1268)	0.0165	0.033	---	---	---	---	---	---
Surrogate								
Decachlorobiphenyl (S)	---	---	50	150	---	50	150	---
Tetrachloro-m-xylene (S)	---	---	50	150	---	50	150	---

MDL - Method Detection Limit

RL - Reporting Limit

LCS - Laboratory Control Sample

LCSD - Laboratory Control Sample Duplicate

MS - Matrix Spike

MSD - Matrix Spike Duplicate

CL - Control Limit

RPD - Relative Percent Difference

Table 7-6 Method Detection Limits, Reporting Limits and Control Limits for PCBs

EPA Method 8082 (Water)

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/L)**	**RL (ug/L)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
PCB-1016 (Aroclor 1016)	0.05	0.1	50	150	20	50	150	30
PCB-1221 (Aroclor 1221)	0.05	0.1	---	---	---	---	---	---
PCB-1232 (Aroclor 1232)	0.05	0.1	---	---	---	---	---	---
PCB-1242 (Aroclor 1242)	0.05	0.1	---	---	---	---	---	---
PCB-1248 (Aroclor 1248)	0.05	0.1	---	---	---	---	---	---
PCB-1254 (Aroclor 1254)	0.05	0.1	---	---	---	---	---	---
PCB-1260 (Aroclor 1260)	0.05	0.1	50	150	20	50	150	30
PCB-1260 (Aroclor 1262)	0.05	0.1	---	---	---	---	---	---
PCB-1268 (Aroclor 1268)	0.05	0.1	---	---	---	---	---	---
Surrogate								
Decachlorobiphenyl (S)	---	---	50	138	---	50	138	---
Tetrachloro-m-xylene (S)	---	---	50	150	---	50	150	---

MDL - Method Detection Limit
RL - Reporting Limit
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

Table 7-7 Method Detection Limits, Reporting Limits and Control Limits for Metals
EPA Method 6010 (TCLP)
Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL (ug/L)**	**RL (ug/L)**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
Arsenic	5	10	80	120	20	75	125	30
Barium	25	50	80	120	20	75	125	30
Cadmium	0.5	1	80	120	20	75	125	30
Chromium	5	10	80	120	20	75	125	30
Lead	1.5	3	80	120	20	75	125	30
Mercury	0.4	0.8	80	120	20	80	120	20
Selenium	7.5	15	80	120	20	75	125	30
Silver	5	10	80	120	20	75	125	30

MDL - Method Detection Limit
RL - Reporting Limit
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

Table 7-8 Method Detection Limits, Reporting Limits and Control Limits for Mercury

EPA Methods 7470/7471

Pace Analytical Laboratory

			LCS/LCSD			MS/MSD		
Analyte	**MDL[1]**	**RL[1]**	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
Soils								
Mercury	0.01	0.02	80	120	20	80	120	20
TCLP								
Mercury	0.4	0.8	80	120	20	80	120	20

MDL - Method Detection Limit

RL - Reporting Limit

LCS - Laboratory Control Sample

LCSD - Laboratory Control Sample Duplicate

MS - Matrix Spike

MSD - Matrix Spike Duplicate

CL - Control Limit

RPD - Relative Percent Difference

[1] - MDL and RL reported in mg/kg for soils and ug/L for TCLP.

Table 7-9 Method Detection Limits, Reporting Limits and Control Limits for Reactivity

Method SW846 (Soils)

Pace Analytical Laboratory

	LCS/LCSD			MS/MSD		
Analyte	**Lower CL**	**Upper CL**	**RPD**	**Lower CL**	**Upper CL**	**RPD**
Cyanide	71	123	23	57	132	23
Sulfide	77	110	30	67	116	30

LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MS - Matrix Spike
MSD - Matrix Spike Duplicate
CL - Control Limit
RPD - Relative Percent Difference

8. INTERNAL QUALITY CONTROL CHECKS

Internal QC is achieved by collecting and/or analyzing a series of QC samples, including duplicates and blanks, to ensure that the analytical results are within the QC limits specified by the program. QC samples will be used to assess laboratory performance and gauge the likelihood of cross-contamination associated with both field and laboratory activities. Laboratory QC samples will be documented at the bench and reported with the analytical results. The QC sample results will be used to quantify precision and accuracy and identify any problems or limitations associated with the sample results.

Standard analytical QC checks to be instituted by field and laboratory personnel include the following:

- Field rinsate blanks.
- Field/Laboratory duplicate samples.
- Field blank.
- Method blanks.
- Method blank spike.
- Laboratory control samples (LCSs).

These types of samples are discussed in the following sections.

8.1 FIELD QC CHECKS

QC samples will be submitted to the laboratory using the same information as routine samples with an alphabetic designation for the type of sample (i.e., field duplicate, field blank) in the sample identification, as discussed in Section 5.

The QA goals for the program will be to eliminate or minimize the potential for inconsistencies in protocols, including the field protocols themselves that can introduce errors into the data collection process. To achieve this goal, SOPs have been developed and will be followed as consistently as possible by all field personnel, given the variability of natural conditions encountered in the field. This performance will be monitored by the Field Team Manager or designated representative. Any deviation from SOPs necessitated by unanticipated field conditions will be fully documented as they occur and reported to the Project Manager. SOPs are provided in Appendix B of this QAPP.

Field QC checks have been introduced into the sample collection procedures to minimize, and to identify if it occurs, the potential for interference or introduction of nonenvironmental contaminants during sample collection, storage, transport, and/or equipment decontamination. These checks will be provided through the collection of field QC samples. The accuracy of the field instruments will be maintained by calibration as described in Section 6.1. In addition, field instruments will be maintained in-house by WESTON.

8.2 LABORATORY QC CHECKS

Laboratory QC is necessary to control the analytical process, to assess the accuracy and precision of analytical results, and to identify assignable causes for atypical analytical results. The QC checks in the laboratory will be specific to the analytical method and generally will include the use of QC samples as appropriate for the method (see Section 8.3).

Laboratory QC is described in the QA Manual and SOPs included in Appendix A.

8.3 QUALITY CONTROL SAMPLES

QC samples will be collected/analyzed as stated in the following sections. The frequency of sample collection will be as specified.

8.3.1 Field Rinsate Blanks

Analyses of equipment rinsate blanks will be used to assess the efficiency of field equipment decontamination procedures in preventing cross-contamination between samples. Analyte-free reagent water will be poured into/through/over clean (decontaminated) sampling equipment used in the collection of investigative samples, and then collected into calibrated sample bottles, and the sample sealed. The rinsate blank will then be shipped with the environmental samples collected for the same parameter group. For each matrix, a rinsate blank will be collected and analyzed for every 20 samples (or less) collected. The rinsate blanks will be analyzed using the appropriate method as discussed in the QA Manual provided in Appendix A of this QAPP. Rinsate blanks will not be collected when precleaned, dedicated equipment is used for sampling.

8.3.2 Field Duplicate Samples

Field duplicate samples will be collected and analyzed as a component of the QC protocol. A field duplicate sample is a second sample collected at the same location as the original sample.

Duplicate sample results will be used to assess precision, including variability associated with the sample collection process. Field duplicate samples will be collected simultaneously or in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. One duplicate sample will be collected for every 10 samples (or less) collected.

8.3.3 Trip Blank

A trip blank will be prepared at Pace's laboratory and sent with the bottle shipment. These field samples consist of control water (blank) and will be returned to Pace for analysis at the frequency of at least one for every 20 (or less) samples collected. This protocol will only be followed for water matrix samples. Further discussion can be found in the QA Manual, which is provided in Appendix A of this QAPP.

8.3.4 Laboratory Method Blanks

A method blank, also called a reagent or prep blank, is a sample composed of all the reagents (in the same quantities) used in preparing a sample for analysis. It is carried through the same sample preparation (digestion/extraction) procedure as a sample. These blanks will be used to ensure that interferences from the analytical system, reagents, and glassware are under control. The required frequency for analyzing blanks is specified in the QA Manual, which is provided as Appendix A of this QAPP.

8.3.5 Laboratory Control Sample

A laboratory control sample (LCS) is a sample of laboratory-certified reagent-grade water that is fortified (spiked) with the analytes of interest, and prepared and analyzed with the associated sample batch. Discussion pertaining to the frequency of this QC analysis for Pace can be found in the respective analytical methods found in the QA Manual, which is provided as Appendix A of this QAPP.

8.3.6 Calibration Standards

Initial calibration is performed as required for each analytical method, usually using a range of calibration standards with the low standard near the reporting limit (RL) for the compound. These standards will be used to determine the linear dynamic range for the initial instrument calibration. Discussion of Pace's calibration standard preparation can be found in the respective analytical methods found in the QA Manual, which is provided as Appendix A of this QAPP.

8.4 CONTROL LIMITS

Control limits and acceptance criteria for the analytical methods to be used in the VOC/PCB characterization program are presented in Tables 7-1 through 7-9 of this QAPP. The primary intent of these guidelines is to identify any problems and correct the problem before proceeding. Additional corrective action requirements are presented in Section 12 of this QAPP. Pace may propose alternative corrective actions in accordance with their SOPs.

8.5 REPORTING CHECKS

After final laboratory data have been made available, the data will be compiled into tables for the report to facilitate the assessment of results. An independent check of the data entered into these tables will be performed for accuracy and completeness, and corrections will be made, as necessary, as discussed in Sections 9 and 12 of this QAPP.

9. DATA REDUCTION, VALIDATION, AND REPORTING

The data reduction, validation, and reporting procedures described in this section will ensure that complete documentation is maintained; that transcription and data reduction errors are minimized; the quality of the data is reviewed and documented; and the reported results are properly qualified.

9.1 FIELD AND TECHNICAL DATA

The field and technical (nonlaboratory) data that will be collected during a field effort can generally be characterized as either "objective" or "subjective" data. Objective data (e.g., field test results) include all direct measurements of field data such as field screening/analytical parameters. Subjective data include descriptions and observations such as descriptions of sampling locations and conditions, and physical descriptions of soil boring samples.

Field data collected during the field activities will be evaluated for usability by conducting a QA review, which will consist of checking the procedures used and comparing the data to previous measurements. Field QC samples will be evaluated to ensure that field measurements and sampling protocols have been observed and followed. These checks will include the following:

- Use of SOPs.
- Calibration method and frequency.
- Date and time sampled.
- Preservation.
- Samplers.
- Laboratory.
- Chain-of-custody forms.
- Date shipped.

QA review of data obtained from field measurements will be performed by the field staff. The validity of all data will be determined by checking calibration procedures used in the field and by comparing the data to previous measurements, if any, at the specific site. Large variations (greater than 50%) will be examined for possible re-collection of data or assignment to a lower level of validity.

9.1.1 Data Reduction

Geologic logging data will undergo field QC checking and a later technical review after entry into a geologic logging and data management system. Subjective data will be filed as hard copies for later review and incorporation into technical reports, as appropriate.

The subjective data will be formatted into a usable medium, such as a computer database program. The database will allow the generation of summary tables, graphs, and figures, while maintaining the integrity and accountability of the original data.

9.1.2 Data QA Review

The QA review for usability of objective field and technical data will be performed at two different levels. On the first level, data will be reviewed at the time of collection by following standard procedures and QC checks. On the second level, after data reduction into tables or arrays, the data will be reviewed for anomalous values. Any inconsistencies or anomalies discovered by this review will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for collecting the data. All inconsistencies and anomalies will be documented during the validation process.

Subjective field and technical data will be approved for use by review of field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to check recorded data at that time to confirm the recorded observations. Whenever possible, peer review also will be incorporated into the data QA review process, particularly for subjective data, in order to maximize consistency among field personnel. For example, during drilling activities, scheduled periodic reviews of archived lithologic samples may be performed to ensure that the appropriate lithologic descriptions and codes are being used consistently by all field personnel.

9.2 LABORATORY DATA DOCUMENTATION

Analytical data generated in the laboratory will undergo a well-defined, well-documented multi-tier review process before being reported. Laboratory data production and management performed by Pace is described in the QA Manual, provided as Appendix A of this QAPP. The following sections present a summary of the laboratory's data management system.

9.2.1 Data Reduction

Primary analytical data, otherwise known as "raw data," may be generated manually or captured in electronic format. When raw data are generated manually, they will be recorded either in bound logbooks with numbered pages, or on preprinted forms. Records of analysis will indicate, as appropriate, the method used, raw data, calculations, and final results. Entries will be made in ink and initialed and dated by the individual making the entry. It is acceptable to initial and date once for an entire page. Errors will be corrected by drawing a single line through the entry and corrections will be initialed and dated by the individual making the change. Raw data may not be obscured in any way. The use of white-out is prohibited on all raw data, including instrumental hardcopy.

The analyst who completes the analysis will assemble all relevant raw data and results, together with chromatograms, strip chart recordings, instrument settings, and other information essential to data interpretation. For data that are reduced by manual calculations, the calculations will be documented in a laboratory notebook or on an analyst's worksheet. The results will be transferred to a standardized laboratory reporting form that has been approved by the appropriate Supervisor and the QA Department. Reporting forms will include, at a minimum, the sample identification number, the date analyzed, the result expressed per unit volume, the method reference, and the analyst's initials.

Data reduction will be performed by the individual analysts and will consist of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will depend on the specific analytical method and the number of discrete operations (extractions, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

For those methods using a calibration curve, sample response will be applied to the linear regression line to obtain an initial raw result, which will then be factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than three significant figures.

Copies of all raw data and calculations used to generate the final results for analyses performed by Pace will be retained on file to allow reconstruction of the data reduction process at a later date.

9.2.2 Laboratory Data and QA Review

Data review is the internal process by which data are shown to be valid as evidenced by the soundness of the analytical system and successfully meeting the DQOs. In this process, the laboratory will make no judgment as to the usability of the data by the end-user, except with respect to the methodology applied.

A secondary review of the data will be performed by the Supervisor, analyst, or peer reviewer. The peer reviewer is trained by the Section Manager or Unit Leader to perform the data review. The Section Manager or his/her designee reviews the data for precision and accuracy to ensure that the data meet all specifications. After approval by the Section Manager or his/her designee, the analytical report is assembled. The Section Manager or his/her designee reviews the data to ensure consistency with laboratory QC requirements, to verify reasonableness with other generated data, and to determine if program requirements have been satisfied. Selected hardcopy output of the data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly.

Pace will conduct a review of selected reports. Discrepancies will be reported to the appropriate Section Manager and/or QA Manager for resolution.

The Data Reporting Section will verify that the report is compiled in the proper format. The QA Manager will perform a final completeness check before submitting the data report to the client.

9.2.3 Data Reporting/Deliverable Packages

All data resulting from the investigation will be presented in written reports. The reports will consist of a presentation of the raw analytical data, summaries of the review and verification effort, as appropriate, as well as interpretative findings relative to the data.

Reports will contain final results (uncorrected for blanks and recoveries), analytical methods, RLs, surrogate recovery data, method blank data, and results of QC samples (where applicable). In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Data will normally be reported in units commonly used for the analyses performed. Concentrations in liquids will be expressed in terms of weight per unit volume (e.g., micrograms per liter [µg/L]). Concentrations in solid or semisolid matrices will be expressed in terms of weight per unit weight of sample (e.g., milligrams per kilogram [mg/kg]).

Reports will contain applicable data qualifiers. Data qualifiers will be defined in individual laboratory reports.

The final data deliverables provided by the laboratories will include at a minimum:

- A transmittal letter.
- Data qualifiers and abbreviations.
- Chain-of-custody forms.
- Laboratory chronicle.
- Method reference sheet.
- A sample data report, including a QC summary.

Case narratives are provided only if technical problems occurred. A QA review will also accompany each report.

Specific components of the data reports include the following:

- Inorganics:
  - Cover letter with Project Manager sign-off.
  - Standard glossary of data qualifiers and abbreviations.
  - Chain-of-custody forms.
  - Laboratory chronicle describing: client ID, analysis, WESTON number, matrix, preparation number, collection date, date received, extraction/preparation date, analysis date, and Section Manager sign-off.
  - Case narrative if any technical problems occurred.
  - Method summary form (if case narrative is not applicable, located after the laboratory chronicle).
  - Inorganic data report.
  - QA summary reports: method blank data report, precision data report, accuracy data report, and LCS report.
- Organics:
  - Cover letter with Project Manager sign-off.
  - Standard glossary of data qualifiers and abbreviations.
  - Chain-of-custody forms.
  - Laboratory chronicle describing: client ID, WESTON number, matrix, preparation number, collection date, date received, extraction/preparation date, analysis date, and Project Manager sign-off.
  - Case narrative if any technical problems occurred.
  - Method summary form.
  - Sample data report.
  - QA summary report/spreadsheet.

9.2.4 WESTON Data Review and Validation

The purpose of analytical data review and validation is to eliminate unacceptable data and to qualify data for any data quality limitations identified during validation. When the laboratory performs its analyses, the subsequent reports will contain final results, analytical methods, RLs, surrogate recovery data, method blank data, and results of QC samples (where applicable). Reports will contain the laboratory’s own qualifiers on the data, as indicated in Section 9.2.3.

In addition to the laboratory QA review, all data deliverables will be evaluated by WESTON at a minimum, for the following:

- Compliance with requested testing and applicable QC limits.
- Completeness of analytical report.
- Confirmation of receipt of all requested deliverables.

The review and validation process will be performed by a third party data validator under the supervision of the designated WESTON QA personnel (e.g., Mr. Michael Corbin, P.E.). A qualified third party will be ascertained to conduct data review and validation. This third party will submit its findings to WESTON within a negotiated time frame. WESTON will then prepare a summary of the data review and validation findings to the 3M Project Manager at specified intervals (time or task related) throughout the RA program.

For data generated by Pace, precision will be evaluated using the relative percent differences (RPDs) for the field duplicates, laboratory duplicates, and the RPDs for the MS/MSDs. The data for the calibrations, method blanks, matrix samples/matrix sample duplicates (MS/MSD) recoveries, surrogate recoveries, and all other QC data will be used based on established principles as set forth by EPA and the objectives established in this document.

All data will be used to the extent possible. The completeness parameter will be determined after the determination of the usability of the data.

The data review and validation process will be performed using the following procedure:

- Review chain-of-custody documents to verify sample identities.
- Review sample log-in documents to verify any potential problems with custody seals, container integrity, sample preservation, labeling, etc.
- Review field blank/field blank (BS) spike data to identify any potential problems with sample container contamination, preservation contamination, laboratory reagent water contamination, or cross-contamination among samples during transport.
- Review method blank data to determine the presence of any sources of contamination in the analytical process.

- Review MS data to evaluate the potential for matrix effects and as a measure of analytical accuracy. MS recoveries will be compared against the acceptance criteria in Section 7 to determine if they are within or outside warning and control limits for percent recoveries.
- Review MS/MSD data to evaluate sample homogeneity and as a measure of analytical precision. MS/MSD data will be compared to the acceptance criteria in Section 7 for the maximum RSD/RPD.
- Review any BS data (if available) as a measure of analytical accuracy. BS recoveries will be compared against the acceptance criteria to determine if they are within or outside warning and control limits for percent recoveries.
- Review BS/blank spike duplicate (BSD) data (if available) as a measure of analytical precision. BS/BSD data will be compared to the acceptance criteria for the maximum RPD.
- Review standard reference material (SRM) or LCS data (if available) as a measure of analytical accuracy. SRM and LCS data will be compared to the certified acceptable ranges of analytical values.
- Review sample and sample duplicate data (if available) as a measure of sample homogeneity and as a measure of analytical precision. Sample and sample duplicate data will be compared against the acceptance criteria in Sections 3 and 7 for the maximum RPD.
- Review surrogate recovery data to assess extraction efficiency, effectiveness of sample introduction, and possible loss during cleanup activities. Surrogate recoveries will be compared to the acceptance criteria to determine if they are within or outside acceptable limits.
- Review sample dates, extraction/digestion dates, and analysis dates to determine if maximum holding times were met or exceeded.
- Identify and report any potential problems, such as MS or RSD/RPD values outside acceptance criteria.

This process will identify analytical methods and compounds for which the QA objectives are not satisfied and corresponding sample data will be qualified with a “flag” indicating the problem. Samples collected on the same day, analyzed in the same run or batch, or individual samples may be flagged, depending on the type of problem that has been identified. Reanalysis or resampling may be recommended as a corrective action at this time if data are determined to be unacceptable for the intended application. Data assessment procedures and the corresponding corrective actions are described in Sections 3 and 12 of this QAPP.

QC results will be summarized by sample matrix and analytical method in tabular form. The measurement data will be reviewed and qualified as appropriate based on the QC results. For example, MS interference will influence specific samples or matrices, while laboratory blank contamination will influence all samples extracted or analyzed on a specific day or during a specific analytical run.

In cases where there are a large number of QC analyses of one type, a second level, or summary, table may be constructed. The summary tables will typically report mean or pooled statistics to describe the overall performance of the method. For example, the summary table of duplicate sample results might report the average RPD for all duplicates measured for the compound, and indicate the number of individual RPDs that did not meet the acceptance criteria. This type of table can serve as an indication of the overall QC results. However, these applications will often have to be developed or modified from existing programs for individual investigations. A summary assessment of the data presented in these tables will be prepared for each phase of sampling, as appropriate.

Custom table formats will be used as an aid to interpretation of the investigative data. The particular format will depend on how the QC results are expected to influence the investigative data and will be developed by data management staff through discussions with the users. For example, QC results may be grouped with analytical batches, field collection batches, individual respective samples, or summarized for the entire project.

9.3 DATA ACQUISITION REQUIREMENTS AND DATA QUALITY MANAGEMENT

After the analytical data are validated for acceptability, the data will be used by WESTON to determine proper soil disposal methods/locations, as stipulated in the RD/RA Plan.

9.3.1 Pace Procedures

Pace utilizes EpicPro LIMS for the management of sample tracking and data storage. This is a customized software program. Further discussion of this system can be found in Pace's QA Manual and SOPs, provided in Appendix A of this QAPP.

9.4 DATA ARCHIVING

One copy of the data reports will remain stored in WESTON's central file. The purpose of the data archive is to ensure the continued integrity of all documentation generated in support of laboratory analyses.

9.5 STANDARD PLANS AND REPORTS

Project reports will include a section (or appendix) on QA review. This review will summarize field documentation, field audits, field screening, sample collection and method analysis, duplicate samples, field blanks, trip blanks, sample holding times, MS recoveries, surrogate recoveries, MSD results, and laboratory method blank results. Any corrective actions taken will also be discussed.

10. SYSTEM AND PERFORMANCE AUDITS

A QA audit is an independent appraisal of a measurement system. It typically includes a performance evaluation using apparatus and/or standards that are different from those used in the measurement system. It also may include an evaluation of the potential of the system to produce data of adequate quality to satisfy the objectives of the measurement efforts. The independent, objective nature of the audit requires that the auditor be functionally independent of the sampling/analytical team.

System and performance audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures in the RD/RA. The audits of field and laboratory activities include two independent parts: internal and external audits.

QA audits play an important role in an overall QA/QC program. The internal and external audits may consist of two types: system audits and performance audits. The purpose of a system audit is to determine whether appropriate program systems are in place. A performance audit is used to indicate whether those systems are functioning properly. This section describes the role of the QA Auditor and the nature of both system and performance audits. A complete description of the analytical laboratory's QA auditing program is presented in the Pace QA Manual (Appendix A of this QAPP).

10.1 QUALITY ASSURANCE AUDITOR

The QA Auditor is the person who designs and/or performs QA systems and performance audits. Since QA audits represent, by definition, independent assessments of a measurement system and associated data quality, the auditor must be functionally independent of the measurement effort to ensure objectivity. However, the auditor must be experienced with the objectives, principles, and procedures of the measurement efforts to perform a thorough and effective evaluation of the measurement system. The auditor's technical background and experience provide a basis for appropriate audit standard selection, audit design, and data interpretation. Especially important is the ability to identify components of the system that are critical to overall data quality so that the audit focuses heavily on these elements. The auditor also must have writing skills sufficient to clearly document the findings and recommendations of the audit. The functions of the QA Auditor are the following:

- Observe procedures and techniques in use in the various measurement efforts, including field sampling and analysis.
- Check and verify instrument calibration records.
- Assess the effectiveness of and adherence to the prescribed QC procedures.
- Review document control and chain-of-custody procedures.
- Submit audit samples of comparable composition to those being tested for analysis.
- Review the malfunction reporting procedures.
- Identify and correct any weaknesses in the sampling/analytical approach and techniques.
- Assess the overall data quality of the various sampling/analytical systems.

Challenge the various measurement systems with certified audit standards.

10.2 PROJECT SYSTEM AUDITS

WESTON's corporate management, on an announced or unannounced basis, can call for a corporate project audit (system audit). The WESTON Project Manager will respond by submitting the Project QC Plan (in this case, the QAPP), with the auditor determining whether the QAPP is in place. The auditor will also determine whether the reviews called for in the QAPP have been and are being conducted. These audits will involve an in-depth evaluation of the implementation of the QAPP for the project as they apply to field and data analysis and reduction procedures.

10.3 TECHNICAL PERFORMANCE AUDITS

WESTON will conduct announced and unannounced technical performance audits on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical analyses, including manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of QC review, numerical analysis, and peer review. All records of numerical analyses will be legible, of reproduction quality, and complete enough to permit logical reconstruction by a qualified individual other than the originator.

10.4 FIELD AUDITS

Periodic in-field announced and unannounced performance audits will be conducted by the appropriate technical QA Officers or their designee for the particular discipline of field activities. The purpose of field audits is to ensure that the methods and protocols detailed in this QAPP and the SOPs are being consistently adhered to in the field.

Prior to an audit, the auditing QA Officer will prepare checklists to ensure the completeness of the review and to document the results of the audit. Items to be examined may include the following, as appropriate:

- Availability and implementation of approved work procedures.
- Calibration and operation of equipment.
- Packaging, storage, and shipping of samples obtained.
- Documentation procedures.

The records of field operations will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed would include, but not be limited to, the following:

- Calibration records of field equipment.
- Daily field activity logs.
- Chain-of-custody documentation.
- Field logs.

During an audit and upon its completion, the auditors will discuss the findings with the individuals audited and cite any corrective actions to be initiated. Findings will be noted on the audit checklist and the results provided to the Project Manager. The contractor’s Project Manager will ensure that the corrective actions are implemented. An example Field Audit Checklist is included as Figure 10-1.

10.5 LABORATORY AUDITS

The laboratory internal audit protocols are described in the QA Manual (Appendix A of this QAPP). The Laboratory QA Auditor will audit the performance of the laboratory on this project as part of internal laboratory audits. The audit will consist of a review of systems, procedures, and documentation. Any deficiencies/deviations will be documented, and a summary report prepared.

10.5.1 Internal Laboratory Audits

Internal auditing will be conducted by the Laboratory QA Auditor or a designee in accordance with the laboratory procedures as outlined in Appendix A of this QAPP. Typically, these audits will focus on either performance relative to an SOP or a specific project. Systems audits typically will consist of a thorough review of procedures and documentation to confirm that work is being performed in accordance with the Study Protocol, analytical methods, SOPs and/or project QAPP, and that adequate documentation exists to satisfy the project requirements.

Internal performance audits conducted at the bench level provide the analyst with a tool to evaluate the acceptability of a specific data set. This is accomplished through analysis of LCSs or spiked blanks of known concentration to the analyst that must meet minimum performance standards. When these QC checks are performed in duplicate, method accuracy and precision information can be generated to demonstrate the proper functioning of the total measurement system.

Systems audits address general laboratory operations and conformance to the laboratory standard operating procedures. Systems audits of laboratory operations typically will be performed at a minimum frequency of once per year per laboratory group (i.e., wet chemistry, metals, organic extractions, and gas chromatography [GC] and gas chromatography/mass spectrometry [GC/MS]).

The systems audits will be performed by the laboratory QA department personnel. Audit checklists will be used to ensure that all salient points are addressed and documented.

The checklists will be filled out legibly and reproducibly, in ink, by the auditor, and signed and dated by the auditor when completed. The audit checklist will be based on EPA laboratory evaluation criteria, the provisions of the Laboratory Quality Manual (QAM) or Laboratory Quality Management Program (LQM), and the laboratory SOPs. Project audit checklists will be drawn from the applicable procedural documents, as well as relevant provisions of those documents.

System audit checklists will cover the following areas:

- Personnel qualifications and training records.
- Adequacy of laboratory facilities, including workspace, lighting, ventilation, and supplies.
- Maintenance and calibration recordkeeping for analytical equipment.
- Safety (facility configuration and practices).
- General operations, including glassware cleaning, inventory and checking of reagents and standards, and storage procedures.
- Recordkeeping, including sample log-in and tracking, traceability of standards, control charts, and raw data recording and tracking.
- Sample log-in and chain-of-custody records.
- Sample storage procedures and records.
- Sample preparation and analysis procedures.
- Method validation (where applicable).
- Conformance to the project QAPP.
- Conformance to laboratory SOPs.
- Control charts (if applicable).
- Precision and accuracy assessment.
- Method blanks, reagent blanks, duplicates, check samples, fortifications, and surrogates.
- Calibration.
- Data packages.
- Analyst qualifications.
- Data validation and reporting.

10.5.2 External Laboratory Audits

For the RA program, the laboratory will participate in external performance audits, if initiated by 3M and/or MPCA. These audits may be in the form of laboratory tours and procedure or recordkeeping reviews, or in the form of blind performance samples submitted by the field crews. Announced or unannounced audits of the laboratory may be conducted by MPCA. Written reports on the results of these audits will be distributed to the 3M Project Manager and WESTON's Project Manager. Details of the external performance audits will be specified by MPCA.

Pace is audited by clients and external regulatory authorities, both governmental and nongovernmental. A complete list of the external agency performance and system audits, along with the type and frequency of audits, can be provided by Pace upon request.

10.5.3 QA Reporting and Corrective Action

Each system audit (internal or external) will be followed immediately by a debriefing, in which the auditor discusses his/her findings with the laboratory representatives. The debriefing will serve a two-fold purpose. First, laboratory management will be afforded an early summary of findings, which will allow them to begin formulating corrective strategies, and second, the auditor will have a chance to test preliminary conclusions and to correct any misconceptions before drafting his/her report.

The systems audit report (which may or may not contain performance audit findings) will be issued to the Laboratory Operations Manager and appropriate supervisors and personnel for corrective action. Responses to the findings will be forwarded, in writing, to the auditor. The auditor will then circulate the report to the QA Officer and laboratory management.

The results of internal laboratory performance surveys and in-house audits, along with unresolved corrective action items, will be reported to the Laboratory Manager by the QA Officer.

Figure 10-1 Field Audit Checklist

Inspector:

Audit Number:

Audit Date:

CERTIFICATION OF PERSONNEL

	Yes	No
Personnel on-site are currently active on certification list?	☐	☐
Site Safety Officer and Site Supervisor are qualified?	☐	☐

Comments:

PROJECT LOGBOOKS

	Yes	No
All entries in site log made in ink?	☐	☐
Dates & times recorded for all observations?	☐	☐
Entries signed at end of the day/before new author?	☐	☐
Blank spaces crossed out and initialed?	☐	☐
Corrections crossed out with a single line & initialed?	☐	☐
Entries are legible?	☐	☐
Entries provide detail or provide clear sequence of events?	☐	☐
Unusual occurrences are recorded (e.g., breakdowns, meets, taskings)?	☐	☐
Directives from management are recorded?	☐	☐
Site entry and exit times are recorded?	☐	☐
Weather conditions are recorded?	☐	☐
Reference to individual logbooks is provided?	☐	☐

Comments:

PROJECT INVESTIGATION PROCEDURES

	Yes	No
All activities conducted according to written project procedures?	☐	☐

List of procedures checked:

FIELD LOGS

	Yes	No
Borehold log completed for each soil boring?	☐	☐
Chain-of-custody forms completed and properly filed?	☐	☐
Project logbook up-to-date?	☐	☐
Sample ID documents available and in use?	☐	☐

Comments:

Figure 10-1 Field Audit Checklist

MEDICAL AND FIRST AID

	Yes	No
First aid kits accessible and identified?	☐	☐
First aid and CPR certified person on-site?	☐	☐

Comments:

SITE SAFETY/EMERGENCY PLANS

	Yes	No
Safety plan posted on-site & available for review by each person?	☐	☐
Initial site safety meeting held and documanted before work begins?	☐	☐
Hazardous material information available for all site hazards?	☐	☐
Emergency telephone numbers posted?	☐	☐
Emergency routes designated?	☐	☐
Emergency Contingency Plan reviewed will all persons?	☐	☐
Directions to hospital clearly defined and posted?	☐	☐

Comments:

PERSONAL PROTECTION EQUIPMENT

	Yes	No
All equipment meets ANSI/OSHA/EPA criteria?	☐	☐
Levels of protection established?	☐	☐
Site control zones clearly designated?	☐	☐
Personnel familiar with PPE protocols?	☐	☐
Employees fit-tested for respirators?	☐	☐
Sufficient quantities of equipment?	☐	☐
Instruments properly calibrated?	☐	☐
Calibration logs up-to-date?	☐	☐
Defective equipment tagged out?	☐	☐

Comments:

DECONTAMINATION

	Yes	No
Decontamination system set up on-site?	☐	☐
Appropriate decontamination system/liquids utilized?	☐	☐
Contamination zone clearly delineated?	☐	☐
Appropriate waste receptables available for wastes?	☐	☐
Receptables properly closed at end of day?	☐	☐
Decontamination liquids properly contained and disposed of?	☐	☐

Comments:

Figure 10-1 Field Audit Checklist

SITE FILE SYSTEM (TECHNICAL)

	Yes	No
Chain-of-custody forms completed and properly filed?	☐	☐
Product data sheets available (MSDSs)?	☐	☐
Sampling logs completed and up-to-date?	☐	☐

Comments:

11. PREVENTATIVE MAINTENANCE

The primary objective of a preventive maintenance program is to promote the timely and effective completion of a measurement effort. The preventive maintenance program is designed to minimize the downtime of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused on three primary areas:

- Establishment of maintenance responsibilities.
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus.
- Establishment of an adequate inventory of critical spare parts and equipment.

11.1 RESPONSIBILITIES AND PROCEDURES

Equipment and apparatus used in the contractor's environmental measurement programs fall into two general categories:

- Field sampling equipment available for use on an as-needed basis (e.g., field meters, pumps, and vehicles).
- Equipment permanently assigned to a specific laboratory.

Maintenance responsibilities for field equipment are assigned to the Field Team Manager, WESTON Corporate Equipment Stores staff, and appropriate subcontractors. However, the field team using the equipment is responsible for checking the status of the equipment prior to use, and reporting any problems encountered. The field team is also responsible for ensuring that critical spare parts are included as part of the field equipment checklist. Nonoperational field equipment will be removed from service and a replacement obtained.

Maintenance of laboratory instruments is the responsibility of the laboratory contracted to perform the analytical portion of this program. Generally, the Laboratory Manager or supervisor of a laboratory is responsible for the instruments and equipment in his or her work area. The Laboratory Manager will establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although the Laboratory Manager will retain responsibility for ensuring adherence to prescribed protocols. All laboratories are bound by analytical contractual agreements to maintain the ability to produce data that meet the project objectives and to follow method specifications. This ensures that adequate spare parts, maintenance, schedules, and emergency repair services are available. Pace's preventive maintenance program is presented in the QA Manual (Appendix A).

11.2 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

As discussed in Section 6 of this QAPP, the field equipment will be in good general working condition, properly calibrated and batteries will be charged prior to the beginning of each workday. Maintenance and calibration of equipment prior to field use will be a prerequisite. As appropriate, field instruments will be maintained in accordance with manufacturers' specifications.

All field instruments will be properly protected against inclement weather conditions during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of the ranges that will be encountered during cold-weather working conditions. At the end of each workday, field instruments will be taken out of the field and placed in a locked facility for overnight storage. Field instrumentation and equipment maintenance, repair, and calibration procedures will be in accordance with the manufacturers' specifications.

All subcontractor equipment (e.g., drill rigs, etc.) will arrive at the site each day in proper working condition. All lubrication, hydraulic, and motor oils will be checked by the subcontractors prior to the start of each workday to ensure that all fluid reservoirs are full and that there are no leaks.

Prior to the start of each workday, the Field Team Manager will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

11.3 LABORATORY PREVENTIVE MAINTENANCE

The ability to generate valid analytical data requires that all analytical instrumentation be properly maintained. The effectiveness of any maintenance program depends to a large extent on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted on an as-needed basis. Each laboratory will be responsible for maintaining full-service contracts or in-house trained service personnel for all major instruments. These service contracts should not only provide routine preventive maintenance, but also emergency repair service. Manufacturers' recommendations will provide the primary basis for the established maintenance schedules, and manufacturers' service contracts provide the primary maintenance for many major instruments (e.g., GC instruments, and analytical balances).

In addition to the calibration and maintenance programs detailed in Pace's QA Manual (Appendix A), an effective preventive maintenance program includes proper documentation of activities in instrument maintenance logbooks. Each analytical instrument will be assigned an instrument logbook. All maintenance activities are to be recorded in the instrument logbook, and the information entered will include the following:

- Date of service.
- Person performing service.
- Type of service performed and reason for service.
- Replacement parts installed (if appropriate).
- Miscellaneous information

If service is performed by the manufacturer, a copy of the service record will be taped to the page facing the notebook page or filed separately where the information listed is entered.

11.4 SPARE PARTS

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. The inventory will include those parts (and supplies) with the following characteristics:

- Are subject to frequent failure.
- Have limited useful lifetimes.
- Cannot be obtained in a timely manner should failure occur.

The Field Team Manager and the respective Laboratory Managers will be responsible for maintaining an adequate inventory of spare parts (e.g., spare sources, batteries, vacuum pumps, and filaments for GC/MS units). The instrument operators have the responsibility, with the appropriate Laboratory Project Manager or Group Leader, to ensure that an acceptable inventory of spare parts is maintained.

In addition to spare parts and supply inventories, a backup supply of the pertinent equipment and instrumentation for the field sampling will be maintained.

12. CORRECTIVE ACTION

12.1 INTRODUCTION

During the course of the RA program, it will be the responsibility of the WESTON Project Manager, QA Coordinator, Field Team Manager, Laboratory Project Manager, and the sampling team members to see that all measurement procedures are followed as specified, and that measurement data meet the prescribed acceptance criteria presented in Tables 7-1 through 7-9 and in Section 8. In the event a problem arises, it is imperative that prompt action be taken to correct the problem(s).

When errors, deficiencies, unusual occurrences, or out-of-control situations arise, the QA program provides systematic procedures, called “corrective actions,” to resolve the problems and restore proper functioning to the analytical system. Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-control performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment.

Problems or questions about field or analytical data quality that may require corrective action will be documented by the Field Team Manager or the laboratory and reported to the WESTON Project Manager. Corrective actions may be required if QC results exceed method or project criteria, reporting or flagging errors are identified, or requested information has not been reported. Laboratory response usually will involve a written explanation of the problem or reissuing laboratory reports and/or electronic data files. If significant data quality problems occur and the data are critical to decisionmaking, samples may be reanalyzed or recollected and reanalyzed. That determination must be made by the WESTON Project Manager in association with the Laboratory Project Manager and with the cooperation of the WESTON staff.

All corrective actions proposed and implemented should be documented and provided to the WESTON Project Manager. Corrective action should be implemented only after approval by the WESTON Project Manager or his designee (e.g., the WESTON Field Team Manager). If immediate corrective action is required, approvals secured by telephone from the WESTON Project Manager should be documented.

12.2 FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. The Field Team Manager is responsible for verifying that all QC procedures are followed. This requires that the Field Team Manager assess the correctness of field methods and the ability to meet QA objectives. If a problem occurs that might jeopardize the integrity of the project or cause a specific QA objective to not be met, the Field Team Manager will notify the WESTON Project Manager and the appropriate technical QA Officer (QA Coordinator, QA Auditor). An appropriate corrective action will then be decided upon and implemented. The Field Team Manager will document the problem, the corrective action, and the results. Copies of the documentation form will be provided to the WESTON Project Manager and the appropriate technical QA Officer.

12.3 LABORATORY CORRECTIVE ACTION

The responsibility to monitor the quality of an analytical system lies with the Pace laboratory. The laboratory will verify that all QC procedures are followed and that the results of analysis of QC samples are within the acceptance criteria. This requires that the laboratory assess the correctness of the following items, as appropriate:

- Sample preparation procedure.
- Initial calibration.
- Calibration verification.
- Method blank result.
- Laboratory control standard.
- Laboratory duplicate analysis.
- Fortified sample result.

If the assessment reveals that any of the QC acceptance criteria are not met, the laboratory must immediately assess the analytical system to correct the problem. The analyst will notify the Laboratory Section Manager and QA Manager of the problem and, if possible, will identify potential causes and corrective action. Specific details of Pace’s corrective action program are provided in their QA Manual (Appendix A). The approach to corrective action procedures for individual analyses will be based on the laboratory LQM/SOPs.

The nature of the corrective action obviously depends on the nature of the problem. For example, if a continuing calibration verification is determined to be out-of-control, the corrective action may require recalibration of the analytical system and reanalysis of all samples since the last acceptable continuing calibration standard.

When the appropriate corrective action measures have been defined and the analytical system is determined to be “in control,” the analyst will document the problem, the corrective action, and the data demonstrating that the analytical system is in control.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency noted in the case narrative. Where sample results are impaired, the Laboratory Project Manager will be notified and appropriate corrective action (e.g., reanalysis) will be taken.

12.4 CORRECTIVE ACTION REPORT

The WESTON Project Manager, Laboratory Project Manager, and/or QA Manager, or other project members will initiate a corrective action request in the event that QC results exceed acceptability limits, or upon identification of some other problem or potential problem. Such problems are followed up by the WESTON Project Manager and/or Laboratory Project Manager. Corrective action also can be initiated by the WESTON Project Manager based on QC data or audit results. Corrective actions range from the use of data qualifier flags, reanalysis of the sample or samples affected, resampling and reanalysis, and recommending a change in procedures, depending on the severity of the problem. Problems that require corrective action will be documented by the use of a Corrective Action Report (CAR).

12.5 RECOMMENDATION FOR CORRECTIVE ACTION

A system for issuing formal Recommendations for Corrective Action (RCAs) will be established to address significant and systematic deficiencies identified during audits or other independent QA reviews of field and laboratory procedures. The specific procedures and structure of corrective action systems vary, but the system will provide structure and formats for the following:

- Recommendations issued by the WESTON Project Manager, WESTON QA Coordinator(s), Laboratory Project Manager, or Laboratory QA Manager.
- Requests addressing specific problems or deficiencies identified during QA audits of laboratory or field operations.
- A specific, recommended time-frame for response and implementation of corrective actions.
- If satisfactory resolution is not obtained, requests transmitted to higher levels of management until a corrective action is agreed upon, or until another response is deemed sufficient.

RCAs are issued only by a member of the QA Group, or by their designee in a specific role. The QA Group is made up of the WESTON Project Manager, WESTON QA Coordinator(s), WESTON Field Team Manager, Laboratory Project Manager, and Laboratory QA Manager. Each RCA will address a specific problem or deficiency, usually identified during QA audits of laboratory or project operations (Section 10). Although the RCA system provides for distinguishing among problems of different urgency, RCAs are typically issued only to address significant, systematic deficiencies. Each of these formal written recommendations requires a written response from the responsible party (i.e., to whom the RCA was issued). Each RCA response will require verification by the QA Group that the corrective action has been implemented before the status is changed. In the event that there is no response to the RCA within 30 days, or if the corrective action is disputed, the recommendation and/or conflict will be pursued to successively higher management levels until the issue is resolved.

13. REFERENCES

CFR (Code of Federal Regulations). *Definition and Procedure for the Determination of the Method Detection Limit.* Revision 1.11, 40 CFR 136. 1986.

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EXHIBIT A

LABORATORY QA MANUAL AND SOPs

QUALITY ASSURANCE MANUAL

QUALITY ASSURANCE MANUAL

Quality Assurance/Quality Control
Policies and Procedures
Revision 11.2

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Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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PACE ANALYTICAL SERVICES – MINNESOTA
LOCAL PPROVAL

This document has been approved as the Quality Assurance Manual, effective _**11April2008**_, as indicated by the following signatures:

Laboratory General Manager 612-607-6354	11Apr2008 Date
Laboratory Quality Manager 612-607-6352	11Apr2008 Date
Laboratory Technical Director - Chemistry 612-607-6506	4-11-08 Date
Laboratory Technical Director - Dioxin 612-607-6387	4/11/08 Date
Laboratory Technical Director - Air 612-607-6386	4/11/08 Date

Table of Contents

1.0 INTRODUCTION AND ORGANIZATIONAL STRUCTURE

“Working together to protect our environment and improve our health”

Pace Analytical Services Inc. - Mission Statement

1.1 Introduction to PASI

Pace Analytical Services, Inc. (PASI) is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. PASI offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, industrial hygiene testing, explosives, high resolution mass spectroscopy (including dioxins, furans and coplanar PCB’s), radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. PASI has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

Our goal is to combine our expertise in laboratory operations with customized solutions to meet the specific needs of our customers.

1.2 Statement of Purpose

To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3 Quality Policy Statement and Goals of the Quality System

The PASI management is committed to maintaining the highest possible standard of service for our customers by following a documented quality system. The overall objective of this quality system is to provide reliable data through adherence to rigorous quality assurance policies and quality control procedures as documented in this Quality Assurance Manual.

All personnel within the PASI network are required to be familiar with all facets of the quality system and implement these policies and procedures in their daily work. This daily focus on quality is applied with initial project planning, continued through all field and laboratory activities, and is ultimately included in the final report generation.

PASI management demonstrates its commitment to quality by providing the resources, including facilities, equipment and personnel to ensure the adherence to these documented policies and procedures and to promote the continuous improvement of the quality system. All PASI personnel comply with all current applicable state, federal, and industry standards (such as the NELAC and ISO 17025 standards).

1.4 Pace Analytical Services Core Values

- **INTEGRITY**
- **VALUE EMPLOYEES**
- **KNOW OUR CUSTOMERS**
- **HONOR COMMITMENTS**
- **FLEXIBLE RESPONSE TO DEMAND**
- **PURSUE OPPORTUNITIES**
- **CONTINUOUSLY IMPROVE**

1.5 Code of Ethics

PASI's fundamental ethical principles are as follows:

- Each PASI employee is responsible for the propriety and consequences of his or her actions.
- Each PASI employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where PASI does business or seeks to do business.
- Each PASI employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with customers, suppliers, the public, and one another.

Strict adherence by each PASI employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of PASI.

Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.6 Standards of Conduct

1.6.1 Data Integrity

The accuracy and integrity of the analytical results produced at PASI are the cornerstones of the company. Lack of data integrity is an assault on our most basic values and puts PASI and its employees at grave financial and legal risk. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations and databases. Employees are prohibited from making false entries or misrepresentations of data (e.g., dates, calculations, results or conclusions).

Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work; including commercial, financial, over-scheduling and working condition pressures.

1.6.2 Confidentiality

PASI employees must not (directly or indirectly) use or disclose confidential or proprietary information except when in connection with their duties at PASI. This is effective over the course of employment and for a period of two years thereafter.

Confidential or proprietary information, belonging to either PASI and/or its customers, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and client information, inventions, materials composition, etc.

1.6.3 Conflict of Interest

PASI employees must avoid situations that might involve a conflict of interest or appear questionable to others. The employee must be careful in two general areas:

- Participation in activities that conflict or appear to conflict with PASI responsibilities.

- Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced. This includes bribes, kickbacks or illegal payments.

Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other questionable activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company or participation in any outside business during the employee's work hours.

1.6.4 Compliance

All employees are required to read, understand and comply with the various components of the standards listed in this document. As confirmation that they understand this responsibility, each employee is required to sign an acknowledgment form annually that becomes part of the employee's permanent record. Employees will be held accountable for complying with the Quality Systems as summarized in the Quality Assurance Manual.

1.7 Laboratory Organization

The PASI Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety, and training activities. PASI's Director of Quality, Safety & Technology is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Attachment IIB for the Corporate Organizational structure.

Each laboratory within the system operates with local management, but all share common systems and receive support from the Corporate Office.

A General Manager (GM) supervises each regional laboratory. Some operations may have an Assistant General Manager (AGM) in situations where the General Manager is responsible for multiple laboratory facilities and is not necessarily in the facility on a regular basis. Quality Managers (QM) at each lab report directly to their General Manager (or Assistant General Manager) but receive guidance and direction from the Director of Quality, Safety & Technology.

The General Manager bears the responsibility for the laboratory operations and serves as the final, local authority in all matters. In the absence of the General Manager (and an Assistant General Manager), the Quality Manager serves as the next in command. He or she assumes the responsibilities of the GM until the GM is available to resume the duties of their position. In the absence of the GM and QM, management responsibility of the laboratory is passed to the Technical Director – provided such a position is identified – and then to most senior department manager until the return of the GM or QM. The most senior department manager in charge may include the Client Services Manager or the Administrative Business Manager at the discretion of the General Manager.

A Technical Director who is absent for a period of time exceeding 15 consecutive calendar days shall designate another full-time staff member meeting the qualifications of the technical director to temporarily perform this function. The laboratory General Manager or Quality Manager has the authority to make this designation in the event the existing Technical Director is unable to do so. If this absence exceeds 65 consecutive calendar days, the primary accrediting authority shall be notified in writing.

The Quality Manager has the responsibility and authority to ensure the Quality System is implemented and followed at all times. In circumstances where a laboratory is not meeting the established level of quality or following the policies set for in this Quality Assurance Manual, the Quality Manager has the authority to halt laboratory operations should he or she deem such an action necessary. The QM will immediately communicate the halting of operations to the GM and keep him or her posted on the progress of corrective actions. In the event the GM and QM are not in agreement as to the need for the suspension, the Chief Operating Officer and Director of Quality, Safety and Technology will be called in to mediate the situation.

Under the direction of the General Manager, the technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Product Testing
- Equipment Maintenance
- Microbiology

Appropriate support groups are present in each laboratory. The actual organizational structure for PASI – Minnesota is listed in Attachment IIA. In the event of a change in General Manager, Quality Manager or Technical Director(s), the laboratory will notify its accrediting authorities and revise the organizational chart in the Quality Assurance Manual (QAM) within 30 days. For changes in Department Managers or Supervisors or other laboratory personnel, no notifications will be sent to the laboratory's accrediting agencies; changes to the organizational chart will be updated during or prior to the annual review process. Changes or additions in these key personnel will also be noted by the additional signatures on the QAM Local Approval page. In any case, the QAM will remain in effect until the next scheduled revision.

1.8 Laboratory Job Descriptions

1.8.1 General Manager

1. Oversees all functions of the operations.
2. Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation.
3. Prepares budgets and staffing plans.
4. Monitors the Quality Systems of the laboratory and advises the Quality Manager accordingly.
5. Ensures compliance with all applicable state, federal and industry standards.

1.8.2 Quality Manager

1. Oversees the laboratory Quality Systems while functioning independently from laboratory operations. Reports directly to the General Manager or Regional Quality Manager.
2. Monitors Quality Assurance policies and Quality Control procedures to ensure that the laboratory achieves established standards of quality.
3. Maintains records of quality control data and evaluates data quality.
4. Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or client representatives.
5. Reviews and maintains records of proficiency testing results.
6. Maintains the document control system
7. Assists in development and implementation of appropriate training programs.
8. Provides technical support to laboratory operations regarding methodology and project QA/QC requirements.
9. Maintains certifications from federal and state programs.
10. Ensures compliance with all applicable state, federal and industry standards.
11. Maintains the laboratory training records.

1.8.3 Technical Director

1. Monitors the standards of performance in quality assurance and quality control data
2. Monitors the validity of analyses performed and data generated.
3. Reviews tenders, contracts and QAPPs to ensure the laboratory can meet the data quality objectives for any given project
4. Serves as the general manager of the laboratory in the absence of the GM, AGM and QM.
5. Provides technical guidance in the review, development and validation of new methodologies.

1.8.4 Administrative Business Manager

1. Responsible for financial and administrative management for the entire facility.
2. Provides input relative to tactical and strategic planning activities.
3. Organizes financial information so that the facility is run as a fiscally responsible business.
4. Works with staff to confirm that appropriate processes are put in place to track revenues and expenses.
5. Provide ongoing financial information to the General Manager and the management team so they can better manage their business.
6. Utilizes historical information and trends to accurately forecast future financial positions.
7. Works with management to ensure that key measurements (mileposts) are put in place to be utilized for tread analysis—this will include personnel and supply expenses, and key revenue and expense ratios.
8. Works with General Manager to develop accurate budget and track on an ongoing basis.
9. Works with entire management team to submit complete and justified capital budget requests and to balance requests across departments.
10. Works with project management team and administrative support staff to ensure timely and accurate invoicing.

1.8.5 Client Services Manager

1. Oversees all the day to day activities of the Client Services Department which includes Project Management and, possibly, Sample Control.
2. Responsible for staffing and all personnel management related issues for Client Services.
3. Serves as the primary senior consultant to clients on all project related issues such as set up, initiation, execution and closure.
4. Performs or is capable of performing all duties listed for that of Project Manager.

1.8.6 Project Manager

1. Coordinates daily activities including taking orders, reporting data and analytical results.
2. Serves as the primary technical and administrative liaison between customers and PASI.
3. Communicates with operations staff to update and set project priorities.
4. Provides results to customers in the requested format (verbal, hardcopy, electronic, etc.).
5. Works with customers, laboratory staff, and other appropriate PASI staff to develop project statements of work or resolve problems of data quality.

3. Responsible for solicitation of work requests, assisting with proposal preparation and project initiation with customers and maintain client records.
4. Mediation of project schedules and scope of work through communication with internal resources and management.
5. Responsible for preparing routine and non-routine quotations, reports and technical papers.
6. Interfaces between customers and management personnel to achieve client satisfaction.
7. Manages large-scale complex projects.

8. Supervises less experienced project managers and provide guidance on management of complex projects.
6. Arranges bottle orders and shipment of sample kits to customers.
7. Verifies login information relative to project requirements and field sample Chains-of-Custody.

1.8.7 Project Coordinator

1. Responsible for preparation of project specifications and provides technical/project support.
2. Coordinates project needs with other department sections and assists with proposal preparation.
3. Prepares routine proposals and invoicing.
4. Responsible for scanning, copying, assembling and binding final reports.
5. Other duties include filing, maintaining forms, process outgoing mail, maintaining training database and data entry.

1.8.8 Department Manager/Supervisor

1. Oversees the day-to-day production and quality activities of their assign department.
2. Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied.
3. Assesses data quality and takes corrective action when necessary.
4. Approves and releases technical and data management reports.
5. Ensures compliance with all applicable state, federal and industry standards.

1.8.9 Group Supervisor/Leader

1. Trains analysts in laboratory operations and analytical procedures.
1. Organizes and schedules analyses with consideration for sample holding times.
2. Implements data verification procedures by assigning data verification duties to appropriate personnel.
3. Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs.
4. Reports non-compliance situations to laboratory management including the Quality Manager.

1.8.10 Laboratory Analyst

1. Performs detailed preparation and analysis of samples according to published methods and laboratory procedures.
2. Processes and evaluates raw data obtained from preparation and analysis steps.
3. Generates final results from raw data, performing primary review against method criteria.
4. Monitors quality control data associated with analysis and preparation. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.
5. Reports data in LIMS, authorizing for release pending secondary approval.
6. Conducts routine and non-routine maintenance of equipment as required.
7. Performs or is capable of performing all duties associated with that of Laboratory Technician.

1.8.11 Laboratory Technician

1. Prepares standards and reagents according to published methods or in house procedures.
2. Performs preparation and analytical steps for basic laboratory methods.
3. Works under the direction of a Laboratory Analyst on complex methodologies.

4. Assists Laboratory Analysts on preparation, analytical or data reduction steps for complex methodologies.
5. Monitors quality control data as required or directed. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.12 Sample Management Personnel

1. Signs for incoming samples and verifies the data entered on the Chain-of-Custody forms.
2. Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting.
3. Stages samples according to EPA requirements.
4. Assists Project Managers and Coordinators in filling bottle orders and sample shipments.

1.8.13 Systems Administrator or Systems Manager

1. Assists with the creation and maintenance of electronic data deliverables (EDDs).
2. Coordinates the installation and use of all hardware, software and operating systems.
3. Performs troubleshooting on all aforementioned systems.
4. Trains new and existing users on systems and system upgrades.
5. Maintains all system security passwords.
6. Maintains the electronic backups of all computer systems.

1.8.14 Safety/Chemical Hygiene Officer

1. Maintains the laboratory Chemical Hygiene Plan.
2. Plans and implements safety policies and procedures.
3. Maintains safety records.
4. Organizes and/or performs safety training.
5. Performs safety inspections and provides corrective/preventative actions.
6. Assists personnel with safety issues (e.g. personal protective equipment).

1.9 Training and Orientation

Each new employee receives a five part orientation: human resources, ethics and data integrity, safety, Quality Systems, and departmental.

The human resources orientation includes benefits, salary, and company policies. All records are stored with Human Resources.

The ethics and data integrity training covers the obligations of each employee to ensure the defensibility of laboratory data. Employees are provided with general policies related to ethics in the laboratory and specific examples of improper practices that are unacceptable in any PASI facility. The employee is trained to make the right decisions with regards to laboratory practices and where to go for answers in circumstances where they may be unclear as to the correct protocol.

The safety orientation includes an in-depth review of the PASI Chemical Hygiene Plan/Safety Plan, which are consistent with the requirements of OSHA's Hazard Communication Program (29 CFR 1910.1200) and other pertinent regulations.

The Quality Systems orientation provides the new employee with information through an introduction to the Quality Assurance Manual and SOPs, acceptable record keeping practices, and the individual's responsibility to data quality. Quality Systems training is reinforced with the new employee as specific topics are covered during the departmental or analytical method training. Quality Systems training will address policies and practices that ensure the quality and defensibility of the analytical data. These topics include but are not limited to traceability of measurements, method calibration, calibration verification, accuracy, precision and uncertainty of measurements, corrective actions, documentation and root cause analysis.

The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of PASI and the basic elements of that individual's position.

Supervised training uses the following techniques:

- Hands-on training
- Training checklists
- Lectures and training sessions
- Method-specific training
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.

Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee’s training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability (see Section 3.4 for details on Demonstration of Capability requirements). Training documentation files for each person are kept in a central location.

All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated annually by lab management. Additional information can be found in SOP S-ALL-Q-020 Orientation and Training Procedures or its equivalent revision or replacement.

1.10 Laboratory Safety

It is the policy of PASI to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety by complying with established company rules and procedures. These rules and procedures as well as a more detailed description of the employees’ responsibilities are contained in the corporate Safety Manual and Chemical Hygiene Plan.

1.11 Security and Confidentiality

Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by PASI staff. Keyless door-lock combinations (and computer access codes/logins) are changed periodically. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors to the facility must sign the Visitor's Logbook maintained by the receptionist. A staff member will accompany them during the duration of their stay on the premises unless the GM, QM or TD specify otherwise. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she signs out. The last staff member to leave their department for the day should ensure that all outside access points to that area are secure.

Additional security is provided where necessary, e.g., specific secure areas for sample, data and client report storage, as requested by customers or cases where national security is of concern. These areas are lockable within the facilities, or are in secure offsite storage. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Sample Custodian. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of client report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by client or contract, samples are not to be removed from secure storage areas without filling out the associated internal Chain-of-Custody records.

Standard business practices of confidentiality are applied to all documents and information regarding client analyses. Specific protocols for handling confidential documents are described in PASI SOPs. Additional protocols for internal identification of samples and data by number only are implemented as required under contract-specific Quality Assurance Project Plans (QAPPs).

All information pertaining to a particular client, including national security concerns will remain confidential. Data will be released to outside agencies only with written authorization from the client or where federal or state law requires the company to do so (i.e. federal or state subpoena).

2.0 SAMPLE CUSTODY

2.1 Sampling Support

Each individual PASI laboratory provides shipping containers, sample containers (including applicable chemical preservatives), custody documents, and field quality control samples (e.g., trip blanks) to support field-sampling events. Guidelines for sample container types, preservatives, and holding times for a variety of methods are listed in Attachment VIII. Note that all analyses listed are not necessarily performed at all PASI and there may be additional laboratory analyses performed that are not included in these tables. PASI - Minnesota may provide pick-up and delivery services to their customers when needed.

2.2 Project Initiation

Prior to accepting new work, the laboratory reviews performance capability. The laboratory establishes that sufficient resources (personnel, equipment capacity, analytical method capability, etc.) are available to complete the required work. The client needs and data quality objectives are defined and appropriate environmental test methods are assured to meet client's requirements by project managers or sales representative. Project Managers review laboratory certifications. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability and projected sample load. Management then informs the sales and client services personnel whether or not the laboratory can accept the new project via written correspondence, email, and/or daily operations meetings.

The laboratory maintains records of all such reviews, including discussions with customers. Routine analytical project documentation of quotes, notes, dates, initials and/or recordings is maintained in a project folder by project management. Conditions for new and more complex contracts are determined by the General Managers and sales representatives. Quality Management is consulted on technical requirements and operations staff provides input on volume capacities. Evidence of these reviews is maintained in the form of awarded Request for Proposals (RFPs), signed quotes or contracts, and a Customer Relationship Management (CRM) database. If a review identifies a potential mismatch between customer requirements and laboratory capabilities and/or capacities, Pace will specify its level of commitment by listing these exceptions to the requirements within the RFP, quote or contract.

2.3 Chain-Of-Custody

A chain-of-custody (COC) (see Attachment VII) document provides the legal documentation of samples from time of collection to completion of analysis. Importance is stressed on completeness of COCs. PASI has implemented Standard Operating Procedures to ensure that sample custody traceability and responsibility objectives are achieved for every project.

Field personnel or client representatives complete a chain-of-custody form for all samples. Samples are received by the laboratory accompanied by these forms.

If sample shipments are not accompanied by the correct documentation, the Sample Receiving department notifies a Project Manager. The Project Manager then obtains the correct documentation/information from the client in order for analysis of samples to proceed.

The sampler is responsible for providing the following information on the chain-of-custody form:

- Client project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample type (matrix)
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks (if applicable)
- Custody Seal Number (if applicable)
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met
- Turnaround time requested
- Purchase order number

The record is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples are recorded on the chain-of-custody in the “relinquished” and “received by” sections. All information except signatures is printed.

Additional information can be found in SOP S-MN-C-001 Sample Management or its equivalent revision or replacement.

2.4 Sample Acceptance Policy

In accordance with regulatory guidelines, PASI complies with the following sample acceptance policy for all samples received.

If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory is required to document all non-compliances, contact the client, and either reject the samples or fully document any decisions to proceed with analyses of samples which do not meet the criteria. Any results reported from samples not meeting these criteria are appropriately qualified on the final report.

All samples must:

- Have unique client identification that are clearly marked with durable waterproof labels on the sample containers and that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler’s name and signature
- Have the requested analyses clearly marked
- Have clear documentation of any special analysis requirements (data deliverables, etc.);
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless method allows for laboratory preservation.
- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior client permission.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without client approval.

- Be received within appropriate temperature ranges - not frozen but ≤6°C (See Note 1), unless program requirements or client contractual obligations mandate otherwise (see Note 2). The cooler temperature is recorded directly on the COC and the SCUR. Samples that are delivered to the lab immediately after collection are considered acceptable if there is evidence that the chilling process has been started, for example by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the client will be notified. The analysis will NOT proceed unless otherwise directed by the client. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the client is contacted to avoid missing the hold time. Data will be appropriately qualified on the final report.

  Note 1: Temperature will be read and recorded based on the precision of the measuring device. For example, temperatures obtained from a thermometer graduated to 0.1°C will be read and recorded to ±0.1°C. Measurements obtained from a thermometer graduate to 0.5°C will be read to ±0.5°C. Measurements read at the specified precision are not to be rounded down to meet the ≤6°C limit (i.e. 6.2°C rounded and recorded as 6°C).

  Note 2: Some microbiology methods allow sample receipt temperatures of up to 10°C. Consult the specific method for microbiology samples received above 6°C prior to initiating corrective action for out of temperature preservation conditions.

Upon sample receipt, the following items are also checked and recorded:

- Presence of custody seals or tapes on the shipping containers
- Sample condition: Intact, broken/leaking
- Sample holding time
- Sample pH when required
- Appropriate containers

Samples for drinking water analysis that are improperly preserved, or are received past holding time, are rejected at the time of receipt, with the exception of VOA samples that are tested for pH at the time of analysis.

Additional information can be found in SOP S-MN-C-001 Sample Management or its equivalent revision or replacement.

2.5 Sample Log-in

After sample inspection, all sample information on the chain-of-custody is entered into the Laboratory Information Management System (LIMS).

This permanent record documents receipt of all sample containers including:

- Client name and contact
- Client number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested
- Date and time of lab receipt
- Field ID code
- Date and time of collection
- Any comments resulting from inspection for sample rejection

All samples received are logged into the LIMS system within one working day of receipt. Sample login may be delayed due to client clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances. If the time collected for any sample is unspecified and Pace is unable to obtain this information from the customer, the laboratory will use 00:00 as the time sampled. All hold times will be based on this sampling time and qualified accordingly if exceeded.

The Laboratory Information Management System (EPIC Pro) automatically generates a unique identification number for each sample created in the system. The LIMS sample number follows the general convention of 10-XXXXX-YYY. The 10 represents Minnesota as the laboratory location. The 5 digit "X" number represents the project number followed by a 3 digit sample number. The project number is a sequential number that is assigned as a new project is created. The sample number corresponds to the number of samples submitted by the client. In addition to the unique sample ID, there is a sample container ID that consists of the sample number, the container type (ex. BP1U), and bottle 1 of Y. Together the sample LIMs number and sample container ID number create a unique barcode encryption that can be linked to the sample analysis requested by the client. This unique identification number is placed on the sample container as a durable label and becomes the link between the laboratory's sample management system and the client's field identification; it will be a permanent reference number for all future interactions.

Sample labels are printed from the LIMS system and affixed to each sample container.

Samples with hold times that are near expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or General Manager.

Additional information can be found in SOP S-MN-C-001 Sample Management or its equivalent revision or replacement.

2.6 Sample Storage

2.6.1 Storage Conditions

Samples are stored away from all standards, reagents, or other potential sources of contamination. Samples are stored in a manner that prevents cross-contamination (e.g. volatile samples are stored separate from other samples). All sample fractions, extracts, leachates and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method

2.6.2 Temperature Monitoring

Samples are taken to the appropriate storage location (ambient, refrigerator, freezer) immediately after sample receipt and check-in procedures are completed. All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

The temperature of each refrigerated storage area is maintained at $\leq 6^{\circ}$C unless state or program requirements differ. The temperature of each freezer storage area is maintained at $<0^{o}$C unless state or program requirements differ. The temperature of each storage area is monitored and recorded each workday. If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Corrective action is initiated if necessary.
- The Quality Manager and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.

- The affected customers are notified.
- Documentation is provided on analytical report.

2.6.3 Hazardous Materials

Pure product or potentially heavily contaminated samples are tagged as "hazardous" or "lab pack" and are stored separately from other samples.

2.6.4 Foreign/Quarantined Soils

Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are segregated. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure.

Additional information can be found in SOP MN-Q-253 Procedure for Handling of USDA Regulated Soils or its equivalent revision or replacement.

2.7 Sample Protection

PASI laboratory facilities are operated under controlled access to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted.

Samples are removed from storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

Upon client request, additional and more rigorous chain-of-custody protocols for samples and data can be implemented. For example, some projects may require complete documentation of sample custody within the secure laboratory.

Additional information can be found in SOP S-MN-C-001 Sample Management or its equivalent revision or replacement.

2.8 Subcontracting Analytical Services

Every effort is made to perform chemical analyses for PASI customers within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory (inside or outside the PASI network) becomes necessary, a preliminary verbal communication with an appropriate laboratory is undertaken. Customers are notified in writing of the lab's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential sub-contract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not involved in legal action by any federal, state, or local government agency for data integrity issues and has not been convicted in such investigation at any time during the past 5 years.

The contact and preliminary arrangements are made between the PASI Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include :

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements

- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn around time requirements

Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. Sample receiving personnel re-package the samples for shipment, create a transfer chain-of-custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions (quick turn-around, required detection or reporting limits, unusual information known about the samples or analytical procedure).
- Signature in "Relinquished By"

All subcontracted sample data reports are sent to the PASI Project Manager.

Any Pace Analytical work sent to other labs within the PASI network is handled as subcontracted work (also known as inter-regional) and all final reports are labeled clearly with the name of the laboratory performing the work. Any non-NELAC work is clearly identified. PASI will not be responsible for analytical data if the subcontract laboratory was designated by the Client.

Additional information can be found in SOP S-MN-C-004 Subcontracting Samples or its equivalent revision or replacement.

2.9 Sample Retention and Disposal

Samples (and sample by-products) must be retained by the laboratory for a period of time necessary to protect the integrity of the sample or sample by-product (e.g. method holding time) and to protect the interests of the laboratory and the client.

Unused portions of samples are retained by each laboratory based on program or client requirements for sample retention and storage. The sample retention time is a minimum of 45 days from receipt of the samples. Samples requiring storage beyond this time due to special requests or contractual obligations will not be stored under temperature controlled conditions unless the laboratory has sufficient capacity and their presence does not compromise the integrity of other samples.

After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste.
The preferred method for disposition of hazardous samples is to return the excess sample to the client. If it is not feasible to return samples, or the client requires PASI to dispose of excess samples, PASI will arrange for proper disposal by an approved contractor.

All samples and laboratory waste are managed and disposed in accordance with all Federal and State laws and regulations. Additional information can be found in SOP S-ALL-S-002 Waste Handling and S-MN-C-001 Sample Management or their equivalent revisions or replacements.

3.0 ANALYTICAL CAPABILITIES

3.1 Analytical Method Sources

PASI laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. The latest valid edition of methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH, and State Agencies. Section 11 (References) is a representative listing of general analytical protocol references. PASI discloses in writing to its customers and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

In the event of a client specific need, instrumentation constraint or regulatory requirement, PASI laboratories reserve the right to use valid versions of methods that may not be the most recent edition available.

3.2 Analytical Method Documentation

The primary form of documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP for Preparation of SOPs (ALL-Q-001), or equivalent revisions or replacements.

The SOPs may be supplemented by other training materials that further detail how methods are specifically performed. This training material will undergo annual, documented review along with the other Quality System documentation.

3.3 Analytical Method Validation

In some situations, PASI develops and validates methodologies that may be more applicable to a specific problem or objective. When non-standard methods (e.g. methods other than EPA, NIOSH, ASTM, AOAC, etc.) are required for specific projects or analytes of interest, or when the laboratory develops a method, or modifies a standard method, the laboratory validates the method prior to applying it to client samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include determination of the limit of detection and limit of quantitation, evaluation of precision and bias, and evaluation of selectivity of each analyte of interest.

Additional information can be found in SOP MN-Q-252 Methods Validation and Modification Studies, or equivalent revisions or replacement.

3.4 Demonstration of Capability (DOC)

Analysts complete an initial demonstration of capability (IDOC) study prior to performing a method or when there is a change in instrument type, personnel or test method (when a defined ‘work cell’ is in operation, the entire work cell must meet the criteria). The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard is calculated and compared to method criteria (if available) or established lab criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability and corresponding raw data for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are verified on an annual basis.

Alternative demonstration of capability procedures may be used for IDOC for methods that don’t lend themselves to the “4 replicate” approach. For methods that only measure precision, the precision of four laboratory duplicate pairs will be assessed. The relative percent differences must be within the method acceptance limits. For procedures like TCLP or SPLP, the analyst will demonstrate making the buffered solution and tumbling process. The trainer or supervisor will sign-off on demonstration of capability of the tumbling process. Additional demonstration of capability requirements will be specified in Section 14 – Method Performance of the applicable SOP.

For Continuing Demonstrations of Capability, the laboratories may use Performance Testing (PT) samples in addition to the IDOC procedures or requirements provided in Section 14 of the applicable analytical SOPs.

Pace Analytical utilizes a peer review system for data review and approval. The data review staff are qualified to validate data conversion, transcription, and reporting in addition to assessing deviations from the standard operating procedures. The data review staff are familiar with the analytical method procedures with documentation maintained in their training files. The data reviewers also utilize a method specific checklist which contains the quality control acceptance criteria. Deviations from the standard operating procedure are documented on the checklist by the analyst. Further data review guidance is provided in SOP MN-L-132 Data Reduction, Validation and Reporting in the Environmental Lab.

Additional information can be found in SOP S-ALL-Q-020 Orientation and Training Procedures, or equivalent revision or replacement.

3.5 Regulatory and Method Compliance

PASI understands that expectations of our customers commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore PASI attempts to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the Chain-of-Custody submitted with samples.

PASI makes every effort to detect regulatory or project plan inconsistencies, based upon information from the client, and communicate them immediately to the client in order to aid in the decision-making process. PASI will not be liable if the client chooses not to follow PASI recommendations.

It is PASI policy to disclose in a forthright manner any detected noncompliance affecting the usability of data produced by our laboratories. The laboratory will notify customers within 30 days of fully characterizing the nature of the nonconformance, the scope of the nonconformance and the impact it may have on data usability.

4.0 QUALITY CONTROL PROCEDURES

4.1 Data Integrity System

The data integrity system at PASI provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace Aanalytical is committed to providing a culture of quality throughout the organization. To accomplish this goal, PASI has implemented a data integrity system that encompasses the following four requirements:

1. A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics within this training include:
   - Need for honesty in analytical reporting
   - Process for reporting data integrity issues
   - Specific examples of unethical behavior and improper practices
   - Documentation of non-conforming data that is still useful to the data user
   - Consequences and punishments for unethical behavior
   - Examples of monitoring devices used by management to review data and systems
2. Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual
3. In-depth, periodic monitoring of data integrity: including peer data review and validation, internal data audits, proficiency testing studies, etc.
4. Documentation of any review or investigation into possible data integrity infractions. This documentation, including any disciplinary actions involved, corrective actions taken, and notifications to customers must be available for review for lab assessors and must be retained for a minimum of five years.

PASI management makes every effort to ensure that personnel are free from any undue pressures that affect the quality of their work including commercial, financial, over-scheduling, and working condition pressures.

Corporate management also provides all PASI facilities a mechanism for confidential reporting of data integrity issues that ensures confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern. The anonymous message line is monitored by the Corporate Director of Quality, Safety and Technology who will ensure that all concerns are evaluated and, where necessary, brought to the attention of executive management and investigated. **The message line voice mail box is available at 612-607-6427.**

4.2 Method Blank

A method blank is used to evaluate contamination in the preparation/analysis system. The method blank is processed through all preparation and analytical steps with its associated samples.

A method blank is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (e.g. volatiles), a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The method blank consists of a matrix similar to the associated samples that is known to be free of the analytes of interest. Laboratories will characterize a representative matrix as “clean” if the matrix contains contaminants at less than ½ the laboratory’s reporting limit.

Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater then 1/10 of the amount of that analyte found in any associated sample.

Corrective actions include the re-preparation and re-analysis of all the samples (where possible) along with the full set of required quality control samples. Data qualifiers must be applied to any result reported that is associated with a contaminated method blank.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, the lab must minimize the use of qualified data. In the case of method blank contamination, the lab is required to reanalyze the associated samples with an acceptable blank (no reportable contamination) if there is sufficient sample remaining. The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding method blanks for Ohio VAP projects.

4.3 Laboratory Control Sample

The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis.

An LCS is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (e.g. volatiles), an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

The LCS contains all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the following compounds:

- For multi-peak analytes (e.g. PCBs), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
    - For methods with 1-10 target compounds, the lab will spike with all compounds
    - For methods with 11-20 target compounds, the lab will spike with at least 10 compounds or 80%, whichever is greater
    - For methods with greater than 20 compounds, the lab will spike with at least 16 compounds.

The LCS is evaluated against the method default or laboratory-derived acceptance criteria. Method default control limits will be used until the laboratory has a minimum of 20 (preferably greater than 30) data points from which to derive internal criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier.

For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). NELAC has allowed for a minimum number of marginal exceedances, defined as recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation). The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) or if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes

- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

A matrix spike (MS) can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a NELAC allowance). When this happens, full documentation must be made available to the data user. If this is not allowed by a client or regulatory body, such as Ohio VAP, the associated samples must be rerun with a compliant LCS (if possible) or reported with appropriate data qualifiers.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, the lab must minimize the use of qualified data. In the case of LCS failures, the lab is required to reanalyze the associated samples with an acceptable LCS (all applicable recoveries within acceptable limits) if there is sufficient sample remaining. The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding LCSs for Ohio VAP projects.

4.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch (see LCS).

A **Matrix Spike/Matrix Spike Duplicate** (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific client. This frequency will be specified in the applicable method SOP or client QAPP. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 samples per general matrix (i.e. soil, water, biota, etc.) per method.

The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Lab personnel spike client samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples are prepared and analyzed in the same manner as the original samples and are selected from different customers if possible.

The MS and MSD contain all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the same number of compounds as previously discussed in the LCS section.

The MS and MSD are evaluated against the method or laboratory-derived criteria. Any compound that is outside of these limits is considered to be ‘out of control’ and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site-specific information.

A matrix spike and sample duplicate will be performed instead of a matrix spike and matrix spike duplicate when specified by the client or method.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, the lab must minimize the use of qualified data. In the case of MS/MSD failures, the lab is required to reanalyze the associated samples only when the associated LCS also fails acceptance criteria and if there is sufficient sample remaining. When an LCS is acceptable and the MS results are outside of criteria, and no system anomaly is detected, the samples will be reported with appropriate data qualifiers indicating matrix interference. The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding LCSs for Ohio VAP projects.

4.5 Surrogates

Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

Surrogates are added to each client sample (for organics), method blank, LCS, MS and instrument standards prior to extraction or analysis. The surrogates are evaluated against the method or laboratory-derived acceptance criteria, see applicable analytical SOP for criteria. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, the lab must minimize the use of qualified data. In the case of surrogate failures, the lab is required to reanalyze the associated samples to confirm that a matrix effect is present (if there is sufficient sample remaining). The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding surrogate failures for Ohio VAP projects.

4.6 Sample Duplicate

A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It is used to measure the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific client.

The sample and duplicate are evaluated against the method or laboratory-derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, the lab must minimize the use of qualified data. In the case of duplicate samples exceeding the RPD criteria found in applicable analytical SOPs, the lab is required to reanalyze the associated sample and duplicate as long as no sampling error was detected (if there is sufficient sample remaining). If the sample and duplicate still do not agree, a comment would be made stating there is a sample anomaly (i.e. non-homogeneous). The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding sample duplicates for Ohio VAP projects.

4.7 Internal Standards

Internal Standards are method-specific analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, and sample at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes. At a minimum, the laboratory will follow method specific guidelines for the treatment of internal standard recoveries as they are related to the reporting of data.

Deviations made from this policy must be approved by the Quality Manager prior to release of the data.

For Ohio VAP projects, samples with internal standard failures, outside of method criteria, must be reanalyzed to confirm sample matrix effect. The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding internal standards for Ohio VAP projects.

4.8 Field Blanks

Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples are often referenced as field blanks, rinseate blanks, or equipment blanks. The lab analyzes these field blanks as normal samples and informs the client if there are any target compounds detected above the reporting limits.

4.9 Trip Blanks

Trip blanks are blanks that originate from the laboratory as part of the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the lab. These blanks are routinely analyzed for volatile methods where ambient background contamination is likely to occur.

4.10 Limit of Detection (LOD)

PASI laboratories are required to use a documented procedure to determine a limit of detection (LOD) for each analyte of concern in each matrix reported. All sample-processing steps of the preparation and analytical methods are included in this determination. For any test that does not have a valid LOD, sample results below the lowest calibration standard cannot be reported.

The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. The LOD is, at a minimum, verified on an annual basis. If required by client or accreditation body, the LOD will be reestablished annually for all applicable methods.

Unless otherwise noted, the method used by PASI laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or client, the above referenced procedure will be followed.

Additional information can be found in SOP S-ALL-Q-004 Method Detection Limit Studies or its equivalent revision or replacement.

For Ohio VAP projects, a valid MDL must be in place prior to sample analysis. MDLs must be spiked at or below the reporting limit. The MDL will not be accepted if it was spike higher than the reporting limit.

4.11 Limit of Quantitation (LOQ)

A limit of quantitation (LOQ) for every analyte of concern must be determined. For PASI laboratories, this LOQ is referred to as the PRL, or Pace Reporting Limit. This PRL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g. J flag).

There must be a sufficient buffer between the LOD and the limit of quantitation (LOQ). The LOQ must be higher than the LOD.

To verify the LOQ, the laboratory will prepare a sample in the same matrix used for the LCS. The sample will be spiked with target analytes at the concentration(s) equivalent to or less than the PRL(s). This sample must undergo the routine sample preparation procedure including any routine sample cleanup steps. The sample is then analyzed and the recovery of each target analyte determined. The recovery for each target analyte must meet the laboratories current control limits.

Additional information can be found in SOP S-ALL-Q-004 Method Detection Limit Studies or its equivalent revision or replacement.

4.12 Estimate of Uncertainty

PASI laboratories can provide an estimation of uncertainty for results generated by the laboratory. The estimate quantifies the error associated with any given result at a 95% confidence interval. This estimate does not include bias that may be associated with sampling. The laboratory has a procedure in place for making this estimation. In the absence of a regulatory or client specific procedure, PASI laboratories base this estimation on the recovery data obtained from the Laboratory Control Spikes. The uncertainty is a function of the standard deviation of the recoveries multiplied by the appropriate Student's t Factor at 95% confidence. Additional information pertaining to the estimation of uncertainty and the exact manner in which it is derived are contained in the SOP MN-Q-255 or its equivalent revision or replacement.

The measurement of uncertainty is provided only on request by the client, as required by specification or regulation and when the result is used to determine conformance within a specification limit.

4.13 Proficiency Testing (PT) Studies

PASI laboratories participate in the NELAC-defined proficiency testing program. PT samples are obtained from NIST-approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

The lab initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the Quality Manager. A corrective action plan (including re-analysis of similar samples) is initiated and this report is sent to the appropriate state accreditation agencies for their review.

PT samples are treated as typical client samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

Additional information can be found in SOP S-ALL-Q-010 PE/PT Program or its equivalent revision or replacement.

4.14 Rounding and Significant Figures

In general, the PASI laboratories report data to no more than three significant digits. Therefore, all measurements made in the analytical process must reflect this level of precision. In the event that a parameter that contributes to the final result has less than three significant figures of precision, the final result must be reported with no more significant figures than that of the parameter in question.

Rounding

PASI-Minnesota follows the odd / even guidelines for rounding numbers.

- If the figure following the one to be retained is less than five, that figure is dropped and the retained ones are not changed (with three significant figures, 2.544 is rounded to 2.54).
- If the figure following the ones to be retained is greater than five, that figure is dropped and the last retained one is rounded up (with three significant figures, 2.546 is rounded to 2.55).
- If the figure following the ones to be retained is five and if there are no figures other than zeros beyond that five, then the five is dropped and the last figure retained is unchanged if it is even and rounded up if it is odd (with three significant figures, 2.525 is rounded to 2.52 and 2.535 is rounded to 2.54).

Significant Digits

Unless specified by federal, state or local requirements or on specific request by a customer, PASI-Minnesota reports all analytical results to 3 significant digits, regardless of the magnitude of the value reported.

PASI-Minnesota follows the following convention for reporting to a specified number of significant figures. Unless specified by federal, state or local requirements or on specific request by a customer, the laboratory reports:

- Values > 10 – Reported to 3 significant digits
- Values ≤ 10 – Reported to 2 significant digits

5.0 DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1 Document Management

Additional information can be found in SOP S-ALL-Q-002 Document Management.

Pace Analytical Services, Inc. has an established procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures, Quality Assurance Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system.

A master list of all managed documents is maintained at each facility identifying the current revision status and distribution of the controlled documents. This establishes that there are no invalid or obsolete documents in use in the facility. All documents are reviewed periodically and revised if necessary. Obsolete documents are systematically discarded or archived for audit or knowledge preservation purposes.

Each managed document is uniquely identified to include the date of issue, the revision identification, page numbers, the total number of pages and the issuing authorities. For complete information on document numbering, refer to SOP S-ALL-Q-003 Document Numbering.

As an alternative to the hard copy system of controlled documents, secured electronic copies of controlled documents may be maintained on the local or wide-area network (LAN or WAN). These document files must be read-only for all personnel except the Quality Department and system administrator. Other requirements for this system are as follows:

- Electronic documents must be readily accessible to all facility employees.
- Electronic documents must explicitly indicate that copies are not to be printed from the electronic file. All hardcopy SOPs must be obtained from the Quality Assurance Department.

5.1.1 Quality Assurance Manual (QAM)

The Quality Assurance Manual is the company-wide document that describes all aspects of the quality system for PASI. The base QAM template is distributed by the Corporate Quality Department to each of the regional Quality Managers. The regional management personnel modify the necessary and permissible sections of the base template and submit those modifications to the Corporate Director of Quality for review. Once approved and signed by both the CEO and the Director of Quality, the General Manager, Quality Manager and Technical Director(s) sign the Quality Assurance Manual. Each regional Quality Manager is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document copies. The Quality Assurance Manual template is reviewed on an annual basis by all of the PASI Quality Managers and revised accordingly by the Director of Quality, Safety and Technology.

5.1.2 Standard Operating Procedures (SOPs)

SOPs fall into two categories: company-wide documents (starting with the prefix ALL-) and facility-specific documents (starting with the individual facility prefix).

The purpose of the company-wide (ALL) SOPs is to establish policies and procedure that are common and applicable to all PASI facilities. Company-wide (ALL) SOPs are document-controlled by the corporate quality office and signed copies are distributed to each of the regional Quality Managers. The regional management personnel sign the company-wide (ALL) SOPs.

The regional Quality Manager is then in charge of distribution to employees, external customers or regulatory agencies and maintaining a distribution list of controlled document copies.

Regional PASI facilities are responsible for developing facility-specific SOPs applicable to their respective facility. The regional facility develops these facility-specific SOPs based on the corporate-wide (ALL) SOP template. This template is written to incorporate a set of minimum method requirements and PASI best practice requirements. The regional facilities may add to or modify the corporate-wide (ALL) SOP template provided there are no contradictions to the minimum method or best practice requirements. Facility-specific SOPs are controlled by the regional Quality Manager according to the corporate document management policies.

SOPs are reviewed every year at a minimum (a more frequent review may be required by state or federal agencies or customers). A review of the document does not necessarily constitute a re-issue of a new revision. Documentation of this review and any applicable revisions are made in the last section of each SOP. This provides a historical record of all revisions.

All copies of superseded SOPs are removed from general use and the original copy of each SOP is archived for audit or knowledge preservation purposes. This ensures that all PASI employees use the most current version of each SOP and provides the Quality Manager with a historical record of each SOP.

Additional information can be found in SOP S-ALL-Q-001 Preparation of SOPs or its equivalent revision or replacement.

For Ohio VAP certification, it is required by the Ohio Administrative Code that the lab must seek Ohio VAP review and approval of all SOPs and Quality Manual subsequent modifications prior to implementation.

5.1.3 Other Documentation

Additional documents such as Forms and Spreadsheets are controlled through the document management system.

5.2 Document Change Control

Changes to managed documents are reviewed and approved in the same manner as the original review. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

All controlled copies of the previous document are replaced with controlled copies of the revised document and the superseded copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training is scheduled.

6.0 EQUIPMENT AND MEASUREMENT TRACEABILITY

Each PASI facility is equipped with sufficient instrumentation and support equipment to perform the relevant analytical testing or field procedures performed by each facility. Support equipment includes chemical standards, thermometers, balances, disposable and mechanical pipettes, etc. This section details some of the procedures necessary to maintain traceability and perform proper calibration of instrumentation and support equipment.

6.1 Standards and Traceability

Each PASI facility retains all pertinent information for standards, reagents and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation and use.

Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database and assigned a unique identification number. The entries include the facility's unique identification number, the chemical name, manufacturer name, manufacturer's identification numbers, receipt date and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained for future reference.

Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique PASI identification number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record. This process ensures traceability back to the national standard.

All prepared standard or reagent containers include the PASI identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration with units, and the preparer's initials. This ensures traceability back to the standard preparation logbook.

If a second source standard is required to verify an existing calibration or spiking standard, this standard is purchased from a different supplier. If no second source is available, a second standard from a different lot may be purchased from the same supplier if the lot can be demonstrated as prepared independently from other lots.

Additional information concerning standards and reagent traceability can be found in the SOP S-ALL-Q-025 Standard and Reagent Preparation and Traceability or its equivalent revision or replacement.

6.2 General Analytical Instrument Calibration Procedures

All types of support equipment and instrumentation are calibrated or checked before use to ensure proper functioning and verify that the laboratory's requirements are met. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards or reference standards whose values have been statistically validated.

Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers (e.g. J flag) or explained in a narrative. The Minnesota Department of Health requires that the reporting limit be verified upon initial calibration and monthly there after. The reporting limit verification must be within ± 40% of the true value of the reporting limit standard. The reporting limit may need to be adjusted accordingly to meet this criteria.. The highest calibration standard is the highest concentration for which quantitative data may be reported. Every attempt must be made to dilute and reanalyze the samples to obtain responses that are within the midrange of the linear calibration range. Data that exceeds the highest calibration level is considered to have less certainty and must be reported using appropriate data qualifiers (e.g. E flag) or explained in the narrative. Any specific method requirement for number and type of calibration standards supersedes the general requirement. Instrument and method specific calibration criteria are explained within the specific analytical standard operating procedures for each facility.

Instrumentation or support equipment that cannot be calibrated to specification or is otherwise defective is clearly labeled as out-of-service until it has been repaired and tested to demonstrate it meets the laboratory's specifications. All repair and maintenance activities including service calls are documented in the maintenance log. Equipment sent off-site for calibration testing is packed and transported to prevent breakage and is in accordance with the calibration laboratory's recommendations.

In the event that recalibration of a piece of test equipment casts doubt on the validity of test results already transmitted to the client, the client is notified in writing by the laboratory within 3 business days from the time of discovery. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or replaced.

Raw data records are retained to document equipment performance. Sufficient raw data is retained to reconstruct the instrument calibration and explicitly connect the continuing calibration verification to the initial calibration.

6.2.1 General Organic Calibration Procedures

Calibration standards are prepared at a minimum of five concentrations for organic analyses. Results from all calibration standards must be included in constructing the calibration curve with the following exceptions:

- The lowest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done on an individual analyte basis. The reporting limit must be adjusted to the lowest concentration included in the calibration curve.
- The highest level calibration standard may be removed from the calibration as long as the remaining number of concentration levels meets the minimum established by the method and standard operating procedure. For multi-parameter methods, this may be done an individual analyte basis. The upper limit of quantitation must be adjusted to the highest concentration included in the calibration curve.
- Multiple points from either the high end or the low end of the calibration curve may be excluded as long as the remaining points are contiguous in nature and the minimum number of levels remain as established by method or standard operating procedure. The reporting limit or quantitation range, which is appropriate, must be adjusted accordingly.
- Results from a concentration level between the lowest and highest calibration levels can be excluded from the calibration curve for an acceptable cause with approval from the responsible department supervisor if the results for all analytes are excluded and the point is replaced by re-analysis. Re-analysis must occur within the same 12 hour tune time period for GC/MS methodologies and within 8 hours of the initial analysis for non-GC/MS methodologies. All samples analyzed prior to the re-analyzed calibration curve point must be re-analyzed after the calibration curve is completed.

Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial calibration curve. All initial calibrations are verified with a standard obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples.

Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

The calibration curve is periodically verified by the analysis of a mid-level continuing calibration verification (CCV) standard during the course of sample analysis. Calibration verification is performed at the beginning and end of each analytical batch (except if an internal standard is used only one verification at the beginning of the batch is needed), whenever it is expected that the analytical system may be out of calibration, if the time period for calibration has expired, or for analytical systems that contain a calibration verification requirement. This verification standard must meet acceptance criteria in order for sample analysis to proceed.

In the event that the CCV does not meet the acceptance criteria, a second CCV may be injected as part of the diagnostic evaluation and corrective action investigation. If the second CCV is acceptable, the analytical sequence is continued. If both CCVs fail, the analytical sequence is terminated. All samples analyzed since the last compliant CCV are re-analyzed for methodologies utilizing external calibration.

When instruments are operating unattended, the autosamplers may be programmed to inject consecutive CCVs as a preventative measure against CCV failure with no corrective action. In this case, both CCVs must be evaluated to determine potential impact to the results. A summary of the decision tree and necessary documentation are listed below:

- If both CCVs meet the acceptance criteria, the analytical sequence is allowed to continue without corrective action. (The 12 hour clock begins with the injection of the second CCV.)
- If the first CCV does not meet the acceptance criteria and the second CCV is acceptable, the analytical sequence is continued and the results are reported.
- If the first CCV meets the acceptance criteria and the second CCV is out of control, the samples preceded by the out of control CCV must be re-analyzed in a compliant analytical sequence.
- If both CCVs are out of control, all samples since the last acceptable CCV must be re-analyzed in a compliant analytical sequence.

Some analytical methods require that samples be bracketed by passing CCVs analyzed both before and after the samples. This is specific to each method but, as a general rule, all external calibration methods require bracketing CCVs. Most internal standard calibrations do not require bracketing CCVs.

Some analytical methods require verification based on a time interval; some methods require a frequency based on an injection interval. The type and frequency of the calibration verifications is dependent on both the analytical method and possibly on the quality program associated with the samples. The type and frequency of calibration verification will be documented in the method specific SOP employed by each laboratory.

For Ohio VAP projects, the lab must minimize the use of qualifed data. In the case of calibration verification standard failures, the lab is required to reanalyze the CCV and the associated samples so as not to report qualified data (sample data may only be reported if the failure produces a high bias and the samples are non-detect). Where possible, the second attempt should be made using the original aliquot of the standard unless there is reason to suspect that the standard is the cause of failure. The lab must make every effort to take the appropriate corrective actions and resolve any anomalies regarding calibration verification standard failures for Ohio VAP projects.

6.2.2 General Inorganic Calibration Procedures

The instrument is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. A calibration blank is also included. Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of three standards is used.

The ICP and ICP/MS can be standardized with a zero point and a single point calibration if:

- Prior to analysis, the zero point and the single point calibration are analyzed and a linear range is established,
- Zero point and single point calibration standards are analyzed with each batch
- A standard corresponding to the Reporting Limit/LOQ is analyzed with the batch and meets the established acceptance criteria
- The linearity is verified at the frequency established by the method or manufacturer.

All initial calibrations are verified with a standard obtained from a second manufacturer or second lot from the same manufacturer if the lot can be demonstrated as prepared independently from other lots prior to the analysis of samples. Sample results are quantitated from the initial calibration unless otherwise required by regulation, method, or program.

During the course of analysis, the calibration curve is periodically verified by the analysis of calibration verification standards. A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid. The CCV is also analyzed at the end of the analytical batch.

A calibration blank is also analyzed with each calibration verification standard to verify the cleanliness of the system. All reported results must be bracketed by acceptable CCVs and CCBs. Instrument and method specific calibration acceptance criteria are explained within the specific analytical standard operating procedures for each facility.

Interference check standards are also analyzed per method requirements and must meet acceptance criteria for metals analyses.

6.3 Support Equipment Calibration Procedures

All support equipment is calibrated or verified at least annually using NIST traceable references over the entire range of use. The results of calibrations or verifications must be within the specifications required or the equipment will be removed from service until repaired. The laboratory maintains records to demonstrate the correction factors applied to working thermometers.

Prior to use on each working day, balances, ovens, refrigerators, freezers, and water baths are checked in the expected use range with NIST traceable references in order to ensure the equipment meets laboratory specifications.

6.3.1 Analytical Balances

Each analytical balance is checked and calibrated annually by a qualified service technician. The calibration of each balance is checked each day of use with weights traceable to NIST. Calibration weights are ASTM Class 1 (replaces Class S designation) and are re-certified annually against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.3.2 Thermometers

Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, yearly with equipment directly traceable to NIST.

Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered and assigned a correction factor based on the NIST reference source. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.33 pH/Electrometers

The meter is calibrated before use each day, and once after each four hours of continuous use using fresh buffer solutions.

6.3.4 Spectrophotometers

During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) and continuing calibration verification (CCV) standards.

6.3.5 Mechanical Volumetric Dispensing Devices

Mechanical volumetric dispensing devices including bottle top dispensers, pipettes, and burettes, excluding Class A volumetric glassware, are checked for accuracy on a quarterly basis. Non-Class A glassware and disposable pipettes must be calibrated once per lot prior to first use. The accuracy of glass microliter syringes is verified and documented prior to use.

Additional information regarding calibration and maintenance of laboratory support equipment can be found in SOP ALL-Q-013 *Support Equipment*.

6.4 Instrument/ Equipment Maintenance

The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

The Laboratory Operations Manager and department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems and coordinate instrument repair and maintenance. The analysts have a primary responsibility to perform routine maintenance.

To minimize downtime and interruption of analytical work, preventative maintenance is routinely performed on each analytical instrument. Up-to-date instructions on the use and maintenance of equipment are available to staff in the department where the equipment is used.

Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation are, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software

- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

When maintenance is performed to repair an instrument problem, depending on the initial problem, demonstration of return to control may be satisfied by the successful analysis of a reagent blank or continuing calibration standard. The entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze client samples until it has been repaired and shown to perform satisfactorily.

7.0 CONTROL OF DATA

Analytical results processing, verification and reporting are procedures employed that result in the delivery of defensible data. These processes include, but are not limited to, calculation of raw data into final concentration values, review of results for accuracy, evaluation of quality control criteria and assembly of technical reports for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process prior to being reported to the customer. This section describes procedures used by PASI for translating raw analytical data into accurate, final sample reports and PASI data storage policies.

7.1 Analytical Results Processing

When analytical, field, or product testing data is generated, it is either recorded in a bound laboratory logbook (e.g. Run log or Instrument log) or copies of computer-generated printouts are appropriately labeled and filed. These logbooks and other laboratory records are kept in accordance with each facility's Standard Operating Procedure for documentation storage and archival.

The primary analyst is responsible for initial data reduction and review. This includes confirming compliance with required methodology, verifying calculations, evaluating quality control data, noting discrepancies in logbooks and as footnotes or narratives, and uploading analytical results into the LIMS.

The primary analyst then compiles the initial data package for verification. This compilation must include sufficient documentation for data review. It may include standard calibrations, chromatograms, manual integration documentation, electronic printouts, chain-of-custody forms, and logbook copies.

Some agencies or customers require different levels of data reporting. For these special levels, the primary analyst may need to compile additional project information, such as initial calibration data or extensive spectral data, before the data package proceeds to the verification step.

7.2 Data Verification

Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that reported data are free from calculation and transcription errors, that quality control parameters are evaluated and that any discrepancies are properly documented.

Analysts performing the analysis and subsequent data reduction have primary responsibility for quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data, provided QC criteria have been met for the samples being reported. Data review checklists are used to document the data review process. The primary analyst is responsible for the initial input of the data into the LIMS.

The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). The following criteria have been established to qualify someone as a data reviewer. To perform secondary data review, the reviewer must :

1. Have a current Demonstration of Capability (DOC) study on file and they have an SOP Acknowledgment form on file for the method/procedure being reviewed.; or[See Note]
2. Have a DOC on file for a similar method/technology (i.e. GC/MS) and they have an SOP Acknowledgment form on file for the method/procedure being reviewed; or.[See Note]
3. Supervise or manage a Department and have an SOP Acknowledgment form on file for the method/procedure being reviewed; or

4. Have significant background in the department/methods being reviewed through education or experience and have an SOP Acknowledgment form on file for the method/procedure being reviewed

Note: Secondary reviewer status must be approved personally by the Quality Manager or General Manager in the event that this person has no prior experience on the specific method or general technology (i.e. GC/MS).

This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. This assessment involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer also validates the data entered into the LIMS.

Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data. The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution.

Data Reporting

All data segments pertaining to a particular PASI project number are delivered to the Client Services Department (Project Manager) for assembly into the final report. All points mentioned during technical and QC reviews are included in a case narrative if there is potential for data to be impacted.

Final reports are prepared according to the level of reporting required by the client. A standard PASI final report consists of the following components:

1. A title which designates the report as “Final Report”, “Laboratory Results”, “Certificate of Results”, etc.
2. Name and address of laboratory (or subcontracted laboratories, if used).
3. Phone number and name of laboratory contact where questions can be referred.
4. A unique number for the report (project number). The pages of the report shall be numbered and a total number of pages shall be indicated (usually in the cover letter).
5. Name and address of client and name of project (if applicable).
6. Unique identification of samples analyzed (including client sample numbers).
7. Identification of any sample that did not meet acceptable sampling requirements (from NELAC or other governing agency), such as improper sample containers, holding times missed, sample temperature, etc.
8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less.
9. Identification of the test methods used.
10. Identification of sampling procedures if sampling was conducted by the laboratory.
11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data.
12. Identification of whether calculations were performed on a dry or wet-weight basis.
13. Reporting limits used.
14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.
15. A signature and title of person accepting responsibility for the content of the report (can be an equivalent electronic identification) and date report was issued.
16. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory.
17. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory.
18. Identification of all test results provided by a subcontracted laboratory or other outside source.
19. Identification of results obtained outside of quantitation levels.

20. Additional items may be required per Client QAPPs or different state regulations, i.e. Affidavit for Ohio VAP reports.

Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all lab reports and revisions. For higher levels of data deliverables, a copy of all applicable raw data is sent to the client along with a final report of results. When possible, the PASI facility will provide electronic data deliverables (EDD) as required by contracts or upon client request.

Client data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

Additional information on data reduction and validation can be found in SOP MN-L-132 Data Reduction, Validation and Reporting, or equivalent replacement.

7.4 Data Security

All data including electronic files, logbooks, extraction/digestion/distillation worksheets, calculations, project files and reports, and other information used to produce the technical report are maintained secured and retrievable by the PASI facility.

7.5 Data Archiving

All records compiled by PASI are maintained legible and retrievable and stored secured in a suitable environment to prevent loss, damage, or deterioration by fire, flood, vermin, theft, and/or environmental deterioration. Records are retained for a minimum of five years unless superseded by federal, state, contractual, and/or accreditation requirements. These records may include, but are not limited to, client data reports, calibration and maintenance of equipment, raw data from instrumentation, quality control documents, observations, calculations and logbooks. These records are retained in order to provide for possible historical reconstruction including sampling, receipt, preparation, analysis and personnel involved. NELAP-related records will be made readily available to accrediting authorities. Access to archived data is documented and controlled by the Quality Manager or a designated Data Archivist.

Records that are computer-generated have either a hard copy or electronic write-protected backup copy. Hardware and software necessary for the retrieval of electronic data is maintained with the applicable records. Archived electronic records are stored protected against electronic and/or magnetic sources.

In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the client and/or the appropriate regulatory entity upon request.

7.6 Data Disposal

Data that has been archived for the facility's required storage time may be disposed of in a secure manner by shredding, returning to customer, or utilizing some other means that does not jeopardize data confidentiality. Records of data disposal will be archived for a minimum of five years unless superseded by federal, contractual, and/or accreditation requirements, i.e. Ohio VAP requires 10 year retention period.

8.0 QUALITY SYSTEM AUDITS AND REVIEWS

8.1 Internal Audits

8.1.1 Responsibilities

The Quality Manager is responsible for designing and/or conducting internal audits in accordance with a predetermined schedule and procedure. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be trained, qualified and familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The Quality Manger evaluates audit observations and verifies the completion of corrective actions. In addition, a periodic corporate audit will be conducted by the Director of Quality, Safety & Technology and/or designee. The corporate audits will focus on the execution of the Quality System as outlined in this manual but may also include other quality programs applicable to each laboratory.

8.1.2 Scope and Frequency of Internal Audits

Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality-related system as applied throughout the laboratory.

Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Assurance Manual and all applicable addenda
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, standards, and associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.
- General procedures for data security, review, documentation, reporting and archiving.
- Data integrity issues such as proper manual integrations.

When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain-of-custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

A representative number of data audits are completed annually. The report format of any discrepancy is similar to that of other internal audits.

The laboratory, as part of their overall internal audit program, ensures that a review is conducted with respect to any evidence of inappropriate actions or vulnerabilities related to data integrity. Discovery of potential issues are handled in a confidential manner until such time as a follow up evaluation, full investigation, or other appropriate actions are completed and the issues clarified. All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of customers.

8.1.3 Internal Audit Reports and Corrective Action Plans

Additional information can be found in SOP S-ALL-Q-011 Audits and Inspections.

A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the Quality Manager writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

When audit findings cast doubt on the effectiveness of the operations or on the correctness of validity of the laboratory's environmental test results, the laboratory will take timely corrective action and notify the client in writing within 3 business days, if investigations show that the laboratory results may have been affected.

Once completed, the internal audit report is issued jointly to the Laboratory General Manager and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds within 14 days with a proposed plan to correct all of the deficiencies cited in the audit report. The Quality Manager may grant additional time for responses to large or complex deficiencies (not to exceed 30 days). Each response must include timetables for completion of all proposed corrective actions.

The Quality Manager reviews the audit responses. If the response is accepted, the Quality Manager uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the Quality Manager determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

To complete the audit process, the Quality Manager performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been verified. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2 External Audits

PASI laboratories are audited regularly by regulatory agencies to maintain laboratory certifications, and by customers to maintain appropriate specific protocols.

Audit teams external to the company review the laboratory to assess the existence of systems and degree of technical expertise. The Quality Manager and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the Quality Manager. The Laboratory General Manager provides the necessary resources for staff to develop and implement the corrective action plans. The Quality Manager collates this information and provides a written report to the audit team. The report contains the corrective action plan and expected completion dates for each element of the plan. The Quality Manager follows-up with the laboratory staff to ensure corrective actions are implemented.

8.3 Quarterly Quality Reports

The Quality Manager is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Results of internal systems or performance audits
- Corrective action activities
- Discussion of QA issues raised by customers
- Results of third party or external audits
- Status of laboratory certifications
- Proficiency Testing Study Results
- Results of internal laboratory review activities
- Summary of holding time violations
- Method detection limit study status
- Training activity summary
- SOP revision summary
- 3P Implementation summary (internal program)
- Other significant Quality System items

The Corporate Director of Quality, Safety & Technology utilizes the information from each laboratory to make decisions impacting the Quality Systems of the company as a whole. Each General Manager utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

Additional information can be found in SOP S-ALL-Q-014 Quality System Review or its equivalent revision or replacement.

8.4 Annual Managerial Review

A managerial review of Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

The managerial review must include the following topics of discussion:

- Policy and procedure suitability
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventative actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Client feedback, including complaints

This managerial review must be documented for future reference by the Quality Manager and copies of the report are distributed to laboratory staff. The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed timescale.

9.0 CORRECTIVE ACTION

During the process of sample handling, preparation and analysis, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of PASI provides systematic procedures for documentation, monitoring and completion of corrective actions. This can be done using Pace's LabTrack system that lists among other things, the deficiency by issue number, the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1 Corrective Action Documentation

The following items are examples of laboratory deviations or non-conformances that warrant some form of documented corrective action:

- Quality Control data outside of acceptance criteria
- Sample Acceptance Policy deviations
- Missed holding times
- Instrument failures (including calibration failure)
- Sample preparation or analysis errors
- Sample contamination
- Errors in client reports
- Audit findings (internal and external)
- Proficiency Testing (PT) sample failures
- Client complaints or inquiries

Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g. matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This depends on the extent of the deficiency, the impact on the data, and the method or client requirements for documentation.

The person who discovers the deficiency or non-conformance initiates the corrective action documentation on the Non-Conformance Corrective/ Preventative Action report and/or LabTrack. The documentation must include the affected projects and sample numbers, the name of the applicable Project Manager, the client name and the sample matrix involved. The person initiating the corrective action documentation must also list the known causes of the deficiency or non-conformance as well as any corrective/preventative actions that they have taken. Preventive actions must be taken in order to prevent or minimize the occurrence of the situation.

In the event that the laboratory is unable to determine the cause, laboratory personnel and management staff will start a root cause analysis by going through an investigative process. During this process, the following general steps must be taken into account: defining the non-conformance problem, assigning responsibilities, determining if the condition is significant, and investigating the root cause of the nonconformance problem. General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail. The root cause must be documented within LabTrack or on the Corrective/Preventative Action Report.

After all the documentation is completed, the routing of the Corrective/Preventative Action Report and /or LabTrack will continue from the person initiating the corrective action, to their immediate supervisor or the Project Manager and finally to the Quality Manager, who is responsible for final review and signoff of all formal corrective/preventative actions.

9.2 Corrective Action Completion

9.2.1 Quality Control outside of acceptance criteria

The analyst that is generating or validating Analytical data is responsible for checking the results against established acceptance criteria (quality control limits). The analyst must immediately address any deficiencies discovered. Method blank, LCS or matrix spike failures are evaluated against method, program, and client requirements and appropriate footnotes are entered into the LIMS system. Some deficiencies may be caused by matrix interferences. Where possible, matrix interferences are confirmed by re-analysis.

Quality control deficiencies must be made known to the client on the final report for their review of the data for usability. If appropriate, the supervisor is alerted to the QC failure and if necessary a formal corrective action can be initiated. This may involve the input of the Quality Manager or the General Manager.

The department supervisor and/or Operations Manager are responsible for evaluating the source of the deficiency and for returning the analytical system to control. This may involve instrument maintenance, analytical standard or reagent evaluation, or an internal audit of the analytical procedure.

See applicable analytical SOPs for further guidance on QC acceptance criteria.

9.2.2 Sample Acceptance Policy deviations

Any deviation from the Sample Acceptance Policy listed in this Manual must be documented on the Chain-of-Custody or other applicable form by the sample receiving personnel or by the Project Manager. Analysts or supervisors that discover such deviations must contact the sample receiving personnel or appropriate Project Manager so they can initiate the proper documentation and client contact. If a more formalized corrective action must be documented, the Quality Manager is made aware of the situation.

The client is notified of these deviations as soon as possible so they can make decisions on whether to continue with the sample analysis or re-sample. Copies of this documentation are included in the project file.

9.2.3 Missed holding times

In the event that a holding time requirement has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the Quality Manager must be made aware of these hold time exceedances.

The Project Manager must contact the client for appropriate decisions to be made with the resolution documented and included in the client project file. The Quality Manager includes a list of all missed holding times in their Quarterly Report to the corporate office.

9.2.4 Instrument Failures

In the event of an instrument failure that either causes the necessity for re-analysis or questions the validity of generated results, a formal corrective action must be initiated. The analyst and supervisor evaluate any completed data for validity and usability. They are also responsible for returning the instrument to valid operating condition and for documenting that the system is in control (e.g. acceptable calibration verification).

9.2.5 Sample Preparation or Analysis errors

When there is an error in the preparation or analysis of samples, the analyst evaluates the impact on the usability of the analytical data with the assistance of the supervisor or manager. The affected samples will be re-processed or re-analyzed under acceptable conditions. In the event that no additional sample is available for re-analysis, the client must be contacted for their decision on how to proceed. Documentation may take the form of footnotes or a formal corrective action form.

9.2.6 Errors in client reports

When an error on the client report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g. incorrect analysis reported, reporting units are incorrect, reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the client.

9.2.7 Audit findings

The Quality Manager is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for reporting back to the auditing body, the root cause of the issue, and the corrective action taken to resolve the findings. The Quality Manager is also responsible for providing any back-up documentation used to prove that a corrective action has been completed.

9.2.8 Proficiency Testing failures

Any PT result returned to the Quality Manager as “not acceptable” requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The Quality Manager reviews their findings and initiates another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT results must be monitored by the Quality Manager and reported to the applicable regulatory authorities.

9.2.9 Client Complaints

Project Managers are responsible for issuing corrective action forms for client complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor. After the corrective actions have been listed, the Project Manager reviews the corrective action to determine if the client needs or concerns are being addressed.

Additional information can be found in SOP S-ALL-Q-012 Corrective Action/Preventative Action Process.

10.0 GLOSSARY

3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity and Performance. Best Practices are identified that can be used by all PASI labs.
Accuracy	The agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	A portion of a sample taken for analysis.
Analyte	The specific chemical species or parameter an analysis seeks to determine.
Batch	Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.
Blank	A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.
Blind Sample	A sample for submitted for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test analyst or laboratory proficiency in the execution of the measurement process.
Calibration	To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard must bracket the range of planned or expected sample measurements.
Calibration Curve	The graphic representation of known values, such as concentrations for a series of calibration standards and their instrument response.
Chain-of-Custody (COC)	A record that documents the possession of samples from the time of collection to receipt in the laboratory. This record generally includes the number and type of containers, mode of collection, collector, time of collection, preservation, and requested analyses.
Confirmation	Verification of the identity of a component through the use of an alternate scientific approach from the original method. These may include, but are not limited to: • second-column confirmation • alternate wavelength • derivatization derivative • mass spectral interpretation • additional cleanup procedures
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.

Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: % Completeness = (Valid Data Points/Expected Data Points)*100
Calibration Verification	The process of verifying a calibration by analysis of standards and comparing the results with the known amount.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of nonconforming data.
Corrective Action	The action taken to eliminate the causes of a nonconformity, defect, or other undesirable situation in order to prevent recurrence.
Corrective and Preventative Action (CAPA)	The primary management tools for bringing improvements to the quality system, to the management of the quality system's collective processes, and to the products or services delivered which are an output of established systems and processes.
Data Quality Objective (DOQ)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more usable form.
Demonstration of Capability	A procedure to establish the ability of the analyst to generate acceptable accuracy.
Detection Limit (DL)	General term for the lowest concentration or amount of the target analyte that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value. See definitions for Method Detection Limit and Limit of Detection.
Document Control (Management)	Procedures to ensure that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled (managed) to ensure use of the correct version at the location where the prescribed activity is performed.
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate or Replicate Analysis	The identically performed measurement on two or more sub-samples of the same sample within a short interval of time
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Non Potable Water (Includes surface water, ground water, effluents, water treatment chemicals, and TCLP leachates or other extracts) • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.
Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.

Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Holding Time	The maximum time that samples may be held prior to preparation and/or analysis as defined by the method.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
ILT	Instructor Led Training
Internal Standards	A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Intermediate Standard Solution	Reference solutions prepared by dilution of the stock solutions with an appropriate solvent.
Laboratory Control Sample (LCS)	A blank sample matrix, free from the analytes of interest, spiked with known amounts of analytes or a material containing known amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. Sometimes referred to as Laboratory Fortified Blank, Spiked Blank or QC Check Sample.
Limit of Detection (LOD)	An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory-dependent.
Limit of Quantitation (LOQ) .	The minimum levels, concentrations or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
LMS	Learning Management System
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.

Matrix	The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions are used: • **Aqueous or Non-Potable Water**: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts. • **Drinking Water**: any aqueous sample that has been designated a potable or potentially potable water source. • **Saline/Estuarine**: any aqueous sample from an ocean or estuary, or other saltwater source. • **Non-aqueous liquid**: any organic liquid with <15% settleable solids. • **Biological Tissue**: any sample of a biological origin such as fish tissue, shellfish or plant material. Such sample can be grouped according to origin. • **Solid**: includes soils, sediments, sludges, and other matrices with >15% settleable solids. • **Chemical Waste**: a product or by-product or an industrial process that results in a matrix not previously defined • **Air and Emissions**: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas vapor that are collected with a sorbent tube, impinger solution, filter, or other device.
Matrix Spike (MS)	A sample prepared by adding a known quantity of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency. (sometimes referred to as Spiked Sample or Fortified Sample)
Matrix Spike Duplicate (MSD)	A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of precision of the recovery of each analyte. (sometimes referred to as Spiked Sample Duplicate or Fortified Sample Duplicate)
Method Blank	A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures: and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	One way to establish a Limit of Detection (LOD); defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Precision	The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.
Proficiency Testing	A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Protocol	A detailed written procedure for field and/or laboratory operation that must be strictly followed.
Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures required by a specific project.
Quality Assurance (QA)	An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control (QC)	The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.
Quality Control Sample	A sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.
Quality Assurance Manual	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g. tapes which have been transcribed verbatim, dated and verified accurate by signature), the exact copy or exact transcript may be submitted.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Reference Standard	A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
Reporting Limit (RL)	The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e. statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain-of-Custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.
Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels (concentrations) of a variable of interest.
Standard	A substance or material with properties known with sufficient accuracy to permit its use to evaluate the same property in a sample.

Standard Blank	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Operating Procedure (SOP)	A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks
Stock Standard	A concentrated reference solution containing one or more analytes prepared in the laboratory using an assayed reference compound or purchased from a reputable commercial source.
Surrogate	A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Traceability	The property of a material or measurement result defining its relationship to recognized international or national standards through an unbroken chain of comparisons.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory reagent water and the blank is stored, shipped, and analyzed with its associated samples.
Uncertainty Measurement	The parameter associated with the result of a measurement that characterized the dispersion of the values that could be reasonably attributed to the measurand (i.e. the concentration of an analyte).
WBT	Web based training

11.0 REFERENCES

- “Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act.” Federal Register, 40 CFR Part 136.
- “Test Methods for Evaluating Solid Wastes: Physical/Chemical Methods.” SW-846.
- “Methods for Chemical Analysis of Water and Wastes”, EPA 600-4-79-020, 1979 Revised 1983, U.S. EPA.
- U.S. EPA Contract Laboratory Program Statement of Work for Organic Analysis
- U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis
- “Standard Methods for the Examination of Water and Wastewater.” Current Edition APHA-AWWA-WPCF
- “Annual Book of ASTM Standards”, Section 4: Construction, Volume 04.04: Soil and Rock; Building Stones, American Society of Testing and Materials.
- “Annual Book of ASTM Standards”, Section 11: Water and Environmental Technology, American Society of Testing and Materials.
- “NIOSH Manual of Analytical Methods”, Third Edition, 1984, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health.
- “Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water”, U.S. EPA, Environmental Monitoring and Support Laboratory – Cincinnati (September 1986).
- Quality Assurance of Chemical Measurements, Taylor, John K.; Lewis Publishers, Inc. 1987
- Methods for Non-conventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater, Test Methods, EPA-440/1-83/079C
- Environmental Measurements Laboratory (EML) Procedures Manual, HASL-300, US DOE, February, 1992.
- Requirements for Quality Control of Analytical Data, HAZWRAP, DOE/HWP-65/R1, July, 1990.
- Requirements for Quality Control of Analytical Data for the Environmental Restoration Program, Martin Marietta, ES/ER/TM-16, December, 1992.
- Quality Assurance Manual for Industrial Hygiene Chemistry, AIHA, 1988
- National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards. Most recent
- ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories.

12.0 REVISIONS

The PASI Corporate Quality and Safety Manager files both a paper copy and electronic version of a Microsoft Word document with tracked changes detailing all revisions made to the previous version of the Quality Assurance Manual. This document is available upon request. All revisions are summarized in the table below.

Document Number	**Reason for Change**	**Date**
Revision 11.2	Numbering corrected in Section 1 Additional requirements added to meet Ohio VAP regulations: SECTION 2: • Included language that all lab samples/waste are managed in accordance with all Federal and State laws and regulations SECTION 4: • Added additional criteria and corrective action per Ohio VAP to all lab QC sections. SECTION 6: • 6.2 Added caveat that every attempt must be made to perform dilutions and reanalysis in order to obtain responses in the midrange of the linear calibration range. • 6.2.1 Added that every attempt must be made to reanalyze the same aliquot of calibration standard unless it is suspected to be the cause of failures. SECTION 7: • 7.3 Additional report requirement added, ie affidavit form • 7.5 Added additional records retention criteria for Ohio VAP. Removed Job Description of Regional Quality Manager	08Jan2008
Revision 11.1	Corrected holding time for Summa Canisters to 28 days and 14 for MN	19Nov2007
Quality Assurance Manual Revision 11.0	Overall conversion to template format. Removed all references to Addenda. Changes required based on conversion are not explicitly noted unless change represents a significant policy change. SECTION 1: • Add comment to address continuous improvement to quality system. • Changed statement of purpose in Section header to “Mission Statement”. • Added requirements for appointment when Technical Director absent. • Added requirements for notification to AA’s and updates to organizational charts when management changes. • Added Client Services Manager job description. SECTION 2: • Changed temperature requirements to “Not Frozen but ≤6°C”. • Added flexible section concerning default sampling time in absence of client specified time. • Added flexible section to address sample and container identification by the LIMS. • Changed sample retention requirement to 45 days from receipt of samples. Added comment allowing for storage outside of temperature controlled conditions. SECTION 3: • Inserted allowance for use of older methods. • Changed references to work processing and training documents to allow for use of LMS and other types of training media. • Inserted allowance for alternative DOCs where spiking not possible. SECTION 4: • Inserted reference to Anonymous Message line. • Inserted reference to the use of default control limits. • Inserted allowance for release of data without corrective action for obvious matrix interferences. • Inserted reference to the treatment of internal standards.	September 17th, 2007

Document Number	**Reason for Change**	**Date**
	• Inserted allowance for use of MDL annual MDL verification in lieu of full 40 CFR Part 136 annual MDL studies. • Inserted general procedure for LOQ verification SECTION 5: • Added general process for approval and use of QAM template. • Removed specific reference of Work Process Manuals. Left flexible section to include all other controlled documentation. SECTION 6: • No changes noted. SECTION 7: • Added qualifications for secondary reviewers. SECTION 8: • Changed frequency listing for Corporate Audits. SECTION 9: • Changed references from QA Track to Lab Track – left flexible to accommodate information still in QA Track. SECTION 10: • No changes noted. SECTION 11: • No changes noted. ATTACHMENTS: • Standardized format for Attachments.	
Quality Assurance Manual Revision 10.0	Throughout the document, Pace was replaced with PASI or in some cases with Pace Analytical. Also, corrections were made to wording, grammar, spelling, and formatting. SECTION 1: • Updated the PASI mission statement • Deleted Financial Responsibility, Drug-Free Workplace, Non-Harassment, Proper and Professional Conduct, Protection of Property, and Communication sections. • Added Assistant General Manager/ Operations Manager, Technical Director, Administrative Business Manager, Project Manager, Project Coordinator, Field Analyst, Laboratory Technician & Field Technician job descriptions • Added detailed Chain of Command to Laboratory Organization section • Updated the Training and Orientation section to reflect current practices • Deleted a portion of the Laboratory Safety section and added a reference to the Safety Manual and Chemical Hygiene Plan. SECTION 2: • Switched the order of Chain of Custody and Sample Acceptance Policy sections • Added details of project review documentation to Project Initiation section • Added steps to sample log in SECTION 3: • Deleted reference to local addenda for company wide SOPs • Rearranged sentences • Added “PASI will not be liable if the client chooses not to follow PASI recommendations” to the Regulatory and Method Compliance section.	June 20th, 2006

Document Number	Reason for Change	Date
	SECTION 4: • Added details to the documentation of review or investigation of possible data integrity. • Corrected wording in Method Blank section • Deleted from LCS/LCSD section an out-of-control statement that said affected samples associated with a failing LCS must be re-analyzed SECTION 5: • Added "Electronic documents must be readily accessible to all facility employees" to Documents Management section • Updated the Standard Operating Procedure section to describe the new PASI corporate SOP Templates and distribution. SECTION 6: • Re-organized & re-named sections • Updated the interpretation of the Calibration Verification policy • Added clarification to the definition of the Second Source Standard • Revised Single Point Calibration procedure to address NELAC requirement • Incorporated Spare Parts into Instrument/ Equipment Maintenance SECTION 7: • Updated Analytical Results Processing section to clarify data documentation policy. • Deleted "All data that are manually entered into the LIMS is reviewd at a rate of 100%" and deleted the use of checklists statement from Data Verification section • Integrated paragraphs for better flow • Deleted item # 15, "If required, a statement of the estimated uncertainty of the test results." from the Data Reporting section • Added Data Security section to describe PASI data security practices • Added fire, flood, and vermin protection requirement to Data Archiving section • Added statement to Data Archiving section describing that NELAP related records are available to accrediting authorities. • Added Data Disposal section SECTION 8: • Deleted first paragraph stating that Pace labs are subject to internal and external audits and reviews. • Added description of PASI internal audit program and investigations • Added requirement that corrective action be taken and client notified within 3 days if audit findings show that test results may have been affected • Updated requirement for manager(s)/supervisor(s) to respond to audit findings with a plan to correct all deficiencies within 14 days. Statement included that allows Quality Manager to grant additional time for response. • Added to Annual Managerial Review section that "The laboratory shall ensure that any actions identified during the review are carried out within an appropriate and agreed timescale." SECTION 9: • Added documentation requirement for reporting discovery of deficiency or non-conformance, must be documented "on the Non-Conformance Corrective/ Preventative Action report and/or QA Trak." • Added "Preventative actions must be taken in order to prevent or minimize the occurrence of the situation." • Added a paragraph to describe the new PASI Root Cause Analysis procedure.	

Document Number	Reason for Change	Date
	SECTION 10: • Added the following definitions: Contract Required Detection Limit (CRDL), Contract Required Quantitation Limit (CRQL), Corrective and Preventative Action (CAPA), Non Potable Water (to Environmental Sample definition), Intermediate Standard Solution, Quality Control Sample, Stock Standard, Uncertainty Measurement, Working Standard Solution, SECTION 11: • Added ISO/IEC 17025:2005 reference Appendix: • Added Appendix I: Quality Control Calculations	

ATTACHMENT I

Quality Control Calculations

PERCENT RECOVERY (%REC)

$$\%REC = \frac{(MSConc - SampleConc)}{TrueValue} * 100$$

NOTE: The SampleConc is zero (0) for theLCS and Surrogate Calculations

PERCENT DIFFERENCE (%D)

$$\%D = \frac{MeasuredValue - TrueValue}{TrueValue} * 100$$

where:
TrueValue = Amount spiked (can also be the $\overline{\text{CF}}$ or $\overline{\text{RF}}$ of the ICAL Standards)
Measured Value = Amount measured (can also be the CF or RF of the CCV)

PERCENT DRIFT

$$\%Drift = \frac{CalculatedConcentration - TheoreticalConcentration}{TheoreticalConcentrtion} * 100$$

RELATIVE PERCENT DIFFERENCE (RPD)

$$RPD = \frac{|(R1 - R2)|}{(R1 + R2)/2} * 100$$

where:
R1 = Result Sample 1
R2 = Result Sample 2

CORRELATION COEFFICIENT (R)

$$CorrCoeff = \frac{\sum_{i=1}^{N} W_i * (X_i - \overline{X}) * (Y_i - \overline{Y})}{\sqrt{\left(\sum_{i=1}^{N} W_i * (X_i - \overline{X})^2\right) * \left(\sum_{i=1}^{N} W_i * (Y_i - \overline{Y})^2\right)}}$$

With:	N	Number of standard samples involved in the calibration
	i	Index for standard samples
	Wi	Weight factor of the standard sample no. i
	Xi	X-value of the standard sample no. i
	X(bar)	Average value of all x-values
	Yi	Y-value of the standard sample no. i
	Y(bar)	Average value of all y-values

ATTACHMENT I (CONTINUED)

Quality Control Calculations (continued)

STANDARD DEVIATION (S)

$$S = \sqrt{\sum_{i=1}^{n} \frac{(X_i - \overline{X})^2}{(n-1)}}$$

where:
n = number of data points
X_i = individual data point
$\overline{X}$ = average of all data points

AVERAGE ($\overline{X}$)

$$\overline{X} = \frac{\sum_{n=1}^{i} X_i}{n}$$

where:
n = number of data points
X_i = individual data point

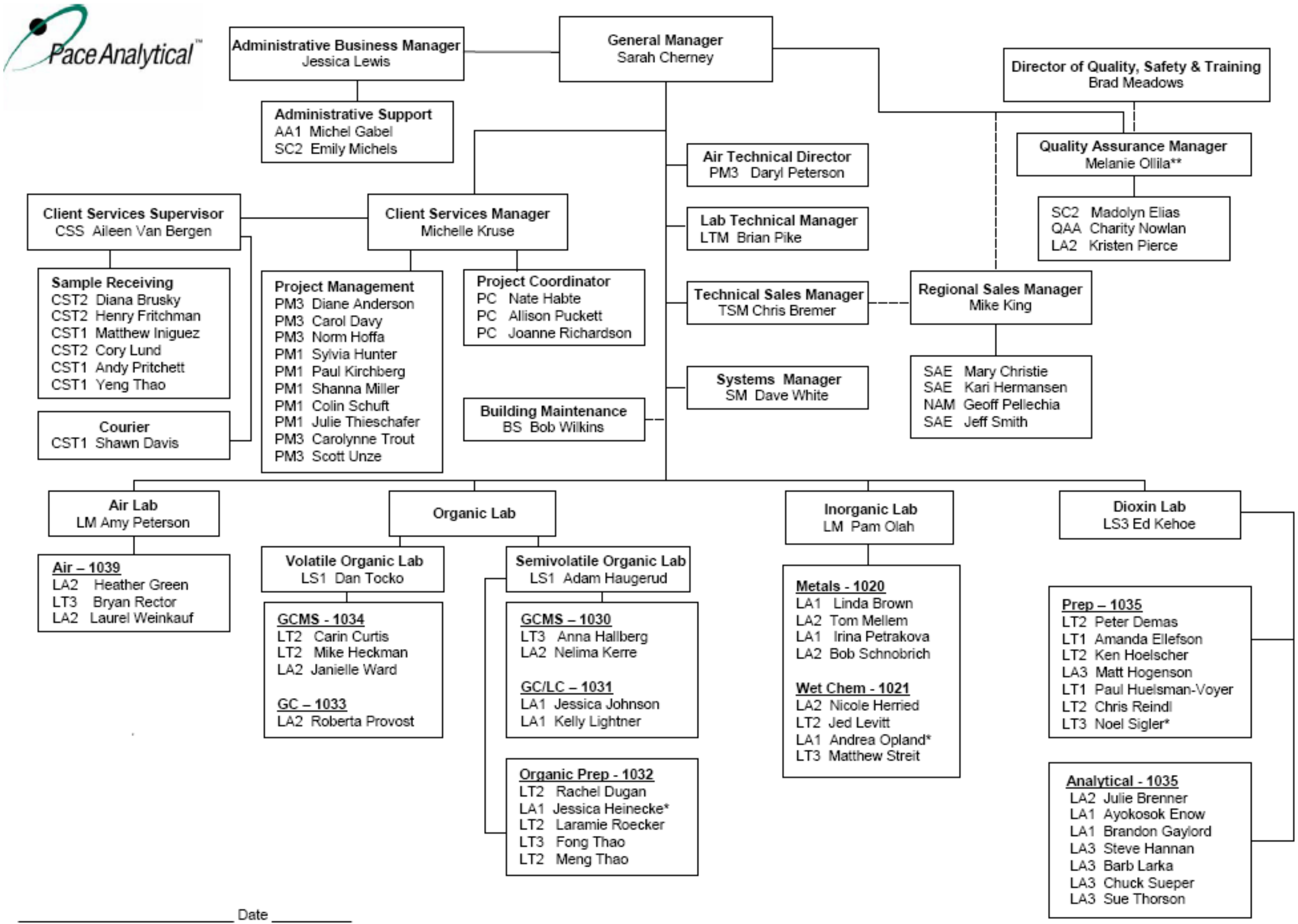
RELATIVE STANDARD DEVIATION (RSD)

$$RSD = \frac{S}{\overline{X}} * 100$$

where:
S = Standard Deviation of the data points
$\overline{X}$ = average of all data points

ATTACHMENT IIA

PASI – MINNESOTA ORGANIZATIONAL CHART

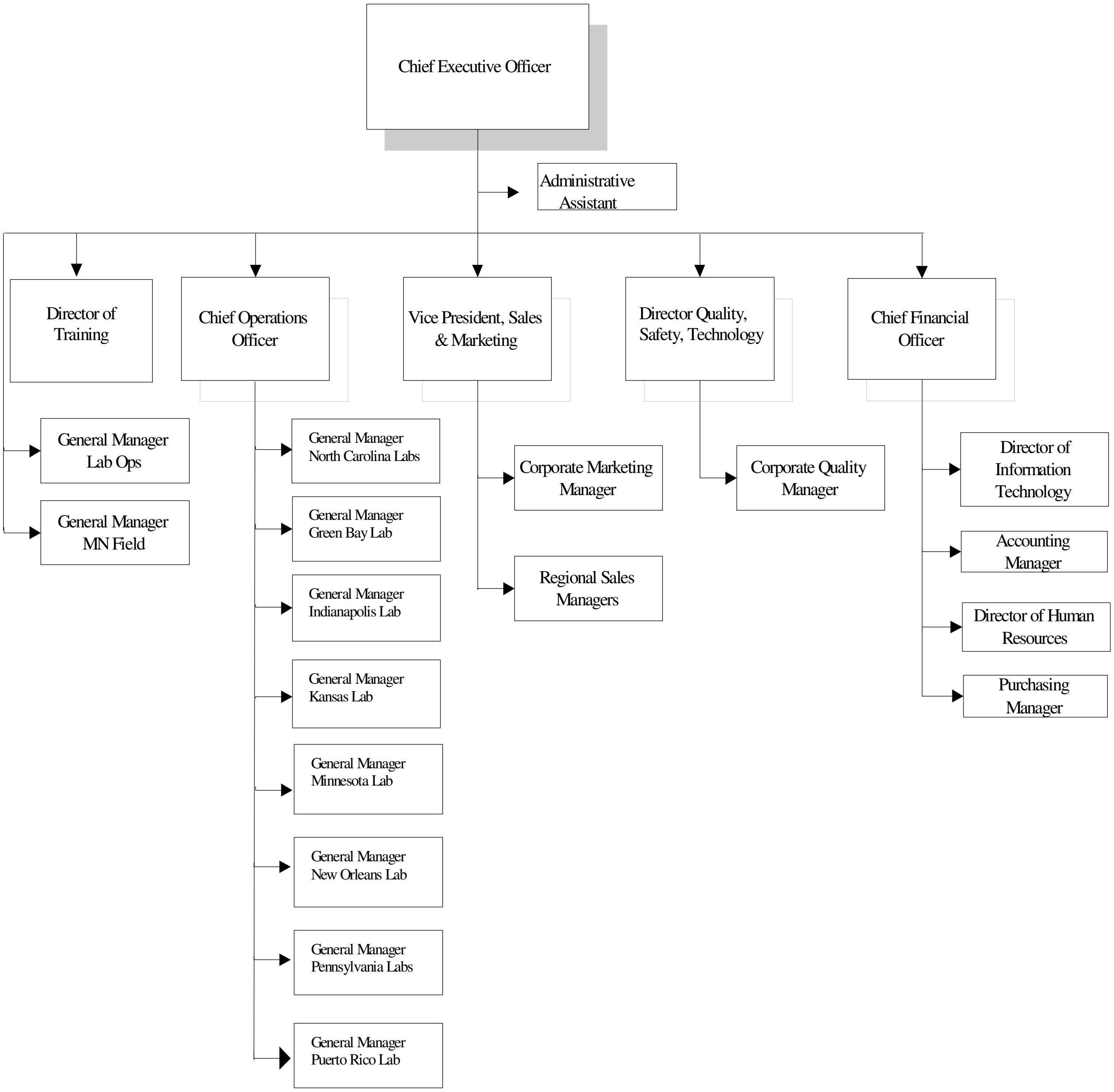


_________________________ Date __________
Sarah Cherney, General Manager
Last Revised: March 25, 2008
*Lead Analyst
**Safety Officer

Minnesota Laboratory

ATTACHMENT IIB

PASI – CORPORATE ORGANIZATIONAL CHART



ATTACHMENT III

PASI – MINNESOTA EQUIPMENT LIST

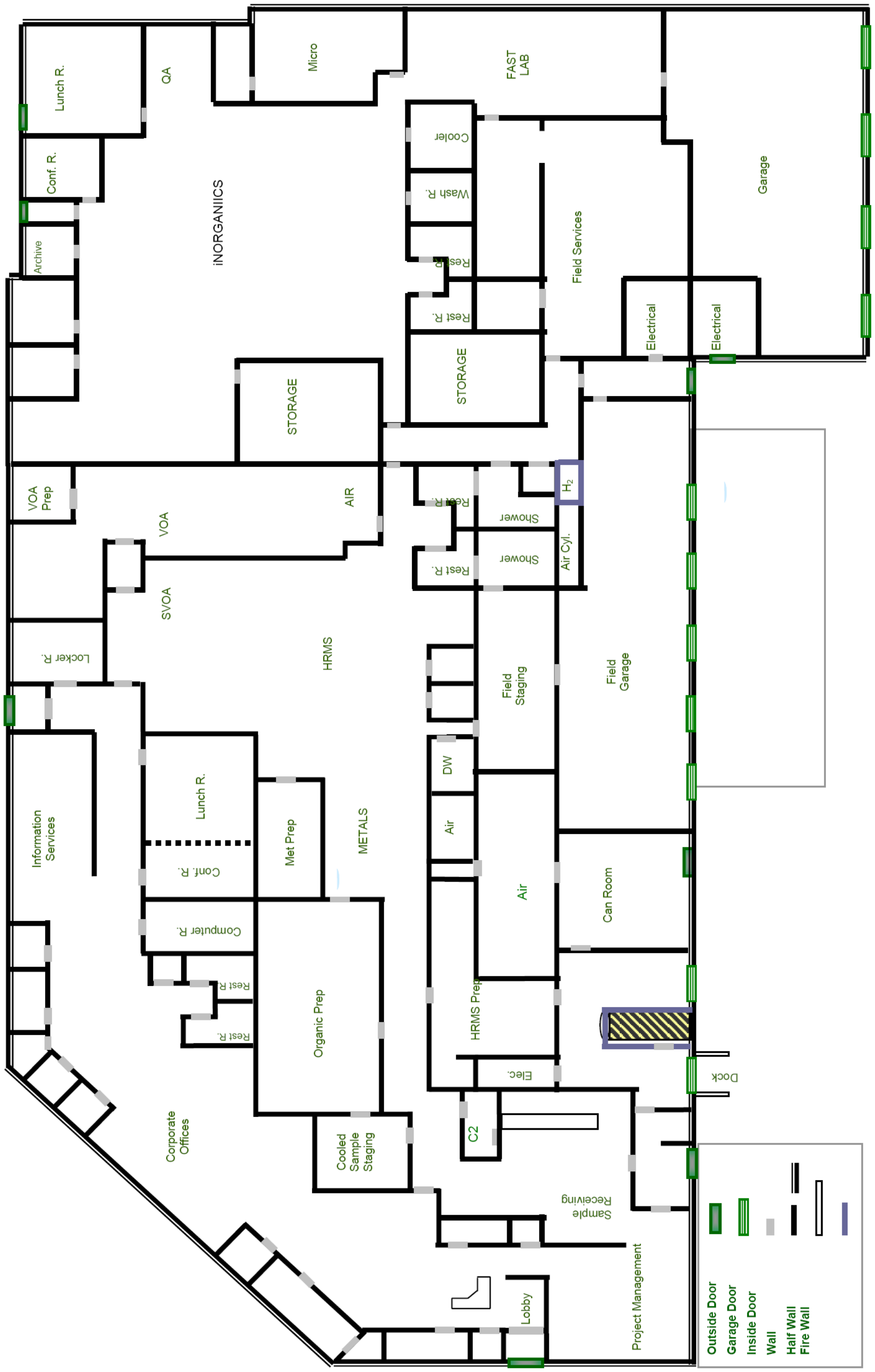
INSTRUMENT	MANUFACTURER	MODEL NUMBER	DETECTOR(S)	ANALYSIS
GC/MS/VOA	Hewlett-Packard	5890	PID/FID	TO3/AIR
GC/MS/VOA	Agilent	6890/5973	MS	TO14/TO15
GC/MS/VOA	Hewlett-Packard	5890/5972	MS	TO14/TO15
GC/MS/VOA	Hewlett-Packard	6890 / 5973	MS	SW8260
GC/MS/VOA	Hewlett-Packard	6890 / 5973	MS	SW8260
GC/MS/VOA	Hewlett-Packard	6890 / 5973	MS	SW8260
GC/MS/VOA	Agilent	6890 / 5973	`	SW8260
GC/MS/VOA	Hewlett-Packard	6890 / 5973	MS	SW8260
GC/MS/VOA	Agilent	6890/5973	MS	524.2
GC/MS/VOA	Agilent	6890/5973	MS	TO14/TO15
GC/MS/SMVOA	Hewlett-Packard	5890 / 5972	MS	BNA
GC/MS/SMVOA	Hewlett-Packard	6890/5973	MS	SIM,agList, cPAH
GC/MS/SMVOA	Hewlett-Packard	5890		8270 SIM
GC/MS/SMVOA	Agilent	6890/5973	MS	SIM,agList, cPAH
GC/MS/SMVOA	Agilent	6890/5973	MS	PCDD/PCDF
GC/MS/SMVOA	Agilent	6890/5973	MS	BNA
GC PETROLEUM RELATED VOLATILES	Hewlett-Packard	5890	PID/FID	BTEX
GC PETROLEUM RELATED VOLATILES	Hewlett-Packard	5890	PID/FID	BTEX
GC PETROLEUM RELATED VOLATILES	Hewlett-Packard	5890	PID/FID	TO3/AIR
GC PETROLEUM RELATED VOLATILES	Agilent	6890/1888	TCD/FID	Headspace
GC PETROLEUM RELATED VOLATILES	Hewlett-Packard	5890	TCD/FID	Fixed Gases
GC PETROLEUM RELATED SMVOA	Hewlett-Packard	5890	FID	DRO
GC SMVOA	Hewlett-Packard	5890	DUAL ECD	PCB
GC SMVOA	Hewlett-Packard	6890	DUAL ECD	Pest/PCB
GC SMVOA	Hewlett-Packard	6890	FID	DRO
HPLC	Hewlett-Packard	1100 Series	UV/FL/MS	PAH
ICP	Perkin-Elmer	Optima 3300DV	SCCD	Metals
ICP	Perkin-Elmer	Optima 4300DV	SCCD	Metals
ICP/MS	Perkin-Elmer	ELAN9000	MS	Metals
MERCURY ANALYZER	Perkin-Elmer	FIMS 100	Spectrometer	Mercury

AUTO ANALYZER	Konelab	20	Spectrometer	Anions
ION CHROMATOGRAPH	Dionex	DX5000	Conductivity	Anions
OVEN	Tempcon	N8620-10	NA	Preparation
OVEN	Lab Line	Imperial II	NA	Preparation
OVEN	Despatch	NA	NA	AIR
OVEN	VWR	1370F	NA	General
OVEN	Precision	STM135	NA	General
OVEN	Thelco	130DM	NA	General
OVEN	Baxter	DK63	NA	HRMS
OVEN	Fisher Scientific	650G	NA	% moisture
OVEN	Fisher Scientific	550-126	NA	General
INCUBATOR	Fisher Scientific	307	NA	BOD
INCUBATOR	VWR	2020	NA	BOD
TURBIDITY	HF Scientific	Micro 100	NA	Turbidity
TURBIDITY	HF Scientific	Micro 100	NA	Turbidity
AUTOCLAVE	Heinicke Co.	Sterilquick	NA	Autoclave
AUTOCLAVE	Market Forge	Sterilmatic	NA	Autoclave
CENTRIFUGE	Becton Dickenson	CompactII	NA	HRMS
HIGH RESOLUTION MASS SPECTROMETER	MicroMass	Ultimas	MS	PCDD/PCDF
HIGH RESOLUTION MASS SPECTROMETER	MicroMass	Ultimas	MS	PCDD/PCDF
HIGH RESOLUTION MASS SPECTROMETER	VG	AUTOSPEC	MS	PCDD/PCDF
HIGH RESOLUTION MASS SPECTROMETER	MicroMass	AUTOSPEC	MS	PCDD/PCDF
DISSOLVED OXYGEN METER	YSI	5000	NA	BOD
ION ANALYZER	Orion	EA 940	NA	pH
ION ANALYZER	Orion	EA 940	NA	fluoride, pH
pH METER	Orion	290A	NA	pH
CONDUCTIVITY METER	Oakton	RS232/CON 110	Probe - 1D7	specific conductivity
COD REACTOR	Bioscience		NA	COD
MICROWAVE EXTRACTION UNIT	Milestone	Ethos E	NA	Dioxin
MIDI DISTILLATION UNIT	Env. Express	Pace # 19582		CN, NH3, phenols
MIDI DISTILLATION UNIT	Env. Express	Pace # 19604		CN, NH3, phenols
METALS MICROWAVE DIGESTOR	CEM Corporation	MDS-2100	NA	Metals Dig
METALS HOT BLOCK	Env. Express	SC 154	NA	Metals Dig
METALS HOT BLOCK	Env. Express	SC 154	NA	Metals Dig
METALS HOT BLOCK	Env. Express	SC 154	NA	Metals Dig
SONICATOR	Misonix	XL 2020	NA	3550

SONICATOR	Misonix	XL 2015	NA	3550
SONICATOR	Misonix	3000		3550
SONICATOR	Misonix	3000		3550
DENVER MAXX BALANCE	Denver Instrumentation	MXX-212	NA	NA
A&D BALANCE	A&D	FX 3200		Soil Prep
BALANCE	A&D	FX 4000	NA	
BALANCE	Mettler	AJ100	NA	
BALANCE	A&D	FX-3200	NA	
MilliQ Purification System	MilliQ	MilliQUV plus	NA	

ATTACHMENT IV

PASI – MINNESOTA



ATTACHMENT V

PASI – MINNESOTA SOP LIST

SOP Title	SOP Number
Determination of Methane, Ethane, and Ethene in Air Modified TO-3	S-MN-A-002
Analysis of Air Samples for Volatile Organic Compounds by Gas Chromatography/PID-FID method TO-3	S-MN-A-003
Cleaning, Certification, Leak Checking and Preparation for Shipment of SUMMA Passivated Canisters	S-MN-A-004
Determination of Fixed Gases in Air by Modified 3C	S-MN-A-005
Methane, Ethane, Ethene, and Propane in Water by GCFID mod. 3810 and RSK 175	S-MN-A-007
Sample Preparation and Analysis of Polychlorinated Biphenyls (PCBs) in Ambient Air using High Volume Polyurethane Foam	S-MN-A-010
Analysis of Whole Air Sample for Volatile Organic Compound by GC/MS EPA TO15/TO14	S-MN-A-013
Analysis of Whole Air Sample for Volatile Organic Compound by GC/MS EPA TO15-SIM	S-MN-A-014
Operation and Maintenance of the Perkin Elmer ELAN 6000 ICP-MS	S-MN-BE-004
Sample Management	S-MN-C-001
Bottle Order Database	S-All-C-002
Bottle Preparation	S-MN-C-003
Internal Chain of Custody	S-MN-C-005
Subcontracting Samples	S-MN-C-004
Preparing Waste for Shipment	S-MN-C-703
Preparation and Analysis of Samples for the Determination of Dioxins and Furans by USEPA Method 8290	S-MN-H-001
Preparation and Analysis of Samples for the Determination of Dioxins and Furans using USEPA Method 1613B	S-MN-H-002
Preparation and Analysis of Samples for the Determination of 2,3,7,8-TCDD using USEPA Method 1613B, Drinking Water	S-MN-H-003
Percent Lipids Determination	S-MN-H-004
Preparation and Analysis of Samples for the Determination of PCDDs, PCDFs, and PCBs by modified USEPA Method 23, TO9, or NY State Guidelines	S-MN-H-005
Preparation and Analysis of Samples for the Determination of Dioxins and Furans by USEPA Method 8280	S-MN-H-007
Method 1668, PCB Congener (WHO List)	S-MN-H-009
Method 1653, Chorinated Phenols	S-MN-H-010
Preparation and Analysis of Samples for the Determination of Chlorinated Biphenyl Congeners by USEPA Method 1668A	S-MN-H-014
Preparation and Analysis of Samples for the Determination of Polybrominated Diphenyl Ether Congeners	S-MN-H-016
RapidScreen Analysis of Samples for PCDDs and PCDFs	S-MN-H-017
Determination of Anions by Ion Chromatography	S-MN-I-301
Measurement of Solids in Water and Wastewater	S-ALL-I-014
Measurement of pH in Water, Soil, and Waste	S-ALL-I-015
TCLP/SPLP	S-MN-I-312
Inductively Coupled Plasma Atomic Emission Spectroscopy (RCRA)	S-MN-I-313
Water Extraction of Soil	S-MN-I-334
Hardness by Calculation	S-MN-I-338
Biochemical Oxygen Demand (BOD)	S-MN-I-348
COD-Titrimetric, Low Level	S-MN-I-351

SOP Title	SOP Number
Phenols	S-MN-I-354
Oil & Grease - 1664	S-MN-I-357
Hexavalent Chromium in Water, Wastewater, and Soil	S-MN-I-358
Mercury in Liquid and Solid/Semis-Solid Waste	S-MN-I-359
Alkalinity, Titrimetric	S-MN-I-365
Total Cyanide in Water	S-MN-I-366
Percent Solids (Moisture)	S-MN-I-367
Digest Procedure for Aqueous Samples to be Analyzed by Induct Coupled Plasma (SW-846)	S-MN-I-458
Metals Preparation for Solid samples, Wipes and Filters	S-MN-I-460
Fluoride in Water and Wastewater	S-MN-I-470
Chemical Oxygen Demand (COD) in Water, Wastewaters and Industrial Wastes	S-MN-I-472
Total Phosphorus in Water	S-MN-I-473
Specific Conductivity	S-MN-I-474
Total Cyanide in Soil	S-MN-I-476
Ortho Phosphorus	S-MN-I-477
Particulate Matter (PM10) (Method 5) in the Atmosphere	S-MN-I-484
Settleable Solids	S-MN-I-486
Analysis of Air Samples by EPA Method 29	S-MN-I-487
Metals Analysis by ICP/MS - Method 6020 and 200.8	S-MN-I-492
Standard Test Method for Screening Apparent Specific Gravity and Bulk Density Waste	S-MN-I-493
Determination of Total Recoverable Phenolics by Flow Injection Colorimetry	S-MN-I-494
Operation and Maintenance of the MDS-2100 Microwave	S-MN-I-499
Turbidity in Water	S-MN-I-501
Chlorine, Total Residual in Water	S-MN-I-502
Use and Maintenance of the Konelab	S-MN-I-507
Determination of Nitrate/Nitrite in surface and wastewaters by Flow Injection Analysis with the Konelab (Low Flow Method)	S-MN-I-508
Determination of Chloride by Konelab	S-MN-I-509
Determination of Sulfate by Konelab	S-MN-I-510
Determination of Ammonia by Konelab Analysis, Colorimetry	S-MN-I-511
Determination of Nitrite by Konelab (Spectrophotometric Method)	S-MN-I-514
Amenable Cyanide and Weak Dissociable Cyanide in Water	S-MN-I-515
Paint Filter Liquids Test	S-MN-I-516
Mercury in End Caps and Glass Samples	S-MN-I-517
Gravimetric Determination of Oil and Grease by SPE	S-MN-I-520
Determination of Perchlorate by IC	S-MN-I-521
Cyanide Extraction Procedure for Solids and Oils	S-MN-I-522
Preparation of Aqueous Samples for ICPMS Analysis by Method 3030C	S-MN-I-523
System Security and Integrity	S-ALL-IT-001
Back Up Policy	S-ALL-IT-002
Data Archiving	S-MN-L-106
Reagent Water Quality	S-MN-L-110
Generation of EDD	S-MN-L-112
Handling and Analysis of North Carolina Samples	S-MN-L-113
Preventative, routine, and non-routine maintenance	S-MN-L-114
Common Laboratory Calculations and Statistical Evaluation of Data	S-MN-L-125
Data Reduction, Validation, and Reporting in the Env Lab	S-MN-L-132

SOP Title	SOP Number
Out of Specification Investigation	S-MN-L-133
Syringe Technique	S-MN-L-139
Procedure for Handling Aqueous Organic Extractable Samples Containing Sediment	S-MN-L-142
Total Coliform Bacteria	S-MN-MB-001
Fecal Coliform by MF	S-MN-MB-002
Heterotrophic Plate Count	S-MN-MB-003
Total Coliform Bacteria by MF	S-MN-MB-005
Sample Container Sterility Verification	S-MN-MB-006
Method For Sonicator Tuning	S-MN-O-414
Determination of Polynuclear Aromatic Hydrocarbons in Soil (8310)	S-MN-O-419
The Determination of Specific Aromatic Compounds and Gasoline Range Organic in Water	S-MN-O-427
Analysis of Polychlorinated Biphenyls in Oil, Soil, Water, Wipe and Air Matrixes	S-MN-O-432
Extractable Base/Neutral and Acid Organic Compounds in Liquid, Solid, and TCLP Matrices by Gas Chromatography/Mass Spectrometry Capillary Column Technique	S-MN-O-436
Determination of Polynuclear Aromatic Hydrocarbons in Water (8310 and EPA 610)	S-MN-O-449
Cleaning Glassware in the Organic Laboratory	S-MN-O-465
Determination of Diesel Range Organics in Water (Wisconsin modified DRO)	S-MN-O-466
Determination of Diesel Range Organics in Soil (Wisconsin modified DRO)	S-MN-O-467
Determination of Organophosphorus Pesticides in Water and Soil (MN.Dept.of AG list 1)	S-MN-O-471
The Determination of Specific Aromatic Compounds and Gasoline Range Organics in Soil	S-MN-O-487
Determination of Diesel Range Organics In Water & Soil SW8015 (Modified)	S-MN-O-489
Determination of Acid Cleanup of PCB Extracts	S-MN-O-494
Sonication Extraction Technique (SW3550) for Base/Neutral and Acid Compounds	S-MN-O-495
Continuous Liquid-Liquid Extraction (SW3520) for Base/Neutral and Acid Compounds	S-MN-O-496
Spike Verification in the Organic Prep Lab	S-MN-O-497
Preparation of Anhydrous Sodium Sulfate for Extraction Purposes	S-MN-O-500
Nitrogen Evaporation Technique	S-MN-O-503
Sample Concentration Technique	S-MN-O-504
Continuous Liquid-Liquid Extraction (SW3520) for Polyaromatic Hydrocarbons by 8270-SIM	S-MN-O-506
8270-L Extractable Base/Neutral and Acid Organic Compounds in Water and Liquid Matrices by GC/MS Capillary Column Technique w/Selective Ion Monitoring	S-MN-O-507
Solvent Exchange into Hexane	S-MN-O-509
Sample Conversion to Acetonitrile	S-MN-O-510
Analysis of Volatile Organic Compounds by GC/MS Method 8260	S-MN-O-521
Purgeable Total Petroleum Hydrocarbons in Water (8015 Mod / CA LUFT/ NWTPH/OA-1)	S-MN-O-525
Copper Cleanup Procedure for Pesticides and Polychlorinated Biphenyls	S-MN-O-527
Analysis of Volatile Organic Compounds by GC/MS Method 624	S-MN-O-529
Extractable Base/Neutral and Acid Organic Compounds in Liquid by EPA Method 625	S-MN-O-532
Analysis of Air samples by GC/MS - Method TO-13	S-MN-O-534
Continuous Liq/Liq extraction for Method 8270C (Dual pH) by SW 3520C	S-MN-O-539
Soxhlet Extraction for PAH Analysis by GC/MS:SIM	S-MN-O-540
Volatiles Sample Compositing Procedure	S-MN-O-541
Analysis of Volatile Organic Compounds in Water Method 524.2	S-MN-O-546
Extraction and Analysis of PCBs From Acid-Soluble Solids-Eastman Method	S-MN-O-548
Extractable Base/Neutral and Acid Organic Compounds in Liquid by EPA Method 525	S-MN-O-549
Low Level Extractable Base/Neutral and Acid Organic Compounds by GC/MS Capillary Column Technique	S-MN-O-552
Sample Management	S-MN-C-001

SOP Title	SOP Number
Bottle Preparation	S-MN-C-003
Internal Chain of Custody	S-MN-C-005
Subcontracting Samples	S-MN-C-004
Preparation of SOPs	S-ALL-Q-001
Document Management	S-ALL-Q-002
Document Numbering	S-ALL-Q-003
Method and Instrument Detection Limit Studies	S-ALL-Q-004
Purchasing of Laboratory Supplies	S-All-Q-005
Receipt and Storage of Laboratory Supplies	S-ALL-Q-006
Laboratory Documentation	S-ALL-Q-009
Performance Evaluation (PE)/Proficiency Testing (PT) Program	S-ALL-Q-010
Audits and Inspection	S-ALL-Q-011
Corrective Action/ Preventative Action Process	S-ALL-Q-012
Support Equipment	S-ALL-Q-013
Quality System Review	S-ALL-Q-014
Manual Integrations	S-ALL-Q-016
Subcontracting Samples	S-ALL-Q-017
Monitoring Storage Units	S-ALL-Q-018
Training Procedures	S-ALL-Q-020
Sub-Sampling (Sample Homogenization)	S-ALL-Q-021
3P Program: CIP	S-ALL-Q-022
Standard and Reagent Preparation and Traceability	S-ALL-Q-025
Use and Operation of Lab Track System	S-ALL-Q-028
Precision and Accuracy Measurement, Evaluation, and Trend Assessment	S-MN-Q-205
Control of Hazardous Energy Program - Lockout/Tagout	S-MN-Q-249
Method Validation and Modification Studies	S-MN-Q-252
Procedure for Handling of USDA regulated soils	S-MN-Q-253
Laboratory Spreadsheet Validation	S-MN-Q-254
Estimation of Measurement Uncertainty	S-MN-Q-255
Hazard Assessments	S-ALL-S-001
Waste Handling	S-ALL-S-002

ATTACHMENT VI

PASI – MINNESOTA CERTIFICATION LIST

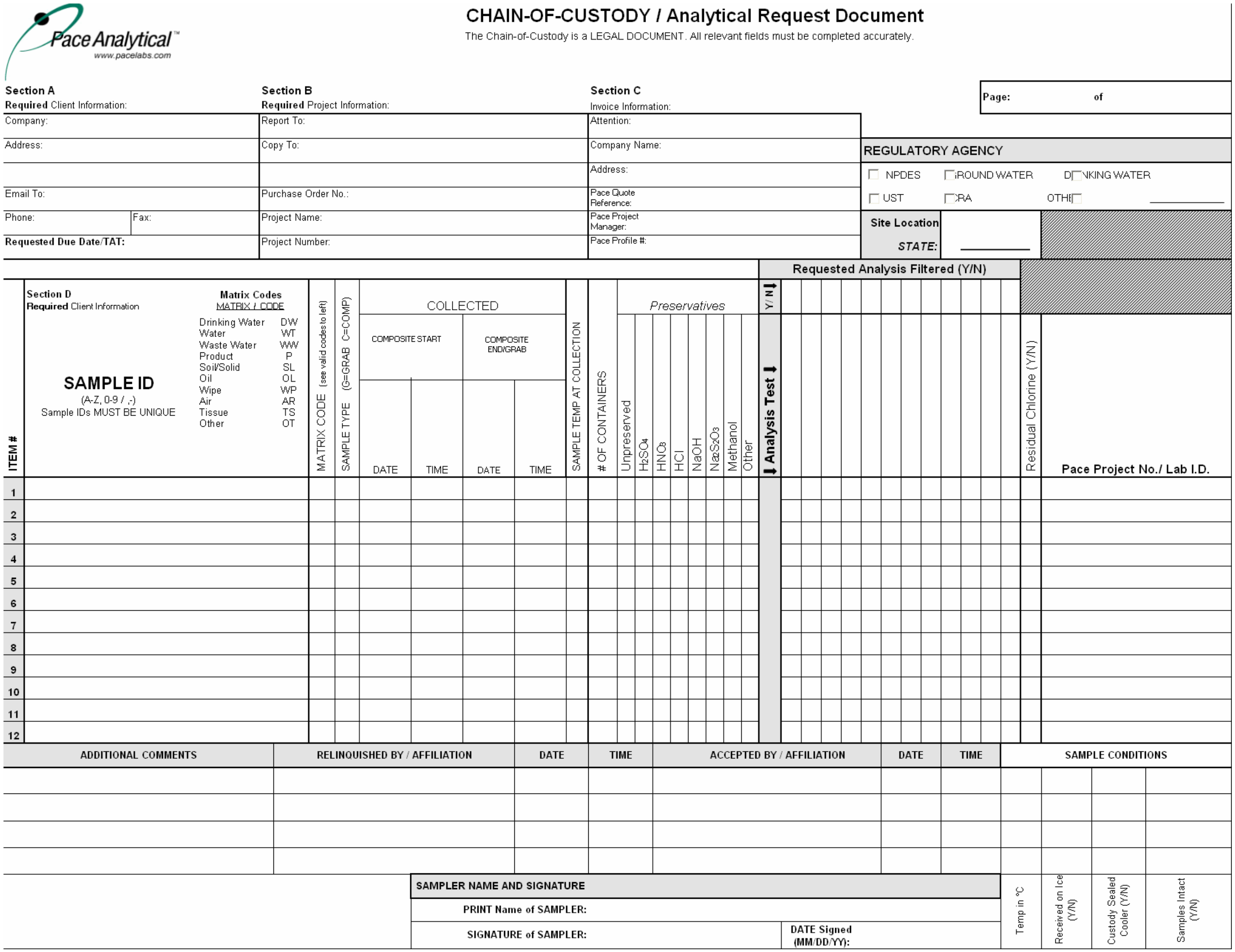
State	Agency	Program	Cert #
Alabama	Dept of Environmental Mgmt	Dioxin-DW	40770
Alaska	Dept. of Environmental Conservation	Contaminated Sites (6010B, 6020, 8260B, PCBs, PAHs)	UST-078
Alaska	Dept. of Environmental Conservation	Dioxin-DW	MN64-07
Arizona	Dept of Health Services	Dioxin-DW, WW, HW	AZ0014
Arkansas	Dept of Environmental Quality	Dioxins	88-0680
California	Dept of Health Services	Dioxin-DW, WW, HW Envir-DW, WW, HW	01155CA
Colorado	Dept. of Public Health & Environment	Dioxin-DW	Pace Analytical
Connecticut	Dept of Public Health	Dioxins	PH-0256
Delaware	Health & Solical Services	Dioxin-DW	
EPA Region 5	Water Division	Dioxin-DW	WD-15J
EPA Region 8	Water Division	Dioxin-DW	8TMS-Q
Florida (NELAP)	Dept of Health Services	Diox-DW, WW, HW, Air Envir-DW, WW, HW, Air	E87605
Georgia	Environmental Protection Division	Dioxin-WW, HW via NELAP	E87605
Georgia	Dept of Natural Resources	Dioxin-DW	959
Guam	Guam EPA	Dioxin-DW	Pace Analytical
Idaho	Dept. of Health & Welfare	Dioxin-DW	Pace Analytical
Hawaii	Dept of Health	Dioxin-DW	SLD
ILLA	ILLA	ISO 17025	1706.01
Illinois	Illinois EPA	Dioxin-DW, HW, WW via NELAP	200011
Indiana	Dept of Health	Dioxin-DW via EPA Region 5	C-MN-01
Iowa	Dept.of Natural Resources	Envir.-DW, WW, UST	368

Kansas	Dept of Health and Environment	Dioxin-DW Envir-DW, WW, HW	E-10167
Kentucky	Dept of Environmental Protection	Dioxin-DW	90062
Louisiana	Department of Environmental Quality	Dioxin-WW, HW, Air	3086
Louisiana	Department of Health and Hospitals	Dioxin-DW	LA050005
Maine	Dept of Human Services	Dioxin-DW via EPA Region 5	2007029
Maryland	Dept. of Heath and Mental Hygiene	Dioxin-DW	322
Michigan	Dept. of Public Health	Dioxin-DW	9909
Minnesota	Dept of Health	Envir-DW, WW, HW Dioxin-DW, WW, HW	027-053-137
Mississippi	Dept. of Health and Environmental Control	Dioxin-DW	Pace
Nebraska	Dept. of Health & Human Services.	Dioxin-DW	Pace
Nevada	Health Division	Dioxin-DW, WW	MN_00064_2000_72
New Jersey	Dept of Environmental Protection	Dioxin-DW, WW, HW Envir-WW, HW, Air	MN002
New Mexico	NM Environment Dept. Drinking Water Bureau	Dioxin-DW	Pace
New York	Dept of Health	Dioxin-DW, WW, Air Envir-Air	11647
North Carolina	Dept of Environment, Health and Natural Resources	Envir-WW, HW	530
North Carolina	State Public Health Laboratory	Dioxin-DW	27700
North Dakota	Dept of Health and Consolidated Labs	Envir-DW, WW, HW	R-036
Ohio	Ohio EPA	Dioxin-DW via EPA Region 5	4150
Oklahoma	Dept of Environmental Quality	Dioxin-DW	D9921
		Envir-HW	9507
Oregon	ELAP	Dioxin-DW, WW, HW, Air Enviro: Air	MN200001
Pennsylvania	Dept of Environmental Protection	Dioxin-DW, WW, HW Envir: DW, WW, HW	68-00563

Saipan (CNMI)	Div. Of Environmental Quality	Dioxin-DW	Pace Analytical
South Carolina	Dept. of Health and Environmental Control	Dioxin-DW, WW, HW	74003001
Texas	Department of Health	Dioxin-DW, WW, HW	T104704192-07-TX
Tennessee	Dept of Health	Dioxin-DW Envir-DW	2818
Utah	Department of Health	Dioxin-DW, WW, HW	ID# PAM Account# 6126071700
Virginia	Dept of General Services	Dioxin-DW	251
Washington	Dept of Ecology	Dioxin-DW, WW, HW Envir-DW, WW, HW	C754
Wisconsin	Dept of Natural Resources	Dioxin-DW, WW, HW Envir-DW, WW, HW	999407970
West Virginia	Dept of Health and Human Resources	Dioxin-DW	9952C

ATTACHMENT VII

PASI – CHAIN OF CUSTODY



Pace Analytical™
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

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

Page: of

Section A
Required Client Information:
Company:
Address:
Email To:
Phone: Fax:
Requested Due Date/TAT:

Section B
Required Project Information:
Report To:
Copy To:
Purchase Order No.:
Project Name:
Project Number:

Section C
Invoice Information:
Attention:
Company Name:
Address:
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY
☐ NPDES ☐ROUND WATER D☐NKING WATER
☐ UST ☐RA OTH☐

Site Location
STATE:

Section D
Required Client Information

Matrix Codes
MATRIX / CODE

Drinking Water	DW
Water	WT
Waste Water	WW
Product	P
Soil/Solid	SL
Oil	OL
Wipe	WP
Air	AR
Tissue	TS
Other	OT

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED: COMPOSITE START DATE	COLLECTED: COMPOSITE START TIME	COLLECTED: COMPOSITE END/GRAB DATE	COLLECTED: COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Y/N ➡ **Analysis Test ➡**													Residual Chlorine (Y/N)	**Pace Project No./ Lab I.D.**
1																																
2																																
3																																
4																																
5																																
6																																
7																																
8																																
9																																
10																																
11																																
12																																

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER:
SIGNATURE of SAMPLER: **DATE Signed (MM/DD/YY):**

ATTACHMENT VIII
METHOD HOLD TIME, CONTAINER AND PRESERVATION GUIDE

PASI – MINNESOTA

Parameter	Matrix	Container	Preservative	Max Hold Time
2, 3, 7, 8-TCDD	Soil	8 oz Glass Jar		90/40 Days
2, 3, 7, 8-TCDD	Water	1 L glass		90/40 Days
Acidity	Water	250 mL Plastic		14 Days
Alaska 101 GRO	Water	40 mL glass	HCl	14 Days
Alaska 101 GRO	Soil	4 oz jar	surrogated MeOH	14 Days
Alaska 102 DRO	Water	1L amber glass	HCl	14 Days*
Alaska 102 DRO	Soil	4 or 8 oz. amber jar or core tube		14 Days*
Alaska 103 RRO	Soil	4 or 8 oz. amber jar or core tube		14 Days*
Alkalinity	Water	250 mL Plastic		14 Days
Alpha Emitting Radium Isotopes	Water	1L glass	HNO_3	180 days
Anions by IC, including Br, Cl, F, NO_2, NO_3, SO_4	Water	250 mL plastic		Br, Cl, F, SO_4 (28 Days) NO_2, NO_3 (48 Hours)
Aromatic and Halogenated Volatiles	Soil	5035 vial kit		14 days
Aromatic and Halogenated Volatiles	Water	3 40 mL glass	HCl, $Na_2S_2O_3$	14 Days
Bacteria, Total Plate Count	Water	100 mL Plastic	$Na_2S_2O_3$	24 Hours
Base/Neutrals and Acids	Soil	8 oz Glass Jar		14/40 Days
Base/Neutrals and Acids	Water	1 L glass	HCl, $Na_2S_2O_3$	7/40 Days
Base/Neutrals, Acids & Pesticides	Water	1 L glass	HCl, $Na_2S_2O_3$	7/30 Days
BOD/cBOD	Water	500 mL Plastic		MN 24hrs otherwise 48 hours
BTEX/Total Hydrocarbons	Air	Summa Canister		14 Days
BTEX/Total Hydrocarbons	Air	Tedlar Bag		48 Hours
CARB 429 (HRMS PAH)	Water	1 Liter		1 Year to Extraction*
CARB 429 (HRMS PAH)	Solid	4 or 8 oz. Jar		1 Year to Extraction*
CARB 429 (HRMS PAH)	Tissue	4 or 8 oz. Jar		1 Year to Extraction*
Chloride	Water	250 mL Plastic		28 Days
Chlorinated Herbicides	Soil	8 oz Glass Jar		14/40 Days
Chlorinated Herbicides	Water	1 L glass	HCl, $Na_2S_2O_3$	14/28 Days
Chorine, Residual	Water	500 mL plastic		Analyze within 15 minutes
COD	Water	250 mL plastic	H_2SO_4	28 Days
Color	Water	250 plastic		48 Hours
Condensable Particulate Emissions	Air	Solutions		6 Months
Cyanide, Reactive	Water	250 mL plastic		28 Days
Cyanide, Total and Amenable	Water	250 mL plastic	NaOH	14 Days, 24 Hours if Sulfide present
Diesel Range Organics	Soil	8 oz Glass Jar		14/40 Days
Diesel Range Organics	Water	1L glass		7/40 Days
Dioxins & Furans	Air	PUF		30/45 Days
EDB & DBCP	Water	1 L glass	HCl, $Na_2S_2O_3$	14 Days
Explosives	Water	1 L glass		7/40 Days
Explosives	Soil	8 oz Glass Jar		14/40 Days
Coliform, Fecal SM9222D	Water	100mL	10% sodium thiosulfate	6 hours for waste water, 30 hours for potable water
Coliform, Total SM9223B	Water	100mL	10% sodium thiosulfate	6 hours for waste water, 30 hours for potable water
Ferrous Iron	Water	250 mL plastic		Immediate
Flashpoint/Ignitability	Water	250 mL plastic		28 Days
Fluoride	Water	500 mL plastic		28 Days
Gamma Emitting Radionuclides	Water	1 L glass	HNO_3	180 days
Gas Range Organics	Water	40 mL glass	HCl	14 Days
Gasoline Range Organics	Soil	5035 vial kit		14 days
Gross Alpha (NJ 48Hr Method)	Water	1L glass	HNO_3	48 Hrs
Gross Alpha and Gross Beta	Water	1L glass	HNO_3	180 days
Haloacetic Acids	Water	40 mL glass	NH_4Cl	14/7 Days
Hardness, Total ($CaCO_3$)	Water	250 mL plastic	HNO_3	6 Months
Hexavalent Chromium	Water	250 mL plastic		24 Hours
Hydrogen Halide & Halogen Emissions	Air	Solutions		6 Months
Lead Emissions	Air	Filter/Solutions		6 Months
Low Level Mercury	Water	Glass	BrCl	90 days (if preserved and oxidized)

Parameter	Matrix	Container	Preservative	Max Hold Time
Mercury	Soil	8 oz Glass Jar		28 days
Mercury	Water	250 mL plastic	HNO_3	28 Days
Metals	Air	Filters		6 Months
Metals	Soil	8 oz Glass Jar		6 months
Metals (and other ICP elements)	Water	250 mL plastic	HNO_3	6 Months
Methane, Ethane, & Ethene	Water	20 mL glass	HCl	14 Days
Methane, Ethane, Ethene	Air	Summa Canister		14 Days
Methane, Ethane, Ethene	Air	Tedlar Bag		48 Hours
Method 23/TO9	Air	Sampling Head		30 Days to Extraction*
Method 1631E	Water	500mL Glass	Performed in the lab	Oxidized in bottle within 28 days.
Nitrogen, Ammonia	Water	500 mL plastic	H_2SO_4	28 Days
Nitrogen, Kjeldahl	Water	1 L plastic	H_2SO_4	28 Days
Nitrogen, Nitrate	Water	250 mL plastic		48 Hours
Nitrogen, Nitrate & Nitrite	Water	250 mL plastic	H_2SO_4	28 Days
Nitrogen, Nitrite	Water	250 mL plastic		48 Hours
Nitrogen, Organic	Water	250 mL plastic	H_2SO_4	28 Days
Non-Methane Organics	Air	Summa Canister		14 Days
Non-Methane Organics	Air	Tedlar Bag		48 Hours
Odor	Water	1 L glass		24 Hours
Oil and Grease/HEM	Water	1 L glass	H_2SO_4	28 Days
Organchlorine Pesticides and PCB's	Water	1 L glass	HCl, $Na_2S_2O_3$	7/40 Days
Organochlorine Pesticides & PCBs	Air	PUF		7/40 Days
Organochlorine Pesticides and PCB's	Water	1 L glass	HCl, $Na_2S_2O_3$	7/40 Days
Organochlorine Pesticides and PCBs	Soil	8 oz Glass Jar		14/40 Days
Organophosphorous Pesticides	Soil	8 oz Glass Jar		14/40 Days
Organophosphorous Pesticides	Water	1 L glass	HCl, $Na_2S_2O_3$	7/40 Days
Oxygen, Dissolved (Probe)	Water	500 mL plastic		Analyze within 15 minutes
Paint Filter Liquid Test	Water	250 mL plastic		N/A
Particulates	Air	Filters		6 Months
Permanent Gases	Air	Summa Canister		14 Days
Permanent Gases	Air	Tedlar Bag		48 Hours
pH	Water	250 mL plastic		Analyze within 15 minutes
Phenol, Total	Water	1L glass	H_2SO_4	28 Days
Phosphorus, Orthophosphate	Water	250 mL plastic		Filter within 15 minutes, Analyze within 48 Hours
Phosphorus, Total	Water	250 mL plastic	H_2SO_4	28 Days
Polynuclear Aromatic Hydrocarbons	Air	PUF		7/40 Days
Polynuclear Aromatic Hydrocarbons	Soil	8 oz Glass Jar		14/40 Days
Polynuclear Aromatic Hydrocarbons	Water	1L glass	HCl, $Na_2S_2O_3$	7/40 Days
Radioactive Strontium	Water	1L glass	HNO_3	180 days
Radium-226 Radon Emanation Technique	Water	1L glass	HNO_3	180 days
Radium-228	Water	1L glass	HNO_3	180 days
Silica, Dissolved	Water	250 mL plastic		28 Days
Solids, Settleable	Water	1L plastic		48 Hours
Solids, Total	Water	1L plastic		7 Days
Solids, Total Dissolved	Water	1L plastic		7 Days
Solids, Total Suspended	Water	1L plastic		7 Days
Solids, Total Volatile	Water	1L plastic		7 Days
Specific Conductance	Water	250 mL plastic		28 Days
Stationary Source Dioxins & Furans	Air	XAD Trap		30/45 Days
Stationary Source Mercury	Air	Filters		6 Months, 28 Days for Hg
Stationary Source Metals	Air	Filters		6 Months, 28 Days for Hg
Stationary Source PM10	Air	Filters		6 Months
Stationary Source Particulates	Air	Filter/Solutions		6 Months
Sulfate	Water	250 mL plastic		28 Days
Sulfide, Reactive	Water	250 mL plastic		28 Days
Sulfide, Total	Water	500 mL plastic	NaOH,ZnOAc	7 Days
Sulfite	Water	500 mL plastic		Analyze within 15 minutes
Surfactants	Water	250 mL plastic		48 Hours
Total Organic Carbon (TOC)	Water	250 mL glass	H_2SO_4 or HCl	28 Days
Total Organic Halogen (TOX)	Water	500 mL glass		14 Days
Tritium	Water	1L glass	HNO_3	180 days
Turbidity	Water	250 mL plastic		48 Hours

Parameter	Matrix	Container	Preservative	Max Hold Time
Uranium Radiochemical Method	Water	1L glass	HNO_3	180 days
Volatiles	Air	Summa Canister		28 Days (14 Days for MN)
Volatiles	Air	Tedlar Bag		48 Hours
Volatiles	Soil	5035 vial kit		14 days
Volatiles	Water	3 40 mL glass	HCl, $Na_2S_2O_3$	14 Days
Volatiles	Water	3 40 mL glass		7 unpreserved
WIGRO	Water	3 40 ml vials	HCl	14 Days
WIGRO	Solid	5035 vial kit	See *Note*	14 Days
WIDRO	Water	1 Liter	HCl	7 Days to Extraction*
WIDRO	Solid	Tared 4 oz. Jar		14 Days to extraction*
1614	Water	1 Liter		1 Year to Extraction*
1614	Solid	4 or 8 oz. Jar		1 Year to Extraction*
1614	Tissue	4 or 8 oz. Jar		1 Year to Extraction*
1653	Water	2 L	pH<2 H_2SO_4	30 Days to Extraction; 30 days to analysis
1668	Water	1 Liter		1 Year to Extraction*
1668	Solid	4 or 8 oz. Jar		1 Year to Extraction*
1668	Tissue	4 or 8 oz. Jar		1 Year to Extraction*
8015 (MeOH, EtOH)	Water	3 40 ml vials	HCl	14 Days
8280	Water	1 Liter		30 Days to Extraction*
8280	Solid	4 or 8 oz. Jar		30 Days to Extraction*
8290	Solid	4 or 8 oz. Jar		30 Days to Extraction*
8290	Water	1 Liter		30 Days to Extraction*
8290	Waste	2 oz		30 Days to Extraction*

**40 Days from Extraction to Analysis. (EPA 1613,WI DRO)*
45 Days from Extraction to Analysis (SW8290, 1668, 8280 and Method 23/TO9)
***Note: 5035 kit contains 2 vials water, preserved by freezing or 2 vials aqueous $NaHSO_4$ preserved at** 4^oC **and 1 vial MeOH preserved at** 4^oC **and 1 vial unpreserved at** 4^oC.*

STANDARD OPERATING PROCEDURE
EPIC PRO: ACODE VALIDATION

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STANDARD OPERATING PROCEDURE

EPIC Pro: Acode Validation

Reference Methods: N/A

SOP NUMBER: ALL-Q-007-rev.0

EFFECTIVE DATE: Date of Final Signature

SUPERSEDES: N/A

APPROVAL

John P. Dullag
John P. Dullaghan, COO
4/04/05
Date

Sarah A Cherney
Sarah A. Cherney, Director of Quality & Safety
15Apr2005
Date

Bruce Ward
Laboratory General Manager
4/25 22/05
Date

Laboratory Quality Manager
4/25/05
Date

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Table of Contents

1. Purpose

This procedure describes the process of validating acodes for use in EPIC Pro, the Pace Analytical Services laboratory information management system (LIMS).

2. Scope and Application

2.1. This SOP will provide instructions for the acode initiation and validation at the laboratory level.

2.2. The validation scripts identify what functionality must be checked in EPIC Pro rather than providing specific instruction regarding how to make the various transactions in EPIC Pro. The scripts identify what functionality must be checked within the EPIC Pro windows. The user shall be trained on how to access the information through training and the user documentation prior to validating an acode.

2.3. By comparison with information from current LIMS, the output from EPIC Pro must be the same in order for the acode to be considered 'validated'.

3. Summary of Methods

Not applicable

4. Interferences

Not applicable

5. Safety

Not applicable

6. Definitions

6.1. Acode –Analysis code – A repository of information on a particular method that is specific to the matrix, regulatory requirements, and preparation.

6.2. LIMS – A system for transferring, processing, storing and reporting analysis results. The Pace Analytical LIMS is named EPIC Pro.

6.3. Performance Qualification (PQ) – PQ proves the system performs consistently as intended during normal operational use.

6.4 IssueTrak – The software system used by IT to track changes and requests to the LIMS.

6.5 Current LIMS – The laboratory information management system that was utilized prior to implementation of EPIC Pro.

7. Responsibilities and Distribution

7.1. Personnel

7.1.1. Lab personnel involved in testing acodes are responsible for adherence to this SOP. A controlled copy will be available for review and consultation within their area. Personnel are responsible for ensuring that any deviations to this SOP are reported to management in writing.

7.2. Management

7.2.1. Management is responsible for ensuring adherence to this SOP and for reporting any required revisions to the Quality Assurance Office along with designating responsible personnel to perform the validation.

7.3. Quality Office

7.3.1. The Corporate Quality Office is responsible for ensuring that all revisions to the SOP are implemented and for maintaining the original and complete distribution records to each laboratory.

7.3.2. The Laboratory Quality Manager (QM) and/or designee is responsible for:

7.3.2.1. Reviewing and approving the test checklist and validation checklist performed on the laboratory's acodes.

7.3.2.2. Maintaining the final documentation in a retrievable fashion for the lifetime of the product.

8. Sample Collection, Preservation, and Handling

Not applicable

9. Equipment and Supplies

All software packages utilized below may be updated to the most current documented version without updating the process for acode validation outlined in this document.

9.1. Horizon version 8.2.2

9.1.1 Report Manager version 8.2

9.1.2 Control Table Manager version 8.2 (where applicable)

9.2. Actuate 7 Service Pak 2 – PC must be configured for Actuate.

9.3. NuGenesis version 6.0 – Software installation required for NuGenesis.

9.4. Printer

9.5. Validation scripts

10. Reagents and Standards

Not applicable

11. Calibration

Not applicable

12. Procedure

12.1 The Acode validation checklist (Attachment I) will be used to validate the acode. Any discrepancies will be documented on the checklist. If IT intervention is needed, an IssueTrak should be logged and the number documented on the Checklist.

12.1.1 The information packet for the acode will be created typically by the EPIC Pro Project Coordinator in each laboratory facility and attached to the Acode validation checklist. The packet will include the following information, if available:

12.1.1.1 Complete set of example raw data, if the information cannot be retrieved from 12.1.1.4.

12.1.1.2 Percent (%) Moisture (where applicable).

12.1.1.3 Extraction/Digestion sheets (where applicable).

12.1.1.4 Validation list from 'current LIMS'.

12.1.1.5 Final Report and Invoice from 'current LIMS'.

12.1.1.6 EPIC Pro Acode Profile Report (Attachment II).

12.1.1.7 Acode Validation checklist

12.1.2 The use of a regularly scheduled meeting to facilitate the transfer of information and documentation is recommended.

12.2. Login

12.2.1. A profile line item must be created utilizing a 'dummy' client called "Pace

LIMS Validation Check". The address and other information will be unique to the person log-in information.

12.2.2 The profile should include the acode that is to be tested at a minimum, but may include multiple acodes. Each acode in the test would need a separate Acode Validation Checklist.

12.2.3 The samples are logged in and the containers (and preservatives) for the acode will default into the login form in EPIC Pro providing the acode is loaded by loading a profile line item.

12.2.4 The Sample Receipt form (SRF) is printed and included with the data package.

12.2.5. The acode schedules the correct procedure(s) to facilitate tracking of the sample preparation and analysis steps as well as any decision steps such as switch procedures.

12.2.6. Accurate holding times are computed for each procedure and these times are calculated from the correct initial date (collection date, received date, etc).

12.2.7 Print the labels and insert within the information packet.

12.3. Preparation (as applicable to the Acode) and Analysis

12.3.1. The samples are batched with the correct batch type/rule.

12.3.2. Mandatory QC sample types are logged in automatically for each batch. The user can insert optional QC sample types for the batch rule. No "impossible" QC types are available in the Add QC form.

12.3.3. QC and samples are automatically assigned with correct working or stock standards, and the correct spike amount(s). These standards follow Pace's Standard Naming Convention document.

12.3.4. When a two step acode (i.e. an acode that has a defined preparation and analytical step) section 12.3.1 thru 12.3.3 will be conducted as the preparation step.

12.3.4.1 At the second step stage, the samples are batched again by cloning the previous batch. Ensure that all the same samples and QC are in the cloned batch.

12.3.5. Analytical results can be manually entered and edited. The results are sorted in the same order as the instrument report.

12.3.6. Results are entered in their unadjusted form.

12.3.7. Calculations, if any, specific to the acode are performed automatically.

12.3.8. If Pace will be using automatic upload from the instrument for this acode, the instrument report yields the complete set of required results and the automated interface is operational. Also, the instrument data (posted data) has the same units as the compound list uses for manual posting.

12.3.9. QC results (percent recovery and RPD) are automatically computed upon results entry.

12.3.10. The list of reportable analytes for the sample coincides with the list the acode is expected to yield. The list of reportable analytes should be fully comprehensive for that acode as EPIC PRO defines subset lists at the profile level and not the acode level.

12.3.11. Check the initial and final sample amounts in each step of the acode are correct in that they define the expected amounts of sample required to meet the nominal detection limits.

12.3.12. The reportable results and all detection limits are appropriately adjusted, with any corrections necessary for volume/weight adjustments, dilution factors, dry weight and unit conversion.

12.3.13. Each reportable result (except text and certain numeric results, such as pH) has a detection limit. Both MDL and PQL are online and active in EPIC Pro. The criteria with which the detection limits are stored are sufficient to define the detection limit lists for all matrices performed by that acode.

12.3.14. The detection limit that is paired with each result is adjusted by the same factors as the result. The reportable result and detection limit are expressed in the expected unit of measure.

12.4. Final Report

12.4.1. Check the EPIC Pro Final Report against the current final report or, if unavailable, check against the data to ensure all data in the report is accurate and all parts of the report are acceptable.

12.4.2 Generate the invoice and compare to the invoice from the previous LIMS.

12.4.3 If an EDD or PDF of the final report was required for the current LIMS report, generate the same information and compare to ensure it was properly created.

12.5. Quality Assurance

12.5.1. Check the Validation Checklist to ensure that the entire form is filled out and signed appropriately and that any issues have been resolved and documented.

12.5.2. Inform IT that the acode is acceptable and passes the validation testing. IT then activates the acode in the main database and the laboratory staff is informed.

13. Quality Control

Not Applicable

14. Method Performance

Not Applicable

15. Pollution Prevention and Waste Management

Not Applicable

16. References

12.6. Horizon User Help (Help > User Help)

16.2 Horizon System Administrator Guide (Help > System Administrator Guide)

17. Tables, Diagrams, Flowcharts, Appendices, etc.

12.7. Attachment I – Acode Validation Checklist, Form # ALLQ021

12.8. Attachment II - Acode Profile Report

12.9. Attachment III - Validation Flow diagram, Form # ALLQ010

18. Revisions

Document Number	Reason for Change	Date
ALL-Q-007-rev.0	New ALL SOP	February 15, 2005

Attachment I
Acode Validation Checklist (Example), Page 1 of 4

Pace Analytical

Acode Validation Checklist

Acode: «ACODE»

Acode Description:	Matrix:	Price:	Holding Time Prep: Holding Time Analytical:	Addenda Attached ☐

Project Number from currentLIMS	Workorder Number (EPIC Pro)	Current LIMS (EPIC) Sample Numbers	EPIC Pro Sample Numbers

Supporting Documentation

Attachment (AT)	Supporting Document Attachments (**if applicable)	Source:	Yes	N/A	Issues
1	Raw Data, if needed	File	☐	☐	
2	% Moisture (where applicable)	File	☐	☐	
3	Extraction Sheet (where applicable)	File	☐	☐	
4	Validation List	Current LIMS	☐	☐	
5	Invoice	Current LIMS	☐	☐	
6	Final Report	Current LIMS	☐	☐	
7	Acode Profile Report	EPIC Pro	☐	☐	
8	Sample Receipt Form	EPIC Pro	☐	☐	
9	Batch Worklist	EPIC Pro	☐	☐	
10	QC Report (Actuate)	EPIC Pro	☐	☐	
11	Invoice	EPIC Pro	☐	☐	
12	EDD or PDF	EPIC Pro	☐	☐	
13	Final Report	EPIC Pro	☐	☐	

Attachment I
Acode Validation Checklist (Example), Page 2 of 4

Pace Analytical

Acode Validation Checklist

Acode: «ACODE»

* if an issue is logged in IssueTrak, document the IssueTrak # in the appropriate comment section.

Step	Expected Action or Value	AT	Pass	Fail	N/A	Comments / Documentation	Initial

Lab Area: Login

1	Acode is available for use.		☐	☐	☐		
2	If the analyte list for the acode is variable, that list is shown in Analyte List Editor window pops up. If analyte list is not variable, the Analyte List Editor does not pop up. Print SRF upon completion.	8	☐	☐	☐		
3	EPIC Pro schedules the expected procedures and correct holding times (as noted above). Print current LIMS final report and invoice upon completion.	5,6	☐	☐	☐		

Login Approval (signature): **Date:**

Lab Area: Sample Prep

4	Correct Standards are entered in EPIC Pro and are linked by standard names (see EPIC Pro acode profile report).		☐	☐	☐		
5	The New Batch window defaults in the mandatory batch QC. The original sample for MS/MSD is the first paying sample in the batch. The Add QC button displays all the optional QC sample types. Print batch worklist upon completion.	9	☐	☐	☐		
6	The expected defaults for initial and final volume appear in Posting by Worklist. In the Spiked Amounts tab, the expected spiking solution names are displayed, and no errors regarding spikes appear (see acode profile report).		☐	☐	☐		
7	The prep batch successfully releases after the batch_review is posted, moving the status of each schedule to an "F" state.		☐	☐	☐		

Sample Prep Approval (signature): **Date:**

Attachment I
Acode Validation Checklist (Example), Page 3 of 4

Pace Analytical

Acode Validation Checklist

Acode: «ACODE»

* if an issue is logged in IssueTrak, document the IssueTrak # in the appropriate comment section.

Step	Expected Action or Value	AT	Pass	Fail	N/A	Comments / Documentation	Initial

Lab Area: Sample Analysis

8	Current LIMS Analyte IDs and names coincide with the EPIC Pro IDs and names.		☐	☐	☐		
9	Manual Posting: in Posting by Worklist, analytes are presented in a natural order to facilitate easy data entry—same ordering as the instrument report or the benchsheet. Appropriate columns are displayed for results entry. The Properties tab accurately indicates which dilution factors, if any, are reflected in the analytical result.		☐	☐	☐		
10	Hardness calculation and percent moisture only (automated acode-specific calculations): the analyte names for calculated values do not appear on the Posting by Worklist window during initial results entry. Calculated values are automatically and correctly computed, as evident in their display in edit mode. Calculated values are correctly recomputed if one of the constituent input values is edited.		☐	☐	☐		
11	Autoposting: the instrument reports are placed into the Autopost Pipe. The data is correctly parsed from the instrument report—run header data, complete list of analytes, and results.		☐	☐	☐		
12	Autopost successfully posts the run sequence.	10	☐	☐	☐		

Sample Analysis Approval (signature): **Date:**

Lab Area: Validation

13	The required identification information with regard to instrument ID and analysis date are correct. Some information may not be necessary, for example, if no instrument is used the instrument ID field is not required. Print QC report upon completion.		☐	☐	☐		
14	No required results are missing in the sample.		☐	☐	☐		
15	Multiple dilutions or dual columns: these additional runs are automatically added to the batch. The batch ordering mimics the run sequence appropriately.		☐	☐	☐		
16	Computed QC results are correct and no blanks with ND results are marked out of control.		☐	☐	☐		

Attachment I
Acode Validation Checklist (Example), Page 4 of 4

Pace Analytical™

Acode Validation Checklist

Acode: «ACODE»

* if an issue is logged in IssueTrak, document the IssueTrak # in the appropriate comment section.

Step	Expected Action or Value	AT	Pass	Fail	N/A	Comments / Documentation	Initial

Lab Area: Validation (continued)

17	QC Report (Validation Report) shows accurate QC and sample results. The Epic Pro validation report matches the current LIMS validation report.		☐	☐	☐		
18	Results are released and follow-up scheduling is carried out.		☐	☐	☐		
19	Reportable results for a sample are correctly assembled and identical to the results in current LIMS. Adjustments for instrument dilution factor and conversion from liquid to solid units are appropriately carried out.		☐	☐	☐		
20	Results are appropriately adjusted for initial volume or sample size. If the analysis is for a soil matrix amenable to dry weight correction, the dry weight correction factor was correctly applied to both the detection limits and results.		☐	☐	☐		

Sample Validation Approval (signature): **Date:**

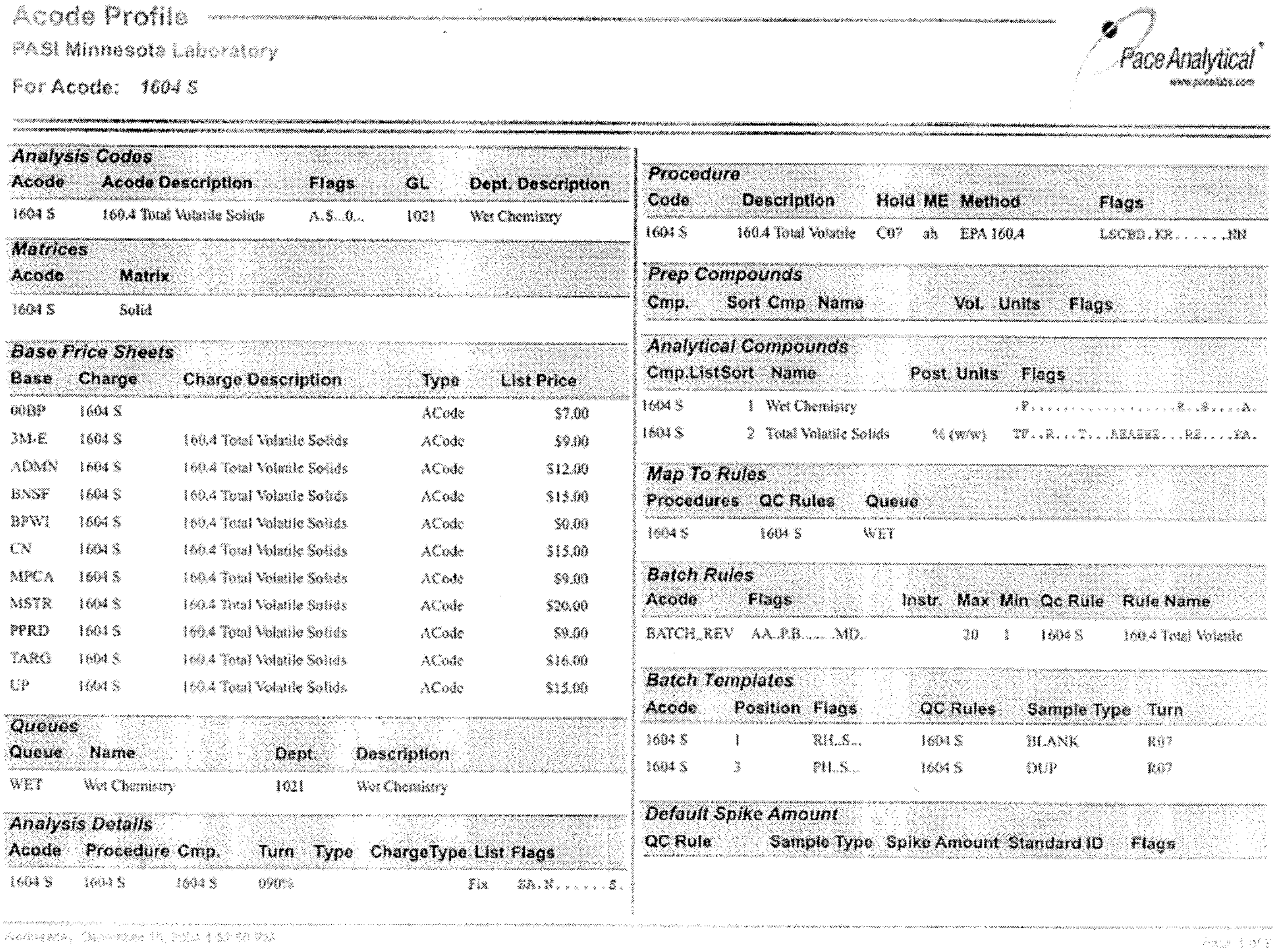
Lab Area: Project Management

21	Generate final report. Does the EPIC Pro final report contain the same data as the EPIC report? Is the report satisfactory?	13	☐	☐	☐		
22	Generate invoice. Is invoice information identical to the current LIMS invoice information?	11	☐	☐	☐		
23	PM ascertains if any EDD or PDF reports are required. Is all EPIC Pro data identical to current LIMS data? Are all reports satisfactory?	12	☐	☐	☐		

Project Management Approval (signature): **Date:**

Quality Management Approval (signature): **Date:**

Attachment II
Acode Profile Report (Example), Page 1 of 2



Acode Profile
PASI Minnesota Laboratory
For Acode: 1604 S

Analysis Codes

Acode	Acode Description	Flags	GL	Dept. Description
1604 S	160.4 Total Volatile Solids	A.S..0..	1021	Wet Chemistry

Matrices

Acode	Matrix
1604 S	Solid

Base Price Sheets

Base	Charge	Charge Description	Type	List Price
00BP	1604 S		ACode	$7.00
3M-E	1604 S	160.4 Total Volatile Solids	ACode	$9.00
ADMN	1604 S	160.4 Total Volatile Solids	ACode	$12.00
BNSF	1604 S	160.4 Total Volatile Solids	ACode	$13.00
BPWI	1604 S	160.4 Total Volatile Solids	ACode	$0.00
CN	1604 S	160.4 Total Volatile Solids	ACode	$15.00
MPCA	1604 S	160.4 Total Volatile Solids	ACode	$9.00
MSTR	1604 S	160.4 Total Volatile Solids	ACode	$20.00
PPRD	1604 S	160.4 Total Volatile Solids	ACode	$9.00
TARG	1604 S	160.4 Total Volatile Solids	ACode	$16.00
UP	1604 S	160.4 Total Volatile Solids	ACode	$15.00

Queues

Queue	Name	Dept.	Description
WET	Wet Chemistry	1021	Wet Chemistry

Analysis Details

Acode	Procedure	Cmp.	Turn	Type	ChargeType	List	Flags
1604 S	1604 S	1604 S	090%		Fix		SA,N......S.

Procedure

Code	Description	Hold	ME	Method	Flags
1604 S	160.4 Total Volatile	C07	ah	EPA 160.4	LSCBD.XR......RN

Prep Compounds

Cmp.	Sort	Cmp Name	Vol.	Units	Flags

Analytical Compounds

Cmp.List	Sort	Name	Post.	Units	Flags
1604 S	1	Wet Chemistry			.P......................R..S....A.
1604 S	2	Total Volatile Solids		% (w/w)	TF..R...T...AEAEEE...RS....EA.

Map To Rules

Procedures	QC Rules	Queue
1604 S	1604 S	WET

Batch Rules

Acode	Flags	Instr.	Max	Min	Qc Rule	Rule Name
BATCH_REV	AA.P.B......MD.		30	1	1604 S	160.4 Total Volatile

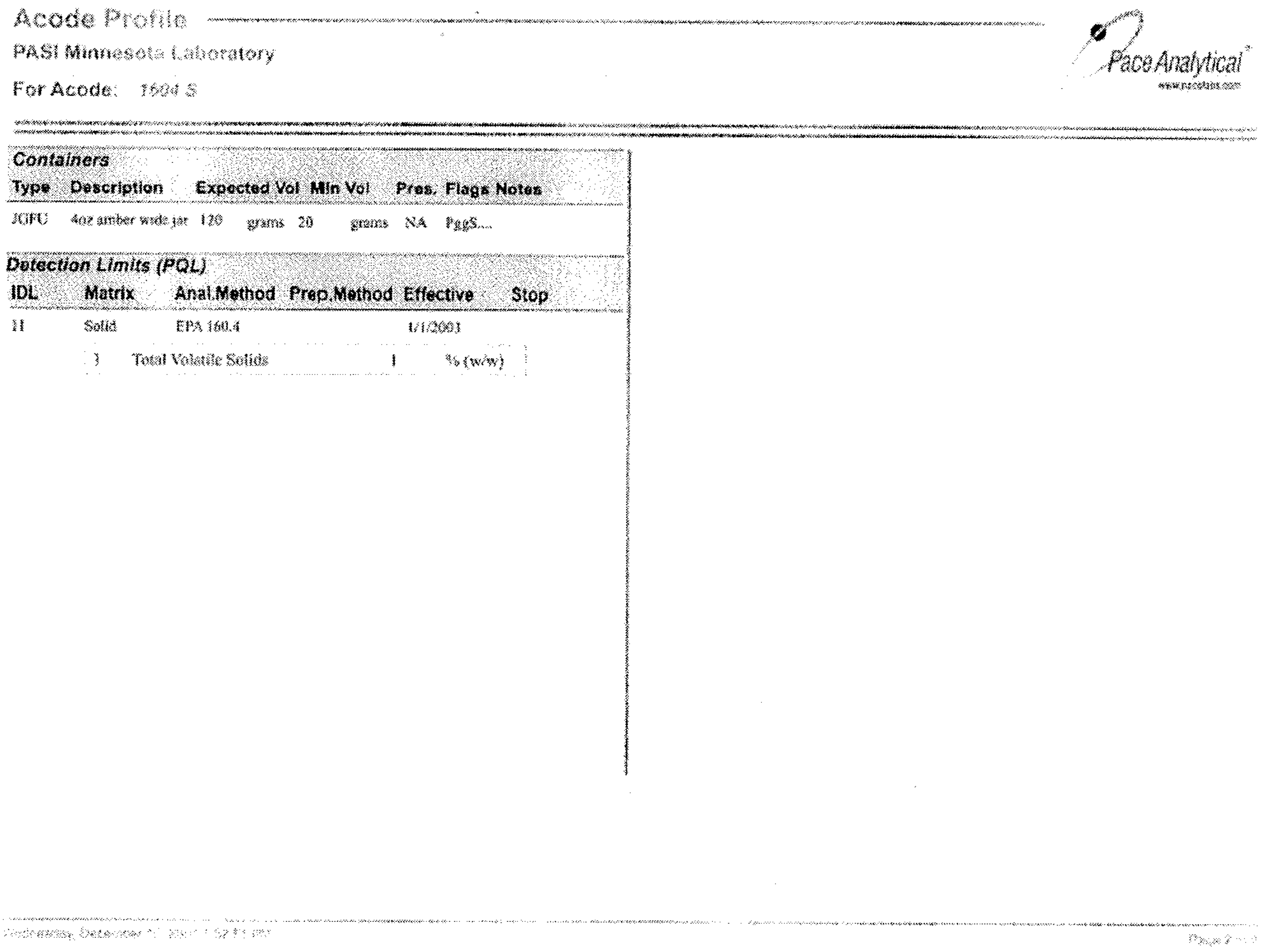
Batch Templates

Acode	Position	Flags	QC Rules	Sample Type	Turn
1604 S	1	RH.S...	1604 S	BLANK	R07
1604 S	3	PH.S...	1604 S	DUP	R07

Default Spike Amount

QC Rule	Sample Type	Spike Amount	Standard ID	Flags

Attachment II
Acode Profile Report (Example), Page 2 of 2



Acode Profile

PASI Minnesota Laboratory

For Acode: 1604 S

Containers

Type	Description	Expected Vol	Min Vol	Pres.	Flags	Notes
JGFU	4oz amber wide jar	120 grams	20 grams	NA	PggS...	

Detection Limits (PQL)

IDL	Matrix	Anal.Method	Prep.Method	Effective	Stop
11	Solid	EPA 160.4		1/1/2003	

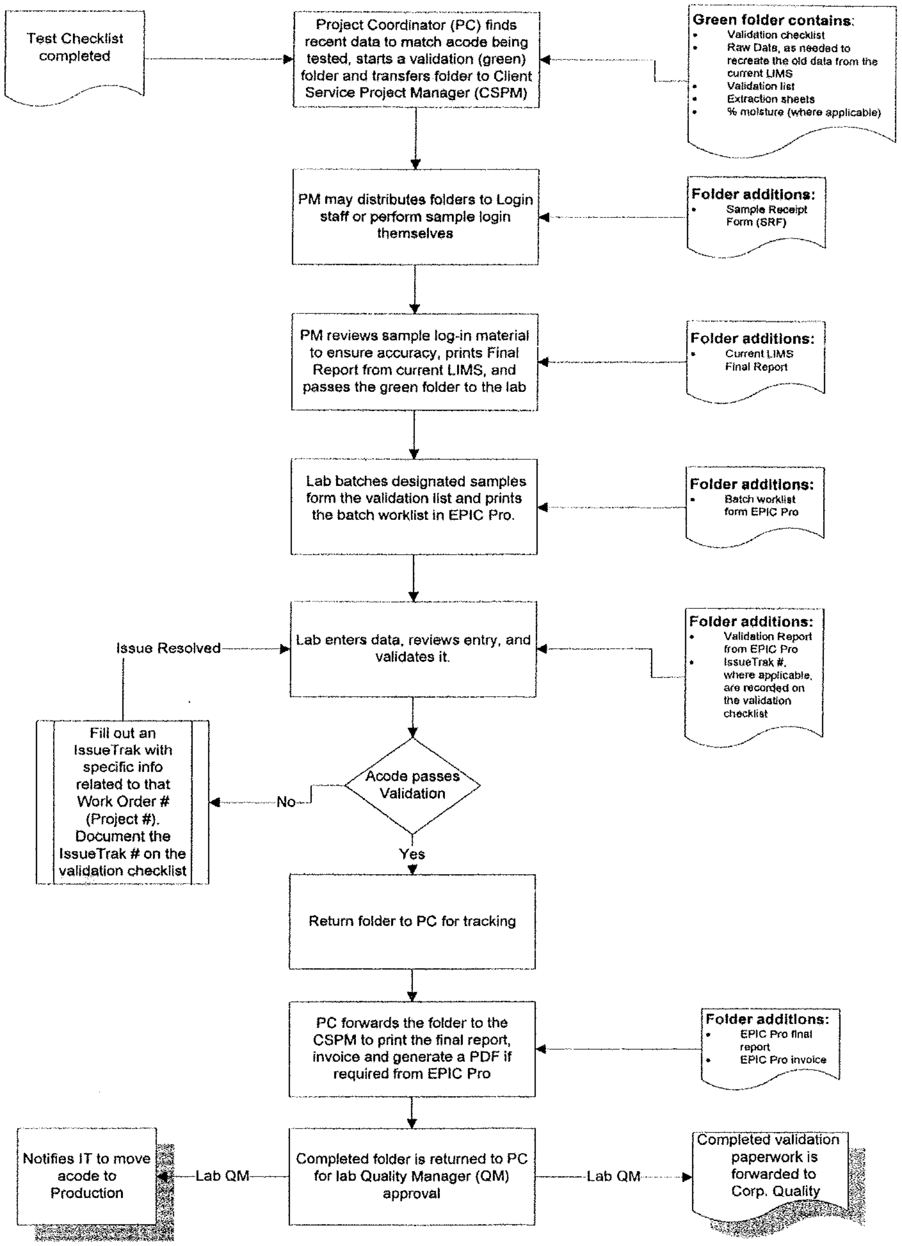
3 Total Volatile Solids 1 % (w/w)

Wednesday, December [illegible]

Page 2 [illegible]

Attachment III
Acode Validation Flow Diagram

Acode Validation Process
(New Acodes Only**)**



STANDARD OPERATING PROCEDURE
AUDITS AND INSPECTIONS

Pace Analytical®

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Minneapolis, MN 55414

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STANDARD OPERATING PROCEDURE

AUDITS AND INSPECTIONS

REFERENCE METHOD: N/A

SOP Number:	S-ALL-Q-011-Rev.01
Effective Date:	Date of Final Signature
Supersedes:	ALL-Q-011-rev.0

APPROVALS

	11/27/2007
Brad Meadows, Director of Quality, Safety and Technology	Date
	11DEC2007
Laboratory General Manager	Date
	21Apr2008
Laboratory Quality Manager	Date

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

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Signature	Title	Date
Signature	Title	Date

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TABLE OF CONTENTS

SECTION ..... PAGE

1. Purpose

This Standard Operating Procedure (SOP) sets forth the policies and procedures governing the performance and response to internal and external audits.

2. Scope and Application

The policies and procedures set forth in this document are applicable to all personnel participating in or responding to audits.

3. Summary of Method

Audits are used to assess the systems utilized within the laboratory. All deficiencies must be addressed in a timely fashion to ensure the quality of data is not impacted.

4. Interferences

Not Applicable

5. Safety

Standard laboratory safety precautions must be followed during the inspection (e.g., safety glasses, lab coats, etc.).

6. Definitions

Definitions of terms found in this SOP are found in the Glossary section of the current version of the Pace Quality Assurance Manual or an explanation of specific terminology is provided in this section.

6.1. Second-Party Audit – A second-party audit is an external audit performed by or on behalf of the client to determine if proper capabilities and quality systems are in place.

6.2. Third-Party Audit – A third-party audit is an audit conducted by an external party other than the client (e.g., EPA, FDA, etc.). These audits are typically conducted to ensure that the laboratory is meeting the regulatory requirements.

6.3. Internal Audit – A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity by person(s) within the same company.

7. Sample Collection, Preservation, and Handling

Not applicable

8. Equipment and Supplies

8.1. Checklist (Examples are available within the local or Corporate QA office)

8.2. Standard office Supplies

9. Reagents and Standards

Not applicable

10. Calibration

Not applicable

11. Procedure

11.1. Internal Audits

11.1.1. The Quality Manager (QM) must notify Management of an upcoming internal audit or facility inspection, a minimum of 1 day prior to the inspection. The audit will be rescheduled if necessary and the situation allows. Extenuating circumstances may require the audit proceed regardless of the availability of management or other personnel.

11.1.2. An internal audit must be conducted on an annual basis per laboratory area. The schedule must be compiled and distributed to lab staff prior to the end of the preceding year.

11.1.3. Audit team members may include the QM and/or any other associated personnel that are independent of the activity or method that is to be audited.

11.2. General Audit Process

11.2.1. Use a relevant checklist as a guide when performing the audit or inspection and note results and comments. The checklists are located within the QA Office and may vary but should cover the following items in each area of the laboratory (the list is not all inclusive and items may be added or dropped). Note: Appropriate on-the-spot corrections may be made, but the observation must still be recorded along with its corrected status.

11.2.2. Quality Documentation: includes Standard Operating Procedures (SOPs), Quality Manuals, copies of approved methods, preparation and analytical logbooks or sequence logs, maintenance logbooks, equipment documentation, and chemical inventories. The auditor will check for completeness (whether the logbooks are current) and for proper internal document management. The auditor will also check for traceability of standards, reagents, and calibrations.

11.2.3. Monitoring Forms: includes temperature and balance monitoring forms, reagent water monitoring forms, etc. The auditor will check for completeness (whether the values were monitored for every day of laboratory operations). The auditor will also check to see if out-of-control values were flagged, if corrective actions were taken to resolve any problems and if the outcome of the corrective actions were noted.

11.2.4. Peer review: the auditor will check to see that all projects completed within an area have been reviewed by another qualified analyst or supervisor and whether proper documentation of this review exists.

11.2.5. Sample and Standard Storage: the auditor will check to see that sample and standards are stored at the temperatures required by the methods or by the suppliers and that no contamination possibilities exist between standards and samples. The auditor also checks standard preparation logs to trace standards back the raw materials provided by outside suppliers. The auditor can request copies of the Certificates of Analysis to be presented showing traceability to national standard.

11.2.6. Procedures: the auditor will question analysts about the method they perform. The auditor may request to observe an activity to insure that the analyst is performing that activity in compliance with the published method and the corresponding SOP. This may include standard preparation, instrument calibration, quality control indicators, sample analysis, or data reporting procedures. The auditor will also check corrective action procedures and how non-conformances are communicated to clients.

11.2.7. Final reports: The auditor will check final reports for completeness and traceability. Final results should be traceable to an initial calibration. Initial calibrations should be traceable to the prepared standards. The prepared standards should be traceable to the Certificates of Analysis provided by the vendor. The Project Manager and analysts involved with each project should be able to answer any questions pertaining to the final reports.

11.2.8. Computer systems: The auditor will assess the validity of the results generated by the laboratory information management system (LIMS) and any applicable secondary computer system. Final results should be traceable to the raw numbers posted by the analyst or the automated instrument. The auditor may check the calculations to insure they are being performed correctly by the automatic system.

11.3. Audit Report and Corrective Actions

11.3.1. Once the internal audit is completed, the lead auditor will have no more than thirty days to complete the audit report listing deficiencies and findings. (See Section "Quality Control")

11.3.2. Laboratory management is given a copy of the audit report. Corrective action is noted on the audit report by laboratory management, signed, and returned to the auditor within 14 days. If the auditor submits a proposed corrective action, management must review, sign and return to the auditor within 5 days. If the proposed corrective action is not accepted by operations, the lab must provide and alternative corrective action. Laboratory management may also distribute to laboratory staff as needed.

11.3.3. The process for documenting any laboratory investigation is outlined in ALL-Q-013, Corrective Action/Preventive Action. This process may not be applicable to all findings. In the event that it is not used, alternative means may be used as long as all steps in the investigative process are clearly documented.

11.3.4. The corrective action does not necessarily have to be implemented by the time of the report. At a minimum, a schedule detailing the timeframe for implementation and monitoring of the corrective action must be provided in the report.

11.3.5. The response to the QA office should detail the items reviewed, findings, and proposed corrective actions. If no corrective actions can be determined, contact the laboratory manager and/or QA office for assistance.

11.3.6. When audit findings cast doubt on the validity of the results, the data must be reviewed thoroughly to determine the impact on the finding. If a problem is found that would impact the usability of the data (i.e. QC does not pass, analysis out of hold time), those clients affected will be notified in writing and the original data retracted. A revised report with case narrative will be issued that lists the revised results and summarizes the impact of the finding on the data.

11.3.7. Once submitted to the QA Office, the documentation is reviewed and any questions are discussed with lab management until a resolution is found. Once the QA Office has agreed to all the proposed corrective/preventative actions and signed the final report, all the documentation pertaining to the audit is filed.

11.3.8. After approximately 3 months, the corrective actions are reviewed to ensure completeness and effectiveness of the implementation. This review must be documented and must also assure that all corrective actions that were given a projected timeline are completed.

11.4. External Audits

11.4.1. Arrival of Auditor(s)

11.4.1.1. All auditors are required to sign in and out in the Pace Analytical Services, Inc. visitor logbook.

11.4.1.2. Each auditor will wear a visitor badge and be assigned a pair of safety glasses (if needed) while at the Pace Analytical Services, Inc. facility. The badge will be returned when they leave.

11.4.1.3. When the auditor arrives, the QA Manager should be notified of the arrival. The QA Manager will then notify other key personnel of the auditor's arrival.

11.4.1.4. Opening introductions will initiate the audit. In the event Management is unfamiliar with the auditor(s), the QA Manager will ask to see the credentials of the auditor(s) if not offered and any other relevant documentation. Typical items discussed at the opening meeting are:

- Introductions
- Reasons for Inspection
- Scope
- Schedule
- History and scope of the lab facility
- Ground rules for the audit
- Reports to be generated are discussed
- Topics for the exit conference

11.4.1.5. The Audit

Typical audits may include the following items depending on the nature of the inspection:

- Master Study Schedule Review. The auditor(s) may select additional studies to review from the Master Schedule (GLP only).
- Phase Audits/Data Audits (GLP only – see separate lab-specific SOPs for conduct of audits)
- Personnel Review. This includes review of the organizational chart (signed by management), training of personnel, and training records.
- Quality System Review. This is to determine how active and responsible the QA Office is within the Pace Analytical laboratory.
- Facilities Review
- Equipment Review
- Standard Operating Procedures (SOPs)
- Protocols
- Data Collection and Recording
- Reporting
- Several policies apply to the conduct of the audits.

11.4.1.6. The QM (or designated representative) shall accompany the auditor(s) in the laboratory at all times.

11.4.1.7. All required documents will be made readily available to the auditor(s). If the auditor(s) need to take documents, copies will be made and the destination recorded.

11.4.1.8. Reasonable attempts will be made to allow the auditor(s) access to all lab personnel but with consideration for continued laboratory work flow.

11.4.1.9. All efforts must be made to maintain the confidentiality of all other client information.

11.4.2. Closing Conference

11.4.2.1. At a minimum, the QA Manager, laboratory management, and affected project managers should attend the closing conference.

11.4.2.2. If the auditor presents findings or issues that the laboratory does not believe to be correct, clarifying questions should be asked to ensure that the auditor correctly understood or observed the item / process in question. If the auditor does not change their position, it should be noted with the intent to address the matter in the audit response. Arguing with an auditor over a finding either during the audit or in the closing conference is inappropriate and counterproductive.

11.4.3. QA Manager Follow-up

11.4.3.1. The QM should write a memorandum describing pertinent discussions or conversation held with audit personnel during the audit or closing conference and distribute to affected lab areas.

11.4.3.2. Upon receipt of the written audit report, the QA Manager (with input from lab personnel and management) shall write a response to the finding made by the auditor(s). The response should be sent to the auditor(s) attention. The specific address may be obtained from the auditor(s) at the time of the audit.

11.4.3.3. All findings and responses will be documented on the Corrective Action process and tracked through completion.

12. Quality Control

12.1. The documentation of an internal audit will consist of all checklists and notes made by the auditor, the formal report from the auditor to management, and the corrective action report created in response to the audit findings. The report will include the finding, the date of the finding, the proposed root cause of the problem, the person assigned to the corrective action, the corrective action taken, the date the finding was resolved and a list of any supporting documentation needed to prove that the finding was resolved.

12.2. The documentation should also contain any follow-up that was conducted at a later date to determine if corrective actions were still in place.

13. Method Performance

All personnel must read and understand this procedure with written documentation maintained in his/her training file.

14. Pollution Prevention and Waste Management

Not applicable

15. References

15.1. National Environmental Laboratory Accreditation Conference (NELAC), Chapter 5, “Quality Systems”, most current version.

15.2. 21CFR Part 58, Code of Federal Regulations

15.3. Pace Analytical Services Quality Manual, most current version.

16. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

Not Applicable

17. Revisions

Document Number	Reason for Change	Date
ALLQ011-Rev.0	First Issue	December 30, 2004
S-ALL-Q-011-rev.01	1. Converted to new SOP format 2. Changed criteria for corrective action plans to be submitted by management to be within 14 days and 5 days for proposed CAs. (instead of 30 days). 3. Elaborated data recall protocol for audit findings that affect data usability. 4. Removed Responsibilities and Distribution section.	November 27, 2007

STANDARD OPERATING PROCEDURE
CORRECTIVE ACTION/PREVENTATIVE ACTION PROCESS

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STANDARD OPERATING PROCEDURE

Corrective Action / Preventative Action Process

Reference Methods: N/A

SOP NUMBER:	ALL-Q-012rev.0
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	First Issue

APPROVAL

John Dullaghan John P. Dullaghan, COO	7/1/05 Date
Sarah A Cherney Sarah Cherney, Director of Quality and Safety	05Jul2005 Date
Laboratory General Manager	1/27/06 Date
Laboratory Quality Manager	1/30/06 Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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Table of Contents

1. Purpose

1.1 The purpose of this Standard Operational Procedure is to define the responsibilities and process for identifying and investigating non-conformances, for taking action to mitigate any negative impacts caused, and for applying corrective and preventative actions at Pace Analytical Services, Inc.

1.2 The non-conformance events to be reported in a Corrective/Preventative Action Report, CAR, are deviations encountered in the routine operation of the laboratory. These deviations are from the policies and procedures of the quality system or from the technical operation. These cover the areas of sampling, receiving of samples, processing of the samples, instrumental conditions, environmental conditions and calculations.

1.3 The Preventative Action (PA) is not a non-conformance, but an action that is taken to prevent the situation from becoming a non-conformance. Every time a Corrective Action is necessary, a preventative action must be taken in order to prevent or minimize the occurrence of the situation.

2. Scope and Application

2.1 A Preventative Action will be taken to eliminate or minimize the cause of potential non-conformity, or other undesirable situation in order to prevent occurrence.

2.2 This SOP covers the following general areas of corrective action (more details are discussed in the procedure section):

- 2.2.1 Non-conformances in the laboratory
- 2.2.2 Proficiency testing failures
- 2.2.3 Audit findings, internal and external
- 2.2.4 Client Complaints

2.3 The policies and procedures contained in this SOP are applicable to all personnel within this facility.

3. Summary of Method

3.1. Corrective action reports, for non-conformances in the laboratory, can be initiated by any laboratory personnel (example form is included as the first attachment). This form, when completed, contains information on the non-conformance, the corrective and preventative actions taken, and the necessary signatures of laboratory personnel. A copy of each form is filed in the applicable project folder and a copy or electronic version is retained by the Quality Manager.

3.2. Corrective actions for proficiency testing failures are initiated by the Quality Manager after reviewing PT results. They are documented through the use of QA Trak. When completed, QA Trak contains information on the analytes missed, the possible sources of error, and possible corrective action steps to take to avoid future misses. This information is then compiled by the Quality office to document an official response to the client or state agency.

3.3. Corrective actions for audit findings are maintained by the Quality Manager. The event is entered into QA Trak and assigned to the Quality Manager for tracking purposes, but actions are assigned to responsible individuals within the laboratory. QA Trak will document the information on the audit finding, the corrective actions taken, the current status, and the documentation needed to confirm the corrective actions are implemented over an extended period of time.

3.4. Corrective action and preventative actions for client complaints are handled in the same manner as 3.3 above. The Quality Assurance office monitors QA Trak and if a procedure or system shows chronic deviations from standard operating procedures, then a corrective action report will be initiated to determine the root cause as a means of prevention. See flow diagram of the corrective action / preventative action processes in Attachment III.

4. Interferences

Not Applicable

5. Safety

Not Applicable

6. Definitions

6.1. Definitions of terms found in this SOP are found in the Pace Quality Manual Glossary.

6.2. Discrepancy - Any divergence or disagreement from the standard operating procedures or what is expected or desired.

6.3. Corrective Action - Action taken to eliminate the causes of an existing non-conformity, defect or other undesirable situation in order to prevent recurrence.

6.4. Correction - refers to repair, rework, or adjustment and relates to the disposition of an existing nonconformity.

6.5. Preventative action – Action taken to eliminate or minimize the cause of a potential non-conformity, defect, or other undesirable situation in order to prevent occurrence. These can be identified during customer audits and usually are identified as recommendations to improve the quality system.

6.6. Assignable Cause – Explanation of aberrant or suspect results that are supported by a well-documented investigation that may be used to invalidate data. In some cases, an assignable cause equals to the " root cause" of a deviation event. In other cases, an assignable cause is actually the outcome o r symptoms of the real underlying "root cause" (for example assignable cause: human error; root cause: inadequate training, inadequate procedure, careless work).

6.7. CAPA – Corrective and Preventative Action System

6.8. Deviations – Any event where a departure from standard operating procedures, analytical methods, specifications, protocols, practice or use of equipment has occurred prior to sample analysis.

6.9. Human Error – A deviation caused by laboratory personnel while executing a procedure (for example actions that differ from established procedures or omissions of required activities).

6.10. Equipment/Instrument Failure – the failure of laboratory equipment to operate as intended.

6.11. Invalid result – a result that is solely attributed to an assignable cause.

6.12. Laboratory Deviation Form – A form that is used to document a non-conformance event and captures the event, conclusions, corrective and preventive actions.

7. Responsibilities and Distribution

7.1. Personnel:

7.1.1. Employee recommendations for changing the SOP must be made to their supervisor or the Quality Manager in writing.

7.1.2. All personnel are responsible for adherence to this SOP. A controlled copy will be available for review and consultation within the area methods manual. Personnel are responsible for ensuring that any deviations to this SOP are reported to the laboratory manager.

7.1.3. It is the responsibility of each person working in the laboratory for reporting non-conformance deviations, starting with the sampling, receiving and handling of the samples and followed by the analysis, instrumental conditions, environmental conditions and calculations.

7.1.4. It is the responsibility of the person initiating the report to properly complete a description of the non-conformance, including corrective and preventative action and to obtain approval of the Supervisor or designated person.

7.2. Laboratory Manager:

7.2.1. The department manager will ensure that the SOP procedure is followed and is responsible for communicating any changes in writing to the Quality Manager.

7.2.2. If is the responsibility of the Laboratory Manager to verify that the problem was corrected, that the corrective and preventative action taken was correct based on the findings and to obtain the final approval from the QA Manager.

7.2.3. The implementation is the responsibility of all operation and management personnel associated with the areas utilizing the SOP.

7.3. Quality Manager (QA Manager):

7.3.1. The Quality Manager is responsible for monitoring the implementation of the SOP and the good laboratory practices associated with it. The Quality Manager will participate in the revision of the SOP and make sure it is current. The Quality Manager will approve all SOPs.

7.3.2. It is the responsibility of the QA Manager to perform a verification of effectiveness for each report and to close it based on the findings.

7.3.3. It is the responsibility of the QA Manager to keep a log and to prepare a trending summary of the reports on a quarterly basis (at a minimum) to be discussed with management. The trending report should monitor the type of non-conformances, department and analyst. The purpose of this trending report is to identify training needs, to track and highlight method/instrumentation problems and to specifically evaluate analysts performance.

7.4. General Manager (GM)

7.4.1. The GM is responsible for the overall implementation of and adherence to this SOP. The GM is responsible for reviewing this SOP with the Quality Manager and the department manager.

7.5. Distribution

7.5.1. A copy of this SOP will be available to all applicable personnel.

8. Sample Collection, Preservation, and Handling

Not Applicable

9. Equipment and Supplies

Not Applicable

10. Reagents and Standards

Not Applicable

11. Calibration

Not Applicable

12. Procedure

12.1. Corrective and Preventative actions may be initiated from any department of the laboratory or facility covered under the Pace Analytical Services Quality Manual. This includes but is not limited to:

- Internal Laboratory Non-Compliance
- PE/PT Sample Results
- Internal and External Audits
- Client Complaints
- Client Inquiries

12.2. Non-conformances in the laboratory:

12.2.1. There are several types of laboratory deviation problems or non-conformances that may occur in the laboratory that would require the initiation of a corrective and preventative action report:

12.2.1.1. Preparation error: any error encountered during the preparation of samples such as spiking mistakes or omissions, sample extracts concentrated down too far, etc. which can be caused by human errors.

12.2.1.2. Contamination: any instance where contamination has occurred or is thought to be possible whether from direct contact with other samples or from airborne solvent contaminants, or from contaminated reagents and /or glassware.

12.2.1.3. Calibration failure: any instance where a calibration failure could have an impact on the sample data that was reported.

12.2.1.4. Internal Standard failure: this would apply to GC or GC/MS analyses where problems occurred when adding internal standards to samples, thus affecting the sample results. It does not apply to instances where there is a known matrix interference.

12.2.1.5. LCS failure: any instance where an LCS failure could have an impact on the sample data that was reported.

12.2.1.6. Hold time error: any instance of missed holding time requires a corrective action form. Missed holding times are tracked by the Quality Manager for the corporate office.

12.2.1.7. Lab accident: any instance where an accident within the lab could have an impact on the sample data that was reported such as a broken container.

12.2.1.8. Spike failure: any instance where spike failures could have an impact on the sample data that was reported.

12.2.1.9. Instrument failure: any instance where an instrument failure could have an impact on the sample data or affect the hold time of a sample.

12.2.1.10. Final reporting error: any instance where errors were discovered in the final report such as reporting units, dry weight versus wet weight, missed analytes, calculation errors, etc.

12.2.2. After the problem has been identified and explained on the Laboratory Non-Conformance Corrective/Preventative Action form, the person initiating the report then explains the suspected or known cause of the incident.

12.2.3. Other required information on this form includes:

12.2.3.1. The project number and samples that are affected.

12.2.3.2. The name of the Project Manager

12.2.3.3. The client name

12.2.3.4. The matrix of the samples involved

12.2.4. The person initiating the report will also fill in any corrective and preventative actions that they have taken. They sign and date the form and then pass it along to their supervisor or the applicable project manager who will evaluate the correctness and completion of the corrective and preventive action.

12.2.5. The form is reviewed by the appropriate personnel involved with the affected project samples, who in turn sign and date the Laboratory Non-Conformance Corrective/Preventative Action form.

12.2.6. The Quality Manager is the final person to review and sign the form. The Quality Manager assigns a unique number to the corrective action form and makes two copies; one to be retained by the Quality Manager in a master file and another copy for the project file.

12.3. Proficiency Testing (PT) failures:

12.3.1. The laboratory analyzes proficiency testing samples to internally monitor preparation and analytical procedures. Results are submitted to accrediting authorities for certification purposes.

12.3.2. PT results are sent to the Quality Manager from the PT provider. Results are either marked as 'acceptable' or 'not acceptable'. Any results that are marked as 'not acceptable' require the initiation of a Laboratory Non-Conformance Corrective/Preventative Action report QA Trak issue.

12.3.3. The appropriate analyst or supervisor will study the raw data, calibration data, and preparation data associated with failing PT results and will list any possible sources of error.

12.3.3.1. The form in Attachment II is a means of documenting this investigation. The investigation process is documented in section 12.11 of this document.

12.3.4. They will also list any possible preventative actions that may be used to eliminate future failures for that analyte. The Laboratory Non-Conformance QA Trak is signed by the Quality Manager and a written response is compiled and filed with the applicable PT study. Another PT sample will be ordered from the PT provider if necessary or an internal PT sample will be issued to the analyst to try and correct the previous failure. Any replacement PT samples will also be documented in the Quality Systems office.

12.4. Audit Findings

12.4.1. The laboratory is subject to external audits from regulatory agencies and clients throughout each calendar year. Also an internal audit is conducted annually by the Quality Manager. Any deficiency will be documented through the use of QA Trak.

12.4.2. The following information is included within QA Trak:

12.4.2.1. The date initiated (usually the audit date)

12.4.2.2. The deficiency that was found by the auditor (taken straight from the audit reports)

12.4.2.3. The initials of the laboratory personnel assigned to take care of the corrective action procedures

12.4.2.4. The current status of the corrective action process

12.4.2.5. The due date assigned by the auditor

12.4.2.6. The date the issue was resolved

12.4.2.7. The documentation necessary to prove that the corrective actions have been addressed (i.e. revised Standard Operating Procedure, copies of monitoring forms, bench sheets, training records, etc.)

12.4.2.8. An updated status if any follow-up was performed to confirm that corrective actions are still being implemented

12.4.3. The Quality Manager is responsible for maintaining QA Trak and information is made available to internal audit personnel or corporate quality personnel through log-in access to the system.

12.4.4. Details of the audit deficiencies and possible corrective actions are discussed and implemented in Operations meetings and Quality Team meetings.

12.5. Client Complaints

12.5.1. Client complaints are documented through the use of QA Trak. The system is configured to immediately e-mail the respective GM of any complaints within the laboratory and to assign the complaint to the QA Office for facilitating the documentation of the investigation (see 12.11) and written follow-up.

12.5.2. Usually a Project Manager initiates the forms dealing with client complaints because they are the primary contact for clients.

12.5.3. After listing the client complaint (or request for reporting changes), the Project Manager will pass the corrective action form along to the appropriate analyst, laboratory supervisor or to the Quality Manager.

12.5.4. The Quality Manager is the final person to review and sign the form. They assign a unique number to the corrective action form and make two copies; one to be retained in a master file in the Quality Systems office and another copy for the project file.

12.5.5. Client complaints should be resolved and completed in a satisfactory period of time, but not exceeding 30 calendar days from the initial call. If for any reason a delay is necessary, then the customer must be informed and approval of the GM is necessary.

12.6. The Non-Conformance Corrective/Preventative Action must follow a hierarchy within the organization: analysts – Supervisors – QA – GM or its designee.

12.11 Laboratory Non-Conformance Investigation

12.11.1 Determining the root cause will involve an investigative process that involves the management staff and laboratory personnel. The following general steps must be taken. Refer to Table 1 for a more complete guide of possible corrective/preventive actions. For immediate or long-term corrective actions, steps comprising a closed-loop corrective action system are as follows:

12.11.1.1 Define the non-conformance problem.

12.11.1.2 Assign responsibilities for problem investigation.

12.11.1.3 Determine if the condition is significant.

12.11.1.4 Investigate and determine the **root cause** of the non-conformance problem (time, resources, upper management support, training, discipline and/or organization). See Figure 1 for diagram indicating that the surface causes must be broken through to get at and correct the root cause, thus eliminating the problem.

12.11.1.5 Document the root cause within QA Trak or on the Corrective Action Report.

12.11.2 General non-conformance investigative techniques follow the path of the sample through the process looking at each individual step in detail.

12.11.2.1 The problem is identified.

12.11.2.2 A representative checklist has been compiled and is located in Attachment II to assist with this process.

12.11.2.3 Each item in this checklist needs to be investigated until a possible source is ascertained. Documentation must be checked, mathematical computations reviewed, interviews with laboratory personnel must be documented, etc.

12.11.2.4 These will generally lead to causes, which on the surface, may correct the problem, but may not prevent it from re-occurring. The investigator must be diligent in continuing to ask why an issue occurred to ensure the root cause is identified and the true issue may be corrected.

12.11.2.5 An example is noted as follows: Relative Percent Difference outside of acceptance criteria.

Corrective Action

- Why were the results outside of acceptance criteria?
- Check for calculation errors, sample misidentification, transcription errors, and sample contamination (Why?)
- Was the sample homogeneous?
- Simply footnoting the results is not corrective action since no root cause is addressed.

- Based on the evaluation of the Laboratory Non-Conformance, the sample may be re-analyzed, re-tested or re-sampled if necessary. The re-test can be done only if the root cause is identified as an assignable cause.

- Re-Analysis – any additional testing from the original standards and sample preparations. This may include, but is not limited to additional testing of original working solutions, re-dilutions and re-injections of the original sample stock preparations. The re-analysis is a tool used for confirmatory testing to determine whether there is an assignable cause or non-assignable cause for the non-conformance.

- Re-Test – testing new sample from the original sample reserve after results from the original sample have been invalidated following an assignable cause for the non-conformance.

- Re-Sample – an entirely new sample is requested due to holding time being exceeded or lack of original sample.

13. Quality Control

Not Applicable

14. Method Performance

Personnel must read and understand this procedure with written documentation maintained in his/her training file.

15. Pollution Prevention and Waste Management

Not Applicable

16. References

Not Applicable

17. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

17.1 Attachment I – Corrective Action Report

17.2 Attachment II – CAPA Investigation Checklist

17.3 Attachment III – QA Trak Work flow

17.4 Figure I – Root Cause Analysis Figure (The Five Why's)

17.5 Table I – Possible corrective actions

18. Revisions

Document Number	Reason for Change	Date
ALLQ015-Rev.0	First Issue	31Jan2005

Attachment I (Example)

Pace Analytical™

Non-Conformance Corrective/Preventative Action Report

Initiator: ____________________**Date:** _________**CAR No:** ________**Dept. Code:** ______

Project(s): _________________________________ **Project Manager:**___________________

Client: _____________________________**Client Contacted:** yes no

Priority: ___*Immediate Response!* ___**Respond within 24 hours** ___**Respond within 1 week**

Nature of Non-Conformance Discrepancy:

____

Affected Samples(s):____

Corrective Action: ____

Corrective Action Completed By: ________________________________ **Date:** ____________

Preventative Action: ____

Preventative Action Completed By: ________________________________ **Date:** ____________

Routing:

1. **Dept. Manager:** ____ **Date:** ____________
2. **Project Manager:** ______________________________________ **Date:** ____________
3. **Individual Responsible for corrective/preventative action. (see above)**
4. **QAO:** ____ **Date:** ____________
5. **Copy to QAO File:** ________
6. **Copy to General Manager:** ________
7. **Original to Project File:**______

Attachment II (Example)

Tracking Number: CAR#

Client / Project ID:

Analytical Method

Define situation:

If already documented on the corrective action report mark here ☐

Do not destroy and test sample or standard preparations until directed to do so upon completion of the investigation.

YES	NO	
☐	☐	**INSTRUMENT** Has the instrument met the established method specifications in the analytical method? If no, provide comment on what is out of specification and steps taken to bring into compliance.
☐ **Review**		
☐	☐	**TUNING, (when applicable)** Was the system tuned according to specification outlined in the method? If not, explain why samples were analyzed and impact on reported
☐ **Review**		
☐	☐	**INITIAL CALIBRATION(S)** Was the initial calibration within the criteria specified in the analytical method? If no, provide comment on what is out of specification and steps that need to be taken in order to bring the calibration into compliance.
☐	☐	Was a second source standard analyzed to verify the initial calibration? If not, why?
☐	☐	Was the second source within the criteria specified in the analytical method? If no, provide comment on what is out of specification and steps that need to be taken in order to bring the calibration into compliance.
☐ **Review**		
☐ ☐ ☐	☐ ☐ ☐	**CONTINUING CALIBRATIONS** Was a continuing calibration performed at the proper frequency as outlined in the analytical method? Was the continuing calibration analyzed at the proper concentration as outlined in the analytical method? Was the correct initial calibration utilized to evaluate the continuing calibration?
☐ ☐	☐ ☐	**CONTINUING CALIBRATIONS (continued)** The response factors must be spot checked to ensure the calculations are being performed correctly. Completed? Was the continuing calibration within the criteria specified in the analytical method? If no, provide comment on what is out of specification and steps that need to be taken in order to bring the calibration into compliance.
☐ **Review**		

YES	NO	**INTERNAL STANDARD AREA SUMMARY** (mark box if not applicable ☐)
☐	☐	Percent recovery of each internal standard within control limits established within the analytical method and also within the retention time guidelines established in the analytical method? If no, provide comment on what is out of specification and steps that need to be taken in order to bring into compliance

☐ **Review**

YES	NO	**BLANK ANALYSIS**
☐	☐	Compliant method blank analyzed on each instrument associated with sample analysis?
☐	☐	Target analytes present at or below the reporting limits?, If not, provide comment on what is out of specification and steps that need to be taken in order to bring into compliance

☐ **Review**

YES	NO	**LABORATORY CONTROL SAMPLE**
☐	☐	LCS performed with each batch of samples?
☐	☐	Percent recovery of each compound in the LCS with control limits established within the analytical method? If no, provide comment on what is out of specification and steps that need to be taken in order to bring into compliance.

☐ **Review**

YES	NO	**SAMPLE DATA**
☐	☐	All samples were within calibration range of the analytical system?
☐ **Review**		List any sample anomalies and provide comment on what is out of specification and steps that need to be taken in order to bring into compliance.

ADDITIONAL COMMENTS

Attachment III

Corrective action process for PE/PT Failures, Internal Audits, and External Audits.

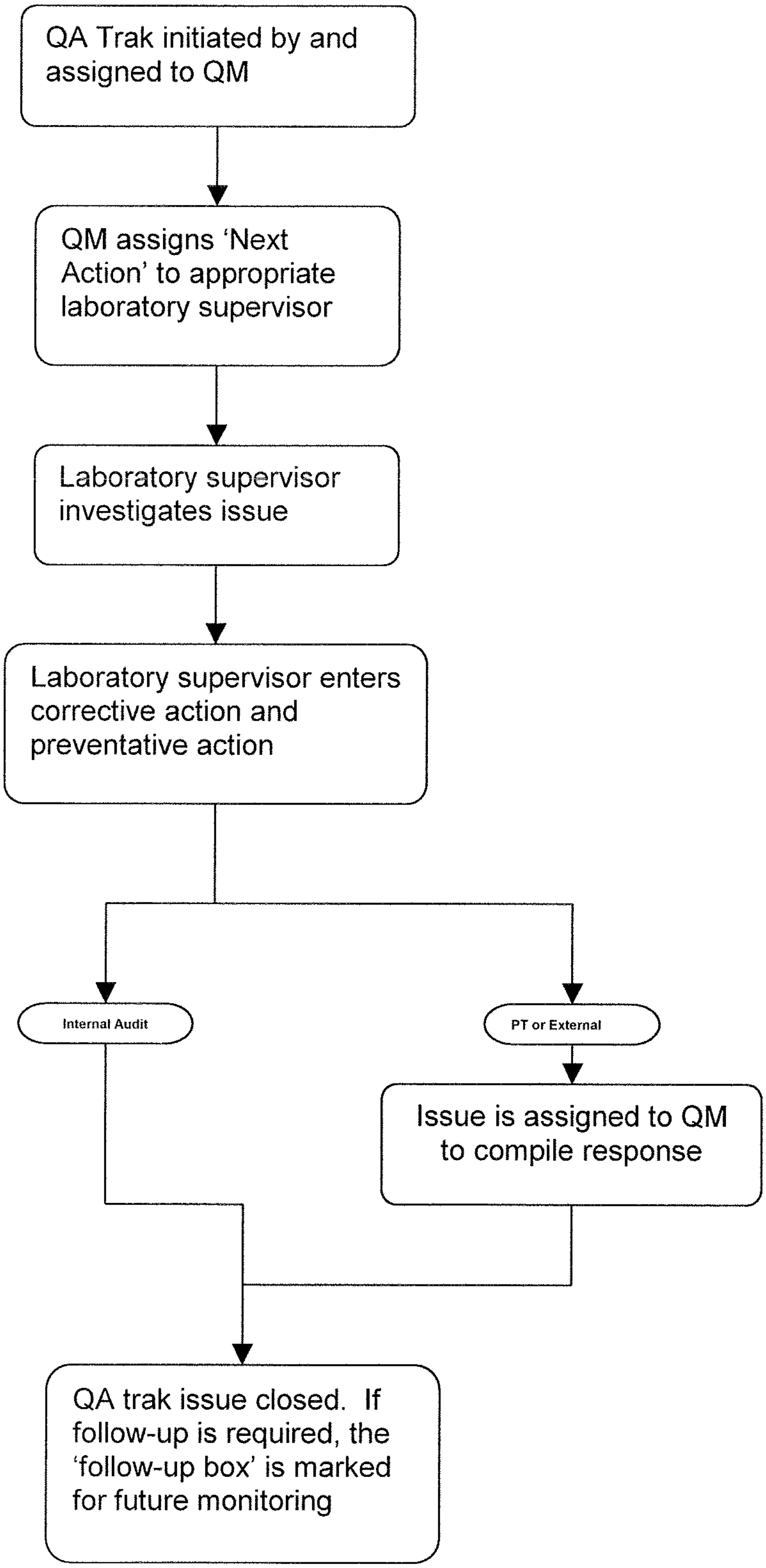

FIGURE 1

(Root Cause Diagram)

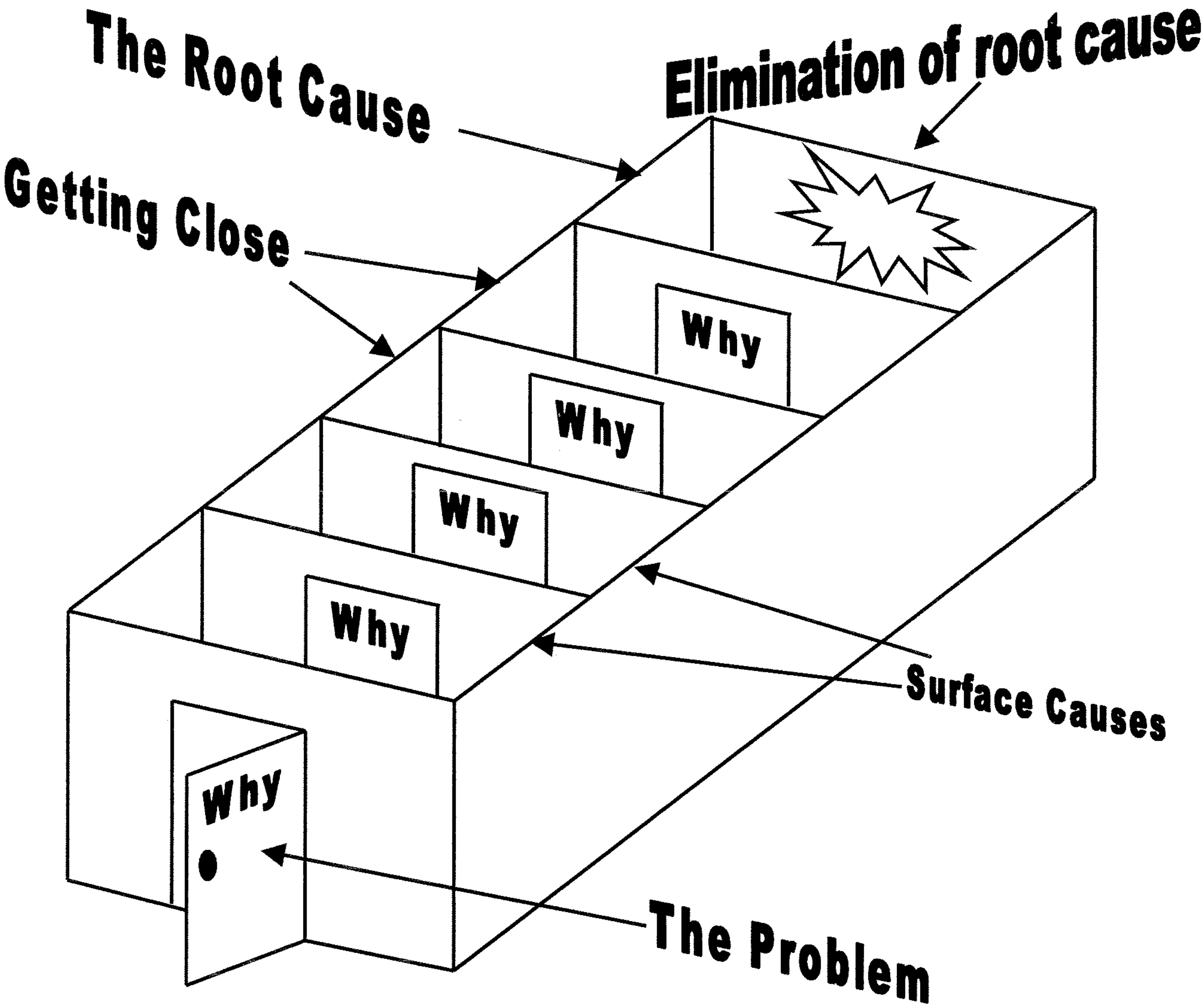

TABLE 1
(Corrective / Preventative Actions)

Problem	Impact of Problem	Corrective Action	Preventative Action
Holding Time			
Samples close to holding time	Other samples delayed	Contact Lab management or client for guidance	Increase lab capacity or use approved backup lab
Sample analyzed past holding time	Possible change in sample composition; data may not be accepted; resampling	Qualify data, or resample depending on client guidance	Communication /action prior to holding time exceedance
Instrument Calibration			
Outside Method Criteria	Possible lack of accuracy or precision in instrument measurements	Take necessary action to obtain acceptable results, Reanalyze affected sample, and Qualify data	Improve performance
Not performed at required frequency	Lack of confidence in instrument performance and associated data	Reanalyze, if within holding time, Qualify data, or Resample	Training, verify by conducting audits
Standards not traceable	Sample data may be inaccurate	Analyze reference material. If acceptable, report qualified data. If not acceptable, reanalyze any affected samples.	Analyze reference material after each initial calibration and document in the calibration file.
Laboratory Control Sample			
Outside Control Limits	Lack of Accuracy for affected analytes	Take necessary action to improve recovery, Reanalyze any affected samples, and Qualify data	Improve laboratory performance
Not included	Laboratory accuracy not known	Reanalyze, Qualify data, or Resample	Training; verify by conducting audits
Field Blank			
Contamination Present	Results for same analyte in sample(s) may be questionable or unusable	Analyze additional field blanks, if available, or Qualify data, or Resample	Improve sampling technique
Not included	Field background not known	Qualify data, or Resample	Contact client to prevent future occurrences

TABLE 1 (continued)

Problem	Impact of Problem	Corrective Action	Preventative Action
Laboratory Blank			
Contamination Present	Results for same analyte in sample(s) may be questionable or unusable	Determine and correct source of contamination, Reanalyze samples, or Qualify data	Improve laboratory procedures for cleaning and avoiding cross-contamination
Not included	Laboratory background not known	Reanalyze, if within holding time, Qualify data, or Resample	Training, verify by conducting audits
Field Duplicates			
Lack of precision	Variability or lack of confidence in sample results	Reanalyze for verification, Qualify data, or Resample	Improve sampling technique
Not included	Field precision not known	Qualify data, or Resample	Contact client to prevent future occurrences
Laboratory Duplicates			
Lack of precision	Variability or lack of confidence in sample results	Reanalyze for verification, Homogenize and reanalyze sample, if available, or Qualify data	Evaluate sample; if required, improve laboratory procedures
Not included	Laboratory precision not known	Reanalyze, if within holding time, Qualify data, or Resample	Training, verify by conducting audits
Matrix Spike/Matrix Spike Duplicate			
Outside control limits	Possible bias in sample results	Check LCS, and qualify affected data	Evaluate sample, if required improve laboratory procedures
Not included	Sample bias not known	Reanalyze, if within holding time, Qualify data, Resample	Training, verify by conducting audits

TABLE 1 (Continued)

Problem	Impact of Problem	Corrective Action	Preventative Action
Surrogates			
Outside control limits for sample	Possible bias in sample results	Evaluate data, Reanalyze sample, and Qualify data if results duplicate or report reanalysis of acceptable	Evaluate sample matrix bias, if required, improve laboratory procedures
Outside control limits for blank or LCS	Questionable laboratory performance and sample data	Check calculations Take necessary action to correct recovery, and reanalyze affected samples	Improve laboratory performance
Not included	Sample specific recovery not known	Reanalyze, if within HT, Qualify data, or Resample	Training; verify by conducting audits
Other			
Incorrect calculation	Can result in inappropriate decision	Correct incorrectly calculated results, if calculation error is identified, and Correct laboratory calculation procedures	Training, verify by conducting audits and introducing blind samples to check calculations.
Transcription or reporting error	Can result in inappropriate decision	Correct incorrect results, if transcription/reporting error is identified	Training, verify by conducting audits and introducing blind samples to check reporting procedures
Incomplete laboratory documentation	Lack of defensibility	Obtain documentation, if available	Improve documentation procedures so that records area attainable
Insufficient sample	Higher detection limit or cannot perform tests	Use another bottle, if available, or Resample	Review Pace Analytical Organic/Inorganic Analytical Guide
Incorrect bottle type	Contamination(i.e., phthalates), adsorption (i.e., fluoride on glass), or light degradation (i.e., PAHs)	Use an appropriate bottle, if available, or Resample Qualify data and contact client	Review Pace Analytical Organic/Inorganic Analytical Guide

TABLE 1 (Continued)

Problem	Impact of Problem	Corrective Action	Preventative Action
Other (Continued)			
Samples not chemically preserved	Possible change in sample composition	Use another preserved bottle, if available Preserve immediately if appropriate, or Resample Qualify data and contact client	Review Pace Analytical Organic/Inorganic Analytical Guide
Sample preserved incorrectly (i.e., HCl instead of H_2SO_4)	Contamination or analytes of interest could be affected	Use a correctly preserved bottle, if available, or Resample	Review Pace Analytical Organic/Inorganic Analytical Guide
Samples not chilled to 4°C	Possible change in sample composition due to evaporation or decomposition	Chill immediately, Contact client and analyze as received or qualify data, or Resample	Review Pace Analytical Organic/Inorganic Analytical Guide
Sample received outside of holding time	Possible change in sample composition; data may not be acceptable	Contact client and analyze as received with qualifications, or Resample	Review Pace Analytical Organic/Inorganic Analytical Guide
Trip blank contamination	Sample results may be questionable or unusable	Analyze all other field and lab blanks to determine source of contamination, Qualify data, or Resample	Eliminate source of contamination either in the laboratory or by contacting the client
Chain of Custody (COC) record not used or incomplete	Data may not be legally admissible	Contact client and prepare COC record, Analyze sample as received and qualify data, or Resample	Contact client to prevent future occurrences
Custody seal not used or not intact	Data may not be legally admissible	Contact client and analyze sample as received and qualify data, or Resample	Use secure custody seals, when required by the client
ID on sample label does not match COC record	Cannot prove sample identification	Contact client, Review field records to determine correct ID, or Resample	Contact client to prevent future occurrences

STANDARD OPERATING PROCEDURE
STANDARD AND REAGENT MANAGEMENT AND TRACEABILITY

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STANDARD OPERATING PROCEDURE

Standard and Reagent Management and Traceability

Reference Methods: none

SOP NUMBER: ALL-Q-025-rev.1

EFFECTIVE DATE: Date of Final Signature

SUPERSEDES: ALL-Q-025-rev.0

APPROVAL

John P. Dullagh	7/12/06
John P. Dullaghan, COO	Date
	7-7-06
Brad A. Meadows, QST Director	Date
	15MAY2007
Laboratory General Manager	Date
	19 OCT 2006
Laboratory Quality Manager	Date

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Table of Contents

1. Purpose

The purpose of this SOP is to provide the laboratory specific procedures for the management and traceability of standards and reagents used in the laboratory. Procedures specific to the preparation of the standards or reagents described within will be contained in the SOPs specific to any given method. Given the array of requirements across similar methodologies, the intent of this SOP is to provide direction and a base set of guidelines that the laboratory will follow in the event a method lacks the specificity required to ensure accuracy, precision and traceability of measurements.

2. Scope and Application

The policies and procedures contained in this SOP are applicable to all personnel involved in the preparation of standards and reagents within this facility.

3. Summary

3.1. Standards and some reagents are purchased with Certificates of Analysis (COA) that document the purity and source of neat or stock materials. The COA includes the manufacturers' lot number and statements of purity; the COA provides traceability back to the NIST certified material.

3.2. Materials and solutions used for organic and inorganic preparations and analyses are prepared according to method, laboratory SOP or manufacturer's instructions. The preparation of these materials is recorded in standard logbooks (either bound or electronic) to provide traceability of final analytical results back to the stock standards or reagents used in the analysis. Ultimately, the laboratory must be able to trace the final analytical result back to the NIST certified material.

3.3. The documentation must include but is not limited to the purity of the stock standard or reagent, the source of the material, the concentration(s) prepared, the date prepared, the expiration date and the initials of the preparer. Each standard is given a unique number that is traceable throughout the analytical process.

4. Interferences

Not applicable to this SOP.

5. Safety

5.1. The toxicity or carcinogenicity of each reagent used in the analytical methods may not be fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included in the analytical SOPs for known extremely hazardous materials or procedures.

5.2. Each laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals. A reference file of Material Safety Data Sheets (MSDS) must be made available to all personnel involved in the chemical analysis. The preparation of a formal safety plan is also advisable.

5.3. Analysts should take necessary safety precautions when handling chemicals and samples. Proper personal protective equipment may include safety gloves, lab coats, and safety glasses or goggles. Analysts should be familiar with the MSDS sheets for all chemicals and reagents they use for this procedure and the location of the MSDS sheets within the laboratory. Any questions or concerns should be taken to the laboratory Chemical Hygiene/Safety Officer.

6. Definitions

6.1. **Traceability** - The ability to trace the source and accuracy of a material or prepared solution (i.e. standard) to a recognized certified source through an unbroken chain of references and / or documentation.

6.2. **Neat Material** – A commercially purchased, base material obtained in a highly purified form. Neat materials are weighed and diluted in an appropriate solvent to create stock standard solutions. Neat materials with purities of greater than or equal to 96% may be used without a mathematical correction for purity.

6.3. **Stock Standard** – A concentrated reference solution containing one or more analytes prepared in the laboratory using a neat material or purchased from a reputable commercial source. Stock standards purchased from commercial sources must be accompanied by a Certificate of Analysis that documents the manufacturer, the manufacturer's lot number, the concentration(s) of all analytes and the expiration date of the standard.

Ampulated Stock Solutions

Stock standards purchased from a certified source are regularly received in amber (occasionally clear) glass ampules. They are certified for accuracy and hermetically sealed to prevent against degradation. While these standards remain unopened, the laboratory may treat them as "neat" standards, observing the manufacturers' expiration date. Once opened, the specific ampule is considered a stock standard and needs to be treated as such. The day the ampulated standard is opened will be used as its creation date from which all expiration dates will be based.

Stock standards diluted with solvent by any factor are no longer a "stock standard solution". It is now considered an intermediate or working standard solution (depending on the usage) and should be stored and handled as such.

6.4. **Intermediate Standard Solution** – Reference solutions prepared by dilution of the stock solutions with an appropriate solvent. Intermediate standards are made to lessen the degree of dilution required in the preparation of working solutions. Intermediate standards are similar to stock solutions in that they are not accessed on a regular basis as part of the analytical process.

6.5. **Working Standard Solution** – Reference solutions that are used in practical laboratory work, i.e. for the preparation of calibration curves. Working standard solutions can be prepared from either the intermediate or the stock solutions, depending on the desired concentration.

6.6. Additional definitions can be found in the Glossary of the Quality Manual.

7. Sample Collection, Preservation, and Handling

Not applicable to this SOP.

8. Equipment and Supplies

8.1. **Standard logbooks**: Bound and paginated (or electronic); an example standard preparation logbook page is attached to this SOP.

9. Reagents and Standards

9.1. **Reagents and Analytical Standards:** specific reagents and standards are not listed in this SOP. For this information, please consult the individual method SOPs.

10. Calibration

Not applicable to this SOP.

11. Procedure

11.1. Procurement and Inventory Control

Chemical standards of the highest purity should be purchased whenever possible from available suppliers. NVLAP, EPA, A2LA or NIST-traceable standards are to be used for calibration standards and second source verification standards, as available. When stock solutions are available from suppliers, these can be used in place of standards prepared in the laboratory from neat compounds.

The Certificates of Analysis accompanying the standards or reagents must be kept so that standard solutions can be traced back to the original material received by the laboratory. Stock solutions and neat materials must be assigned a unique identification number on receipt and the date received must be noted on the container. The laboratory must have a logbook (hardcopy or electronic) for this purpose; it may be combined with the standard preparation logbook to minimize the number of logbooks distributed to the laboratory.

In the absence of an equivalent alternative process, the identification number assigned to the standard should be recorded on the appropriate COA for ease of traceability. The COA must be stored in a logical, sequential order to facilitate retrieval.

11.2. Expiration Dates and Storage Conditions

All standards and reagents used in the laboratory must have an expiration date. Standards and reagents still in existence after this date must be removed from the laboratory and should be given to the person in charge of hazardous waste disposal. The laboratory is not permitted to use expired standards and reagents in any part of the analytical process where test results are to be reported to a client, agency or other data user. Should the laboratory elect to not immediately dispose of expired standards, they must be clearly marked as unusable and segregated from all other standards to prevent accidental use.

Most analytical methods provide some type of expiration date requirement for the standards and reagents associated with the method. However, methods from different programs or agencies that are similar in nature with similar compound lists may not necessarily be in agreement on the guidelines for establishing these dates. Likewise, standard and reagent manufacturers may not be in agreement over the stability or storage conditions of their products. **Therefore, PASI laboratories will observe the following guidelines for establishing expiration dates and storage conditions in the absence of method specific requirements.**

11.2.1. _Storage Conditions- All Standards_ - All standards will be stored at the conditions specified for the parent standard. If purchased from a commercial source, this means that all standards are stored according to the manufacturers recommended conditions. In the event a standard is made from more than a single source with different condition, the child standard will be stored according to the conditions specified in the analytical method.

If the manufacturer does not provide recommended storage conditions, store them as follows: volatile organics, store frozen; semi-volatile organics, store refrigerated; wet chemistry, store at room temperature; metals, store at room temperature. For all other general standards and reagents not listed above, store at room temperature.

Reagents and standards stored at other than ambient temperature shall be equilibrated to ambient temperature prior being opened for use.

11.2.2. *Expiration Dates - Semi-volatile Organic Standards* - Stock standards will be given a one year expiration date from the date of creation and refrigerated. This applies to all standards made from neat sources or opened from a sealed ampule. However, the expiration date observed may not extend past the manufacturer's expiration date.

Working, intermediate and calibration standards will be given a one year expiration date. However, the expiration date may not extend past the earliest expiration date of any stock standard used to create the solution. If made as dilutions from stock solutions, these standards include the 2nd Source, LCS, matrix, internal standard and surrogate spiking solutions used for sample preparation.

11.2.3. *Expiration Dates - Volatile Organic Standards* - Non-Gas stock standards will be given a six month expiration date and stored frozen. This applies to all standards made from neat sources or opened from a sealed ampule. However, the expiration date observed may not extend past the manufacturers expiration date.

Gas stock standards will be given a two month expiration date and stored frozen. This applies to all standards made from neat sources or opened from a sealed ampule. However, the expiration date observed may not extend past the manufacturers expiration date.

If intermediate or working standards contain gas components, assign a one week expiration date. Otherwise, the expiration date will be one month from the date of creation. However, in either case, the expiration date may not extend past the earliest expiration date of any stock standard used to create the solution. If made as dilutions from stock solutions, these will include the LCS, matrix, internal standard and surrogate spiking solutions used for sample preparation.

Calibration and calibration verification standards must be made on the day of use.

11.2.4. *Expiration Dates - Wet Chemistry Standards* - Stock standards, if made from neat sources, will be given a one year expiration date and stored at room temperature. The expiration date observed may not extend past the neat standard's expiration date. Certified stock standards obtained from commercial suppliers may be used up to the manufacturer's expiration date.

Intermediate and Working standards will be given a three month expiration date. However, the expiration date may not extend past the earliest expiration date of any stock standard used to create the solution.

Calibration and calibration verification standards should be made on the day of use.

11.2.5. *Expiration Dates - Metals Standards* - Stock standards, if made from neat sources, will be given a one year expiration date and stored at room temperature The expiration date observed may not extend past the neat standard's expiration date. Certified stock standards obtained from commercial suppliers may be used up to the manufacturer's expiration date.

Intermediate and Working standards will be given a six month expiration date. However, the expiration date may not extend past the earliest expiration date of any stock standard used to create the solution.

Calibration and calibration verification standards should be made on the day of use.

11.2.6. *Expiration Dates – Isotopically Labeled Standards* - Stock solutions containing isotopically labeled compounds are routinely received with expiration dates exceeding one year. Given the stability of the dioxin, polychlorinated biphenyl and other similarly structured isomers and the typical low volatility of the stock solution diluent, standards for these analyses may be used up to the manufacturers' expiration dates regardless of the day the original container may have been opened.

Intermediate and working solutions will be assigned an expiration date of one year. However, the laboratory may elect to perform a verification process allowing the expiration date to be extended for another year. This process may continue until the expiration exceeds that of the original stock solution.

The standard verification process with acceptance criteria is outlined in the method specific SOP.

11.2.7. *Expiration Dates - Air Standards* - Standards for air analysis may be received in a variety of forms. Some standards are single or multi-component standards prepared and certified commercially. Other standards may be received as neat materials, gaseous or liquid, and need to be prepared into an intermediate standard.

Standards received as certified mixtures from commercial sources or as neat materials may be used up to the manufacturers specified expiration date. In the event the laboratory has not consumed the entire contents of the standard, the laboratory may elect to have the standard (certified mixtures) recertified against an NIST standard by a third party.

Standards prepared in SUMMA canisters by the laboratory from the certified mixtures or the neat materials must be assigned an expiration date one month from the date of preparation, or equivalent to the expiration of the parent standard(s), whichever is sooner. On expiration, these standards must be removed from service and discarded. No recertification process is available for these prepared standards.

11.2.8. *Expiration Dates - Bulk Chemicals -* When no other expiration date is provided by the manufacturer or method, the following default expiration dates are used for bulk chemicals:

- Dry inorganic chemicals: 5 years from receipt
- Aqueous acids: 2 years from receipt
- Organic solvents: 2 year from receipt
- Other aqueous solutions: 1 year from receipt

11.3. Documentation – Recordkeeping and Labeling

11.3.1. *Expiration Dates by Month / Year* - When an expiration date on a chemical is listed in the form of month/year, the default expiration date is to be the last day of the indicated month (i.e. if the expiration date is listed as May 2004, then the actual expiration date to be recorded should be May 31, 2004). In the absence of a recordkeeping system that mandates a particular date format, the date will be recorded in the format "mm-dd-yy".

11.3.2. *Standard Concentrations* - Standards produced by commercial vendors are almost always advertised and sold at even rounded concentrations (i.e. 2000ppm, 1000ppm, 500pm). However, the actual standard received may not necessarily reflect the exact concentration advertised. The concentration indicated on the Certificate of Analysis may indicate a value close to but slightly different than the theoretical value with some amount of uncertainty for the measurement.

When documenting these standards and their concentrations, the laboratory may use the theoretical concentration (i.e. 2000ppm) in place of the certified concentration (i.e. 2010ppm) if the theoretical concentration falls within the measurement of uncertainty assigned to the certified value. In this case, if the measurement of uncertainty were ±15ppm (1995 – 2025ppm), then the laboratory may record and use the value of 2000ppm in all calculations. If the measurement of uncertainty were ±5ppm (2005-2015ppm), then the laboratory must record 2010ppm as the true value of the standard and use this value in all calculations.

11.3.3. The preparation of all stock solutions, working standards, and calibration standards must be documented in a standard preparation logbook or electronic equivalent. Each lab area has a standard preparation logbook assigned by the Quality Manager or has an electronic access database available to log in standard or reagent preparations.

11.3.4. Each entry should be initialed and dated by the analyst and given a unique number. Each individual laboratory has their own code for their standards . This number is then used to represent that standard in future entries in the standard prep logbook (dilutions, for example), entries in the instrument or sample preparation logbooks for calibration standard preparation or for use in samples. Each standard is therefore traceable from the analysis of samples back through the standard preparation logbook and end at the vendor-supplied COA.

11.4. Any calibrated equipment (i.e. balance or autopipette) used in the preparation of solutions from neat standards must be clearly identified and documented using an instrument or serial number.

11.5. Other information which must be documented in the standard preparation logbook includes:

11.5.1. Name of standard or reagent

11.5.2. Purity of reference standards prepared from neat, if known

11.5.3. Concentration of original material and final concentration of prepared standard

11.5.4. Manufacturer or supplier of the original material

11.5.5. Identity and lot number of the solvent used, if any, to dilute the original material

11.5.6. The expiration date of the original material and the expiration date of the prepared working standard

11.5.7. Date of standard preparation and initials of preparer

11.6. The actual standard or reagent containers must also be clearly labeled. Standards or reagents received from an outside vendor must be labeled with receipt date by sample receiving personnel or by the analyst. The analyst must then assign an opening date when the standard or reagent is opened and an expiration date (described above). Working standards or reagents must also have an expiration date on their container.

11.7. Besides an expiration date, the working standard or reagent must have the following information written somewhere on the standard container:

11.7.1. The number identification which traces the standard or reagent back to the standard preparation logbook

11.7.2. The name or description of the standard or reagent

11.7.3. The expiration date of the standard or reagent

11.8. Standard Verification:

11.8.1. *Calibration Standard Verification* - A standard prepared from a second source stock solution (purchased from a vendor other than the supplier of the calibration stock standard or from the same vendor but originating from a different preparation lot) containing the full list of target analytes is analyzed. The calculated concentration is used to verify the accuracy of the calibration standard solutions.

Few, if any, analytical methods provide specific criteria for the evaluation of a secondary source verification standard. Therefore, unless criteria are specified in the determinative method, the control range used for secondary source verification (also known as Initial Calibration Verification [ICV]) will be 10 percentage points greater than the control criteria used for the continuing calibration verification. If the calibration contains more than 20 compounds of interest, then up to 5% of the compounds (marginal exceedances [ME]) may use control criteria 20 percentage points greater than those used for the continuing calibration verification. An example of these applied criteria is listed below.

Method	CCV Limits	2nd Source Limits	ME Allowance Limits
8021 (Full List)	± 15%	± 25%	± 35%
8081 (DDT, DDE, DDD)	± 15%	± 25%	None
8260 (BTEX Only)	± 20%	± 30%	None
8270 (Full List)	± 20%	± 30%	± 40%

For those analytical methods that require control on only a subset of target compounds (i.e. 8260B, 8270C), the CCV criteria specified for these subsets will be applied across the entire target compound list. All target compounds must be evaluated against a secondary source standard.

Sample analysis should not begin before the calibration can be successfully verified against a secondary source. Instruments not meeting these criteria need to be maintained, restored to working order and recalibrated. In the event that analyses have commenced prior to this corrective action (i.e. due to automated analyses performed during off hours), the laboratory may report data against the original calibration provided that:

- No additional sample is available for analysis.
- Results for analytes not meeting verification criteria are qualified and reported as estimated values.

Preparation of the calibration verification standard must be documented in the same manner as the calibration standards to maintain traceability back to the secondary source. A CCV report (% Difference / % Drift) should be generated to easily determine the acceptance of the calibration verification.

11.8.2. *Extractable Spike Verification* - All organic extractable spiking solutions should undergo a documented verification prior to be used on extractable samples. This includes all matrix spikes, LCS and surrogate solutions. The verification requirement is not mandatory for all PASI laboratories. However, if spike verification is required by accrediting authority, program or a specific client, then the laboratory will follow the following guidelines and requirements.

After spiking solutions are prepared and prior to use on samples, a small amount of each solution is placed in a labeled vial and given to the applicable analyst. The verification should be prepared at the concentration the laboratory would expect to find assuming 100% extraction efficiency. These diluted spikes should not be stored with sample extracts but, in the event they are, must be clearly marked so as to not confuse this standard with an actual extracted spike.

The applicable analyst runs the freshly-prepared spiking solutions in the same manner as normal samples and determines the percent recovery of each analyte. The laboratory will evaluate the recoveries against a predetermined set of control limits and determine the acceptability of the solution for use. The control criteria will be determined by the individual laboratory and documented in the analytical method-specific SOP. Solutions not meeting the laboratory's acceptance criteria will be discarded and a new solution prepared.

Adequate documentation must exist such that the laboratory can reliably trace the verification of the standard back to the actual raw data. It is recommended to record the instrument, the date of analysis and data file ID in the recordkeeping system to maintain this traceability.

12. Quality Control

12.1. Reagents and stock standards accompanied by a Certificate of Analysis do not require testing prior to being used. Quality is verified through routine Quality Control analyses of Laboratory Control Samples, Initial Calibration Standards, Continuing Calibration Standards, and Method Blanks. QC criteria are defined in the analytical method Standard Operating Procedures. QC results can be found in the laboratory specific database.

12.2. Reagents without a Certificate of Analysis, and reagents to be used in analyses of samples that can **not** be reanalyzed, are tested for contamination and results are recorded in the reagent logbook. Reagents with interfering contaminants detected above the method reporting limits must not be used. Contaminated reagents should be returned to the manufacturer.

12.3. If sample reanalysis is unlikely (due to short hold times or limited sample quantities), the suitability of all reagents to be used in original analyses of those samples must be verified prior to use.

12.4. All logbooks, including standard preparation logbooks, must be periodically audited, at a minimum of once per year, by the Quality Manager. Any deviations from the policies in this SOP will be noted by the Quality Manager and reported to management.

13. Method Performance

13.1. The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14. Pollution Prevention and Waste Management

14.1. Procedures for handling waste generated during this analysis are addressed in individual laboratory SOPs for waste management.

14.2. In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount that may be used in a reasonable amount of time (i.e. before a reagent expires).

14.3. The laboratory Chemical Hygiene Plan contains additional information on pollution prevention.

15. References

15.1. Pace Quality Manual

15.2. NELAC Standard Chapter 5 "Quality Systems", 2003

16. Tables, Diagrams, Flowcharts, Attachments, Appendices, Etc.

Not applicable to this SOP.

17. Revisions

Document Number	Reasons for Change	Date
ALL-Q-025-rev.0	New Document	2/28/2006
ALL-Q-025-rev.1	Revised to modify expiration dates Revised verification requirements Added specific conditions by analyses Revised overall content and format	7/7/2006

STANDARD OPERATING PROCEDURE
SAMPLE MANAGEMENT

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STANDARD OPERATING PROCEDURE

SAMPLE MANAGEMENT

Reference Methods: N/A

LOCAL SOP NUMBER: S-MN-C-001-Rev.01
EFFECTIVE DATE: 10 June 2008
SUPERSEDES: S-MN-C-001-Rev.00
SOP TEMPLATE NUMBER: SOT-ALL-C-001-Rev.00

LOCAL APPROVAL

Laboratory General Manager — Date: 09JUN2008

Laboratory Quality Manager — Date: 10 Jun 2008

Michelle Kruse
Department Manager — Date: 6/9/08

ANNUAL REVIEW
SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

This is **COPY#**__12__ distributed on _23 Dec 08_ by ___mae__and is ______**CONTROLLED or** __X___**UNCONTROLLED.**

TABLE OF CONTENTS

SECTION **PAGE**

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to outline the procedures involved with the receipt, login, and staging for samples received by Pace Analytical Services, Inc, MN.

2. Scope and Application

2.1. The policies and procedures contained in this SOP apply to all personnel involved in the receipt, login, analysis, disposal, and transfer of samples.

2.2. A sample acceptance policy is contained within the procedure section that outlines guidelines for acceptable sample conditions (11.1.5). Any deviation from these guidelines requires detailed documentation within the report as a footnote, on the chain-of-custody (COC), or Sample Condition Upon Receipt Form (SCURF) and may require client contact.

3. Summary of Method

3.1. The laboratory receives samples from several shipping methods. Upon receipt, samples are checked for adherence to the Sample Acceptance Policy with any discrepancies noted. Discrepancies are communicated to the client for their acknowledgement.

3.2. The Laboratory Information Management System (LIMS, EpicPro) assigns all samples with a unique sample number and manages the analyses assigned to each.

3.3. Samples receive a barcode label and are staged in refrigerated storage, if necessary. If no refrigeration preservation is required, samples are stored on open air shelves. Samples will remain under these conditions until prepared and / or analyzed.

3.4. Samples and associated sub-samples (digestates, extracts, etc.) are maintained for 30 days after the final report is issued unless otherwise requested by the client or other regulatory agency. Air samples have different method specific requirements.

3.5. Samples are disposed of in accordance with local laboratory regulatory requirements and the laboratory's waste handling procedures.

4. Interferences

4.1. Samples may be prone to cross contamination from others within the same delivery group or from other client projects. The sample receiving personnel must ensure that no cross contamination occurs.

4.2. Preservation checks are one of the most likely situations where cross contamination may occur. Materials used in the process must be specific to each sample and may not used for multiple samples.

4.3. Samples are stored under specific conditions and in specific locations, typically by container type. However, consideration must be given to samples that are uniquely different from others. Samples that are anticipated to be severely contaminated should be segregated from others in anticipation that the high levels of contaminants may cross contaminate others in close proximity.

5. Safety

5.1. Hazards and Precautions - Use extreme caution in handling samples and wastes as they may be hazardous. Each sample, reagent, and chemical used in this method should be treated as a potential health hazard. Reduce exposure by the use of gloves, lab coats, safety glasses and ventilation hoods. Material Safety Data Sheets (MSDS) for each reagent and chemical used are on file and available to all personnel.

5.2. All personnel involved in sample management are responsible for complying with OSHA and DOT regulations. These regulations pertain to the safe handling and/or shipping of the chemicals specified in this procedure. A reference file of Material Safety Data Sheets (MSDS) is available to all personnel. Refer to the Sample Control Supervisor for any questions or concerns related to the safe handling and shipment of hazardous materials.

5.3. Other laboratory safety requirements are contained in the Chemical Hygiene Plan/ Safety Manual. Immediate questions can also be addressed with the local Health and Safety Officer.

6. Definitions

6.1. Definitions of terms found in this SOP can also be found in the Pace Quality Manual. When definitions are not consistent with NELAC defined terms, an explanation is provided in this SOP or the Pace Analytical Services' Quality Manual Glossary.

6.2. **LIMS - Laboratory Information Management System:** a computer system used to manage the flow and traceability of environmental samples and associated data within the laboratory.

6.3. **NELAC - National Environmental Laboratory Accreditation Conference:** a national laboratory-accrediting agency.

6.4. **MSDS - Material Safety Data Sheet:** contains information on chemicals used in the laboratory.

6.5. **COC - Chain-of-Custody:** a form used to record the field identification of samples collected, analyses requested, date and time of collection, sample preservation used, and traceability of samples from time of collection until delivery to the laboratory. This is a legal document.

6.6. **SCURF - Sample Condition Upon Receipt Form:** a form used to record the condition of samples received in the laboratory.

6.7. **Matrix:** the bulk characteristics of a sample. See Table 6.1.

6.8. **SRF – Sample Receipt Form:** form generated by LIMS system after a project is logged in. Contains sample and project information.

6.9. **UN Number** - identification numbers preceded by the letters UN are associated with proper shipping names considered appropriate for international and domestic transportation. These shipping names along with the identification numbers are located in the Federal Register (49CFR172.101).

6.10. **Sample Custody:** a sample is considered to be in someone's custody if:

6.10.1. It is in one's physical possession.

6.10.2. It is in someone's view, after being in someone's physical possession.

6.10.3. It is kept in a secured area, restricted to authorized personnel only.

Table 6.1

NELAC defined matrix	Pace Analytical defined matrix
Aqueous: any liquid sample not defined as drinking water or saline. Includes surface water, groundwater, effluents, TCLP and other extracts.	Waters: includes groundwater, wastewaters, drinking waters, effluents, and any free-flowing liquids.
Drinking water: any aqueous sample that has been designated as potable or potentially potable.	Not assigned as a separate matrix, but samples are assigned to drinking water methods.
Saline/Estuarine: any aqueous sample from an ocean, estuary or other salt water source	Not assigned as a separate matrix from waters.
Non-aqueous liquid: any organic liquid with <15% settleable solids.	Other: Not assigned as a separate matrix from waters.
Biological tissue: any sample from a biological origin such as fish tissue or plant material.	Tissue: would include tissue and plant samples.
Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids	Soils: includes soils, sediments, sludges; other solid materials such as wood, metal, etc. may fall under another heading.
Chemical waste: a product or by product of an industrial process that results in a matrix not defined above.	Oil: includes any non-solid material not classified as waters.
Air: vapor samples including those contained within sorbent tubes, filters or other devices.	Air: vapor samples including those contained within sorbent tubes, filters, or other devices.
No corresponding matrix to wipe; wipes would be included in with solids.	Wipe: includes wipe samples or swabs taken to check for surface contamination.

7. Sample Collection, Preservation, and Handling

7.1. Acceptable sample preservation, containers, and hold times are located in Pace Analytical Services' Quality Manual, the laboratory's method SOP, or in the applicable test method. Samples are stored separately from all standards and reagents and any known highly contaminated samples.

NOTE: To avoid contamination, no food or drink products can be located near the areas where samples are unpacked, labeled, or staged.

7.2. Sample Storage – See Section 11.3 for general storage guidelines.

8. Equipment and Supplies

Table 8.1

Equipment/Supplies	Description/ Comments
Sample Labels	
Thermometers	Infrared, digital, NIST traceable
Sample storage cooling units	Capable of holding required storage temperatures
Chain-of-Custody forms	
Sample Condition Upon Receipt Form (SCURF)	
pH Paper	
Label Printer	
LIMS computer system	EPIC Pro
Disposable pipettes	
Sample containers	C&G

9. Reagents and Standards

9.1. All reagents used in this procedure must be labeled with:

- Laboratory reagent identification number
- Unless otherwise noted, the name and concentration of the reagent

- Date the reagent was received, opened and, as needed, prepared
- Person preparing reagent
- Expiration date

9.2. **Reagents**

Table 9.1 – Sample Preservation Reagents

Reagent	Formula	Concentration
Sulfuric Acid	H_2SO_4	1+1
Nitric Acid	HNO_3	1+1
Hydrochloric Acid	HCl	1+1
Sodium Hydroxide	NaOH	50% or Pellets
Sodium Thiosulfate	$Na_2S2O_3{\cdot}5H_2O$	
Zinc Acetate Solution (for sulfide)		
Methanol	MeOH	Purge and Trap Grade
Ascorbic Acid (for cyanide and 524)		
Sodium Bisulfate		

9.3. The information for acids, bases, and other reagents from other laboratory departments is located in the department's reagent preparation log. In the event that these reagents are managed within the Sample Receiving group, the department must maintain its own reagent preparation log.

10. Calibration

10.1. Thermometers and other equipment used for measuring temperatures must be calibrated according to S-ALL-Q-013, *Support Equipment*. IR Guns are calibrated monthly.

11. Procedure

11.1. Sample Receipt

11.1.1. The laboratory receives client samples via three major methods: mail/commercial delivery service, Pace Analytical courier/field services, and hand delivery.

11.1.2. The chain of custody (COC) (see Attachment I) is signed immediately upon receipt of the samples from the client. If the client drops off the samples or they are picked up by the Pace courier, a copy of the signed COC is given to the client at that time. If samples are received via commercial carrier or mail delivery, the COC should be signed immediately when the cooler or package is opened and ultimately placed in the project file.

11.1.3. Sample Receiving personnel should review the COC for any indication of rush turnaround requests and analyses with short hold times. Projects that fall under these conditions should be given immediate attention. If the lab has not been previously notified by the client of an incoming rush, the project manager must first confirm with the client before processing. Once the sample(s) are logged into the LIMS, the sample technician and project manager will coordinate the notification and delivery of samples to the laboratory.

11.1.4. Pace Analytical has a full-time courier who picks up client samples on a regularly set schedule or an as-needed basis communicated by project management staff or direct client interaction.

When the client is present during a courier pick-up the client signs the COC relinquishing the samples to the Pace courier. The courier signs the COC as accepting the samples and provides the client with a copy of the COC. When the courier returns to the laboratory with the client samples he/she signs the COC as relinquishing the samples to the laboratory.

If the client is not present during pick-up, the courier signs the COC as accepting the samples and leaves a copy of the COC for the client. In addition, many clients have a sample log which the courier signs and dates when the samples are picked up. When the courier returns to the laboratory with the client samples he/she signs the COC as relinquishing the samples to the laboratory.

To ensure sample security the Pace courier custody seals all coolers being picked up and the courier vehicle is locked at each client pick-up location.

11.1.5. **Sample Acceptance Policy** - This section constitutes the laboratory's sample acceptance policy. Copies of this policy should be provided, in the form of a letter, fax, or e-mail to each client or sampler, as necessary. Samples are considered acceptable if they meet the following criteria:

- There is proper, full, and complete documentation (i.e. chain-of-custody) including:
  - Unique client sample identification. Sample containers are labeled using unique client sample identifications (traceable to the chain-of-custody or other documentation) on durable, waterproof labels or equivalent.
  - Location of sampling (site), time and date of sample collection;
  - Sampler's name and signature;
  - Preservative used (if any);
  - Sample type (matrix);
  - Requested analyses;
  - Any special analysis requirements
- Appropriate sample containers have been used.
- Holding times have not been exceeded upon receipt (holding times are available in Attachment IV). If they have been exceeded, client permission to proceed is required.
- Adequate sample volume has been received for all tests requested (if not, client permission to proceed is required). For data packages requiring quality control samples to be analyzed on client specific samples, the client must include enough sample to complete the QC samples as well.
- When there is insufficient sample to complete the QC samples and the client does not wish to send more sample or more sample cannot be obtained because of sample volume available or holding time issues, the lack of appropriate volume or weight is noted as a sample acceptance policy deviation on the final report. Batch quality control samples will be used in place of project-specific quality control samples.
- Samples that require sub-ambient thermal preservation are considered acceptable if they are within +/- 2.0 °C of the required temperature (for samples needing to be at 4.0 °C, the acceptable range is just above freezing to 6.0 °C, as defined by NELAC). The sample cooler (ice chest) temperature is recorded directly on the COC. Samples received outside of this criterion must have a notation on the COC and/or on the SCURF, indicating the temperature was outside of criteria upon receipt.
- Samples delivered to the lab immediately after collection are considered acceptable if there is evidence (i.e. samples arrive packed with ice) that the chilling process has been begun. If samples arrive at temperatures that are outside these requirements, the client

will be notified and analysis will NOT proceed unless otherwise directed by the client. Data will be appropriately qualified.

11.1.6. **Sample Temperature –** Quantify the temperature of the samples by reading the temperature blank (TempB). If there is no TempB in the cooler, measure the temperature of two to five representative sample bottles using the infrared (IR) thermometer gun. A representative sample will reflect an "average" condition of the samples in the cooler and, depending on the manner in which they are packed, may not necessarily be in direct contact with the cooling material. If the TempB is received packed differently from the samples resulting in different temperatures, record the temperature of the representative sample and the TempB on the SCURF and COC.

NOTE: If an IR gun is used, the temperature should be taken from an opaque surface such as the bottle label. Measurements taken through a transparent surface (clear or amber glass) may not be reliable and should incorporate a specific temperature correction factor for that surface reading.

11.1.7 Record the temperature on the COC (example in Attachment I) and/or SCURF (example in Attachment II). If multiple containers are used, record the average temperature of those measured. In addition, record the type of "ice" used for packing the cooler (i.e. wet ice, "blue ice", etc.)

11.1.8 If samples within a project are spread over multiple coolers and one or more of the coolers are outside of the temperature criteria, the cooler(s) must be inventoried and evaluated for samples affected by the inconsistent condition. Affected samples are marked with a red sticker. Record these inventories on the SCURF, using the back side of the page as necessary.

- If the temperature blank is received frozen, check all associated samples to confirm that everything received is frozen. If not, check representative samples according to 11.1.5. Record all observations on the SCURF.

11.1.9 Unpack the cooler and chain of custody (COC). Organize samples, grouped by client sample ID, according to the order on the COC. Review COC against samples to make sure the bottles received match the analysis requested. All anomalies must be recorded on the SCURF.

11.1.10 Discard any ice, water, or packing material that remains in the cooler. Water or ice should be discarded in a sink that drains into the local sewer. Packing materials are disposed of in the garbage. If a sample container was broken, the contents remaining in the cooler must be treated at hazardous and MUST be discarded in a manner consistent with the hazardous waste handling standard operating procedure.

11.1.11 **pH Verification Instructions**

- The pH of the sample must be verified on all preserved sample bottles requiring pH preservation (see exceptions below).
- Open each preserved bottle (except as noted below). Use a new disposable pipette, a stirring bar or another inert utensil to withdraw a small portion of the sample. Dispense the aliquot on a sample specific narrow-range pH strip and check the pH.

  NOTE: Do not check the pH of samples for coliform, volatiles, TOC, WI-DRO, oil and grease, or hexane extractables (method 1664). These analyses will be checked by the analyst at the bench and should not be opened by sample management personnel.

Table 11.1 – General pH Preservation Requirements by Preservative

Sample Preservatives	Sample pH Requirement
HCl	must be less than 2
HN03	must be less than 2
H2SO4	must be less than 2
NaOH	must be greater than 12
ZnAcetate & NaOH	must be greater than 9

- If the pH is not within the required range, indicate the anomaly on the SCURF form or on the COC. If all bottles are unpreserved for a sample, write N/A in the section of the SCURF.

11.1.12 pH Preservation Adjustments

- If a preserved bottle does not meet the pH preservation requirement, the pH of the bottle must be recorded on the SCURF or COC. Additional sample preservative is added so the preservative content is 1% of the sample container volume. The sample is mixed and the pH is taken again. The new pH reading is also recorded on the SCURF along with the amount, type, and lot number of the preservative added. In addition, the sample container is marked with the preservative added, volume, date, time, and initials of the technician.

11.1.13 **Total Residual Chlorine Verification Instructions -** Total residual chlorine must be verified at the time of receipt (or at the bench as required by the method or individual state regulatory agency for certain analyses - see Table 11.2). Do not check the sample bottles for those analyses listed in 11.1.11.

NOTE: This check is done by the extraction laboratories for each test.

Table 11.2 – Analyses requiring Residual Chlorine Verification

Analyses
Ammonia (NH3)
Nitrate (NO3)
Biochemical Oxygen Demand (BOD)
1653 Chlorinated Phenolics
1613 Dioxin
1614 PBDE
1668 PCB

11.1.14 Note any discrepancies pertaining to samples as defined by the sample acceptance policy on the COC or SCURF. Any discrepancies involving temperature, preservation, hold time, collection dates and times, sample volume, sample containers, or unclear analysis must be reported to project management as soon as possible.

11.1.15 For short hold samples, the laboratory is notified and samples are staged per table 11.3.

Table 11.3 – Analyses with Hold Times Less Than 72 Hours

Short Hold Time	Analyses	Details
ASAP	Field Parameters	pH, Dissolved Oxygen
6 Hours	Total / Fecal Coliform (MPN, MF)	
24 Hours	Hexavalent Chromium	Aqueous Samples Only
30 Hours	Total Coliform (Presence / Absence)	
48 Hours	Color	
48 Hours	MBAS	
48 Hours	Nitrate (unpreserved)	If Preserved, reported as NO3+NO2
48 Hours	Nitrite (unpreserved)	If Preserved, reported as NO3+NO2
48 Hours	Ortho –phosphate	
48 Hours	Settable Solids	
48 Hours	Turbidity	
48 Hours	VOA - Soils by Unpreserved EPA5035	Jars, Encores, Sleeves

11.2 Sample Login

11.2.1 Rush projects and/or project with short holds should be logged in first. After these projects have been addressed, projects should be addressed on a first in, first out basis.

11.2.2 Enter samples in LIMS System according to T-ALL-IT-005.

11.2.3 Generate sample labels and Sample Receipt Form (SRF) (see Attachment III).

- See T-All-IT-005.

11.2.4 Attach the sample labels to the appropriate sample bottles.

- Place labels so that the client sample ID is still visible. If Client sample ID does not match COC, any inconsistencies must be listed on the SCURF and an additional label should be placed on each sample container indicating the sample ID does not match the COC.

11.2.5 The project manager must review and verify the following information by comparing the COC to SRF. Some of this information may not be provided by the client and those fields should be left blank.

- Report Recipient
- Invoice Recipient
- Additional Report Recipient
- PO#
- Project Name
- Project Number
- Requested Due Date
- Sample ID
- Matrix
- Collection Date & Time
- Received Date & Time
- Analysis: Double check compound lists
- Price
- Region Codes
- Work Region % Split (for Pace internal subcontracted work)
- Has Subbed Work been shipped

11.2.6 If any samples require analyses performed outside of the laboratory, samples must be prepared for subcontracting according to the procedures listed in the SOP describing the subcontracting of analytical services, *S-MN-C-004-Rev.00*.

11.2.7 When an air canister or tedlar bag arrives to the facility, there are several important steps necessary to follow when logging in each sample

11.2.7.1Remove canister(s) and/or tedlar bag(s) from box.

11.2.7.2Notate on SCUR form as to media receiver with the project. The quality of each will need to be included with the project for billing purposes.

11.2.7.2.1 Flow controllers

11.2.7.2.2 Gauges

11.2.7.2.3 Individually certified canisters

11.2.7.3Next, the matrix will be taken into account. Be sure to log this data into the "bottle type" field as well.

11.2.7.3.1 Tedlar bag

11.2.7.3.2 Canister

11.2.7.3.3 Puff cartridge

11.2.7.4Log in the samples per the standard operating procedure for logging in samples (see document)

11.2.7.5In addition to analysis log in, the bar code on the canister must be included into the keyword section of the sample, be the user logging in the project.

11.2.7.6Be sure that all tedlar bags are immediately delivered to the laboratory for analysis. A logbook, located in the air laboratory, will be signed at the time of delivery.

11.2.7.7The canisters will be labeled and placed onto a cart for delivery to the can room.

11.2.7.8The boxes will be brought back at a separated time.

11.3 Sample Storage

11.3.1 Samples awaiting login on the day received may remain in the sample receiving cooler prior to login. Once unpacked, samples will be logged in to the LIMS in a timely manner and returned to appropriate storage conditions as soon as possible. For the exceptional case where samples are not logged in the day they were received, they must be stored under appropriate temperature controlled conditions until login takes place.

11.3.2 Once logged into the LIMS and labeled, samples are placed in the appropriate storage areas. Specific temperature requirements are outlined in the analytical methods, but general guidelines are outlined below:

- Volatiles: Stored by receiving date in a segregated volatiles cooler.
- Soils and Other Solids: Staged by receiving on the shelves in the appropriate sample storage cooler. Any solid/soil samples for metals analyses are also staged here.
- Waters and Other Liquids (non-Metals, except Hg): Staged by receiving date on the shelves in the appropriate sample storage cooler.

- Liquids - Metals Analyses (except Hg): Metals, waters and liquids are staged by receiving date on designated shelving in the main laboratory or appropriate designated area. These samples may be stored at ambient temperature.
- Short hold samples and rushes are delivered directly to the laboratory. After analysis has been completed, any remaining sample is placed in the appropriate storage area.
- Biological tissue samples are staged by receiving date or project number on shelves in a freezer.
- Air bags/ summa canisters are delivered directly to the Air Laboratory and are stored in ambient temperature. Delivery of Tedlar bags is recorded in the Tedlar Sign-Off Logbook.

11.4 Disposal of Unconsumed Samples

11.4.1 Refer to the laboratory standard operating procedure for waste handling and disposal, *ALL-S-002*.

12. Quality Control

12.1. For any sample received at the laboratory that does not meet the sample acceptance, hold time or preservation criteria, the client must be contacted by project management and advised of the situation.

12.1.1. If the client instructs the laboratory to proceed with the analysis, all appropriate personnel/departments must be informed and the client approval must be documented. Data will be appropriately qualified.

12.1.2. The client may also instruct the laboratory to preserve the samples at the laboratory prior to proceeding with analysis. This must be documented on the COC or the SCURF, and must be noted in the final laboratory report.

12.1.3. All supporting documentation related to sample custody must be retained by the laboratory. This includes; memorandums, fax transmissions, all paperwork received with the COC, and copies of email transmissions.

12.2. **Documenting Discrepancies during receipt of samples.**

12.2.1. The following are examples of client discrepancies that need to be documented on the appropriate paperwork (SCURF).

- Lost samples/insufficient sample volume
- Broken or missing bottle
- Missing COC
- Mislabeled bottle
- Preservation error
- Missing sample related details (date, time, sample type)

12.2.2. Pace sample management discrepancies will be documented on the SCURF or within the project files. Discrepancies attributable to errors and omissions on the part of the laboratory will be addressed and resolved through the formal corrective action process.

13. Method Performance

13.1. Not Applicable

14. Pollution Prevention and Waste Management

14.1. In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount that may be used in a reasonable amount of time (i.e. before a reagent expires).

14.2. The Chemical Hygiene Plan/ Safety Manual contain additional information on pollution prevention.

14.3 The Environmental Protection Agency (USEPA) requires that laboratory waste management practice be consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult SOP ALL-S-002, or equivalent replacement.

15. References

15.1. Chapter 6, "Sampling Procedures;" Quality Manual - Quality Assurance/Quality Control Policies and Procedures, Pace Analytical Services, Inc., Current revision.

15.2. Chapter 3, "Inorganic Analytes;"SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, USEPA, Rev. 3, 1996.

15.3. Code of Federal Regulations, Chapter 40, Part 136.3, Table II

15.4. From section 5.11.3.a.1 Sample Receipt Protocols

15.4.1. NELAC Program Policy and Structure.

15.4.2. National Environmental Laboratory Accreditation Conference (NELAC), Chapter 5. July 1, 2001, Revision 14, Program Policy and Structure.

15.5. American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 1995, Standard Methods for the Examination of Water and Wastewater, A.E. Greenberg, L.W. Clesceri, A.D. Eaton and M.A.H. Franson, eds., 19th ed., American Public Health Association, Washington D. C.

15.6. U.S. Environmental Protection Agency, 1983, Methods for Chemical Analysis of Water And Wastes, EPA-600/4-79-020, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

15.7. U.S. Environmental Protection Agency, 1996, Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition, Office of Solid Waste and Emergency Response, Washington D.C.

15.8. U.S. Environmental Protection Agency, 1988, Methods for Determination of Organic Compounds in Drinking Water, EPA/600/4-88/039, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio.

16. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

16.1. Attachment I – Chain of Custody, Form # FALLQ020

16.2. Attachment II – Sample Condition Upon Receipt Form, Form # FALLC003

16.3. Attachment III – Sample Receipt Form (SRF), example

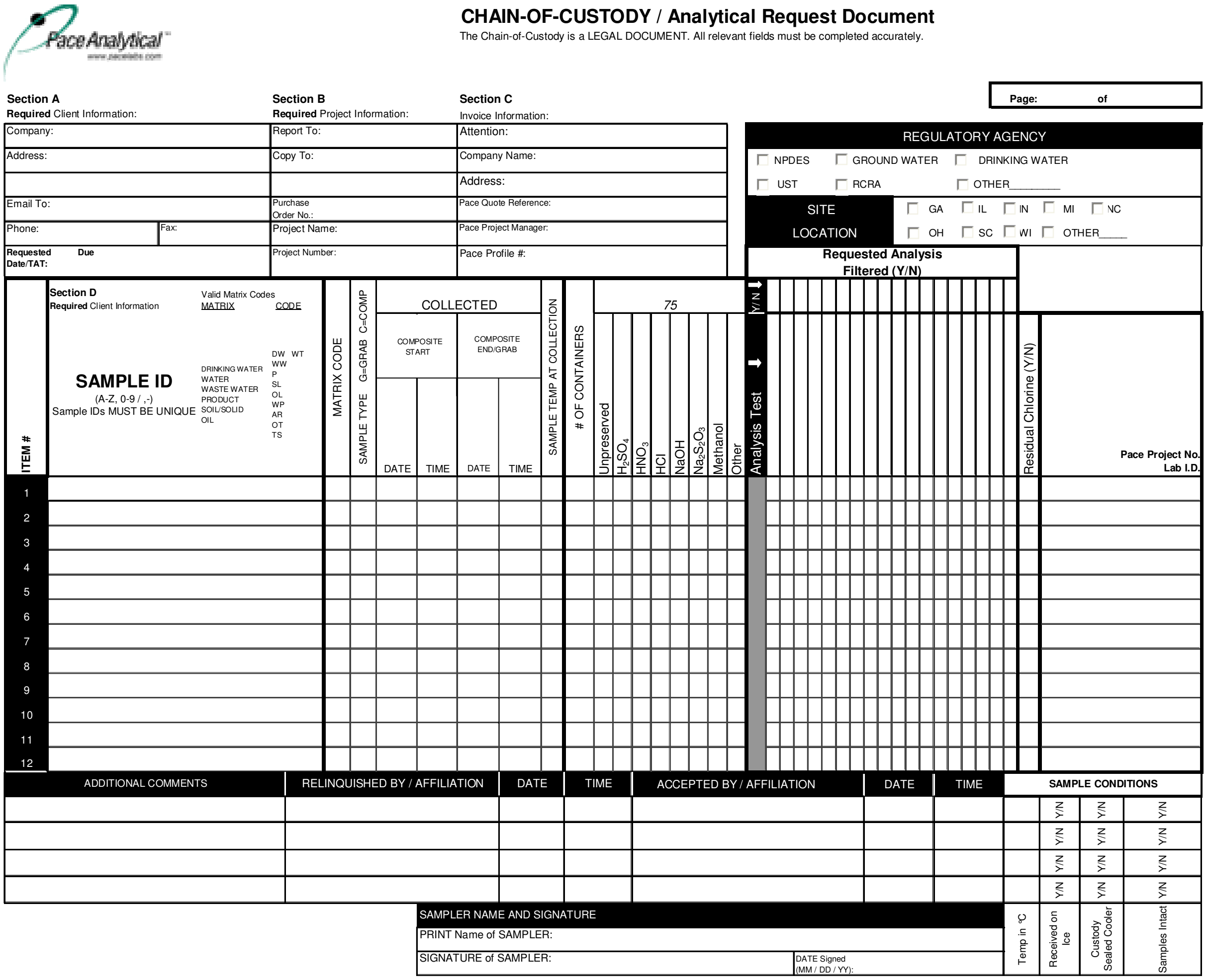
16.4. Attachment IV – Method Hold Times

17. Revisions

Document Number	Reason for Change	Date
ALL-C-001-rev.0	New	July 12, 2004
ALL-C-001rev.0	Removed information on waste and disposal and referred to ALL-S-002, *Waste Handling* Removed information on subcontracting samples and referred to ALL-C-003, *Subcontracting Samples* Removed information on residual chlorine testing in sample management. Those laboratories that require or perform this test in sample management, will include the information in their local addenda Added a general reference to the type of containers purchased in 9.1.10 Added information on the re-use of returned empty sample containers in section 12.1.4 Added shelf life criteria for trip blanks in 12.1.13 Provided more detail on how to check pH preservation in 12.2.8 Added Attachment I, II, III	March 30, 2005
SOT-ALL-C-001rev.00	Converted to SOP Template Removed bottle order preparation details for conversion to separate SOP Template Updated COC form Updated SCUR form Included requirement to add Bottle Lot #s to the Bottle Order Form Added Attachment IV –Method Hold Times	December 28, 2006
S-MN-C-001-Rev.00	First revision of the corporate template. Added in MN practices throughout the document Residual Chlorine done in extraction labs	06NOV2007
S-MN-C-001-Rev.01	Added AK Method Holding Times to Attachment IV Added Ascorbic Acid for preservatives to Table 10.2 Added Residual Chlorine Confirmation to Table 12.2 Clarified sample storage locations in section 11 Section 7 – "Distribution and Responsibilities" removed. Information found in QAM.	07May2008

Attachment I – Example COC Form

Example Chain of Custody (COC)



Pace Analytical™
www.pacelabs.com

CHAIN-OF-CUSTODY / Analytical Request Document

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

Page: **of**

Section A **Required** Client Information:	**Section B** **Required** Project Information:	**Section C** Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER________

SITE LOCATION ☐ GA ☐ IL ☐ IN ☐ MI ☐ NC
☐ OH ☐ SC ☐ WI ☐ OTHER_____

Requested Analysis Filtered (Y/N)

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
	WP
	AR
	OT
	TS

ITEM #	SAMPLE ID	MATRIX CODE	SAMPLE TYPE G=GRAB C=COMP	COLLECTED				SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	75								Y/N ➡																			Residual Chlorine (Y/N)	Pace Project No. Lab I.D.
				COMPOSITE START		COMPOSITE END/GRAB																																
				DATE	TIME	DATE	TIME			Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	➡ Analysis Test																				
1																																						
2																																						
3																																						
4																																						
5																																						
6																																						
7																																						
8																																						
9																																						
10																																						
11																																						
12																																						

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	**SAMPLE CONDITIONS**			
								Y/N	Y/N	Y/N
								Y/N	Y/N	Y/N
								Y/N	Y/N	Y/N
								Y/N	Y/N	Y/N
							Temp in °C	Received on Ice	Custody Sealed Cooler	Samples Intact

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

SIGNATURE of SAMPLER:

DATE Signed (MM / DD / YY):

Attachment II – Example SCURF

Sample Condition Upon Receipt Form (SCURF) – Example

Contents may change without updating this SOP

Sample Condition Upon Receipt

Client Name:__________________ Project #_______________

Optional
Proj. Due Date:
Proj. Name:

Courier: ☐ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other________
Tracking #: ____________________
Custody Seal on Cooler/Box Present: ☐ yes ☐ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐Bubble Bags ☐ None ☐Other_________

Thermometer Used _______________ **Type of Ice:** Wet Blue None ☐ Samples on ice, cooling process has begun

Cooler Temperature_______________ **Biological Tissue is Frozen:** Yes No
Temp should be above freezing to 6°C

Date and Initials of person examining contents:____________________

Comments:

Chain of Custody Present:	☐Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☐Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☐Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☐Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☐Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☐No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☐No ☐N/A	7.
Sufficient Volume:	☐Yes ☐No ☐N/A	8.
Correct Containers Used:	☐Yes ☐No ☐N/A	9.
-Pace Containers Used:	☐Yes ☐No ☐N/A	
Containers Intact:	☐Yes ☐No ☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☐N/A	11.
Sample Labels match COC:	☐Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix:_______________		
All containers needing preservation have been checked.	☐Yes ☐No ☐N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes ☐No ☐N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes ☐No	Initial when completed ______ Lot # of added preservative ______
Samples checked for dechlorination:	☐Yes ☐No ☐N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☐No ☐N/A	15.
Trip Blank Present:	☐Yes ☐No ☐N/A	16.
Trip Blank Custody Seals Present	☐Yes ☐No ☐N/A	
Pace Trip Blank Lot # (if purchased):____________		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted:______________________________ Date/Time: ___________________

Comments/ Resolution:____

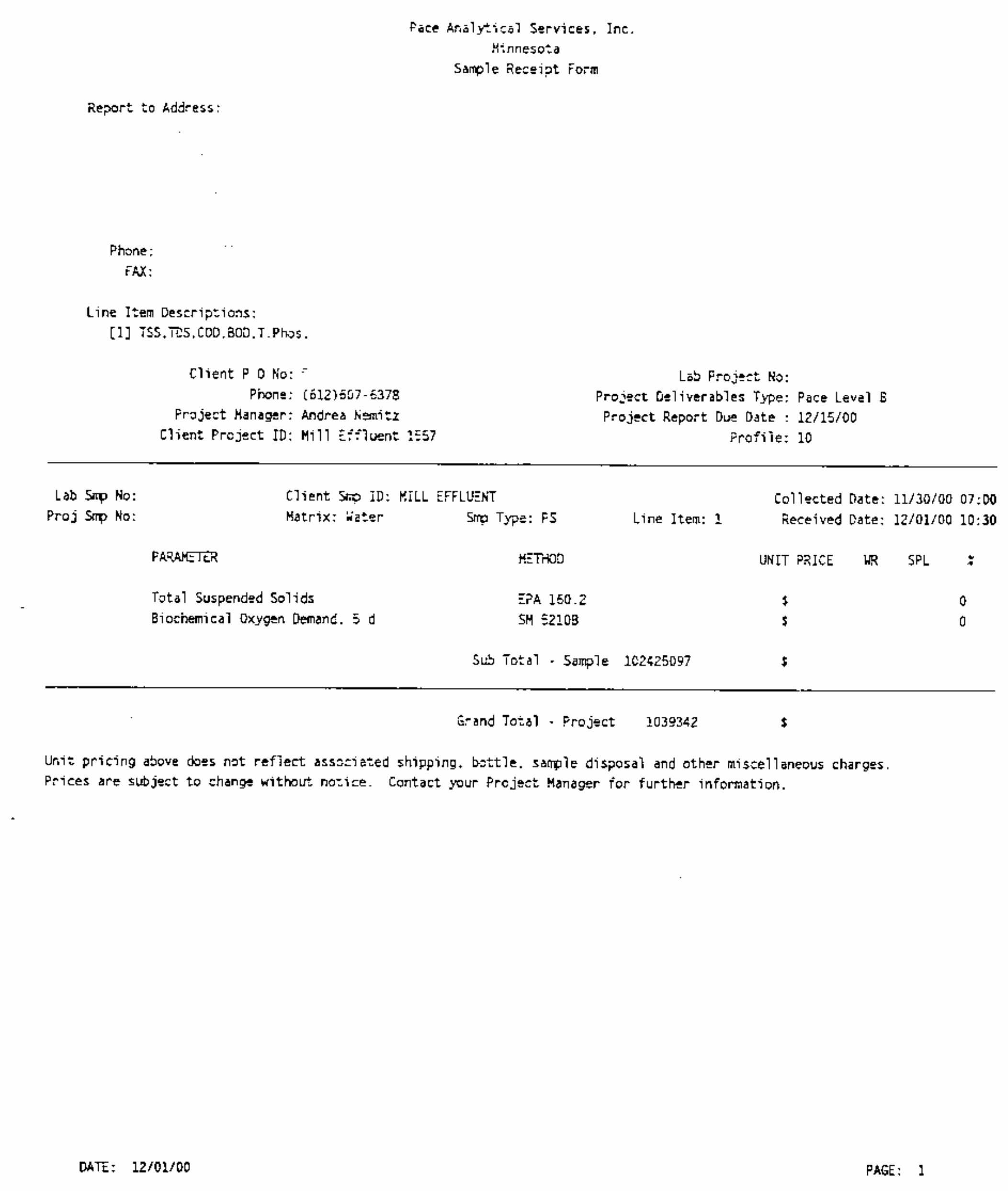
Project Manager Review: ________________________________ **Date:**____________________

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

Control number: F-ALL-C-003

Attachment III – Example SRF

Sample Receipt Form (SRF) - example



Pace Analytical Services, Inc.
Minnesota
Sample Receipt Form

Report to Address:

Phone:
FAX:

Line Item Descriptions:
[1] TSS.TDS.COD.BOD.T.Phos.

Client P O No:
Phone: (612)607-6378
Project Manager: Andrea Nemitz
Client Project ID: Mill Effluent 1557

Lab Project No:
Project Deliverables Type: Pace Level B
Project Report Due Date : 12/15/00
Profile: 10

Lab Smp No: Client Smp ID: MILL EFFLUENT Collected Date: 11/30/00 07:00
Proj Smp No: Matrix: Water Smp Type: PS Line Item: 1 Received Date: 12/01/00 10:30

PARAMETER	METHOD	UNIT PRICE	WR	SPL	$
Total Suspended Solids	EPA 160.2	$			0
Biochemical Oxygen Demand. 5 d	SM 5210B	$			0
	Sub Total - Sample 102425097	$			

Grand Total - Project 1039342 $

Unit pricing above does not reflect associated shipping. bottle. sample disposal and other miscellaneous charges.
Prices are subject to change without notice. Contact your Project Manager for further information.

DATE: 12/01/00 PAGE: 1

Attachment IV – Method Hold Times

Parameter	Matrix	Methods	Max Hold Time
2, 3, 7, 8-TCDD	Soil	EPA 1613B	90/40 Days
2, 3, 7, 8-TCDD	Water	EPA 1613B	90/40 Days
Acidity	Water	EPA 305.1,SM 2310B	14 Days
Alkalinity	Water	EPA 310.1/310.2,SM 2320B	14 Days
Alpha Emitting Radium Isotopes	Water	EPA 903,EPA 9315	180 days
Anions by IC, including Br, Cl, F, NO_2, NO_3, PO_4, SO_4, SO_3	Water	EPA 300,EPA 9056	By anion
Aromatic and Halogenated Volatiles	Soil	EPA 5035/8021	14 days
Aromatic and Halogenated Volatiles	Water	SM 601/602,EPA 8021	14 Days
Bacteria, Total Plate Count	Water	SM 9221D	24 Hours
Base/Neutrals and Acids	Soil	EPA 8270	14/40 Days
Base/Neutrals and Acids	Water	SM 625,EPA 8270	7/40 Days
Base/Neutrals, Acids & Pesticides	Water	EPA 525.1/525.2	7/30 Days
BOD/cBOD	Water	EPA 405.1,SM 5210B	48 hours
BTEX/Total Hydrocarbons	Air	EPA TO-3	14 Days
BTEX/Total Hydrocarbons	Air	EPA TO-3	48 Hours
Chloride	Water	EPA 325.2/325.3,SM 4500-Cl,EPA 9250/9251/9252	28 Days
Chlorinated Herbicides	Soil	EPA 8151	14/40 Days
Chlorinated Herbicides	Water	EPA 515.1,EPA 8151	14/28 Days**
Chorine, Residual	Water	EPA 330.1/330.5/ 330.2,SM 4500-Cl	Immediate
COD	Water	EPA 410.1/410.2/ 410.4,SM 5220C	28 Days
Color	Water	EPA 110.3/110.2,SM 2120B,C,E	48 Hours
Condensable Particulate Emissions	Air	EPA 202	6 Months
Cyanide, Reactive	Water	EPA Chapter 7	28 Days
Cyanide, Total and Amenable	Water	EPA 335.2/335.3/ 335.4,SM 4500-CN,EPA 9010/9012	14 Days (24 hrs if sulfide present)
Diesel Range Organics	Soil	EPA 8015	14/40 Days
Diesel Range Organics	Water	EPA 8015	7/40 Days
Diesel Range Organics	Soil	AK102	14/40 Days
Diesel Range Organics	Water	AK102	14/40 Days
Residual Range Organics	Soil	AK103	14/40 Days
Dioxins & Furans	Air	EPA TO-9	30/45 Days
EDB & DBCP	Water	EPA 504.1,EPA 8011	14 Days
Explosives	Water	EPA 8330	7/40 Days
Explosives	Soil	EPA 8330	14/40 Days
Ferrous Iron	Water	SM 3500-Fe-D	Immediate
Flashpoint/Ignitability	Water	EPA 1010/1030	28 Days
Fluoride	Water	EPA 340.1/340.2,SM 4500-Fl C,D	28 Days
Gamma Emitting Radionuclides	Water	EPA 901.1	180 days
Gas Range Organics	Water	EPA 8015	14 Days
Gasoline Range Organics	Soil	EPA 5035/8015	14 days
Gasoline Range Organics	Water	AK101	14 Days
Gasoline Range Organics	Soil	AK101	14 Days

Gross Alpha (NJ 48Hr Method)	Water	EPA NJAC 7:18-6	48 Hrs
Gross Alpha and Gross Beta	Water	EPA 900,EPA 9310	180 days
Haloacetic Acids	Water	EPA 552.1/552.2	14/7 Days
Hardness, Total ($CaCO_3$)	Water	EPA 130.2/130.1,SM 2340B or C	6 Months
Hexavalent Chromium	Water	EPA 218.4,SM 3500-Cr,EPA 7196	24 Hours
Hydrogen Halide & Halogen Emissions	Air	EPA 26	6 Months
Lead Emissions	Air	EPA 12	6 Months
Low Level Mercury	Water	EPA 1631	90 days (if preserved and oxidized)
Mercury	Soil	EPA 7471	28 days
Mercury	Water	EPA 245.1,EPA 7470	28 Days
Metals	Air	EPA IO-3.5	6 Months
Metals	Soil	EPA 6010 or 6020	6 months
Metals (and other ICP elements)	Water	EPA 200.7/200.8,EPA 6010/6020	6 Months
Methane, Ethane, & Ethene	Water	EPA 3810M	14 Days
Methane, Ethane, Ethene	Air	EPA 3C-M	14 Days
Methane, Ethane, Ethene	Air	EPA 3C-M	48 Hours
Nitrogen, Ammonia	Water	EPA 350.1/350.2/ 350.3,SM 4500-NH3	28 Days
Nitrogen, Kjeldahl	Water	EPA 351.2/351.3,SM 4500-Norg	28 Days
Nitrogen, Nitrate	Water	EPA 352.1/353.2/ 353.3,SM 4500-N03	48 Hours
Nitrogen, Nitrate & Nitrite	Water	EPA 353.2,SM 4500-N03	28 Days
Nitrogen, Nitrite	Water	EPA 354.1,SM 4500-N02	48 Hours
Nitrogen, Organic	Water	EPA 351.3,SM 4500-Norg	28 Days
Non-Methane Organics	Air	EPA 25C	14 Days
Non-Methane Organics	Air	EPA 25C	48 Hours
Odor	Water	EPA 140.1,SM 2150B	24 Hours
Oil and Grease/HEM	Water	EPA 1664A,SM 5520B,D,EPA 9070	28 Days
Organchlorine Pesticides and PCB's	Water	EPA 608	7/40 Days
Organochlorine Pesticides & PCBs	Air	EPA TO-4	7/40 Days
Organochlorine Pesticides and PCB’s	Water	EPA 8081/8082	7/40 Days
Organochlorine Pesticides and PCBs	Soil	EPA 8081/8082	14/40 Days
Organophosphorous Pesticides	Soil	EPA 8141	14/40 Days
Organophosphorous Pesticides	Water	EPA 8141	7/40 Days
Oxygen, Dissolved	Water	EPA 360.1,SM 4500-D	Immediate
Paint Filter Liquid Test.	Water	EPA 9095	N/A
Particulates	Air	EPA PM10	6 Months
Permanent Gases	Air	EPA 3C	14 Days
Permanent Gases	Air	EPA 3C	48 Hours
pH	Water	EPA 150.1/150.2,SM 4500-H,EPA 9040/9041	Immediate
Phenol, Total	Water	EPA 420.1/420.2,SM ,EPA 9065/9066	28 Days

Phosphorus, Orthophosphate	Water	EPA 365.1/365.2/ 365.3,SM 4500-P	48 Hours
Phosphorus, Total	Water	EPA 365.1/365.2/ 365.4,SM 4500-P	28 Days
Polynuclear Aromatic Hydrocarbons	Air	EPA TO-13	7/40 Days
Polynuclear Aromatic Hydrocarbons	Soil	EPA 8310	14/40 Days
Polynuclear Aromatic Hydrocarbons	Water	EPA 610,EPA 8310	7/40 Days
Radioactive Strontium	Water	EPA 905	180 days
Radium-226 Radon Emanation Technique	Water	EPA 903.1	180 days
Radium-228	Water	EPA 904,EPA 9320	180 days
Silica, Dissolved	Water	EPA 370.1,SM 4500-Si D	28 Days
Solids, Settleable	Water	EPA 160.5,SM 2540F	48 Hours
Solids, Total	Water	EPA 160.3,SM 2540B	7 Days
Solids, Total Dissolved	Water	EPA 160.1,SM 2540C	7 Days
Solids, Total Suspended	Water	EPA 160.2,SM 2540D	7 Days
Solids, Total Volatile	Water	EPA 160.4,SM 2540E	7 Days
Specific Conductance	Water	EPA 120.1,SM 2510B,EPA 9050	28 Days
Stationary Source Dioxins & Furans	Air	EPA 23	30/45 Days
Stationary Source Mercury	Air	EPA 101	6 Months, 28 Days for Hg
Stationary Source Metals	Air	EPA 29	6 Months, 28 Days for Hg
Stationary Source PM10	Air	EPA 201A	6 Months
Stationary Source Particulates	Air	EPA 5	6 Months
Sulfate	Water	EPA 375.4/375.2,SM 4500-S04,EPA 9036/9038	28 Days
Sulfide, Reactive	Water	EPA Chapter 7	28 Days
Sulfide, Total	Water	EPA 376.1, 376.2,SM 4500-S,EPA 9030	7 Days
Sulfite	Water	EPA 377.1,SM 4500-S03	Immediate
Surfactants	Water	EPA 425.1,SM 5540C	48 Hours
Total Organic Carbon (TOC)	Water	EPA 415.1/415.2,SM 5310B,C,D,EPA 9060	28 Days
Total Organic Halogen (TOX)	Water	EPA 450.1,SM 5320,EPA 9020/9021	14 Days
Tritium	Water	EPA 906	180 days
Turbidity	Water	EPA 180.1,SM 2130B	48 Hours
Uranium Radiochemical Method	Water	EPA 908,SM D5174-97	180 days
Volatiles	Air	EPA 18	14 Days
Volatiles	Air	EPA 18	48 Hours
Volatiles	Air	EPA TO-14	14 Days
Volatiles	Air	EPA TO-14	48 Hours
Volatiles	Air	EPA TO-15	14 Days
Volatiles	Soil	EPA 5035/8260	14 days
Volatiles	Water	EPA 524.1/524.2	14 Days
Volatiles	Water	SM 624	14 Days (7 unpreserved)
Volatiles	Water	EPA 8260	14 Days

STANDARD OPERATING PROCEDURE
SUBCONTRACTING SAMPLES

Pace Analytical™
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414

Phone: 612.607.1700
Fax: 612.607.6444

STANDARD OPERATING PROCEDURE

SUBCONTRACTING SAMPLES

Reference Methods: N/A

LOCAL SOP NUMBER:	*S-MN-C-004-Rev.00*
EFFECTIVE DATE:	22 May 2008
SUPERSEDES:	*All-Q-017-Rev.1*
SOP TEMPLATE NUMBER:	SOT-ALL-C-003-Rev.01

LOCAL APPROVAL

Laboratory General Manager	12 May 2008 Date
Laboratory Quality Manager	22 May 2008 Date
Department Manager	22 May 2008 Date

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

This is **COPY#**__6___ distributed on __23 Dec 08_ by ___mae__and is ______**CONTROLLED or** ___X__**UNCONTROLLED.**

TABLE OF CONTENTS

SECTION PAGE

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish a uniform system in the event that samples must be transferred to another laboratory for analysis. The following procedures are intended to prevent any negative impact on data quality or turnaround time, maintain accurate records of shipped samples, and ensure proper revenue allocation.

2. Scope and Application

This SOP is applicable to all samples requiring transfer to another laboratory in order to meet holding time, certification, or method requirements.

3. Summary of Method

3.1. Samples are subcontracted to a Pace Analytical Services network laboratory or to an outside laboratory when the analysis cannot be performed by the owner region/laboratory. Samples are subcontracted only with the consent and approval of the client. The subcontracted laboratory must maintain current National Environmental Laboratory Accreditation Conference (NELAC) or other primary state accreditation for the state the samples originated from unless prior approval from the client is received to use an alternate laboratory. Whenever possible all arrangements for a subcontracted analysis must be made prior to start of the project.

3.2. Sample analysis may be subcontracted when the group leader and/or the operations manager determines that the present workload of the laboratory prohibits the analysis of samples within the required hold times or project due date, the requested method/parameter has not been developed, or when the required certification or accreditation is not current.

3.3. All revenue must be properly allocated through the LIMS or alternate system.

4. Interferences

Not Applicable

5. Safety

Samples to be shipped to another laboratory for analyses must be shipped according to the handling and preservation requirements of the analysis to be performed.

6. Definitions

6.1. Definitions of terms found in this SOP are described in the Pace Analytical Services Quality Manual, Glossary Section.

6.2. Owner Region – this is also referred to as the sending region. This is the laboratory that originally received the samples and will be producing the invoice.

6.3. Work Region – also referred to as the receiving region. This is the laboratory that receives the samples from another Pace Analytical Services laboratory.

6.4. SI Code - Subcontracting code used to define which area in the laboratory will receive the payment.

6.5. Acode - This is a group of data which describes a specific analysis. It is comprised of all the data necessary to perform procedures and report results.

6.6. SRF - The Sample Receipt Form contains the scope of work to be performed and the prices associated with that work.

7. Sample Collection, Preservation, and Handling

Not Applicable

8. Equipment and Supplies

Not Applicable

9. Reagents and Standards

Not Applicable

10. Calibration

Not Applicable

11. Procedure

11.1. When it is determined that a Pace Analytical Services laboratory cannot perform an analysis, the Project Manager or Project Coordinator (PM/PC) associated with those samples must locate and secure the services of another facility.

11.1.1. If the analysis is routine to the owner region and the sample must be shipped (e.g. due to capacity issues, equipment failure, etc.) then the laboratory department manager is responsible for notifying the Project Manager that the samples must be shipped.

11.2. The PM/PC must obtain client approval before subcontracting the samples.

11.3. Contractual obligations must be considered in the decision of where to send samples. Client permission may be obtained verbally but must be received via e-mail, facsimile, and/or writing prior to the submission of results. **Note:** Copies of telephone logs may be used as a form of documentation when inserted into the project file.

11.3.1. If contractual agreement exists with a client, this procedure may be superseded.

11.3.2. All subcontract laboratories must submit proof of accreditation prior to placing samples. Only pre-approved laboratories may be utilized.

- The QA office updates a master list which is in a shared location. Prior to updating the list, the QA Office sends a ‘Supplier Profile’ questionnaire to the proposed laboratory or facility (see Attachment I). * See below.

- The proposed facility fills out questionnaire, signs, and returns to Pace Analytical Services along with the requested information. *See below.

- The facility is added to the master list, the questionnaire posted in a shared location, and Client Service personnel may then send samples.

- **Note:** All laboratories within the Pace Analytical Services network must also fill out, sign and append questionnaire to the shared location to ensure Client Service personnel have the most current information.*

- If the subcontract laboratory is not qualified to perform the work Pace Analytical Services can either refrain from sending samples or initiate a formal inspection of the proposed facility.*

11.4. When subcontracting samples to another laboratory, the PM/PC must discuss the following information:

- Analyses/Methods
- Number of samples
- Matrix
- Receipt Date
- Due Date
- Dry weight for soil samples
- Holding Time Constraints
- Analyte List
- Required reporting limits
- QC Deliverables
- Certification requirements

11.5. If samples are sent to another Pace Laboratory (inter-regionally) the owner region will perform the following tasks:

11.5.1. Log the samples into the LIMS using the appropriate 'Sub-In' analysis Acodes.

11.5.2. Once the subbed project is logged in the sample receiving personnel who logged in the project will enter the project into the Sub-out Logbook (Attachment VI). Information entered includes:

- Date

- Workorder Number

- Sample Reciving Intials.

11.5.3. After the project is entered into the Sub-Out Logbook the Sample Reciept Form is printed, the COC is attached and provided for Project Manager review.

11.5.4. The Project Manager will review the project and generate the Sub-in COC and Inter-Regional Work Order form.

11.5.5. Sub-in COC (Attachment VIII) – A Sub-in COC is generated through EPIC Pro in Submit Jobs, Sub-in COC. Enter the WO number to generate the Sub-in COC. The generated COC automatically inputs the Sample ID, Collect Date/Time, Lab ID, Matrix and Bottle Types. The Project Manager inputs the requested analysis, signs the COC with date and time completing the Sub-in COC.

12.5.5 Inter-Regional Work Order (IRWO) (Attachement II) – The IRWO is an Excel file that requires the following information to be completed:

- Inter-Laboratory Work Order # - Project number/Work Order Number– assigned by LIMS in original laboratory..

- Today's date in the space marked "Date prepared" and the date the results are due to the sending region is noted in "Requested Completion Date".

- Sending region, receiving region, state the sample were collected from, the type of QC deliverable, client and project manager should be filled in on the IRWO form.

- Current region codes are noted below. More may be added without updating this document.

    - 10 = Minnesota
    - 38 = Waltz Mill

- 92 = Asheville and Charlotte
- 60 = Kansas
- 50 = Indianapolis
- 45 = Kimberly
- 20 = Seattle

20 = Gulf Coast
30 = Pittsburgh
40 = Green Bay
17 = Pace Life Sciences
98 = Puerto Rico

- Check off what type of work being sent, the units the receiving region should utilize, and whether to report the data moisture corrected (dry weight).

- Enter quantity, description including method number and costs.

  - Total Price, which is split between the two laboratories. The system will default to 80/20 for all tests (except for dioxin which is typically a 90/10 split), if different enter the correct split. This means that 80% of the money goes to the receiving region and 20% of the money goes to the sending region.

  - Mark if the samples are to be returned to the sending laboratory, otherwise the receiving laboratory is responsible for final disposition of the remaining sample volume.

  - Mark the matrix of the samples

11.5.6. Attach the Sub-in COC and mark the appropriate box on the IRWO form.

11.5.7. . Attach a copy of the Sample Condition Upon Receipt form (SCUR) (Attachment VII) that is completed during sample check-in, see the S-MN-C-001 Sample Management, or equivalent replacement.

11.5.8. Attach a copy of the Sample Receipt Form (SRF) (Attachment V) that is generated from the original laboratory highlighting the samples that are being subcontracted.

11.5.9. File a copy of the IRWO and Sub-COC in the project folder.

11.5.10. If sending extracts, include prep batch logs and standards prep information.

11.5.11. Include compound list and reporting limits when necessary.

11.5.12. The Project Manager locates the samples to be subbed and places them on a numbered tray along with the Sub-in COC, SCURF, SRF and IRWO in the subcontract cooler.

11.5.13. The Project Manager continues the entry in the Sub-Out Logbook by entering the following information:

- Client

- Subcontract Lab the samples are being sent

- Number of Bottles

- The tray number the samples are located on.

11.5.14. Sample Receiving personnel then complete the Sub-Out Logbook by entering the sample IDs that are being sent, date and initials of the person preparing the samples for shipment and verified by peer review upon completion.

11.5.15. Once the paperwork is complete, with the appropriate documentation pack the samples in a cooler, bubble wrapped to prevent breakage, double bagged, and iced to maintain internal preservation, and add a custody seal to the outside on the cooler.

- Use two seals to a "lift" off lid and one seal for a hinged lid.

11.5.16. Once the samples are received in the work region, the following information is entered into the receiving region's LIMS.:

- Project number – is the work lab's project number assigned by the owner lab's LIMS.
- Work ID – is the sending labs project no. and the external client ID.
- Lab Sample ID – is the sending lab's sample number from the SRF.
- Receipt date – is the receipt date listed on the sending region's SRF
- Turn Around Time – is measured by the sending region's sample receipt date (from SRF) and the due date provided on the IRWO.
- Split between the two labs. System will default to 80/20, if different enter the correct split. The percent entered should be the work region's share of the revenue.
- Full charge for the work being completed.
- Acode - will be the work lab's method specific Acode.

11.5.17. Project completion

- Work Region:
  - Deliver results to the owner lab.
  - Enter a Ship Date in the Project Edit screen, this closes out the project.
  - Sends the IRWO form to the ABM for reconciliation and may keep a copy in the project file.
- Owner Region:
  - Click off the Sub acode in EPIC Pro to complete the project. .

11.6. If samples are sent outside of Pace Analytical the following tasks must be performed once the subcontract laboratory has been approved:

11.6.1. Complete information on Sub-Out Log (Attachment VI) as described above.

11.6.2. Create new COC using Client project and sample identifications but do not put Client name on sending COC (Attachment IV). Retain bottom copy of COC and file with project manager's paperwork.

11.6.3. Note: Attach Compound List and Reporting Limits if clarification as needed.

Once the reports are received from the subcontract labs (internal or external labs), the reports are collated with any information from the Owner laboratory. Click off the Sub acode in EPIC Pro as complete in the project Work Order completing the project . All information pertaining to the analysis of the samples is fully disclosed to the client.

12. Quality Control

Not Applicable

13. Method Performance

The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14. Pollution Prevention and Waste Management

Not Applicable

15. References

15.1. National Environmental Laboratory Accreditation Conference (NELAC), Chapter 5, "Quality Systems", most current version.

16. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

16.1. Attachment I – Supplier Profile Questionnaire, Form # ALLQ008
16.2. Attachment II – Inter Regional Work Order (IRWO), Form # ALLC002
16.3. Attachment III – Sub-In Log
16.4. Attachment IV – Chain of Custody, Form # FALLQ020
16.5. Attachment V – Sample Receipt Form (SRF), printed from LIMS
16.6. Attachment VI – Sub-Out Log
16.7. Attachment VII – Sample Condition Upon Receipt (SCUR)
16.8. Attachment VIII – Sub-In Chain of Custody (COC)
16.9. Attachment IX - IRWO/ Sub-COC Form

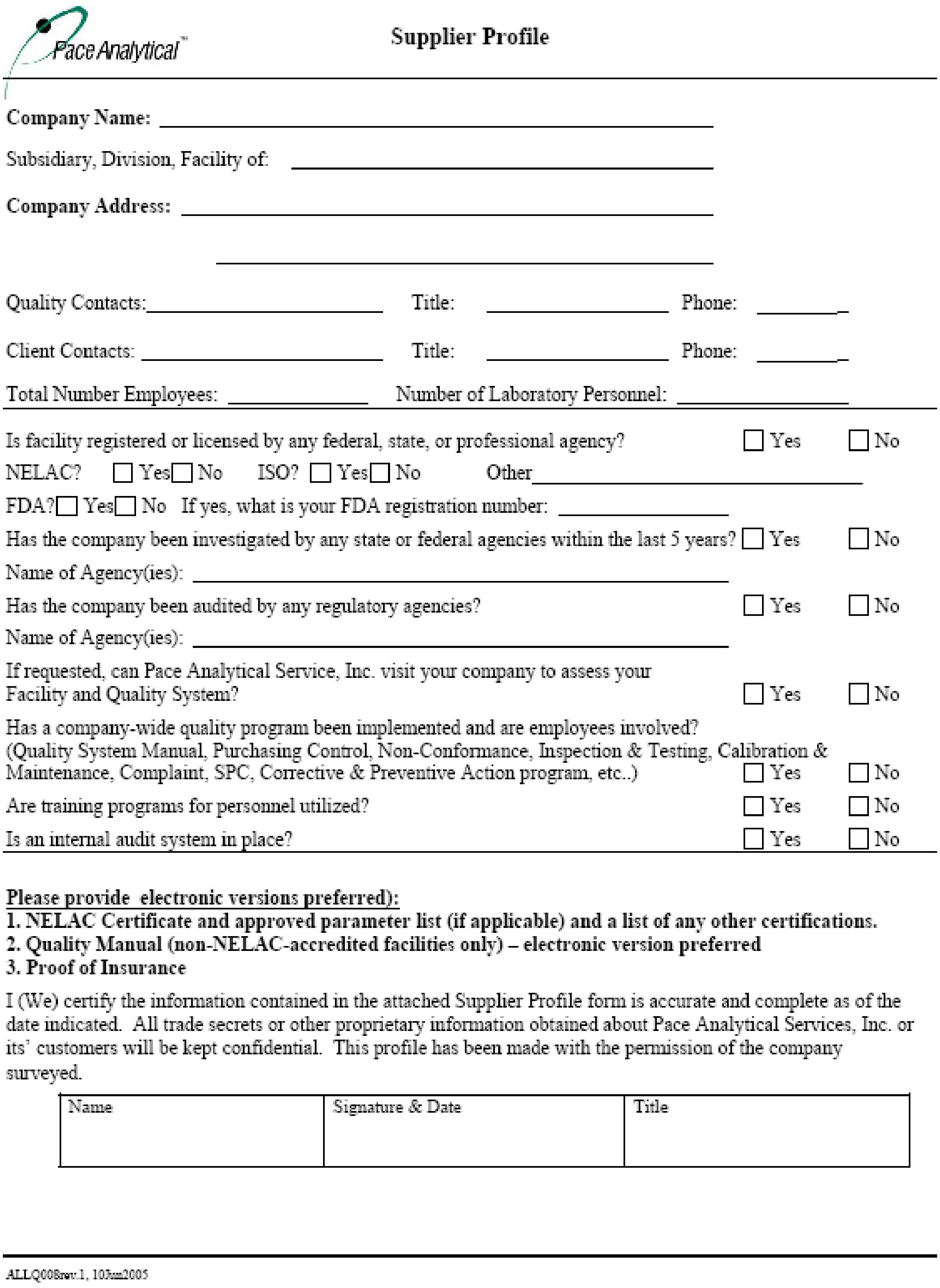
17. Revisions

Document Number	Reason for Change	Date
ALLQ017-Rev.0	First Issue	31Mar2005
ALLQ017-Rev.0	Under 12.5. updated to match form name of Inter Laboratory Work Order. Under 12.5.4.2.1 corrected region codes. Switched the order in 12.5.8 as the electronic forms are the primary means of documentation. There may be remaining 3-part forms out there so the notation of the pink copy has been retained until the next revision.	09 June 2005
SOTALLQ017-rev.00	1. Converted SOP to SOP Template 2. Updated region codes 3. Included IRWO/ Sub-COC form option (for MN & GB specifically due to audit finding) 4. Updatad IRWO form attachment 5. Updated COC attachment 6. Updated Supplier Profile attachment 7. Added IRWO/ Sub-COC Form attachment	16 Nov 2006
SOTALLQ017-rev.01	1. Update "Date Received" documentation requirement in section 12.5.11.	09 Apr 2007

S-MN-C-004-Rev.00	1. Implemented the template to MN document. Given MN document control number. Updated attachments with current forms Updates references to attachments Added Sub-In COC	09May2008

Attachment I

Supplier Profile (example)



Supplier Profile

Company Name: ______________________________

Subsidiary, Division, Facility of: ______________________________

Company Address: ______________________________

____

Quality Contacts: ______________ Title: ______________ Phone: ________

Client Contacts: ______________ Title: ______________ Phone: ________

Total Number Employees: __________ Number of Laboratory Personnel: __________

Is facility registered or licensed by any federal, state, or professional agency? ☐ Yes ☐ No

NELAC? ☐ Yes ☐ No ISO? ☐ Yes ☐ No Other ______________________

FDA? ☐ Yes ☐ No If yes, what is your FDA registration number: __________

Has the company been investigated by any state or federal agencies within the last 5 years? ☐ Yes ☐ No

Name of Agency(ies): ______________________________

Has the company been audited by any regulatory agencies? ☐ Yes ☐ No

Name of Agency(ies): ______________________________

If requested, can Pace Analytical Service, Inc. visit your company to assess your Facility and Quality System? ☐ Yes ☐ No

Has a company-wide quality program been implemented and are employees involved? (Quality System Manual, Purchasing Control, Non-Conformance, Inspection & Testing, Calibration & Maintenance, Complaint, SPC, Corrective & Preventive Action program, etc..) ☐ Yes ☐ No

Are training programs for personnel utilized? ☐ Yes ☐ No

Is an internal audit system in place? ☐ Yes ☐ No

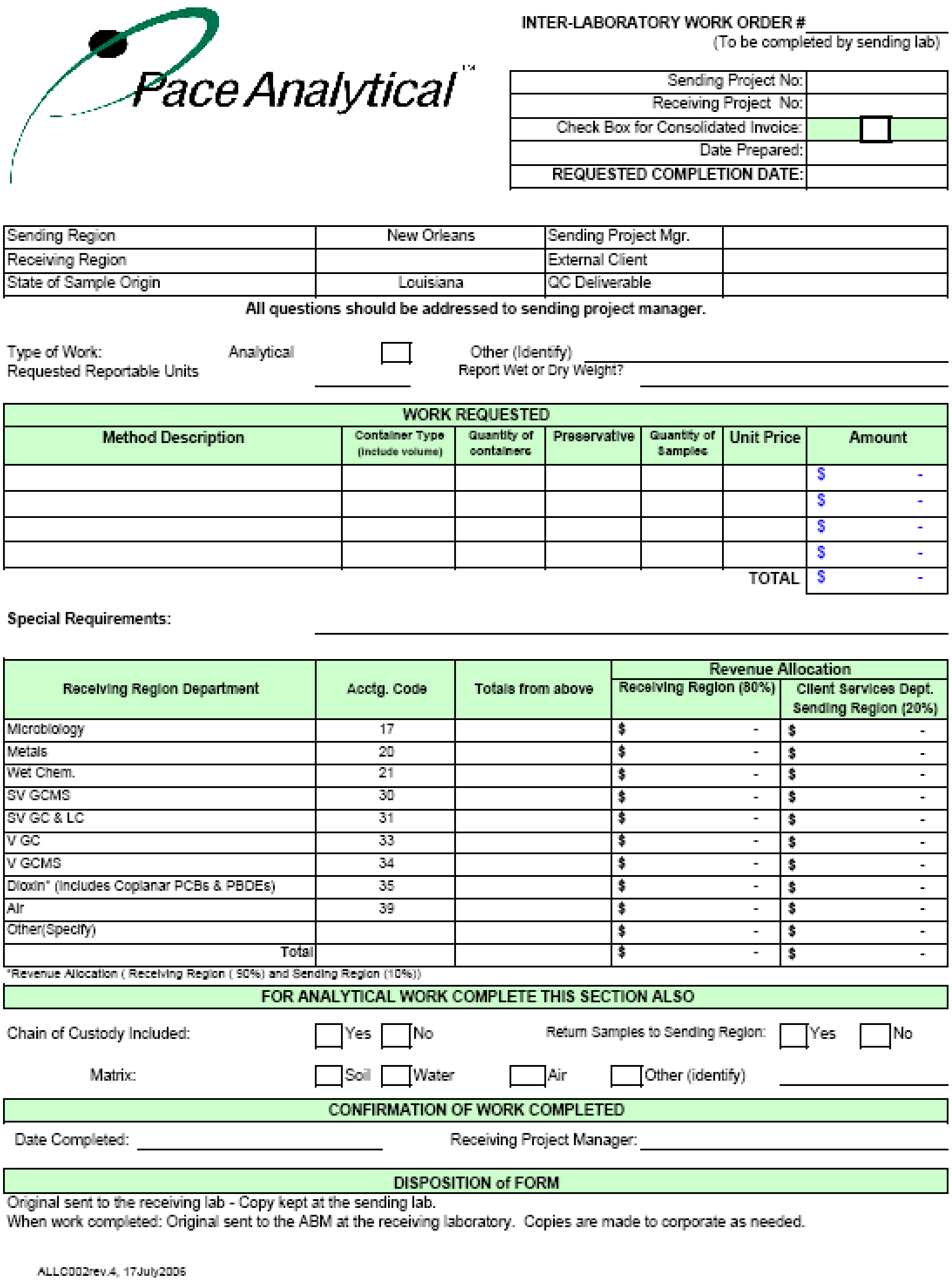
Please provide electronic versions preferred):
1. NELAC Certificate and approved parameter list (if applicable) and a list of any other certifications.
2. Quality Manual (non-NELAC-accredited facilities only) – electronic version preferred
3. Proof of Insurance

I (We) certify the information contained in the attached Supplier Profile form is accurate and complete as of the date indicated. All trade secrets or other proprietary information obtained about Pace Analytical Services, Inc. or its' customers will be kept confidential. This profile has been made with the permission of the company surveyed.

Name	Signature & Date	Title

ALLQ008rev.1, 10Jun2005

Attachment II
Inter-Laboratory Work Order form (example)



Pace Analytical™

INTER-LABORATORY WORK ORDER # ______________
(To be completed by sending lab)

Sending Project No:	
Receiving Project No:	
Check Box for Consolidated Invoice:	☐
Date Prepared:	
REQUESTED COMPLETION DATE:	

Sending Region	New Orleans	Sending Project Mgr.	
Receiving Region		External Client	
State of Sample Origin	Louisiana	QC Deliverable	

All questions should be addressed to sending project manager.

Type of Work: Analytical ☐ Other (Identify) ______________
Requested Reportable Units ______________ Report Wet or Dry Weight? ______________

WORK REQUESTED

Method Description	Container Type (include volume)	Quantity of containers	Preservative	Quantity of Samples	Unit Price	Amount
						$ -
						$ -
						$ -
						$ -
					TOTAL	$ -

Special Requirements: ______________

Receiving Region Department	Acctg. Code	Totals from above	Revenue Allocation Receiving Region (80%)	Client Services Dept. Sending Region (20%)
Microbiology	17		$ -	$ -
Metals	20		$ -	$ -
Wet Chem.	21		$ -	$ -
SV GCMS	30		$ -	$ -
SV GC & LC	31		$ -	$ -
V GC	33		$ -	$ -
V GCMS	34		$ -	$ -
Dioxin* (Includes Coplanar PCBs & PBDEs)	35		$ -	$ -
Air	39		$ -	$ -
Other(Specify)			$ -	$ -
Total			$ -	$ -

*Revenue Allocation (Receiving Region (90%) and Sending Region (10%))

FOR ANALYTICAL WORK COMPLETE THIS SECTION ALSO

Chain of Custody Included: ☐ Yes ☐ No Return Samples to Sending Region: ☐ Yes ☐ No

Matrix: ☐ Soil ☐ Water ☐ Air ☐ Other (identify) ______________

CONFIRMATION OF WORK COMPLETED

Date Completed: ______________ Receiving Project Manager: ______________

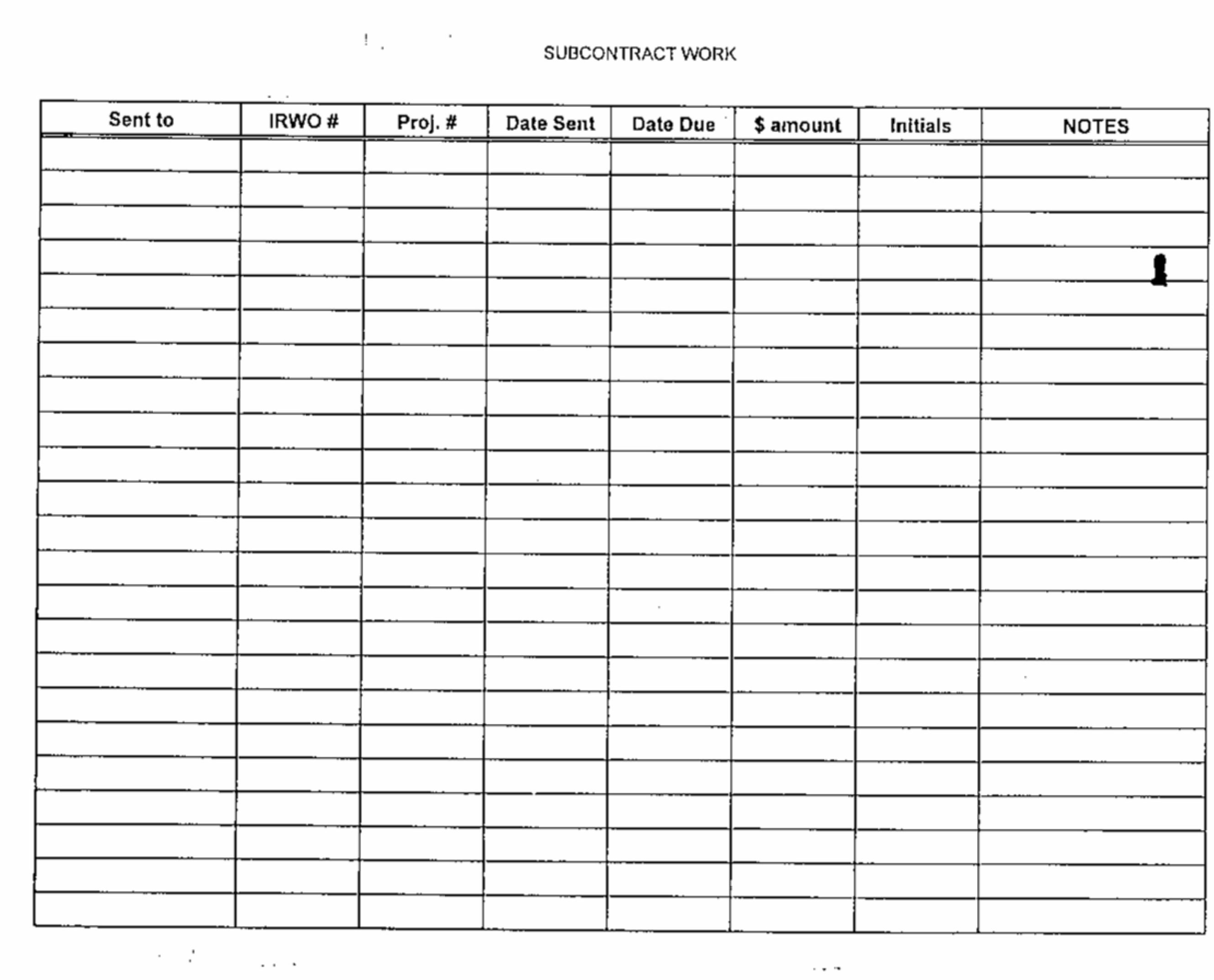
DISPOSITION of FORM

Original sent to the receiving lab - Copy kept at the sending lab.
When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

ALLC002rev.4, 17July2006

Attachment III

Sub-In Logbook (example)

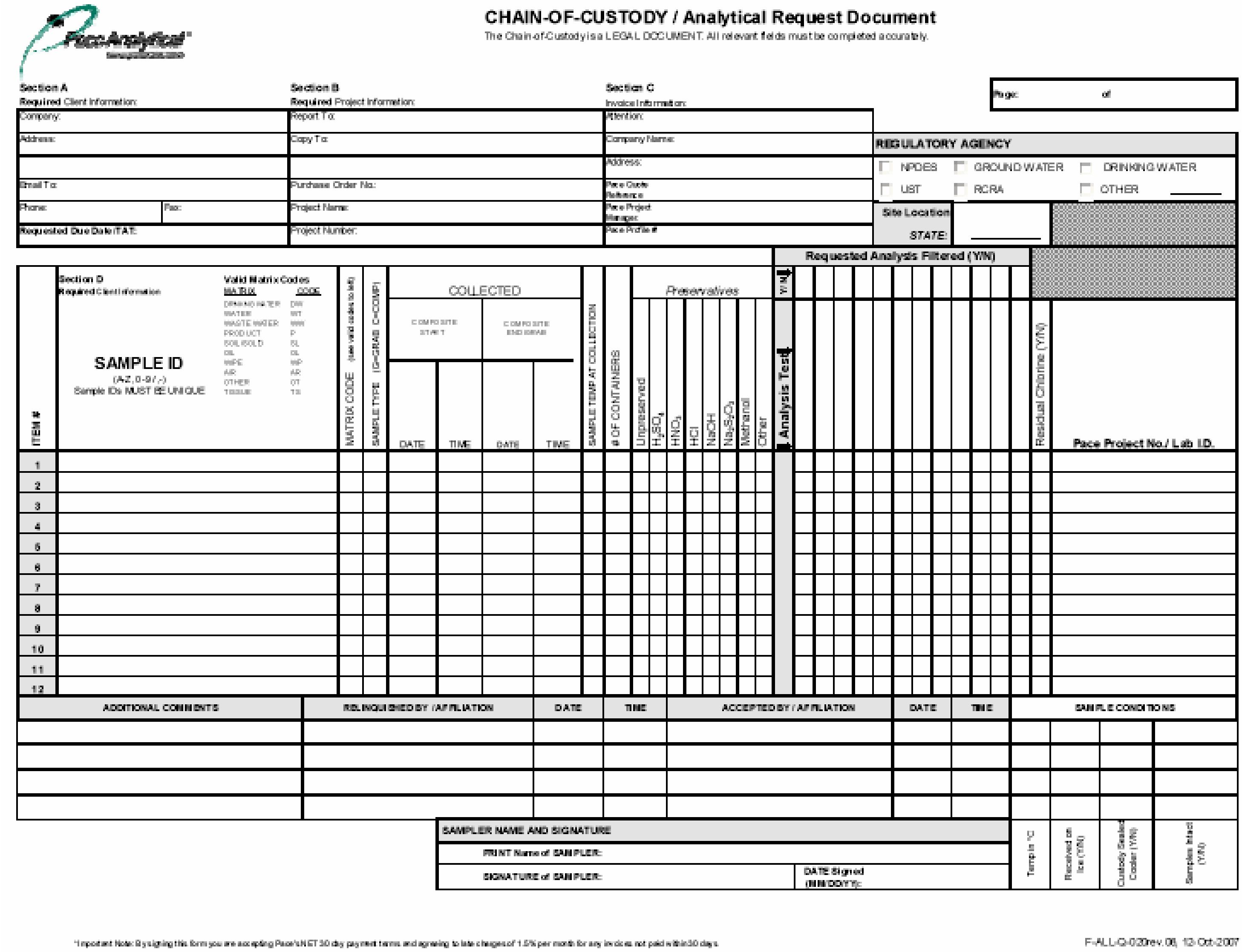


SUBCONTRACT WORK

Sent to	IRWO #	Proj. #	Date Sent	Date Due	$ amount	Initials	NOTES

Attachment IV

Chain of Custody (example)



Pace Analytical®

CHAIN-OF-CUSTODY / Analytical Request Document

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

Page: of

Section A **Required** Client Information:	Section B **Required** Project Information:	Section C Invoice Information:
Company:	Report To:	Attention:
Address:	Copy To:	Company Name:
		Address:
Email To:	Purchase Order No.:	Pace Quote Reference:
Phone: Fax:	Project Name:	Pace Project Manager:
Requested Due Date/TAT:	Project Number:	Pace Profile #:

REGULATORY AGENCY

☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location
STATE:

Section D
Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED COMPOSITE START DATE	COLLECTED COMPOSITE START TIME	COLLECTED COMPOSITE END/GRAB DATE	COLLECTED COMPOSITE END/GRAB TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Requested Analysis Filtered (Y/N)	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					
11																					
12																					

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS			
							Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER:

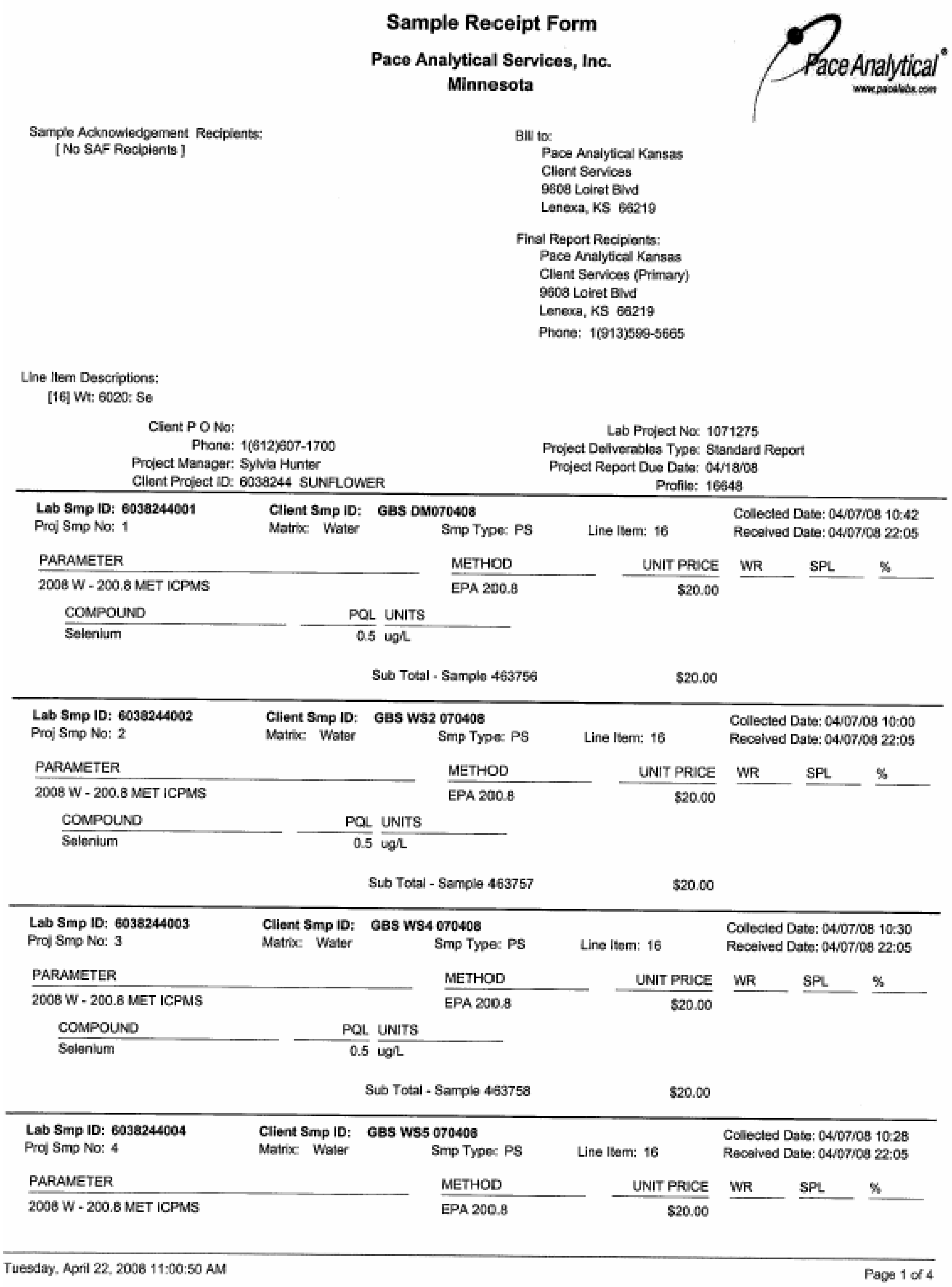
SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY):

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

F-ALL-Q-020rev.08, 12-Oct-2007

Attachment V
Sample Receipt Form (example)



Sample Receipt Form

Pace Analytical Services, Inc.
Minnesota

PaceAnalytical®
www.pacelabs.com

Sample Acknowledgement Recipients:
[No SAF Recipients]

Bill to:
Pace Analytical Kansas
Client Services
9608 Loiret Blvd
Lenexa, KS 66219

Final Report Recipients:
Pace Analytical Kansas
Client Services (Primary)
9608 Loiret Blvd
Lenexa, KS 66219
Phone: 1(913)599-5665

Line Item Descriptions:
[16] Wt: 6020: Se

Client P O No:
Phone: 1(612)607-1700
Project Manager: Sylvia Hunter
Client Project ID: 6038244 SUNFLOWER

Lab Project No: 1071275
Project Deliverables Type: Standard Report
Project Report Due Date: 04/18/08
Profile: 16648

Lab Smp ID: 6038244001 Proj Smp No: 1
Client Smp ID: GBS DM070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:42
Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463756 $20.00

Lab Smp ID: 6038244002 Proj Smp No: 2
Client Smp ID: GBS WS2 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:00
Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463757 $20.00

Lab Smp ID: 6038244003 Proj Smp No: 3
Client Smp ID: GBS WS4 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:30
Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

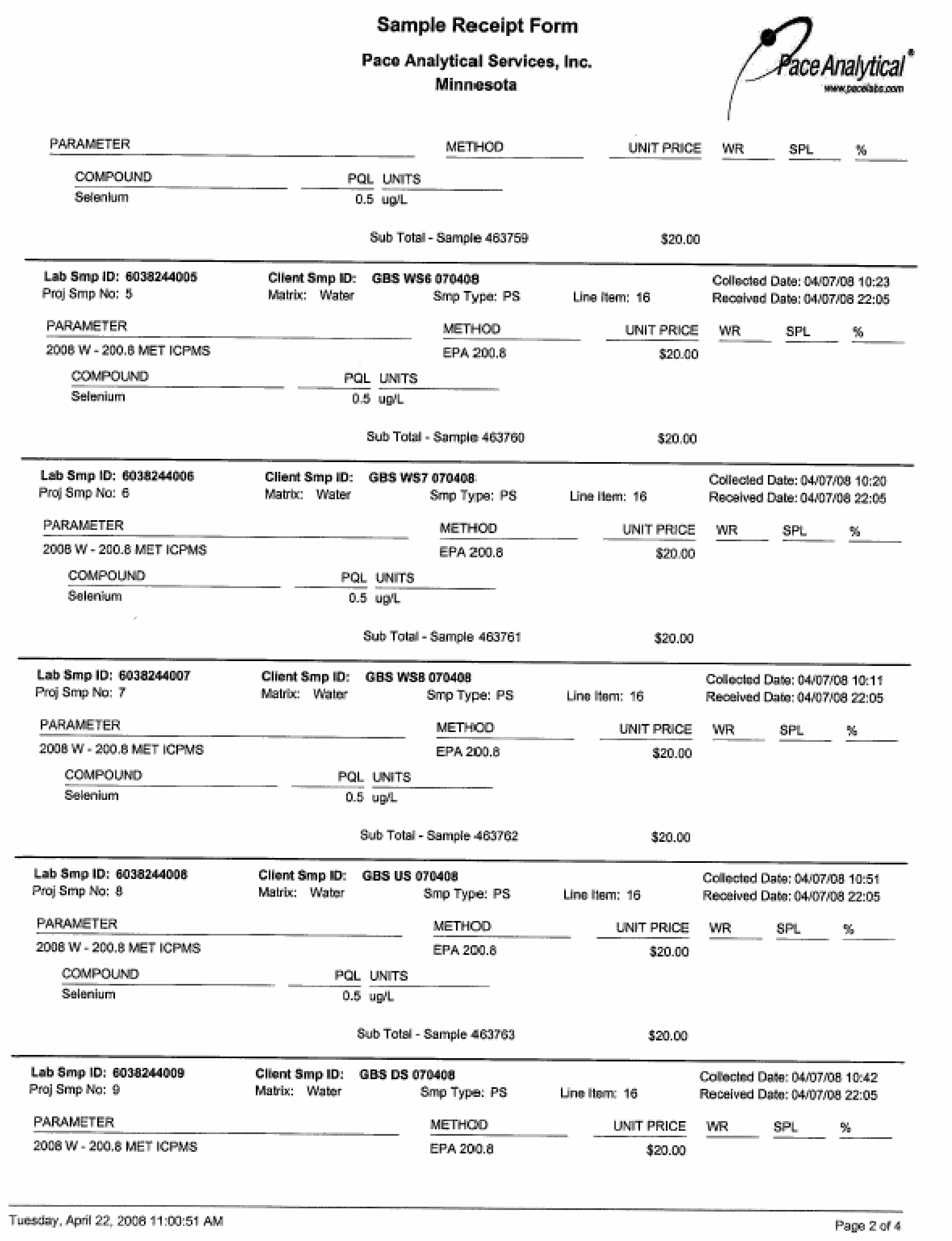
Sub Total - Sample 463758 $20.00

Lab Smp ID: 6038244004 Proj Smp No: 4
Client Smp ID: GBS WS5 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:28
Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

Tuesday, April 22, 2008 11:00:50 AM
Page 1 of 4

Attachment V (cont.)
Sample Receipt Form (example)



Sample Receipt Form

Pace Analytical Services, Inc.
Minnesota

Pace Analytical®
www.pacelabs.com

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463759 $20.00

Lab Smp ID: 6038244005 Proj Smp No: 5
Client Smp ID: GBS WS6 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:23 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463760 $20.00

Lab Smp ID: 6038244006 Proj Smp No: 6
Client Smp ID: GBS WS7 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:20 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463761 $20.00

Lab Smp ID: 6038244007 Proj Smp No: 7
Client Smp ID: GBS WS8 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:11 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463762 $20.00

Lab Smp ID: 6038244008 Proj Smp No: 8
Client Smp ID: GBS US 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:51 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463763 $20.00

Lab Smp ID: 6038244009 Proj Smp No: 9
Client Smp ID: GBS DS 070408 Matrix: Water Smp Type: PS Line Item: 16
Collected Date: 04/07/08 10:42 Received Date: 04/07/08 22:05

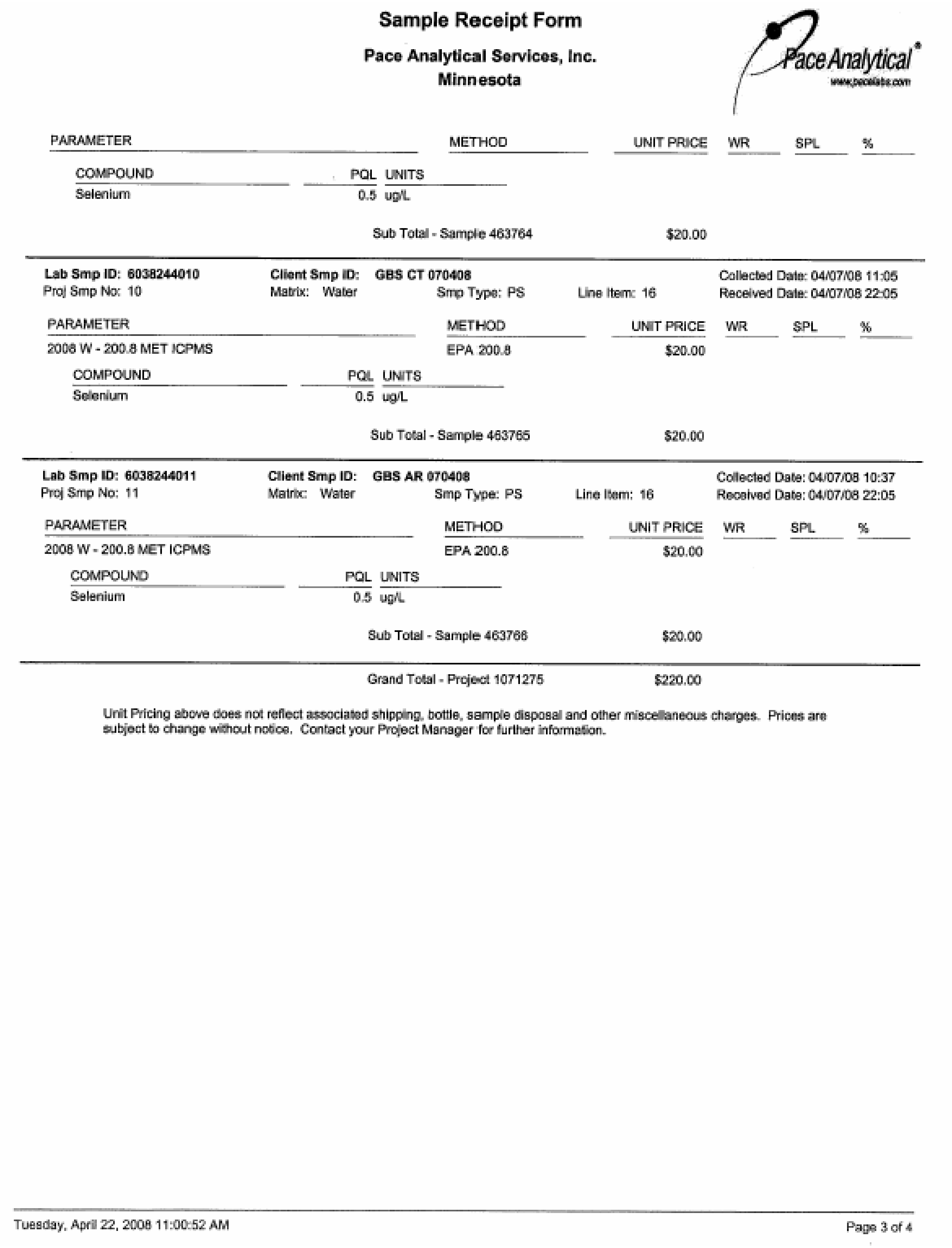
PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

Tuesday, April 22, 2008 11:00:51 AM

Page 2 of 4

Attachment V (cont.)

Sample Receipt Form (example)



Sample Receipt Form

Pace Analytical Services, Inc.
Minnesota

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463764 $20.00

Lab Smp ID: 6038244010 **Client Smp ID: GBS CT 070408** Collected Date: 04/07/08 11:05
Proj Smp No: 10 Matrix: Water Smp Type: PS Line Item: 16 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463765 $20.00

Lab Smp ID: 6038244011 **Client Smp ID: GBS AR 070408** Collected Date: 04/07/08 10:37
Proj Smp No: 11 Matrix: Water Smp Type: PS Line Item: 16 Received Date: 04/07/08 22:05

PARAMETER	METHOD	UNIT PRICE	WR	SPL	%
2008 W - 200.8 MET ICPMS	EPA 200.8	$20.00			

COMPOUND	PQL	UNITS
Selenium	0.5	ug/L

Sub Total - Sample 463766 $20.00

Grand Total - Project 1071275 $220.00

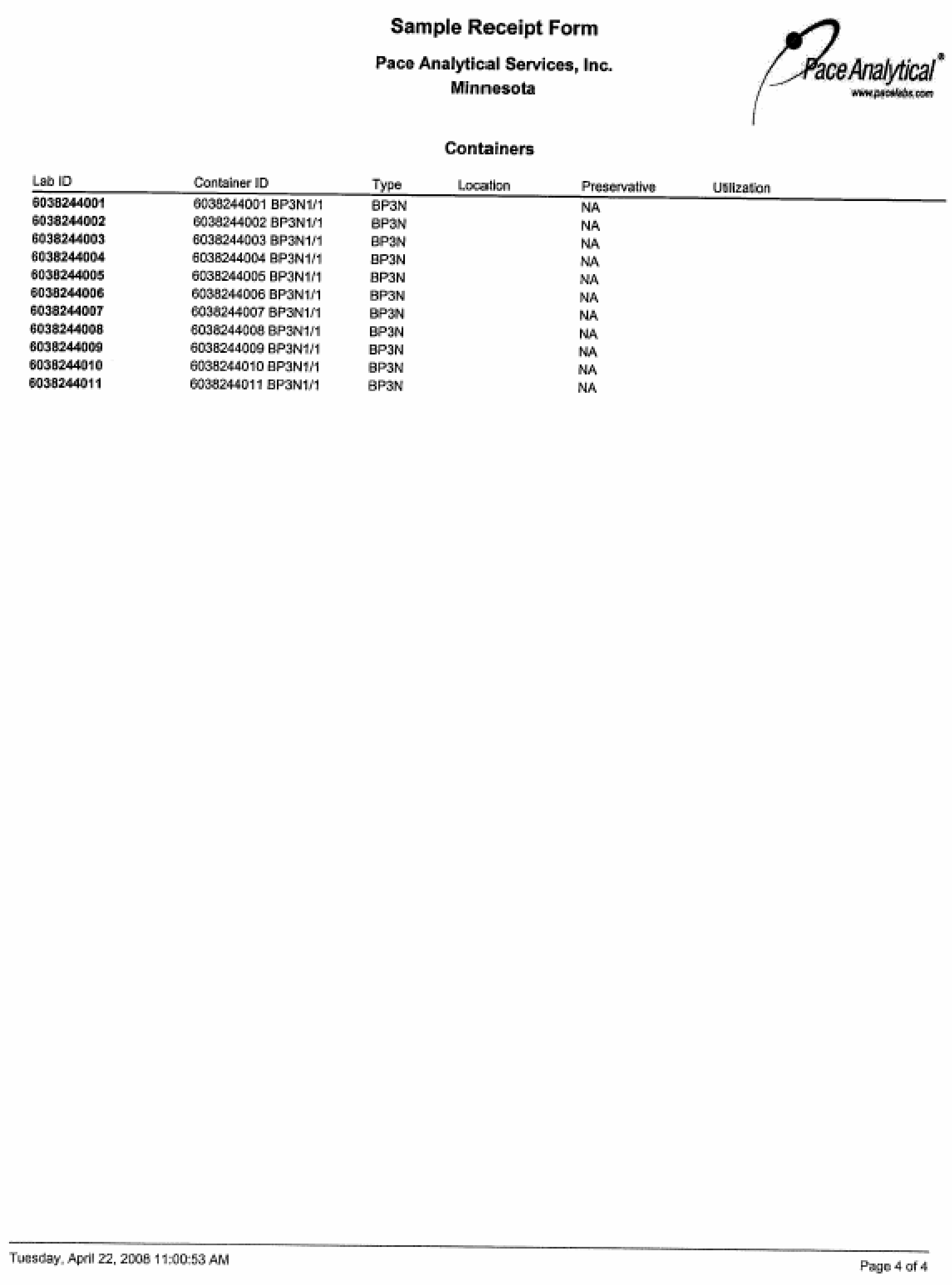
Unit Pricing above does not reflect associated shipping, bottle, sample disposal and other miscellaneous charges. Prices are subject to change without notice. Contact your Project Manager for further information.

Tuesday, April 22, 2008 11:00:52 AM

Page 3 of 4

Attachment V (cont.)

Sample Receipt Form (example)



Sample Receipt Form

Pace Analytical Services, Inc.
Minnesota

Containers

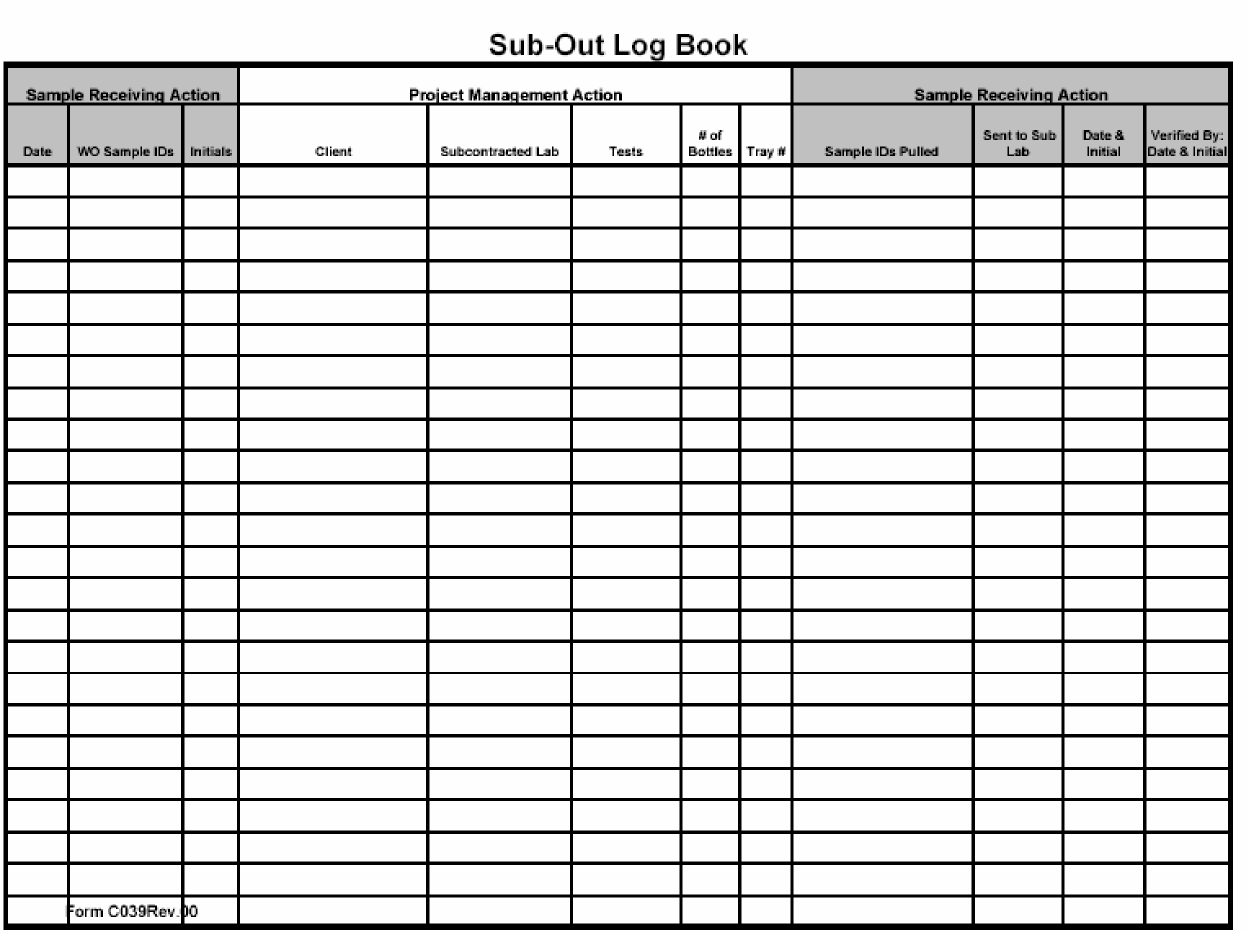
Lab ID	Container ID	Type	Location	Preservative	Utilization
6038244001	6038244001 BP3N1/1	BP3N		NA	
6038244002	6038244002 BP3N1/1	BP3N		NA	
6038244003	6038244003 BP3N1/1	BP3N		NA	
6038244004	6038244004 BP3N1/1	BP3N		NA	
6038244005	6038244005 BP3N1/1	BP3N		NA	
6038244006	6038244006 BP3N1/1	BP3N		NA	
6038244007	6038244007 BP3N1/1	BP3N		NA	
6038244008	6038244008 BP3N1/1	BP3N		NA	
6038244009	6038244009 BP3N1/1	BP3N		NA	
6038244010	6038244010 BP3N1/1	BP3N		NA	
6038244011	6038244011 BP3N1/1	BP3N		NA	

Tuesday, April 22, 2008 11:00:53 AM

Page 4 of 4

Attachment VI

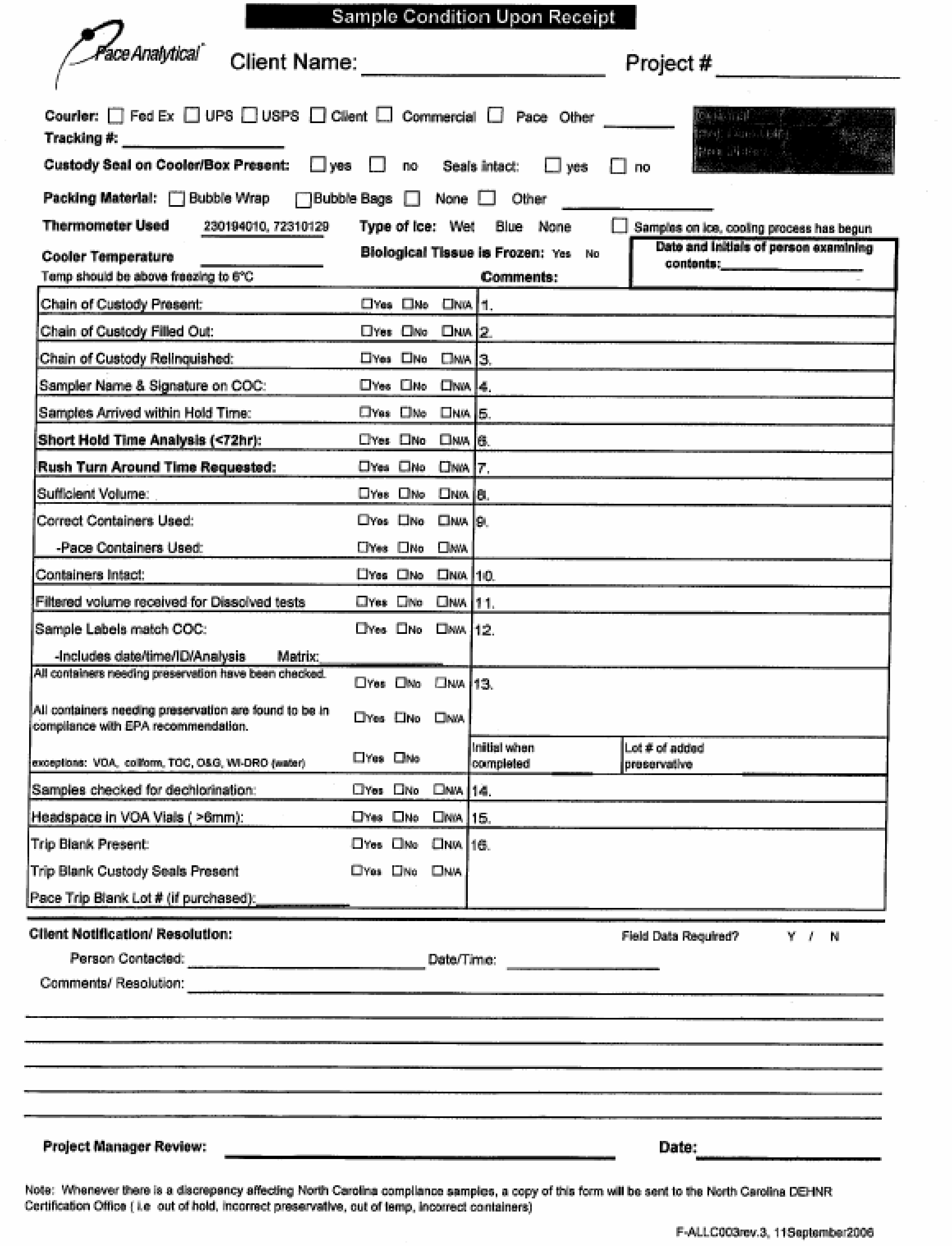
Sub-Out Log Book (example)



Sub-Out Log Book

Sample Receiving Action			Project Management Action					Sample Receiving Action			
Date	WO Sample IDs	Initials	Client	Subcontracted Lab	Tests	# of Bottles	Tray #	Sample IDs Pulled	Sent to Sub Lab	Date & Initial	Verified By: Date & Initial
	Form C039Rev.00										

Attachment VII
Sample Condition Upon Receipt (SCUR)



Sample Condition Upon Receipt

Pace Analytical

Client Name: ____________________ **Project #** ______________

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

Tracking #: ______________

[redacted]

Custody Seal on Cooler/Box Present: ☐ yes ☐ no Seals intact: ☐ yes ☐ no

Packing Material: ☐ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other ____________

Thermometer Used 230194010, 72310129 **Type of Ice:** Wet Blue None ☐ Samples on ice, cooling process has begun

Cooler Temperature ____________ **Biological Tissue is Frozen:** Yes No

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ____________

		Comments:
Chain of Custody Present:	☐Yes ☐No ☐N/A	1.
Chain of Custody Filled Out:	☐Yes ☐No ☐N/A	2.
Chain of Custody Relinquished:	☐Yes ☐No ☐N/A	3.
Sampler Name & Signature on COC:	☐Yes ☐No ☐N/A	4.
Samples Arrived within Hold Time:	☐Yes ☐No ☐N/A	5.
Short Hold Time Analysis (<72hr):	☐Yes ☐No ☐N/A	6.
Rush Turn Around Time Requested:	☐Yes ☐No ☐N/A	7.
Sufficient Volume:	☐Yes ☐No ☐N/A	8.
Correct Containers Used:	☐Yes ☐No ☐N/A	9.
-Pace Containers Used:	☐Yes ☐No ☐N/A	
Containers Intact:	☐Yes ☐No ☐N/A	10.
Filtered volume received for Dissolved tests	☐Yes ☐No ☐N/A	11.
Sample Labels match COC:	☐Yes ☐No ☐N/A	12.
-Includes date/time/ID/Analysis Matrix: ____________		
All containers needing preservation have been checked.	☐Yes ☐No ☐N/A	13.
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes ☐No ☐N/A	
exceptions: VOA, coliform, TOC, O&G, WI-DRO (water)	☐Yes ☐No	Initial when completed ______ Lot # of added preservative ______
Samples checked for dechlorination:	☐Yes ☐No ☐N/A	14.
Headspace in VOA Vials (>6mm):	☐Yes ☐No ☐N/A	15.
Trip Blank Present:	☐Yes ☐No ☐N/A	16.
Trip Blank Custody Seals Present	☐Yes ☐No ☐N/A	
Pace Trip Blank Lot # (if purchased): ____________		

Client Notification/ Resolution: Field Data Required? Y / N

Person Contacted: ______________________ Date/Time: ______________

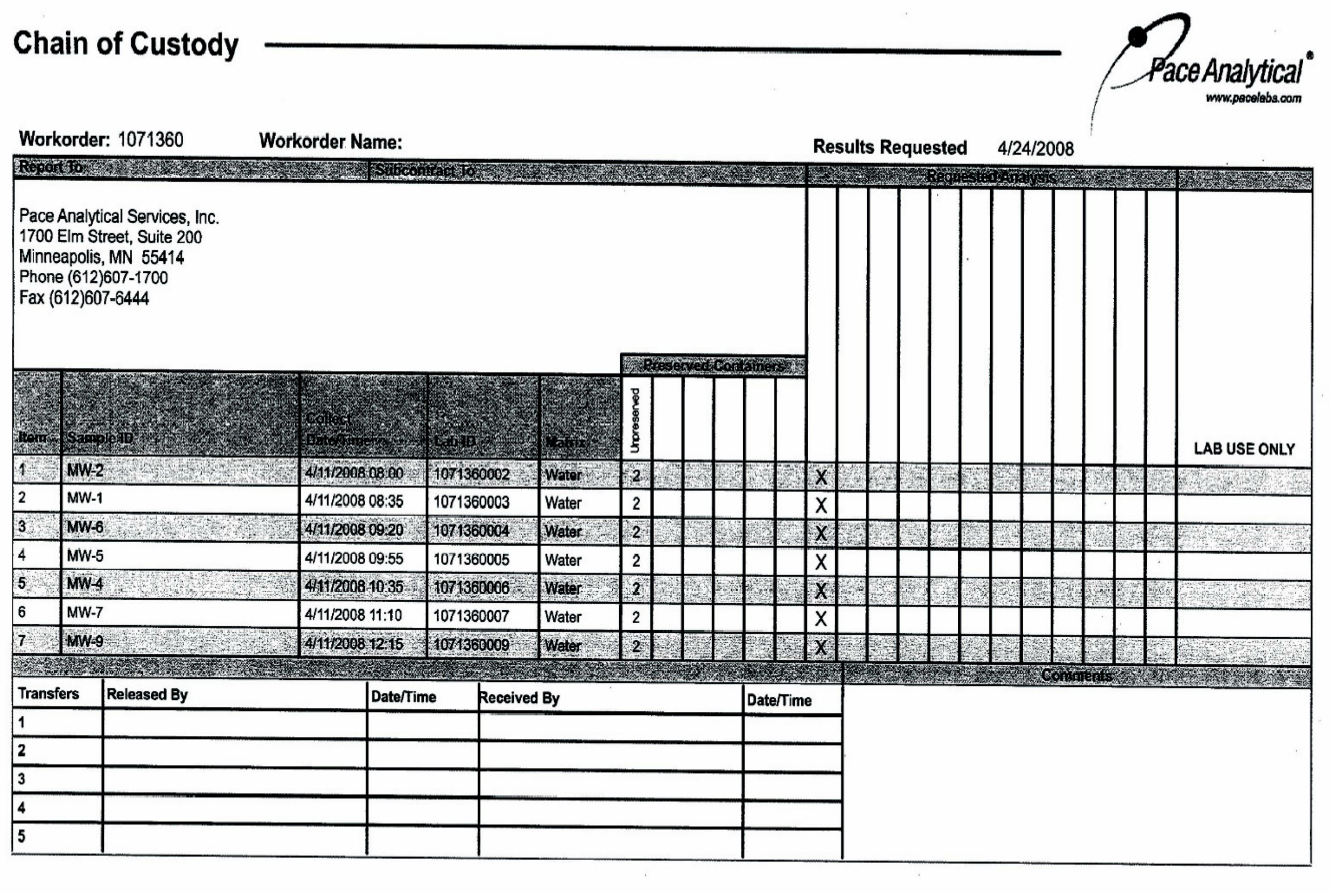
Comments/ Resolution: ____

Project Manager Review: ______________________________ **Date:** ______________

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

F-ALLC003rev.3, 11September2006

Attachment VIII
Sub-In COC



Chain of Custody

Workorder: 1071360 **Workorder Name:** **Results Requested** 4/24/2008

Report To: Subcontract To:

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Phone (612)607-1700
Fax (612)607-6444

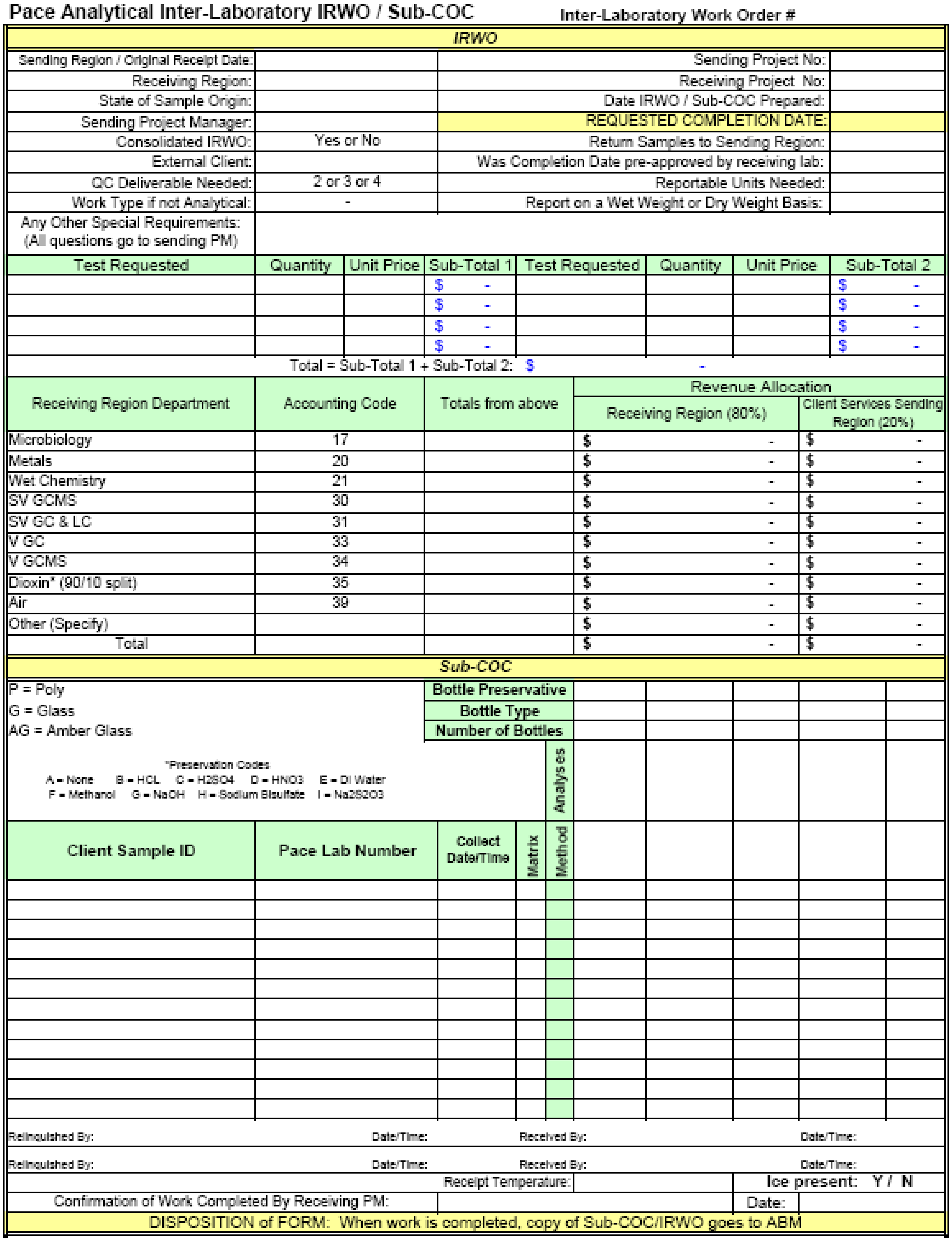
Item	Sample ID	Collect Date/Time	Lab ID	Matrix	Preserved Containers						Requested Analysis												
					Unpreserved																		LAB USE ONLY
1	MW-2	4/11/2008 08:00	1071360002	Water	2						X												
2	MW-1	4/11/2008 08:35	1071360003	Water	2						X												
3	MW-6	4/11/2008 09:20	1071360004	Water	2						X												
4	MW-5	4/11/2008 09:55	1071360005	Water	2						X												
5	MW-4	4/11/2008 10:35	1071360006	Water	2						X												
6	MW-7	4/11/2008 11:10	1071360007	Water	2						X												
7	MW-9	4/11/2008 12:15	1071360009	Water	2						X												

Transfers	Released By	Date/Time	Received By	Date/Time
1				
2				
3				
4				
5				

Comments

Attachment IX

IRWO/ Sub-COC Form (example)



Pace Analytical Inter-Laboratory IRWO / Sub-COC Inter-Laboratory Work Order #

IRWO

Sending Region / Original Receipt Date:		Sending Project No:	
Receiving Region:		Receiving Project No:	
State of Sample Origin:		Date IRWO / Sub-COC Prepared:	
Sending Project Manager:		REQUESTED COMPLETION DATE:	
Consolidated IRWO:	Yes or No	Return Samples to Sending Region:	
External Client:		Was Completion Date pre-approved by receiving lab:	
QC Deliverable Needed:	2 or 3 or 4	Reportable Units Needed:	
Work Type if not Analytical:	-	Report on a Wet Weight or Dry Weight Basis:	
Any Other Special Requirements: (All questions go to sending PM)			

Test Requested	Quantity	Unit Price	Sub-Total 1	Test Requested	Quantity	Unit Price	Sub-Total 2
			$ -				$ -
			$ -				$ -
			$ -				$ -
			$ -				$ -

Total = Sub-Total 1 + Sub-Total 2: $ -

Receiving Region Department	Accounting Code	Totals from above	Revenue Allocation	
			Receiving Region (80%)	Client Services Sending Region (20%)
Microbiology	17		$ -	$ -
Metals	20		$ -	$ -
Wet Chemistry	21		$ -	$ -
SV GCMS	30		$ -	$ -
SV GC & LC	31		$ -	$ -
V GC	33		$ -	$ -
V GCMS	34		$ -	$ -
Dioxin* (90/10 split)	35		$ -	$ -
Air	39		$ -	$ -
Other (Specify)			$ -	$ -
Total			$ -	$ -

Sub-COC

P = Poly
G = Glass
AG = Amber Glass

Bottle Preservative					
Bottle Type					
Number of Bottles					
Analyses					

*Preservation Codes
A = None B = HCL C = H2SO4 D = HNO3 E = DI Water
F = Methanol G = NaOH H = Sodium Bisulfate I = Na2S2O3

Client Sample ID	**Pace Lab Number**	Collect Date/Time	Matrix	Method					

Relinquished By: Date/Time: Received By: Date/Time:
Relinquished By: Date/Time: Received By: Date/Time:
Receipt Temperature: Ice present: Y / N
Confirmation of Work Completed By Receiving PM: Date:

DISPOSITION of FORM: When work is completed, copy of Sub-COC/IRWO goes to ABM

STANDARD OPERATING PROCEDURE
INTERNAL CHAIN OF CUSTODY

www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414

Phone: 612.607.1700
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STANDARD OPERATING PROCEDURE

INTERNAL CHAIN OF CUSTODY

Reference Methods: N/A

SOP NUMBER:	S-MN-C-005-Rev.00
EFFECTIVE DATE:	07 May 2007
SUPERSEDES:	MN-P-014-Rev.1

APPROVAL

General Manager — Date: 01 MAY 2007

Melanie Ollila
Quality Manager — Date: 07 May 2007

ANNUAL REVIEW

Signatures below indicate no changes have been made since approval. SOP is valid for one year from date of last signature.

Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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Table of Contents

1. Purpose

The purpose of this standard operating procedure (SOP) is to establish a uniform procedure for internal chain of custody in the Minnesota laboratory.

2. Scope and Application

This procedure is applicable to the samples received in the laboratory that require Internal Chain of Custody as outlined in the program documentation (e.g. Air Force).

3. Summary of Method

Samples are received by the laboratory and tracked through the laboratory by using logbooks and the laboratory information management system (LIMS).

4. Interferences

Not applicable

5. Safety

Not applicable

6. Definitions

6.1 Internal Chain of Custody – A means of documenting the location and possession of an environmental sample through the laboratory.

6.2 For more definitions, refer to the Pace Analytical Services, Inc. Quality Manual.

7. Responsibilities and Distribution

7.1 Laboratory General Manager – The Laboratory General Manager has overall responsibility for ensuring that SOPs are prepared and implemented for all activities appropriate to the region.

7.2 The General Manager will review and approve all SOPs.All personnel involved with sample preparation and analysis are responsible for adherence to this SOP. A controlled copy will be available for review and consultation within the area methods manual.

7.3 Quality Manager (QM) – The QM is responsible for distribution of this SOP.

7.4 Department Supervisor – The supervisor must ensure that all analysts are properly trained and qualified to use this procedure. The supervisor is also responsible to ensure that the SOP is followed. The supervisor is responsible for reviewing the SOP and communicating recommended changes to the QM.

7.5 Personnel– Any personnel using this procedure is responsible for reading, understanding and following this SOP. Any deviation from this SOP must be reported to the appropriate Supervisor. The analyst must make their recommendations for changing the SOP to their supervisor or the QM in writing.

7.6 Revision – This SOP will be reviewed annually at a minimum. It will also be revised as needed if procedures or methods change.

7.7 Distribution – The official version of this SOP is the signed hardcopy version found in the laboratory, with current applicable addenda. A copy of the SOP shall be kept in the appropriate department for reference.

8. Sample Collection, Preservation, and Handling

Not applicable

9. Equipment and Supplies

Not applicable

10. Reagents and Standards

Not applicable

11. Calibration

Not applicable

12. Procedure

12.1. Sample Receipt and Storage

12.1.1. Samples are received and logged into the LIMS per S-MN-C-001, Sample Management and T-ALL-IT-005, EPIC Pro: Login.

12.1.2. The sample custodian will fill out a copy of the internal COC for each sample storage area.

12.1.3. Each copy of the ICOC must be signed (initials are acceptable) by the sample custodian transferring the sample bottles to the sample storage area. The form must also have the notation of time and date of transfer.

12.1.4. The COC will then be stored with the samples and COC.

12.1.5. The sample bottles are placed in the cooler.

12.2. Sample Retrieval

12.2.1. Once samples have been batched in the LIMS, a worklist is printed which lists all the samples and bottle types needed.

12.2.2. The analyst will go to the appropriate storage location and retrieve the ICOC and the samples.

12.2.3. Prior to using the sample, the analyst must note on the ICOC under the date, time, initials and reason for taking sample.

12.2.4. If the entire container will be consumed, it must be noted on the ICOC.

12.2.5. If the sample is not consumed, the remaining sample and ICOC must be brought back to the original storage location.

12.3. Sample Login

12.3.1 After the appropriate amount of time has passed any remaining sample must be properly disposed of per S-MN-C-001-rev.0 (Sample Management) and ALL-S-002-rev.0 (Waste

Handling).

12.3.2 The sample custodian will retrieve the ICOC and the sample to be disposed.

12.3.3 Each sample is marked as “Disposed” with the date, initials, and time.

13. Quality Control

13.1 Original ICOC will be retained in three-ring binder, and periodically will be spiral bound and stored in the QAO.

14. Method Performance

Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures. The analyst must read and understand this procedure with written documentation maintained in his/her training file.

15. Pollution Prevention and Waste Management

15.1. In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount that may be used in a reasonable amount of time (i.e. before a reagent expires).

15.2. The Chemical Hygiene Plan/Health and Safety Plan contain additional information on pollution prevention.

16. References

Not applicable

17. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

Not applicable

18. Revisions

Document Number	Changes	Date
MN-P-014-rev.1	Deleted Table 1 Deleted Attachment 1 and 2 Changed CF to ICOC throughout SOP Changed MN-C-702 to ALL-C-001 and T-ALL-IT-005 in Section 12	25Jul2006
S-MN-C-005-Rev.00	Update name formatting Update SOP formatting	30Apr2007

STANDARD OPERATING PROCEDURE
DATA ARCHIVING AND RETRIEVAL

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STANDARD OPERATING PROCEDURE

Data Archiving and Retrieval

References N/A

SOP NUMBER	S-MN-L-106-Rev.06
EFFECTIVE DATE	19 December 2008
SUPERSEDES	S-MN-L-106-Rev.05

APPROVAL

Laboratory General Manager. — 19DEC2008
Date

Melanie Ollila
Quality Assurance Manager — 19Dec 2008
Date

ANNUAL REVIEW
SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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TABLE OF CONTENTS

Page No.

1. PURPOSE

This Standard Operating Procedures (SOP) sets forth the policies and procedures to be followed to ensure acceptable performance of data storage and retrieval operations.

2. SCOPE/APPLICATION

2.1. After electronic data have been acquired for specific periods of time, they need to be stored on a device other than the hard drive of the computer that controlled the acquisition process. This process requires that the files be transferred to a compact disc (CD).

2.2 In conjunction with the electronic media storage, all paper documentation must be catalogued and stored for a period of time relating to the federal program guidelines the samples were analyzed under.

3. SUMMARY OF METHOD

3.1 Archives for orderly storage and expedient retrieval of all raw data, documentation, and records generated in the design and operation of the automated data collection system will be maintained by the laboratory. Conditions of storage shall minimize potential deterioration of documents or magnetic media in accordance with the requirements for the retention period and the nature of the documents or magnetic media. Only personnel with documented authorization to access the archives shall be permitted this access.

3.2 The laboratory shall provide adequate storage capability of the automated data collection system or of the facility itself to provide for retention of raw data, including archives of computer-resident data.

4. INTERFERENCES

Not Applicable.

5. SAFETY

Not Applicable.

6. DEFINITIONS

Not Applicable

7. SAMPLE COLLECTION, PRESERVATION AND HANDLING

Not Applicable.

8. EQUIPMENT AND SUPPLIES

Not Applicable.

9. REAGENTS AND STANDARDS

Not Applicable.

10. CALIBRATION

Not Applicable.

11. PROCEDURE

11.1 Hardcopy (paper) archiving and retrieval

11.1.1 Upon analyst completion of data, reports, logbooks, traceability, etc., the information is stored in standard size banker boxes in an organized fashion by batch number, date, etc.

11.1.2 Analysts should inventory the contents of the box as it is filled. The inventory must be written on the front of the box and on a sheet of paper placed in the box.

11.1.3 After a box is full, the analyst or QA must deliver the box to the Tier II storage room in the “boxes to be archived” area. Please refer to Attachment I for complete instructions on data box archiving.

11.1.4 The QA office will add barcode labels to the boxes (see Attachment II). This barcode number should be recorded in the Excel spreadsheet (see Attachment III for an example).

11.1.5 A bright label is placed on the front of the box with a corresponding number according to the barcode/box number spreadsheet (Attachment III) . The QA office will record the information on the outside of the box and any supplemental box detail into an Excel spreadsheet. This spreadsheet should allow for quick retrieval of data if necessary.

11.1.6 Boxes are retained on site in the storage room for approximately 60 days.

11.1.7 When 50-100 boxes are ready for off-site storage, the QA office should contact the offsite storage facility by phone or fax to arrange for pickup of boxes. Generally boxes are picked up within 24 hours of requested pickup. 50+ boxes require warehouse approval, which could take longer.

11.1.8 Data are stored for a minimum of five years or longer depending on federal program or contractual guidelines.

11.1.9 If data needs to be retrieved from storage, the person needing the data will contact the QA office with as many details about the nature of the data needed (dates, batch numbers, lab area, etc.).

11.1.10 The QA office will use the Excel spreadsheet to search boxes

11.1.11 The QA office will contact the offsite storage facility via telephone (ten boxes or fewer) or fax and request boxes by the barcode number assigned in the Excel. Retrieval requests are usually received by 5pm the next business day. Rush delivery is available at additional charge.

11.1.12 When data needs to be returned to storage, the person returning the data will contact the QA office.

11.1.13 The QA office will contact the offsite storage facility via telephone or website to arrange for pickup of boxes.

11.2. Electronic System Backup.

11.2.1. Target-Data Extraction: Each day data is automatically transferred from the winTarget Server to a networked Linux PC equipped with a CD-ROM or DVD burner.

11.2.1.1. A script running in a UNIX crontab entry on each winTarget accomplishes the data transfer. (i.e. autobackup)

11.2.1.2. The data is extracted for a period of three consecutive days and stored on the PC hard drive until such time as the volume stored will fill a CD/DVD. It is stored under \chem\dvdchem directory.

11.2.1.3. The original data remains on the Target Server for approximately five weeks. The data is then transferred to the burner PC, removed from the Target Server via a script (i.e. maketar). The data is then burned on a permanently stored CD/DVD, which is kept in a fireproof file cabinet or in a fireproof safe at offsite location.

11.2.1.4. To burn the data onto a CD/DVD, begin with going to the Linux PC station (i.e. 10TargetArchive)..

11.2.1.5. Start the CD/DVD burning software program (i.e. k3b) and Select New Data DVD Project.

11.2.1.5.1. Under the Data DVD portion of the screen, rename the data label from “k3b data project” to the following format yymmdd_hhmm

11.2.1.6. Drag and drop the files from the /chem/dvdchem or /chem/Archives. directory into the data CD project portion of the screen (i.e. the lower half of screen). Keep the daily and archive data on separate disks.

11.2.1.6.1 Data from \chem\dvdchem is considered "daily" data.

11.2.1.6.2 Data from the \chem\Archives is considered "Archive" data.

11.2.1.7. At the bottom of the card, the total file size brought over will show. One DVD will hold a maximum of 4.7 GB.

11.2.1.8. Note: Never open the instrument directory in the /chem/Archives or /chem/dvddata. If you do, you will continually overwrite each tar directory since they are not unique unless as a part of the instrument pathway. Also, drag only tar files.

11.2.1.9. If you drag too much data onto the Data CD/DVD Layout card to transfer, remove the individual instrument files until you have less than 4.7 GB if DVD.

11.2.1.10. Place a new CD/DVD in the CD or DVD burner. Press the button on the menu bar to BURN CD/DVD. Select "Verify Written Data" and press Burn.

11.2.1.11. Continue above steps until all remaining data on the /chem/Archives or /chem/dvddata. Directory is transferred to a CD/DVD.

11.2.1.12. When finished, return to /chem/dvddata. Directory and grab all files that were transferred successfully in the CD/DVD burn and delete from PC.

11.2.1.13. When finished with the /chem/Archives directory move the data to the appropriate directory under /chem/BurnedToCD. Although this is not necessary it does allow us to keep several months of data "on-line" verses searching through CD/DVD.

11.2.2 Target- Mapping the data for retrieval:

11.2.2.1 Insert the CD/DVD which you just burned to CD/DVD-read drive. You must be logged on as a superuser (#prompt) at the Target system. Perform the following steps:

```
# cd /home/target
```

```
# ./ReadCDDiskContent______[enter]
```

Note: This will automatically mount and un-mount the CD/DVD burner.

11.2.2.2. In the above command, insert the disk number that you want to map in the space. Notice the green light flashing on the CD/DVD-ROM box-working.

11.2.2.3 Once you have mapped your CDs on your local PC, open the appropriate cdfind.mdb database and click an append button. This is located t:\targetbackup.

11.2.2.4 After finishing, return to Target and go to #cd /home/target/logfiles. Then delete 2 files from each of the following locations:

```
#rm –rf FileListOFCDs*
```

```
# rm –rf DiskContentsOfCDs*
```

11.2.2.5 Verify the files were loaded successfully by a random comparison between the disk and the appropriate cdfind.mdb.

11.2.3 Target- Retrieval of data from the CD:

11.2.3.1. Open the appropriate cdfind database to find a CD with data which you need. Insert your CD to the CD- ROM (or DVD) drive.

11.2.3.2. On the local PC, copy/paste the appropriate files from the CD/DVD onto the winTarget server using the Samba drive mapping share. (i.e. u: drive)

11.2.3.3. Log into the Target Server.

11.2.3.4. Change directories by: cd /chem.

11.2.3.5. Extract the data using the following command # tar xvf <batch.tar> [Enter]

11.2.3.6. Once completed delete the tar files # rm *.tar

11.2.3.7. Log out of server.

11.2.3.8. If you want to transfer files from the 10TargetArchive PC directly to the winTarget server

11.2.3.8.1. Log into the 10TargetArchive PC

11.2.3.8.2. Locate the correct instrument/batch file under the /chem./BurnToCD directory

11.2.3.8.3. ftp 10winTarget

11.2.3.8.4. Copy the appropriate files (i.e. using the put command)

11.2.3.8.5. Close FTP and log out of server

11.2.3.8.6. Login into the Target Server

11.2.3.8.7. Move the tar files from the /home/ftpuser directory to the /chem. directory.

11.2.3.8.8. Extract the data using the following command # tar xvf <batch.tar> [Enter]

11.2.3.8.9. Once completed delete the tar files # rm *.tar

11.2.3.8.10. Log out of server

11.2.4 IOMEGA Backup software- Instructions for ICP (Optima) instrumentation

11.2.4.1 Each Optima is backed up n a similar fashion using the IOMEGA software. Only the destination of the data is different.

11.2.4.2 Select “save revisions”. Select all items under notifications and warnings.

11.2.4.3 The software will automatically check for changes every day at 5:45 am.

11.2.4.4 As needed, the files are burned to CD/DVD. The CD/DVDsare stored in a fire resistant cabinet in the server room.

11.2.4.5 The data is also backed up via Net Vault using the standard backup procedures for the Novell server. See SOP #______ for more information. NOTE: Any data on the server on December 31st. will be stored as part of a permanent tape archive.

11.2.4.6 When there is sufficient data, the data will be burned to CD.

11.2.4.7 After the CD is verified to be readable, the data should be removed from the Novell server.

11.2.4.8 The analyst should check periodically to make sure that the back-ups are occurring by checking the data on the Novell Server.

11.2.5 IOMEGA Backup software- Instructions for ICPMS instrumentation

11.2.5.1 Elan data is backed up from c:\elandata and its subdirectories to v:\ICPMS. Each Optima is backed up in a similar fashion using the IOMEGA software. Only the destination of the data is different.

11.2.5.2 ThermoFisher data is backed up from c:\Program Files\ThermoFisher\PlasmaLab\data and its subdirectories to v:\ICPMS3

11.2.5.3 Do not save revisions. Select all items under Notifications and Warnings.

11.2.5.4 The software will automatically check for changes every Sunday at 1:00 am.

11.2.5.5 Approximately once a month the data on the Novell Server is burned to CD/DVD. Two CD/DVDs are made:

11.2.5.5.1 One CD/DVD is burned including the data found under v:\icpms\elandata\dataset. The disk is labeled with month, year, and the unique label ID given to the CD/DVD during the burning process (i.e.icpmsmmddyy_mmtt)

11.2.5.5.2 One CD/DVD is burned including the miscellaneous directories found under v:\icpms\elandata. The disc is labeled with the unique label ID (as described in 5a), along with a general description as to what is on the disk.

11.2.5.6 The CD/DVDs are stored in a fire resistant cabinet in the server room.

11.2.5.7 The data is also backed up via Net Vault using the standard backup procedures for the Novell server. See SOP #______ for more information. NOTE: Any data on the server on December 31st. will be stored as part of a permanent tape archive.

11.2.5.8 After the CD is verified to be readable, the data should be removed from the Novell server.

11.2.5.9 The analyst should check periodically to make sure that the back-ups are occurring by checking the data on the Novell Server.

11.2.6 IOMEGA Backup software- Instructions for FIMs instrumentation

11.2.6.1 The FIMs is backed up n a similar fashion using the IOMEGA software. The following directories are backed up:

11.2.6.1.1 c:\Program Files\WinLab32-AA

11.2.6.1.2 c:\data-AA

11.2.6.1.3 c:\ni-488.2

11.2.6.2 Select “save revisions”. Select all items under notifications and warnings.

11.2.6.3 The software will automatically check for changes every day at 5:45 am.

11.2.6.4 As needed, the files are burned to CD/DVD. The CD/DVDs are stored in a fire resistant cabinet in the server room.

11.2.6.5 The data is also backed up via Net Vault using the standard backup procedures for the Novell server. See SOP #______ for more information. NOTE: Any data on the server on December 31st. will be stored as part of a permanent tape archive.

11.2.6.6 When there is sufficient data, the data will be burned to CD.

11.2.6.7 After the CD is verified to be readable, the data should be removed from the Novell server.

11.2.6.8 The analyst should check periodically to make sure that the back-ups are occurring by checking the data on the Novell Server

11.2.7. Manual Backup- Used for instrumentation not covered by the previously outlined procedures.

11.2.7.1. Analyst will copy data to the appropriate instrument directory on the Novell Server (for example: V:\FIMS\)

11.2.7.4. When there is sufficient data, analyst will burn the data to CD.

11.2.7.5. After the CD is verified to be readable, the data should be removed from the Novell server.

12. QUALITY CONTROL

Not Applicable.

13. METHOD PERFORMANCE

Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures including ALL-IT-002 Computer Backup. The analyst must read and understand this procedure with written documentation maintained in his/her training file.

14. POLLUTION PREVENTION AND WASTE MANAGEMENT

Not Applicable.

15. REFERENCES

All references are to the current issue of the document available at the time the procedure was prepared. As these documents are revised they will supersede the reference documents. The requirements of the most current approved copy shall be implemented for compliance with the requirements of this procedure.

16. TABLES, DIAGRAMS, FLOWCHARTS, APPENDICES, ADDENDA ETC

16.1 Attachment I: Form Q088Rev.01 – Archive Box Instructions

16.2 Attachment II: Recall Sticker

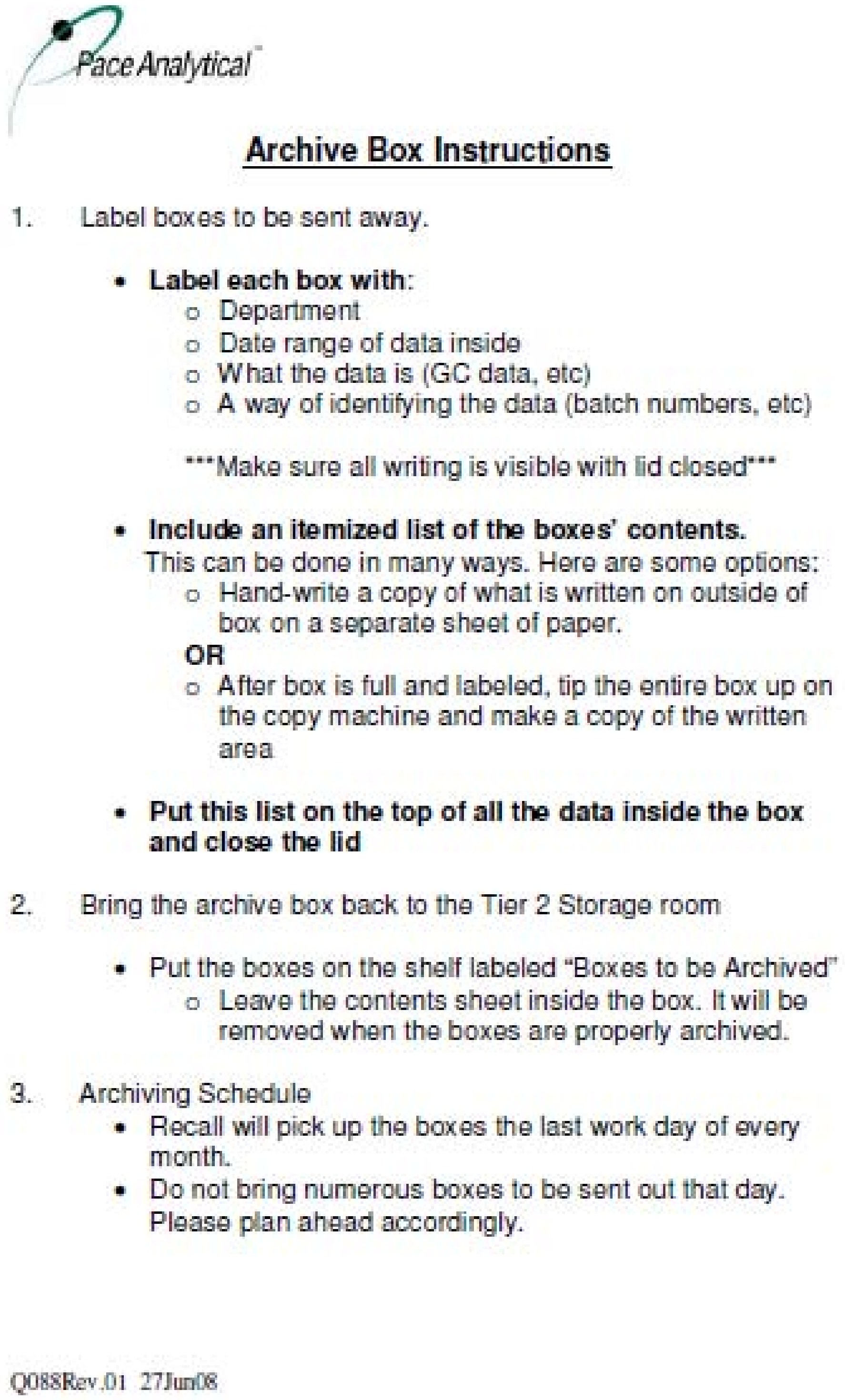
16.3 Attachment III: Example of spreadsheet for barcodes and box numbers

17. REVISIONS

Revision	Change	Date
MN-L-106-rev.4	Changed to new SOP numbering structure Added attachment 1 –Archive label Section 12- added detail for performing data transfer and storage from Target. Section 12.1.8-12.1.13-added data retrieval instructions. Added Attachments 1 and 2 – record box check out and check in forms.	28Dec2005

	Added Attachment 3- box labels	
S-MN-L-106-Rev.05	Updated formatting on front page. Removed Attachment IV and IV (forms no longer used) Updated new Attachment IV to reflect current coding option Updated procedure for archiving paper data based on current procedures. Made some additions to electronic archiving section for clarity.	21Nov2007
S-MN-L-106 Rev.06	Updated sections 11.2.2.1, 11.2.3, and 11.2.5 Added section 11.2.4.6-11.2.4.8 and 11.2.6.3 Removed Responsibilities and Distribution Section	18Dec2008

ATTACHMENT I: Form Q088 – Archive Box Instructions



Archive Box Instructions

1. Label boxes to be sent away.

   - **Label each box with:**
     - Department
     - Date range of data inside
     - What the data is (GC data, etc)
     - A way of identifying the data (batch numbers, etc)

     Make sure all writing is visible with lid closed

   - **Include an itemized list of the boxes' contents.**
     This can be done in many ways. Here are some options:
     - Hand-write a copy of what is written on outside of box on a separate sheet of paper.

     OR
     - After box is full and labeled, tip the entire box up on the copy machine and make a copy of the written area

   - **Put this list on the top of all the data inside the box and close the lid**

2. Bring the archive box back to the Tier 2 Storage room

   - Put the boxes on the shelf labeled "Boxes to be Archived"
     - Leave the contents sheet inside the box. It will be removed when the boxes are properly archived.

3. Archiving Schedule
   - Recall will pick up the boxes the last work day of every month.
   - Do not bring numerous boxes to be sent out that day. Please plan ahead accordingly.

Q088Rev.01 27Jun08

ATTACHMENT II: Recall Sticker

Recall

C 1750139723

Account #

ATTACHMENT III: Spreadsheet for barcodes/box numbers

PACE ID	RECALL BARCODE	PACE ID	RECALL BARCODE
6965	C1750342801	7015	C1750342851
6966	C1750342802	7016	C1750342852
6967	C1750342803	7017	C1750342853
6968	C1750342804	7018	C1750342854
6969	C1750342805	7019	C1750342855
6970	C1750342806	7020	C1750342856
6971	C1750342807	7021	C1750342857
6972	C1750342808	7022	C1750342858
6973	C1750342809	7023	C1750342859
6974	C1750342810	7024	C1750342860
6975	C1750342811	7025	C1750342861
6976	C1750342812	7026	C1750342862
6977	C1750342813	7027	C1750342863
6978	C1750342814	7028	C1750342864
6979	C1750342815	7029	C1750342865
6980	C1750342816	7030	C1750342866
6981	C1750342817	7031	C1750342867
6982	C1750342818	7032	C1750342868
6983	C1750342819	7033	C1750342869
6984	C1750342820	7034	C1750342870
6985	C1750342821	7035	C1750342871
6986	C1750342822	7036	C1750342872
6987	C1750342823	7037	C1750342873
6988	C1750342824	7038	C1750342874
6989	C1750342825	7039	C1750342875
6990	C1750342826	7040	C1750342876
6991	C1750342827	7041	C1750342877
6992	C1750342828	7042	C1750342878
6993	C1750342829	7043	C1750342879
6994	C1750342830	7044	C1750342880
6995	C1750342831	7045	C1750342881
6996	C1750342832	7046	C1750342882
6997	C1750342833	7047	C1750342883
6998	C1750342834	7048	C1750342884
6999	C1750342835	7049	C1750342885
7000	C1750342836	7050	C1750342886
7001	C1750342837	7051	C1750342887
7002	C1750342838	7052	C1750342888
7003	C1750342839	7053	C1750342889
7004	C1750342840	7054	C1750342890
7005	C1750342841	7055	C1750342891
7006	C1750342842	7056	C1750342892
7007	C1750342843	7057	C1750342893
7008	C1750342844	7058	C1750342894
7009	C1750342845	7059	C1750342895
7010	C1750342846	7060	C1750342896
7011	C1750342847	7061	C1750342897
7012	C1750342848	7062	C1750342898
7013	C1750342849	7063	C1750342899
7014	C1750342850	7064	C1750342900

STANDARD OPERATING PROCEDURE
REACTIVE SULFIDE

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STANDARD OPERATING PROCEDURE

REACTIVE SULFIDE

REFERENCE METHODS: SW-846, CHAPTER 7.3.4.2

LOCAL SOP NUMBER:	S-KS-I-031-rev.5
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	KS-I-031-rev.4

LOCAL APPROVAL

Laboratory General Manager	2/6/09 Date
Laboratory Quality Manager	2/3/09 Date
Department Manager	2/2/09 Date

ANNUAL REVIEW

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S-KS-I-031-rev.5

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SECTION **PAGE**

1. Purpose

The purpose of this SOP is to provide a laboratory specific procedure for determining reactive sulfide in water and soil samples meeting the requirements specified in SW-846, Chapter 7.3.4.2.

2. Summary of Method

An aliquot of acid is added to a fixed volume or weight of waste in a closed system. The generated gas is swept into a scrubber. The sulfide is then quantified.

3. Scope and Application

3.1 This SOP includes the measurement of reactive sulfide in all wastes, with the condition that wastes that are combined with acids do not form explosive mixtures. The Practical Reporting Limit (PRL) for reactive sulfide is 10 mg/L in aqueous waste and 100 mg/kg in solid waste.

3.2 This method provides a way to determine the specific rate of release or total releasable hydrogen sulfide upon contact with an aqueous acid.

3.3 This test only measures the hydrogen sulfide evolved at the test conditions. It is not intended to measure forms of sulfide other than those that are evolved under the test conditions.

4. Interferences

Interferences are undetermined.

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5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials.

5.2 Each laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) is made available to all personnel involved in the chemical analysis

5.3 MSDS sheets are located in the Quality Assurance Office and should be consulted prior to handling samples and standards.

5.4 Samples should be considered biological contact hazards. Use appropriate protective equipment (lab coat, gloves and lab glasses) and aseptic techniques when handling these samples. Wash hands with soap and water upon completion of the procedure and clean the work surface with a disinfectant.

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5.6 This procedure must be performed in a fume hood due to possible evolution of hydrogen sulfide.

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6. Definitions

6.1 Accuracy – The degree of agreement between a measured value and the true or expected value.

6.2 Aliquot – A measured portion of a sample taken for analysis.

6.3 Analyte – The specific entity an analysis seeks to determine.

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6.14 EPIC (PRO) – LIMS developed by Pace Analytical (Environmental Project Information Control)

6.15 Holding Time – The elapsed time from the date/time of sample collection by the field personnel until the date/time of its processing/analysis. Holding time requirements are dictated by the method or QAPP.

6.16 Homogeneity – The degree to which a property or substance is evenly distributed throughout a material.

6.17 Initial Calibration – The process of analyzing standards prepared at specified concentrations, to define the quantitative response, linearity and dynamic range of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a continuing calibration do not conform to the requirements of the method in use or at a frequency specified in the method.

6.18 Laboratory Control Sample – A control sample of known composition spiked with a known concentration of analytes of interest. Aqueous and solid laboratory control samples are analyzed using the same preparation, reagents, and analytical methods employed for field samples.

6.19 LIMS – Laboratory Information Management System.

6.20 Lot – A quantity of bulk material of similar composition processed or manufactured at the same time.

6.21 Matrix – The predominant material of which the sample to be analyzed is composed.

6.22 Matrix Spike – Aliquot of sample fortified (spiked) with known quantities of specified target compounds or analytes and subjected to the entire sample preparation and analysis procedure in order to assess the appropriateness of the method for the sample matrix by measuring recovery.

6.23 Matrix Spike Duplicate – A second aliquot of the sample that is treated the same as the original matrix spike sample. The relative percent difference between the matrix spike and matrix spike duplicate is calculated and used to assess analytical precision.

6.24 Method Blank – An analytical control consisting of a blank matrix containing all reagents, internal standards and surrogate standards that are carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and contamination, and to demonstrate that this level does not exceed acceptance limits. Acceptable levels of contamination are defined by project specific data quality objectives.

6.25 Method Detection Limit (MDL)– The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Method Detection Limits are determined using replicate spike samples prepared by the lab and taken through all preparation and analysis steps of the method. The method detection limit is calculated using the appropriate Student’s t-parameter times the standard deviation of a series of spiked samples.

6.26 Precision – The measurement of agreement of a set of replicate results among themselves without any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analysis.

6.27 PQL – The practical quantitation limit (PQL) is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

6.28 Quality Assurance – A system of policies and procedures whose purpose is to ensure, confirm and document that the product or service rendered fulfills the requirements of Pace Analytical and it client. Quality Assurance includes quality planning, quality control, quality assessment (auditing), quality reporting and corrective action.

6.29 Reagent Grade – Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

6.30 Replicate Samples – Samples collected at the same time, from the same place, for the same analysis, as the original sample in order to determine precision between samples.

6.31 Reporting Limit (RL) – The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the statistically determined MDL, but may be higher based on any of the above considerations. Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. Reporting limits are generally two times the MDL.

6.32 Standard – A substance or material, the properties of which are known with sufficient accuracy, to permit its use to evaluate the same property in a sample.

6.33 Standard Curve – A standard curve is a graph which plots concentrations of a known analyte standard versus the instrument response to that analyte.

6.34 Standard Operating Procedure –A procedure adopted for repetitive use when performing specific measurement or sampling operation. It may be an industry accepted standard method or one developed by the user.

6.35 Traceability – The ability to trace the source and accuracy of a material (i.e. standard) to a recognized primary reference source such as the National Institute of Standards and Technology (NIST) or USEPA.

6.36 Validation – The process by which a sample, measurement, method or piece of data is deemed useful for a specified purpose as based upon the DQOs established for quality control measurements such as accuracy, precision, representativeness, and completeness.

7. Responsibilities and Distribution

7.1 Corporate Officers

7.1.1 **Chief Operating Officer (COO)** – The COO has oversight responsibility for Pace Analytical environmental laboratory operations, including compliance with all quality system requirements.

7.1.2 **Director of QST** – The Director of Quality, Safety, and Technology has oversight responsibility for PASI's quality programs, including establishing and monitoring compliance with all quality system requirements.

7.1.3 **Corporate Quality Office** - It is the responsibility of the Corporate QA Office and/or designee to ensure that all new and revised company-wide documents are distributed to QA Offices at each PASI facility, that an original document is maintained on file and that distribution records are updated accordingly. Staff must be informed of new or revised document distribution through written notification.

7.1.4 **Corporate QM** – Corp QM is responsible for ensuring that all revisions to this SOP template are distributed to all PASI QA offices and for maintaining the original and complete distribution records.

7.2 **General Manager (GM)**

The General Manager is responsible for ensuring adherence to this SOP and for reporting any required revisions to the local Quality Assurance Office. The GM must also approve other controlled documents as necessary prior to local distribution.

7.3 **Quality Manager (QM)**

The QM or designee is responsible for ensuring that all revisions to the SOP are implemented and for maintaining the original and complete distribution records at a local level.

7.4 **Department Manager/Supervisor**

The Department Manager/Supervisor is responsible for ensuring all staff members are reading, following, and adequately trained in the use of this SOP. The department manager/supervisor provides initial approval of all Laboratory SOPs and Training Documents within the department. The department manager/supervisor will make recommendations for SOP and Training Document revisions to the QM in writing.

7.5 **Individual Staff**

Individual staff members are responsible for adherence to the specific policies and procedures contained in this SOP. Individual staff members will only use a signed, controlled copy of this SOP. A controlled copy will be available for review and consultation within the Laboratory Department and Quality Assurance department. Personnel are responsible for ensuring that any deviations to this SOP are reported to management. Each person may make recommendations in writing to their manager/supervisor for revising this SOP as the need arises.

7.6 **Revision** - This SOP will be reviewed biennially at a minimum or sooner if procedures or methods change. In the event no changes have been made to the procedures, the cover page of this SOP will be signed and the expiration date will be extended for one year from the date of the reviewer’s signature.

7.7 **Distribution** - The official version of this SOP is the signed hardcopy version found in the laboratory, with current applicable addenda. A copy of the SOP shall be kept in the appropriate department for reference.

8. Sample Collection, Preservation, and Handling

Table 8.1 – Sample Collection, Preservation, Storage and Hold time.

Sample type	Collection per sample	Preservation	Storage	Hold time
Solid	Wide-mouth glass (8-oz)	Cyanide-containing wastes may be preserved with NaOH/ZnAcetate	≤6°C	7 days
Liquid	Plastic or glass (500-mL)	Cyanide-containing wastes may be preserved with NaOH/ZnAcetate	≤6°C	7 days

9. Equipment and Supplies

Table 9.1 – Glassware

Glassware	Description	Vendor / Item # / Description
Round-bottom flask	500-mL, three-neck, 24/40 ground glass joints	Fisher / K606020-1024
Purge Tube	see Section 17 diagram	Fisher / K479155-0052
Dispersion Tube	see Section 17 diagram	Fisher / K479162-0023
Inlet Hose Adapter	24/40 inner joint, see Section 17 diagram	Fisher / K182900-2440

Table 9.2 – Miscellaneous

Item	Description	Vendor / Item # / Description
Magnetic Stirrer	1.5-L capacity	Fisher / 14-259-682
Boiling stones	PTFE	Fisher / 09-191-20
Magnetic Stirbars	1” x 0.31”	Fisher / 14-513-94
Rubber Stopper	Solid, #5	Fisher / 14-130G
Tubing	Clear, PVC, ¼” ID	Fisher / 14-169-7C

10. Reagents and Standards

Table 10.1 – Reagents

Reagent	Concentration/ Description	Requirements/ Vendor/ Item #
Deionized water	ASTM Type II	
Sulfide Stock Solution	1000 mg/L	Fisher / NC9663127
Sulfuric acid	concentrated	ACS Reagent grade / Fisher / A510-212
Sodium hydroxide	pelletized	ACS Reagent grade / Fisher / S-318-3
Nitrogen		Ultra High Purity / Nitrogen Air Pressure Co.

10.1 Sulfuric acid, 1N: Dilute 28 mL of concentrated H_2SO_4 to 1 liter with deionized water. Withdraw 100 mL of that solution and dilute it to 1 liter with deionized water.

10.2 Sodium hydroxide, 0.25 N: Weigh out 10 g NaOH and dissolve in 1 liter of deionized water.

11. Calibration

Not Applicable

12. Procedure

12.1 Liquid Sample Preparation

12.1.1 Method Blank (MB) - Prepare the MB by measuring 100 mL of deionized water into a 500-mL, round-bottom flask containing a magnetic stirbar.

12.1.2 Laboratory Control Sample (LCS) - Prepare the LCS by measuring 100 mL of deionized water into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 2 mL of 1000 mg/L Sulfide Stock Solution. This will yield a 20 mg/L spike concentration (calculate recovery based on 40 mg/L since the volume of the scrubber solution is 50 mL).

12.1.3 Matrix Spike (MS) - Randomly select a sample from the analytical batch for matrix spiking. Prepare the MS by measuring 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 2 mL of 1000 mg/L Sulfide Stock Solution. This will yield a 20 mg/L spike concentration (calculate recovery based on 40 mg/L since the volume of the scrubber solution is 50 mL).

12.1.4 Duplicate Sample (DUP) - Randomly select a sample from the analytical batch for duplicate analysis. Measure 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar. Less sample size may be used if the expected sulfide content is high.

12.1.5 Client Samples - Measure 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar. Less sample size may be used if the expected sulfide content is high.

12.1.6 Add 125 mL of deionized water to all client and QC samples.

12.2 Solid Sample Preparation

12.2.1 Method Blank (MB) - Prepare the MB by weighing 10 g of boiling stones into a 500-mL, round-bottom flask containing a magnetic stirbar.

12.2.2 Laboratory Control Sample (LCS) - Prepare the LCS by weighing 10 g of boiling stones into a 500-mL, round-bottom flask containing a stirbar and spiking with 2 mL of 1000 mg/L Sulfide Stock Solution. This will yield a 200 mg/kg spike concentration.

12.2.3 Matrix Spike (MS) - Randomly select a sample from the analytical batch for matrix spiking. Prepare the MS by weighing 10 g of sample into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 2 mL of 1000 mg/L Sulfide Stock Solution. This will yield a 200 mg/kg spike concentration.

12.2.4 Duplicate Sample (DUP) - Randomly select a sample from the analytical batch for duplicate analysis. Weigh 10 g of sample into a 500-mL, round-bottom flask containing a stirbar. Less sample size may be used if the expected sulfide content is high.

12.2.5 Client Samples: Weigh 10 g of sample into a 500-mL, round-bottom flask containing a stirbar. Less sample size may be used if the expected sulfide content is high.

12.2.6 Add 225 mL of deionized water to all client and QC samples.

12.3 Analysis

12.3.1 Assemble the apparatus:

12.3.1.1 Clamp the round-bottom flask to a support stand.

12.3.1.2 Insert Inlet Hose Adapters in the two outer necks of the round-bottom flask and a rubber stopper into the center neck. Connect the nitrogen supply to one of the Inlet Hose Adapters.

12.3.1.3 Add 50 mL of the 0.25 N sodium hydroxide to the Purge Tube and insert the Dispersion Tube. Connect the Dispersion Tube inlet to the other Inlet Hose Adapter with tubing.

12.3.2 Add 25 mL of 1N H_2SO_4 through the center neck of the round-bottom flask and immediately restopper.

12.3.3 Begin stirring while the acid is entering the round-bottom flask. The stirring speed must remain constant throughout the test.

NOTE: The stirring should not be fast enough to create a vortex.

12.3.4 Start the nitrogen flowing sufficiently to produce a fine stream of bubbles in the Purge Tube and begin the 30-minute testing period.

12.3.5 After 30 minutes, close off the nitrogen and disconnect the Purge Tube from the distillation apparatus.

12.3.6 Measure out 25 mL of the Purge Tube solution and reserve for sulfide analysis. Transfer the remaining amount into a 50-mL centrifuge tube for cyanide analysis.

12.3.7 Determine the amount of sulfide in the scrubber using the technique described in SOP KS-I-027, Total Sulfide. This procedure is in accordance with SW-846, Method 9034.

12.4 EPIC Posting

12.4.1 This is a one-step acode.

12.4.2 Post the sample Initial Volume/Weight in mL or g, default is 100 mL/10 g, and the Final Volume in mL, default is 50 mL for both soil and waters.

12.4.3 Post the sample final analyzed value in mg/L from the sulfide determination. Review the analytical SOP for posting instructions.

12.5 Manual Calculation

12.5.1 Liquid

$$\text{Reactive sulfide, mg/L} = \frac{A \times B}{C}$$

12.5.2 Solid

$$\text{Reactive sulfide, mg/kg} = \frac{A \times B}{D}$$

where:

A = mg/L sulfide from analysis
B = volume of scrubber, mL
C = initial volume of liquid sample, mL
D = initial weight of solid sample, g

13. Quality Control

Table 13.1 – Batch Quality Control Criteria

QA Sample	Components	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Reagent water or boiling stones	One (1) per batch of up to 20 samples	Sulfide must be less than reporting limit. If results are reported to MDL, sulfide in MB should be non-detect.	1) Re-analyze blank to confirm failure. 2) Qualify results and / or re-digest associated samples. ***Exceptions:*** 1) If sample ND, report sample without qualification 2) If sample result >10x MB detects and sample cannot be reanalyzed, report sample with appropriate qualifier indicating blank contamination. 3) If sample result <10x MB detects, report sample with appropriate qualifier to indicate an estimated value. Client must be alerted and authorize this condition.
Laboratory Control Sample (LCS)	Sulfide	One (1) per batch of up to 20 samples	Laboratory Derived Limits	1) Reanalyze the LCS to verify failure 2) If problem persists, check spike solution 3) Re-prep samples where possible ***Exception:*** If LCS recovery > QC limits and sulfide is non-detect in the associated samples, the sample data may be reported with appropriate data qualifiers.
Matrix Spike (MS)and/or MSD	Sulfide	One (1) per batch of up to 20 samples.	Laboratory Derived Limits	1) If LCS and MBs are acceptable, the MS may be reported with appropriate footnote indicating matrix interferences
Duplicate	Sample Dup	One (1) per batch of up to 20 samples.	Laboratory Derived Limits	1) Report results with an appropriate footnote.

14. Method Performance

14.1 Demonstration of Capability (DOC): Every analyst who performs this method must first document acceptable accuracy and precision by passing a demonstration of capability study (DOC) per ALL-Q-020, Training Procedures.

14.2 Analysis of four replicates of reagent water spiked with the Sulfide Stock Solution at a concentration of 20 mg/L or equivalent to the LCS.

14.3 Analysis of four replicates of blank solid matrix (Ottawa sand, boiling stones, glass beads, etc.) spiked with the Sulfide Stock Solution at a concentration of 200 mg/kg or equivalent to the LCS.

14.4 Using the results of each set of four analyses, compute the average percent recovery (X) and the relative standard deviation (RSD) for sulfide.

14.5 If the average recovery is within the matrix-specific LCS recovery limits and the RSD is <20%, system performance is acceptable and analysis of samples may begin. If, however, either RSD exceeds the precision limit or X falls outside the range for recovery, system performance is unacceptable. In this event, correct the problem and repeat the test.

15. Pollution Prevention and Waste Management

15.1 Procedures for handling waste generated during this analysis are addressed in the Pace Environment Management Manual.

15.2 In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount which may be used in a reasonable amount of time (i.e. before a reagent expires)

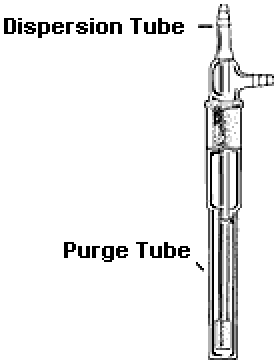
15.3 The company wide Chemical Hygiene and Safety Manual contains additional information on pollution prevention.

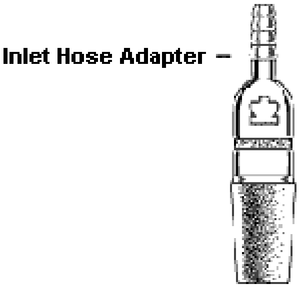
16. References

16.1 Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition, Chapter 7, Section 7.3.4.2.

16.2 Test Methods for Evaluating Solid Waste Physical/Chemical Methods , SW846, Third Edition, Final Update IV, Method 9034.

17. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.





18. Revisions

Document Number	Reason for Change	Date
KS-I-2351-B	Grammatical/Removal of outdated information.	May 18, 2001
KS-I-2351-C	Grammatical/Removal of outdated information.	June 16, 2003
KS-I-2351-D	Grammatical/Removal of outdated information.	November 21, 2003
KS-I-031-rev.4	Section 8.2 – Changed “hydrocyanic acid” to “hydrogen sulfide.” Section 12.1.4 – Changed “cyanide” to “sulfide” Section 12.1.2 – Changed “KS-I-2342” to “KS-I-027”	January 27, 2006
S-KS-I-031-rev.5	SOP- Changed revision number Section 9 – Replaced glass beads with boiling stones. Section 10 - Added Sulfide Stock Solution to table, changed the normality of the sulfuric acid from 0.01 to 1, removed references to 1.25N NaOH. Sections 12 – Replaced glass beads with boiling stones. Changed normality and volume of sulfuric acid. Inserted addition of deionized water to samples. Added assembly instructions. Section 17 – Inserted glassware diagrams.	February 9, 2009

STANDARD OPERATING PROCEDURE
REACTIVE CYANIDE

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STANDARD OPERATING PROCEDURE

REACTIVE CYANIDE

REFERENCE METHODS: SW-846, CHAPTER 7.3.3.2

LOCAL SOP NUMBER:	S-KS-I-032-rev.5
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	KS-I-032-rev.4

LOCAL APPROVAL

	2/13/09
Laboratory General Manager	Date
Charles E [illegible]	2/11/09
Laboratory Quality Manager	Date
	2/9/09
Department Manager	Date

ANNUAL REVIEW

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6.15 Holding Time – The elapsed time from the date/time of sample collection by the field personnel until the date/time of its processing/analysis. Holding time requirements are dictated by the method or QAPP.

6.16 Homogeneity – The degree to which a property or substance is evenly distributed throughout a material.

6.17 Initial Calibration – The process of analyzing standards prepared at specified concentrations, to define the quantitative response, linearity and dynamic range of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a continuing calibration do not conform to the requirements of the method in use or at a frequency specified in the method.

6.18 Laboratory Control Sample – A control sample of known composition spiked with a known concentration of analytes of interest. Aqueous and solid laboratory control samples are analyzed using the same preparation, reagents, and analytical methods employed for field samples.

6.19 LIMS – Laboratory Information Management System.

6.20 Lot – A quantity of bulk material of similar composition processed or manufactured at the same time.

6.21 Matrix – The predominant material of which the sample to be analyzed is composed.

6.22 Matrix Spike – Aliquot of sample fortified (spiked) with known quantities of specified target compounds or analytes and subjected to the entire sample preparation and analysis procedure in order to assess the appropriateness of the method for the sample matrix by measuring recovery.

6.23 Matrix Spike Duplicate – A second aliquot of the sample that is treated the same as the original matrix spike sample. The relative percent difference between the matrix spike and matrix spike duplicate is calculated and used to assess analytical precision.

6.24 Method Blank – An analytical control consisting of a blank matrix containing all reagents, internal standards and surrogate standards that are carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and contamination, and to demonstrate that this level does not exceed acceptance limits. Acceptable levels of contamination are defined by project specific data quality objectives.

6.25 Method Detection Limit (MDL)– The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Method Detection Limits are determined using replicate spike samples prepared by the lab and taken through all preparation and analysis steps of the method. The method detection limit is calculated using the appropriate Student’s t-parameter times the standard deviation of a series of spiked samples.

6.26 Precision – The measurement of agreement of a set of replicate results among themselves without any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analysis.

6.27 PQL – The practical quantitation limit (PQL) is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

6.28 Quality Assurance – A system of policies and procedures whose purpose is to ensure, confirm and document that the product or service rendered fulfills the requirements of Pace Analytical and it client. Quality Assurance includes quality planning, quality control, quality assessment (auditing), quality reporting and corrective action.

6.29 Reagent Grade – Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

6.30 Replicate Samples – Samples collected at the same time, from the same place, for the same analysis, as the original sample in order to determine precision between samples.

6.31 Reporting Limit (RL) – The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the statistically determined MDL, but may be higher based on any of the above considerations. Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. Reporting limits are generally two times the MDL.

6.32 Standard – A substance or material, the properties of which are known with sufficient accuracy, to permit its use to evaluate the same property in a sample.

6.33 Standard Curve – A standard curve is a graph which plots concentrations of a known analyte standard versus the instrument response to that analyte.

6.34 Standard Operating Procedure –A procedure adopted for repetitive use when performing specific measurement or sampling operation. It may be an industry accepted standard method or one developed by the user.

6.35 Traceability – The ability to trace the source and accuracy of a material (i.e. standard) to a recognized primary reference source such as the National Institute of Standards and Technology (NIST) or USEPA.

6.36 Validation – The process by which a sample, measurement, method or piece of data is deemed useful for a specified purpose as based upon the DQOs established for quality control measurements such as accuracy, precision, representativeness, and completeness.

7. Responsibilities and Distribution

7.1 Corporate Officers

7.1.1 **Chief Operating Officer (COO)** – The COO has oversight responsibility for Pace Analytical environmental laboratory operations, including compliance with all quality system requirements.

7.1.2 **Director of QST** – The Director of Quality, Safety, and Technology has oversight responsibility for PASI's quality programs, including establishing and monitoring compliance with all quality system requirements.

7.1.3 **Corporate Quality Office** - It is the responsibility of the Corporate QA Office and/or designee to ensure that all new and revised company-wide documents are distributed to QA Offices at each PASI facility, that an original document is maintained on file and that distribution records are updated accordingly. Staff must be informed of new or revised document distribution through written notification.

7.1.4 **Corporate QM** – Corp QM is responsible for ensuring that all revisions to this SOP template are distributed to all PASI QA offices and for maintaining the original and complete distribution records.

7.2 **General Manager (GM)**

The General Manager is responsible for ensuring adherence to this SOP and for reporting any required revisions to the local Quality Assurance Office. The GM must also approve other controlled documents as necessary prior to local distribution.

7.3 Quality Manager (QM)

The QM or designee is responsible for ensuring that all revisions to the SOP are implemented and for maintaining the original and complete distribution records at a local level.

7.4 Department Manager/Supervisor

The Department Manager/Supervisor is responsible for ensuring all staff members are reading, following, and adequately trained in the use of this SOP. The department manager/supervisor provides initial approval of all Laboratory SOPs and Training Documents within the department. The department manager/supervisor will make recommendations for SOP and Training Document revisions to the QM in writing.

7.5 Individual Staff

Individual staff members are responsible for adherence to the specific policies and procedures contained in this SOP. Individual staff members will only use a signed, controlled copy of this SOP. A controlled copy will be available for review and consultation within the Laboratory Department and Quality Assurance department. Personnel are responsible for ensuring that any deviations to this SOP are reported to management. Each person may make recommendations in writing to their manager/supervisor for revising this SOP as the need arises.

7.6 **Revision** - This SOP will be reviewed biennially at a minimum or sooner if procedures or methods change. In the event no changes have been made to the procedures, the cover page of this SOP will be signed and the expiration date will be extended for one year from the date of the reviewer’s signature.

7.7 **Distribution** - The official version of this SOP is the signed hardcopy version found in the laboratory, with current applicable addenda. A copy of the SOP shall be kept in the appropriate department for reference.

8. Sample Collection, Preservation, and Handling

Table 8.1 – Sample Collection, Preservation, Storage and Hold time.

Sample type	Collection per sample	Preservation	Storage	Hold time
Solid	Wide-mouth glass (8-oz)	None	≤6°C	N/A
Liquid	Plastic or glass (500-mL)	None	≤6°C	N/A

9. Equipment and Supplies

Table 9.1 – Glassware

Glassware	Description	Vendor / Item # / Description
Round-bottom flask	500-mL, three-neck, 24/40 ground glass joints	Fisher / K606020-1024
Purge Tube	see Section 17 diagram	Fisher / K479155-0052
Dispersion Tube	see Section 17 diagram	Fisher / K479162-0023
Inlet Hose Adapter	24/40 inner joint, see Section 17 diagram	Fisher / K182900-2440

Table 9.2 – Miscellaneous

Item	Description	Vendor / Item # / Description
Magnetic Stirrer	1.5-L capacity	Fisher / 14-259-682
Boiling stones	PTFE	Fisher / 09-191-20
Magnetic Stirbars	1” x 0.31”	Fisher / 14-513-94
Rubber Stopper	Solid, #5	Fisher / 14-130G
Tubing	Clear, PVC, ¼” ID	Fisher / 14-169-7C

10. Reagents and Standards

Table 10.1 – Reagents

Reagent	Concentration/ Description	Requirements/ Vendor/ Item #
Deionized water	ASTM Type II	
Cyanide Stock Solution	1000 mg/L	Fisher / LC13545-1
Sulfuric acid	concentrated	ACS Reagent grade / Fisher / A510-212
Sodium hydroxide	pelletized	ACS Reagent grade / Fisher / S-318-3
Nitrogen		Ultra High Purity / Nitrogen Air Pressure Co.

10.1 Sulfuric acid, 1N: Dilute 28 mL of concentrated H_2SO_4 to 1 liter with deionized water.

10.2 Sulfuric acid, 0.1N: Dilute 100 mL of 1N H_2SO_4 to 1 liter with deionized water.

10.3 Sodium hydroxide, 0.25 N: Weigh out 10 g NaOH and dissolve in 1 liter of deionized water.

10.4 Working Cyanide Solution, 1.0 mg/L: Dilute 0.1 mL of the 1000 mg/L Cyanide Stock Solution in 100 mL of deionized water and add 1 g of NaOH.

11. Calibration

Not Applicable

12. Procedure

12.1 Liquid Sample Preparation

12.1.1 Method Blank (MB) - Prepare the MB by measuring 100 mL of deionized water into a 500-mL, round-bottom flask containing a magnetic stirbar.

12.1.2 Laboratory Control Sample (LCS) - Prepare the LCS by measuring 100 mL of deionized water into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 5 mL of the 1.0 mg/L Working Cyanide Solution. This will yield a 0.05 mg/L spike concentration (calculate recovery based on 0.1 mg/L since the volume of the scrubber solution is 50 mL).

12.1.3 Matrix Spike (MS) - Randomly select a sample from the analytical batch for matrix spiking. Prepare the MS by measuring 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 5 mL of the 1.0 mg/L Working Cyanide Solution. This will yield a 0.05 mg/L spike concentration (calculate recovery based on 0.1 mg/L since the volume of the scrubber solution is 50 mL).

12.1.4 Duplicate Sample (DUP) - Randomly select a sample from the analytical batch for duplicate analysis. Measure 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar. Less sample size may be used if the expected cyanide content is high.

12.1.5 Client Samples - Measure 100 mL of sample into a 500-mL, round-bottom flask containing a magnetic stirbar. Less sample size may be used if the expected cyanide content is high.

12.1.6 Add 225 mL of deionized water to all client and QC samples.

12.2 Solid Sample Preparation

12.2.1 Method Blank (MB) - Prepare the MB by weighing 10 g of boiling stones into a 500-mL, round-bottom flask containing a magnetic stirbar.

12.2.2 Laboratory Control Sample (LCS) - Prepare the LCS by weighing 10 g of boiling stones into a 500-mL, round-bottom flask containing a stirbar and spiking with 5 mL of the 1.0 mg/L Working Cyanide Solution. This will yield a 0.5 mg/kg spike concentration.

12.2.3 Matrix Spike (MS) - Randomly select a sample from the analytical batch for matrix spiking. Prepare the MS by weighing 10 g of sample into a 500-mL, round-bottom flask containing a magnetic stirbar and spiking with 5 mL of the 1.0 mg/L Working Cyanide Solution. This will yield a 0.5 mg/kg spike concentration.

12.2.4 Duplicate Sample (DUP) - Randomly select a sample from the analytical batch for duplicate analysis. Weigh 10 g of sample into a 500-mL, round-bottom flask containing a stirbar. Less sample size may be used if the expected cyanide content is high.

12.2.5 Client Samples: Weigh 10 g of sample into a 500-mL, round-bottom flask containing a stirbar. Less sample size may be used if the expected cyanide content is high.

12.2.6 Add 225 mL of deionized water to all client and QC samples.

12.3 Analysis

12.3.1 Assemble the apparatus:

12.3.1.1 Clamp the round-bottom flask to a support stand.

12.3.1.2 Insert Inlet Hose Adapters in the two outer necks of the round-bottom flask and a rubber stopper into the center neck. Connect the nitrogen supply to one of the Inlet Hose Adapters.

12.3.1.3 Add 50 mL of the 0.25 N sodium hydroxide to the Purge Tube and insert the Dispersion Tube. Connect the Dispersion Tube inlet to the other Inlet Hose Adapter with tubing.

12.3.2 Add 25 mL of the 0.1N H_2SO_4 through the center neck of the round-bottom flask and immediately restopper.

12.3.3 Begin stirring while the acid is entering the round-bottom flask. The stirring speed must remain constant throughout the test.

NOTE: The stirring should not be fast enough to create a vortex.

12.3.4 Start the nitrogen flowing sufficiently to produce a fine stream of bubbles in the Purge Tube and begin the 30-minute testing period.

12.3.5 After 30 minutes, close off the nitrogen and disconnect the Purge Tube from the distillation apparatus.

12.3.6 Measure out 25 mL of the Purge Tube solution and reserve for cyanide analysis. Transfer the remaining amount into a 50-mL centrifuge tube for sulfide analysis.

12.3.7 Determine the amount of cyanide in the scrubber using the technique described in SOP (S-)KS-I-036, Total and Amenable Cyanide. This procedure is in accordance with SW-846, Method 9012.

12.4 EPIC Posting

12.4.1 This is a one-step acode.

12.4.2 Post the sample Initial Volume/Weight in mL or g, default is 100 mL/10 g, and the Final Volume in mL, default is 50 mL for both soil and waters.

12.4.3 Post the sample final analyzed value in mg/L from the cyanide determination. Review the analytical SOP for posting instructions.

12.5 Manual Calculation

12.5.1 Liquid

$$\text{Reactive cyanide, mg/L} = \frac{A \times B}{C}$$

12.5.2 Solid

$$\text{Reactive cyanide, mg/kg} = \frac{A \times B}{D}$$

where:

A = mg/L cyanide from analysis
B = volume of scrubber, mL
C = initial volume of liquid sample, mL
D = initial weight of solid sample, g

13. Quality Control

Table 13.1 – Batch Quality Control Criteria

QA Sample	Components	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Reagent water or boiling stones	One (1) per batch of up to 20 samples	Sulfide must be less than reporting limit. If results are reported to MDL, sulfide in MB should be non-detect.	1) Re-analyze blank to confirm failure. 2) Qualify results and / or re-digest associated samples. ***Exceptions:*** 1) If sample ND, report sample without qualification 2) If sample result >10x MB detects and sample cannot be reanalyzed, report sample with appropriate qualifier indicating blank contamination. 3) If sample result <10x MB detects, report sample with appropriate qualifier to indicate an estimated value. Client must be alerted and authorize this condition.
Laboratory Control Sample (LCS)	Cyanide	One (1) per batch of up to 20 samples	Laboratory-derived limits	1) Reanalyze the LCS to verify failure 2) If problem persists, check spike solution 3) Re-prep samples where possible ***Exception:*** If LCS recovery > QC limits and sulfide is non-detect in the associated samples, the sample data may be reported with appropriate data qualifiers.
Matrix Spike (MS)and/or MSD	Cyanide	One (1) per batch of up to 20 samples.	Laboratory-derived limits	1) If LCS and MBs are acceptable, the MS may be reported with appropriate footnote indicating matrix interferences
Duplicate	Sample Dup	One (1) per batch of up to 20 samples.	Laboratory-derived limits	1) Report results with an appropriate footnote.

14. Method Performance

14.1 Demonstration of Capability (DOC): Every analyst who performs this method must first document acceptable accuracy and precision by passing a demonstration of capability study (DOC) per ALL-Q-020, Training Procedures.

14.2 Analysis of four replicates of reagent water spiked with the Working Cyanide Solution at a concentration of 5.0 mg/L or equivalent to the LCS.

14.3 Analysis of four replicates of blank solid matrix (Ottawa sand, boiling stones, glass beads, etc.) spiked with the Working Cyanide Solution at a concentration of 0.5 mg/kg or equivalent to the LCS.

14.4 Using the results of each set of four analyses, compute the average percent recovery (X) and the relative standard deviation (RSD) for cyanide.

14.5 If the average recovery is within the matrix-specific LCS recovery limits and the RSD is <20%, system performance is acceptable and analysis of samples may begin. If, however, either RSD exceeds the precision limit or X falls outside the range for recovery, system performance is unacceptable. In this event, correct the problem and repeat the test.

15. Pollution Prevention and Waste Management

15.1 Procedures for handling waste generated during this analysis are addressed in the Pace Environment Management Manual.

15.2 In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount which may be used in a reasonable amount of time (i.e. before a reagent expires).

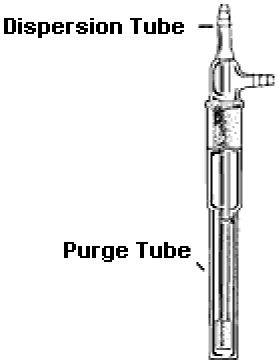
15.3 The company-wide Chemical Hygiene and Safety Manual contains additional information on pollution prevention.

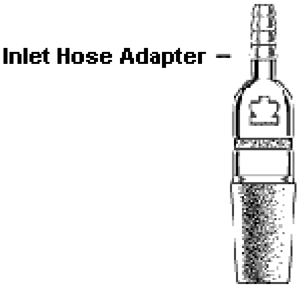
16. References

16.1 Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Third Edition, Update III, Chapter 7, Section 7.3.3.2.

16.2 Test Methods for Evaluating Solid Waste Physical/Chemical Methods , SW-846, Third Edition, Final Update IV, Method 9012B.

17. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.





18. Revisions

Document Number	Reason for Change	Date
KS-I-2352-B	Grammatical/Removal of outdated information.	May 18, 2001
KS-I-2352-C	Grammatical/Removal of outdated information.	June 16, 2003
KS-I-2352-D	Grammatical/Removal of outdated information.	November 21, 2003
KS-I-032-rev.4	SOP - Changed SOP number. Section 12 – Changed cyanide quantitation SOP from “KS-I-2363” to “KS-I-036”	January 30, 2006
S-KS-I-032-rev.5	SOP- Changed revision number Section 8 – Changed preservation and holding time. Section 9 – Replaced glass beads with boiling stones. Section 10 - Changed the normality of the sulfuric acid from 0.01 to 1, removed references to 1.25N NaOH, changed prep and concentration of working standard. Sections 12 – Replaced glass beads with boiling stones. Changed normality and volume of sulfuric acid. Inserted addition of deionized water to samples. Added aparatus assembly instructions. Changed normality of acid that is added to samples. Section 17 – Inserted glassware diagrams.	February 6, 2009

STANDARD OPERATING PROCEDURE
TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) AND SYNTHETIC PRECIPITATION LEACHING PROCEDURE (SPLP)

Pace Analytical Services, Inc.
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STANDARD OPERATING PROCEDURE

Toxicity Characteristic Leaching Procedure (TCLP) & Synthetic Precipitation Leaching Procedure (SPLP)

SOP NUMBER	S-MN-I-312-Rev. 08
EFFECTIVE DATE	22 July 2008
SUPERSEDES	MN-I-312-Rev.07

APPROVAL

Laboratory General Manager — Date: 21JUL2008

Melanie Ollila
Quality Assurance Manager — Date: 22Jul2008

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date

Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

This is **COPY#**__10__ distributed on _12-Feb-09__ by _JAW__and is ______**CONTROLLED or** __X___**UNCONTROLLED**

TABLE OF CONTENTS

1. PURPOSE

1.1. The purpose of this Standard Operating Procedure (SOP) is to establish uniform guidelines for the performance of the toxicity characteristics leaching procedure and the synthetic precipitation leaching procedure as delineated in EPA Methods SW 1311 and SW 1312.

2. SCOPE AND APPLICATION

2.1. The TCLP and SPLP are designed to determine the mobility of both organic and inorganic analytes present in liquid, solid and multiphase wastes. TCLP analytes are listed in Table 1.

TABLE 1 (TCLP)

	COMPOUND	CAS Number	Regulatory Level (mg/L)
VOLATILES			
	Vinyl Chloride	75-01-4	0.2
	1,1-Dichloroethylene	75-35-4	0.7
	Chloroform	67-66-3	6.0
	1,2-Dichloroethane	107-06-2	0.5
	2-Butanone	78-93-3	200
	Carbon tetrachloride	56-23-5	0.5
	Trichloroethylene	79-01-6	0.5
	Benzene	71-43-2	0.5
	Tetrachloroethylene	127-18-4	0.7
	Chlorobenzene	108-90-7	100
SEMIVOLATILES			
	1,4-Dichlorobenzene	106-46-7	7.5
	Hexachloroethane	67-72-1	3.0
	Nitrobenzene	98-95-3	2.0
	Pyridine	110-86-1	5.0
	Hexachloro-1,3-butadiene	87-68-3	0.5
	o-Cresol	95-48-7	200
	m-Cresol	108-39-4	200
	p-Cresol	106-44-5	200
	2,4,6-Trichlorophenol	88-06-2	2.0
	2,4,5-Trichlorophenol	95-95-4	400
	2,4-Dinitrotoluene	121-14-2	0.13
	Hexachlorobenzene	118-74-	0.13
	Pentachlorophenol	87-86-5	100
PESTICIDE			
	g-BHC (Lindane)	58-89-9	0.4
	Heptachlor	76-44-8	0.008
	Heptachlor epoxide	1024-57-3	0.008
	Endrin	72-20-8	0.02
	Methoxychlor	72-43-5	10.0
	Chlordane	57-74-9	0.03

	Toxaphene	8001-35-2	0.5
HERBICIDES			
	2,4-D	94-75-7	10
	2,4,5-TP (Silvex)	93-72-1	1.0
METALS			
	Arsenic	7440-38-2	5.0
	Barium	7440-39-3	100
	Cadmium	7440-43-9	1.0
	Chromium	7440-47-3	5.0
	Lead	7439-92-1	5.0
	Selenium	7782-49-2	1.0
	Silver	7440-22-4	5.0
	Mercury	7439-97-6	0.20

2.2. If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate regulatory levels could not possibly be exceeded, the TCLP need not be run.

2.3. If an analysis of any one of the liquid fractions of the TCLP extract indicates that a regulated compound is present at such high concentrations that, even after accounting for dilution from the other fractions of the extract, the concentration would be equal to or above the regulatory level for that compound, then the waste is hazardous and it is not necessary to analyze the remaining fractions of the extract.

2.4. If an analysis of extract obtained using a bottle extractor shows that the concentration of any regulated volatile analyte equals or exceeds the regulatory level for that compound, then the waste is hazardous and extraction using the ZHE is not necessary. However, extract from a bottle extractor cannot be used to demonstrate that the concentration of volatile compounds is below the regulatory level.

3. SUMMARY OF METHOD

3.1. For liquid wastes (i.e., those containing less than 0.5% dry solid material), the waste after filtration through a 0.6 to 0.8 µm glass fiber filter, is defined as the TCLP extract.

3.2. For wastes containing greater than or equal to 0.5% solids, the liquid, if any, is separated from the solid phase and stored for later analysis; the particle size of the solid phase is reduced, if necessary. The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase. The TCLP extraction fluid employed is a function of the alkalinity of the solid phase of the waste. The SPLP extraction fluid employed is a function of the region of the country where the sample site is located if the sample is a soil. If the sample is a waste or wastewater, the extraction fluid employed is a pH 4.2 solution. A special extraction vessel is used for the testing of volatile analytes (see Table 1 for a list of volatile compounds). Following extraction, the liquid extract is separated from the solid phase by filtration through a 0.6 to 0.8 µm glass fiber filter.

3.3. If compatible (i.e., multiple phases will not form on combination), the initial liquid phase of the waste is added to the liquid extract, and these are analyzed together. If incompatible, the liquids are analyzed separately and the results are mathematically combined to yield a volume-weighted average concentration.

3.4. If the leachate is biphasic, an additional digestion may be required prior to analysis for metal constituents.

4. INTERFERENCES

4.1. Potential interferences that may be encountered during analysis are discussed in the individual analytical methods.

5. SAFETY

5.1. The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials

5.2. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) and a formal safety plan is made available to all personnel involved in the chemical analysis.

5.3. MSDS sheets are located at the front desk and should be consulted prior to handling samples and standards.

5.4. The toxicity or condition of samples analyzed by this method are unknown. Therefore, always wear appropriate personal protective equipment to control exposure to hazards.

6. DEFINITIONS

6.1. Definitions are located in the Glossary Section of the Pace Analytical Services, Inc. Quality Manual.

7. SAMPLE COLLECTION, PRESERVATION AND HANDLING

7.1. Collect all samples in glass containers without preservatives. Store at 4 ± 2°C until extraction. If waste is to be evaluated for volatile analytes, collect samples in Teflon-lined system capped vials.

7.2. Samples must undergo TCLP/SPLP extraction within the appropriate time periods listed in Table 4.

TABLE 4 SAMPLE MAXIMUM HOLDING TIMES (DAYS)

	From: FC To: T/S extraction	From: T/S extraction To: Prep extract	From Prep/extract To: Analysis	Total time
Volatiles	14	NA	14	28
Semivolatiles	14	7	40	61
Mercury	28	NA	28	56
Metals, except mercury	180	NA	180	360

NA = Not applicable
FC = Field Collection
T/S = TCLP/SPLP

If sample holding times are exceeded, the values obtained will be considered minimal concentrations. Exceeding the holding time is not acceptable in establishing that a waste does not exceed the regulatory level. Exceeding the holding time will not invalidate characterization if the waste exceeds the regulatory level.

8. EQUIPMENT AND SUPPLIES

8.1. Agitation apparatus, capable of rotating the extraction vessel in an end-over-end fashion at 30 ± 2 rpm.

8.2. Extraction Vessels

8.2.1. Zero-headspace Extraction Vessel (ZHE). This device is for use only when the waste is being tested for the mobility of volatile analytes (i.e., those listed in Table 1). The ZHE allows for liquid/solid separation within the device, and effectively precludes headspace. This type of vessel allows for initial liquid/solid separation, extraction, and final extract filtration without opening the vessel (section 12.6). The vessels shall have an internal volume of 500-600 mL and be equipped to accommodate a 90-110 mm filter.

8.2.2. Bottle Extraction Vessel –_The extraction bottles may be constructed from various materials depending on the analytes to be analyzed and the nature of the waste. Borosilicate glass bottles are recommended for use when inorganic analysis is requested. Plastic bottles, other than polytetrafluoroethylene, shall not be used if organics are to be investigated.

8.3. Filtration Devices

8.3.1. Zero-headspace Extractor Vessel (ZHE): When the waste is evaluated for volatiles, the zero-headspace extraction vessel described in section 8.2.1 is used for filtration. The device shall be capable of supporting and keeping in place, a glass fiber filter and be able to withstand the pressure needed to accomplish separation (50 psi).

NOTE: When it is suspected that the glass fiber filter has been ruptured, an in-line glass fiber filter may be used to filter the material within the ZHE.

8.3.2. Filter Holder: When the waste is evaluated for other than volatile analytes, any filter holder capable of supporting a glass fiber filter may be used.

8.4. Acid washed filters shall be made of borosilicate glass fiber, shall contain no binder materials, and shall have an effective pore size of 0.6 to 0.8 µm, or equivalent. Prefilters must not be used. (Millipore AP40 or equivalent).

8.5. Stir plate and stir bars

8.6. pH meter, accurate to ± 0.05 units at 25°C.

8.7. Analytical balance, accurate to within ± 0.01.

8.8. Assorted laboratory glassware.

8.9. Hot Plate.

8.10. Min/Max thermometer.

9. REAGENTS AND STANDARDS

9.1. DI Water

9.2. Hydrochloric Acid (1N) Cautiously add 83.0 mL of concentrated Hydrochloric acid to 500 mL of DI water and dilute to a volume of 1 Liter. Store at room temperature. Expires in 1 month.

9.3. Sodium Hydroxide (10N) Cautiously add 400 grams of NaOH pellets to 500 mL of DI water and dilute to a volume of 1 Liter. This is an exothermic reaction. Store in a plastic container at room temperature. Expires in 3 months.

9.4. Glacial Acetic Acid, CH_3COOH, Store at room temperature. Expires 1 year from opening.

9.5. Sulfuric Acid/Nitric Acid (60/40 weight percent mixture) Cautiously mix 60g of concentrated sulfuric acid with 40g of concentrated nitric acid. Store in a plastic container. Expires in 1 month.

9.6. TCLP Extraction Fluid #1 - Add 5.7 mL glacial CH_3COOH to 500 mL of DI water, add 6.43 mL of 10N NaOH, and dilute to a volume of 1 liter. When correctly prepared, the pH of this fluid will be 4.93 ± 0.05. Expires in 1 week. The pH should be taken daily prior to use to verify that the pH still meets criteria. If it does not meet criteria, make up fresh.

9.7. TCLP Extraction Fluid #2 - Dilute 5.7 mL glacial CH_3COOH with DI water to a volume of 1 liter. When correctly prepared the pH of this fluid will be 2.88 ± 0.05. Expires in 1 week. The pH should be taken daily prior to use to verify that the pH still meets criteria. If it does not meet criteria, make up fresh.

9.8. SPLP Extraction Fluid #1 - This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids (or a suitable dilution) to DI water until the pH is 4.20 +/- 0.05. The fluid is used to determine the leachability of soil from a site that is east of the Mississippi River, and the leachability of wastes and wastewater. Expires in 1 week. The pH should be taken daily prior to use to verify that the pH still meets criteria. If it does not meet criteria, make up fresh.

9.9. SPLP Extraction Fluid #2 - This fluid is made by adding the 60/40 weight percent mixture of sulfuric and nitric acids (or a suitable dilution) to DI until the pH is 5.00 +/- 0.05. The fluid is used to determine the leachability of soil from a site that is west of the Mississippi River, and the leachability of wastes and wastewater. Expires in 1 week. The pH should be taken daily prior to use to verify that the pH still meets criteria. If it does not meet criteria, make up fresh.

9.10. SPLP Extraction Fluid #3 - DI water.

10. CALIBRATION

Not Applicable.

11. PROCEDURE

11.1. Perform preliminary TCLP/SPLP evaluations on a minimum 100-gram aliquot of waste.

11.1.1. Preliminary Determination of Percent Solids: Percent solids is defined as that fraction of a waste sample (as a percentage of the total sample) from which no liquid may be forced out by an applied pressure, as described below.

11.1.1.1. If the waste will obviously yield no liquid when subjected to pressure filtration (i.e., is 100% solids) proceed to section 11.2.

11.1.1.2. If the sample is liquid or multiphasic, liquid/solid separation to make a preliminary determination of percent solids is required. The procedure is outlined in sections 11.1.1.3 through 11.1.1.9.

11.1.1.3. Preweigh the filter and the container that will receive the filtrate.

11.1.1.4. Assemble the filter holder and filter following the manufacturer's instructions. Place the filter on the support screen and secure.

11.1.1.5. Weigh out a subsample of the waste (100 gram minimum) and record the weight.

11.1.1.6. Allow slurries to stand to permit the solid phase to settle. Wastes that settle slowly may be centrifuged prior to filtration. Centrifugation is to be used only as an aid to filtration. If used, the liquid should be decanted and filtered followed by filtration of the solid portion of the waste through the same filtration system.

11.1.1.7. Quantitatively transfer the waste sample to the filter holder (liquid and solid phases). Spread the waste sample evenly over the surface of the filter. If filtration of the waste at 4°C reduces the amount of expressed liquid over what would be expressed at room temperature then allow the sample to warm up to room temperature in the device before filtering.

NOTE: If waste material (>1% of original sample weight) has obviously adhered to the container used to transfer the sample to the filtration apparatus, determine the weight of this residue and subtract it from the sample weight determined in section 11.1.1.5 to determine the weight of the waste sample that will be filtered.

11.1.1.8. Gradually apply vacuum until air or pressurizing gas moves through the filter. If this point is not reached under 10 psi, and no additional liquid has passed through the filter in any 2-minute interval, slowly increase the pressure in 10 psi increments to a maximum of 50 psi. After each incremental increase of 10 psi, if the pressurizing gas has not moved through the filter, and if no additional liquid has passed through the filter in any 2-minute interval proceed to the next 10-psi increment. When the pressurizing gas begins to move through the filter or when liquid flow has ceased at 50 psi (i.e. filtration does not result in any additional filtrate within any 2 minute period), stop the filtration.

NOTE: Instantaneous application of high pressure can degrade glass fiber filter and may cause premature plugging.

11.1.1.9. The material in the filter holder is defined as the solid phase of the waste, and the filtrate is defined as the liquid phase.

NOTE: Some wastes, such as oily wastes and some paint wastes, will obviously contain some material that appears to be liquid. Even after applying vacuum or pressure filtration may not occur. Under these circumstances the material within the filtration device is defined as a solid. Do not replace the original filter with a fresh filter under any circumstances. Use only one filter.

11.1.1.10. Determine the weight of the liquid phase by subtracting the weight of the filtrate container from the total weight of the filtrate filled container. Determine the weight of the solid phase of the waste sample by subtracting the weight of the total waste sample, as determined in section 11.1.1.5 or 11.1.1.7.

11.1.1.11. Record the weight of the liquid and solid phases on the bench sheet. Calculate the percent solids from the weights on the bench sheet as follows:

Equation 1

% solids = (e/a) X 100

where:

(a) = Amount of sample
(b) = Container wight that the sample filtrate is to be colleted in.
(c) = Filtrate and container weight
(d) = (c) – (b)
(e) = (a) – (d)

11.1.1.12. If the percent solids determined in section 11.1.1.10 – 11.1.1.11 is equal to or greater than 0.5%, then proceed either to section 11.2 to determine whether the solid material requires particle size reduction or to section 11.1.1.13 if it is noticed that a small amount of the filtrate is entrained in wetting of the filter. If the percent solids determined in section 11.1.1.10 – 11.1.1.11 is less than 0.5%, then proceed to section 11.5 if the nonvolatile TCLP/SPLP is to be performed, and to section 11.6 with a fresh portion of the waste if the volatile TCLP/SPLP is to be performed.

11.1.1.13. Remove the solid phase and filter from the filtration apparatus.

11.1.1.14. Dry the filter and solid phase at 100 +/- 20 degrees C until two successive weighings yield the same value within +/- 1%. Record the final weight.

Note: Caution should be taken to ensure that the subject solid will not flash upon heating. It is recommended that the drying oven be vented to a hood or other approved device.

11.1.1.15. If the percent dry solids is less than 0.5%, then proceed to section 11.5.1 if the nonvolatile TCLP/SPLP is to be performed. If the percent dry solids is greater than or equal to 0.5% and if the nonvolatile TCLP/SPLP is to be performed, return to the beginning of this section 11.1. With a fresh portion of waste, determine whether particle size reduction is necessary (section 11.2) and determine the appropriate extraction fluid (section 11.3). If only the volatile TCLP is to be performed, see the NOTE in section 11.3.

11.2. Particle size reduction: Reduce particle size by crushing, cutting or grinding the waste to a surface area or particle size of approximately 1 mm in diameter or less. If the solids are prepared for organic volatiles extraction, special precautions must be taken (see section 11.6.9).

NOTE: Surface area criteria are meant for filamentous (e.g., paper, cloth, and similar) waste materials. Actual measurements of surface area are not required, nor is it recommended.

11.3. Determination of appropriate extraction fluid: If the solid content of the waste is greater than or equal to 0.5% and if the sample will be extracted for nonvolatile constituents (section 11.5), determine the appropriate fluid (sections 9.5 – 9.9) for the nonvolatile extraction as follows:

NOTE: TCLP extraction for volatile constituents uses only extraction fluid #1 (section 9.5). Therefore, if TCLP extraction for nonvolatile is not required, proceed to section 11.6.

11.3.1. TCLP Extraction Fluid

11.3.1.1. Weigh out a small subsample of the solid phase of the waste, reduce the solid (if necessary) to a particulate size of approximately 1 mm in diameter or less, and transfer 5.0 grams of the solid phase of the waste to a 150 mL beaker .

11.3.1.2. Add 96.5 mL of reagent water to the beaker, cover with a watch glass, and stir vigorously for 5 minutes using a magnetic stirrer. Measure and record the pH. If the pH is <5.0, use extraction fluid #1. Proceed to section 11.5.

11.3.1.3. If the pH from section 11.3.1.2 is >5.0, add 3.5 mL 1N HCl, slurry briefly, cover with a watch glass, heat to 45°C-55°C, and hold at the temperature for 10 minutes.

11.3.1.4. Let the solution cool to room temperature and record pH. If the pH is <5.0, use TCLP extraction fluid #1. (9.6) If the pH is >5.0, use TCLP extraction fluid #2 (9.7).

11.3.2. SPLP Extraction Fluid

11.3.2.1. For soils, if the sample is from a site that is east or the Mississippi River, SPLP extraction fluid #1 (9.8) should be used. If the sample is from a site that is west of the Mississippi River, SPLP extraction fluid #2 (9.9) should be used.

11.3.2.2. For wastes and wastewater, SPLP extraction fluid #1 should be used.

11.3.2.3. For cyanide-containing wastes and/or soils, extraction fluid #3(9.10) must be used because leaching of cyanide-containing samples under acidic conditions may result in the formation of hydrogen cyanide gas.

11.4. Solid Waste Extractions

11.4.1. If Preliminary Determination of Percent Solids (11.1.1) yields over 25 g of solid, non-volatile sample extraction can be performed.

11.4.2. If 25g – 99g of solids remain after above procedure (11.1.1): Use ZHE extraction technique (11.6.1).

11.4.3. If 100g or more remain, use the non-volatile extraction procedure found in section 11.5.

11.5. PROCEDURE WHEN VOLATILES **ARE NOT** INVOLVED

11.5.1. A minimum sample size of 100 grams (solid and liquid phases) is recommended. In some cases, a larger sample size may be appropriate, depending on the solids content of the waste sample (percent solids, see section 11.1.1), whether the initial liquid phase of the waste will be miscible with the aqueous extract of the solid, and whether inorganics, semivolatile organics, pesticides, and herbicides are all analytes of concern. Enough solids should be generated for extraction such that the volume of TCLP/SPLP extract will be sufficient to support all of the analyses required. If the amount of extract generated by a single TCLP/SPLP extraction will not be sufficient to perform all of the analyses, more than one extraction may be performed and the extracts from each combined and aliquoted for analysis.

11.5.2. If the waste will obviously yield no liquid when subjected to pressure filtration (i.e., is 100% solid, see section 11.1.1), weigh out a subsample of the waste (100 gram minimum) and proceed to section 11.5.12.

11.5.3. If the sample is liquid or multiphasic, liquid/solid separation is required. This procedure is outlined in 11.1.1.3-11.1.1.10. The material in the filter holder is the solid phase and the filtrate in the liquid phase. The liquid phase may now be either analyzed or stored at 4 ± 2 $^{\underline{o}}$C until analysis.

11.5.4. If the waste contains <0.5% solids (see section 11.1.12), proceed to section 11.6.16. If the waster contains >0.5% solids (see section 11.1.1) and if particle size reduction of the solid was needed in section 11.5, proceed to section 11.6.14. If the waste as received passes a 9.5 mm sieve, quantitatively transfer the solid material into the extractor bottle along with filter used to separate the initial liquid from the solid phase, and proceed to section 11.6.15.

11.5.5. Prepare the solid portion of the waste for extraction by crashing, cutting, or grinding the waste to a surface area or particle size as described in section 11.2. Quantitatively transfer the solid material into an extractor bottle. Include the filter used to separate the initial liquid from the solid phase.

11.5.6. Determine the amount of extraction fluid to add to the extractor vessel as follows:

Equation 2

$$W_{ef} = \underline{20*(e)}$$

Where W_{ef} = Volume of extraction fluid
(e)= Weight (in grams) of waste filtered (see section 11.1.1.10)

11.5.7. Slowly add this amount of appropriate extraction fluid (see section 11.3) to the extractor vessel. Close the extractor bottle tightly (it is recommended that Teflon tape be used to ensure a tight seal), secure in rotary agitation device, and rotate at 30 ± 2 rpm for 18 ± 2 hours. Ambient temperature (i.e., temperature of room in which extraction takes place) shall be maintained at 23 ± 2°C during the extraction period.

NOTE: As agitation continues, pressure may build within the extractor bottle for some types of wastes (e.g., limed or calcium carbonate containing waste may evolve gases such as carbon dioxide). To relieve excess pressure, the extractor bottle may be periodically opened (e.g. after 15 minutes, 30 minutes, and 1 hour) and vented into a hood.

11.5.8. Following the 18 ± 2 hour extraction, separate the material in the extractor vessel into its component liquid and solid phases by filtering through a new glass fiber filter. For final filtration of the TCLP extract, the glass fiber filter may be changed, if necessary, to facilitate filtration. Filter(s) shall be acid-washed (see section 8.5) if evaluating the mobility of metals.

11.5.9. Prepare the TCLP/SPLP extract as follows:

11.5.9.1. If the waste contained no initial liquid phase, the filtered liquid material obtained from section 11.5.16 is defined as the TCLP/SPLP extract. Proceed to section 11.5.17.

11.5.9.2. If compatible (e.g., multiple phases will not result on combination), combine the filtered liquid resulting from section 11.6.16 with the initial liquid phase of the waste obtained in section 11.6.10. This combined liquid is defined as the TCLP/SPLP extract. Proceed to section 11.6.17.

11.5.9.3. If the initial liquid phase of the waste, as obtained from section 11.5.10, is not or may not be compatible with the filtered liquid resulting from section 11.6.16, do not combine these liquids. Analyze these liquids, collectively defined as the TCLP/SPLP extract, and combine the results mathematically, as described in section 11.5.17.

11.5.10. Following collection of the TCLP/SPLP extract, the pH of the extract should be recorded on form I0104f (see Attachment 1). Immediately aliquot and preserve the extract for analysis. Metals aliquots must be acidified with nitric acid to pH <2. If precipitation is observed upon addition of nitric acid to a small aliquot of the extract, then the remaining portion of the extract for metals analyses shall not be acidified and the extract shall be analyzed as soon as possible. All other aliquots must be stored under refrigeration (4°C±2°C) until analyzed.

11.5.11. The TCLP/SPLP extract shall be prepared and analyzed according to appropriate analytical methods. TCLP/SPLP extracts to be analyzed for metals shall be acid digested except in those instances where digestion causes loss of metallic analytes. If an analysis of the undigested extract shows that the concentration of any regulated metallic analyte exceeds the regulatory level, then the waste is hazardous and digestion of the extract is not necessary. However, data on undigested extracts alone cannot be used to demonstrate that the waste is not hazardous. If the individual phases are to be analyzed separately, determine the volume of the individual phases (to ± 0.5%), conduct the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

Equation 3

$$\textbf{Final Analyte Concentration} = \frac{(V_1)(C_1) + (V_2)(C_2)}{V_1 + V_2}$$

where:

V_1 = The volume of the first phase (L).
C_1 = The concentration of the analyte of concern in the first phase (mg/L).
V_2 = The volume of the second phase (L).
C_2 = The concentration of the analyte of concern in the second phase (mg/L).

11.5.12. Compare the analyte concentrations in the TCLP/SPLP extract with the levels identified in the appropriate regulations. Refer to section 12.0 for quality assurance requirements.

11.6. PROCEDURE WHEN VOLATILES **ARE** INVOLVED

11.6.1. Use the ZHE device to obtain TCLP extract for analysis of volatile compounds only. Extract resulting from the use of the ZHE shall not be used to evaluate the mobility of nonvolatile analytes (e.g. metals, pesticides, etc.). The ZHE should be monitored for leaks during use. If the pressure drops during leaching, test the device for leaks. The device contains a built-in pressure gauge. If pressure is lost check all fittings and inspect and replace o-rings if necessary. Retest the device. If leakage problem cannot be resolved, the manufacture should be contacted.

11.6.2. The ZHE device has approximately a 500 mL internal capacity. The ZHE can thus accommodate a maximum of 25 grams of solid (defined as that fraction of a sample from which no additional liquid may be forced out by an applied pressure of 50 psi), due to the need to add an amount of extraction fluid equal to 20 times the weight of the solid phase.

11.6.3. Charge the ZHE with sample only once and do not open the device until the final extract (of the solid) has been collected. Repeated filling of the ZHE to obtain 25 grams of solid is not permitted.

11.6.4. Do not allow the waste, the initial liquid phase, or the extract to be exposed to the atmosphere for any more time than is absolutely necessary. Any manipulation of these

materials should be done when cold (4 ± 2 °C) to minimize loss of volatiles. Always minimize air exposure.
NOTE: Filtration fluid should never be added directly to the sample.

11.6.5. Place the ZHE piston within the body of the ZHE (it may be helpful first to moisten the piston O-rings slightly with extraction fluid). Adjust the piston within the ZHE body to a height that will minimize the distance the piston will have to move once the ZHE is charged with sample (based upon sample size requirements determined from section 11.6, section 11.1.1 and/or 11.1.12). Secure the gas inlet/outlet flange (bottom flange) onto the ZHE body in accordance with the manufacturer's instructions. Secure the glass fiber filter between the support screens and set aside. Set liquid inlet/outlet flange (top flange) aside.

11.6.6. If the waste is 100% solid (see section 11.1.1), weigh out a subsample (25 gram maximum) of the waste, record weight, and proceed to section 11.6.9.

11.6.7. If the waste contains <0.5% dry solids (section 11.1.12), the liquid portion of waste, after filtration, is defined as the TCLP extract. Filter enough of the sample so that the amount of filtered liquid will support all of the volatile analyses required. For wastes containing >0.5% dry solids (sections 11.1.1 and/or 11.1.12), use the percent solids information obtained in section 11.1.1 to determine the optimum sample size to charge into the ZHE. The recommended sample size is as follows:

11.6.7.1. For wastes containing <0.5% solids (see Section 11.1.1), weigh out a 500 gram subsample of waste and record the weight.

11.6.7.2. For wastes containing >0.5% solids (see Section 11.1.1), determine the amount of waste to charge into the ZHE as follows:

Equation 4

$$\% \text{ solids} = (e/a) \times 100$$

where:
(a) = Amount of sample
(b) = Container weight that the sample filtrate is to be colleted in.
(c) = Filtrate and container weight
(d) = (c) – (b)
(e) = (a) – (d)

11.6.7.3. Weigh out a subsample of the waste of the appropriate size and record the weight.

11.6.8. If particle size reduction of the solid portion of the waste was required in section 11.2, proceed to section 11.6.9. If particle size reduction was not required in section 11.2, proceed to section 11.6.12.

11.6.9. Prepare the waste for extraction by crushing, cutting, or grinding the solid portion of the waste to a surface area or particle size as described in section 11.2. Wastes and appropriate reduction equipment should be refrigerated, if possible, to 4 ± 2 °C prior to particle size reduction. The means used to effect particle size reduction must not generate heat in and of itself. If reduction of the solid phase of the waste is necessary, exposure of the waste to the atmosphere should be avoided to the extent possible.

NOTE: Sieving of the waste is not recommended due to the possibility that volatiles may be lost. The use of an appropriately graduated ruler is recommended as an acceptable alternative. Surface area requirements are meant for filamentous (e.g. paper, cloth) and similar waste materials. Actual measurement of surface area is not recommended.

11.6.10. When the surface area or particle size has been appropriately altered, proceed to section 11.6.12.

11.6.11. Waste slurries need not be allowed to stand to permit the solid phase to settle. Do not centrifuge wastes prior to filtration.

11.6.12. Quantitatively transfer the entire sample (liquid and solid phases) quickly to the ZHE. Secure the filter and support screens onto the top flange of the device and secure the top flange to the ZHE body in accordance with the manufacturer's instructions. Tighten all ZHE fittings and place the device in the vertical position (gas inlet/outlet flange on the bottom). Do not attach the extract collection device to the top plate.

NOTE: If waste material (>1% of original sample weight) has obviously adhered to the container used to transfer the sample to the ZHE, determine the weight of this residue and subtract it from the sample weight determined in section 11.6.7 to determine the weight of the waste sample that will be filtered.

11.6.13. Attach a gas line to the gas inlet/outlet valve (bottom flange) and, with the liquid inlet/outlet valve (top flange) open, begin applying gentle pressure of 1-10 psi (or more if necessary) to force all headspace slowly out of the ZHE device into a hood. At the first appearance of liquid from the liquid inlet/outlet valve, quickly close the valve and discontinue pressure. If filtration of the waste at 4°C reduces the amount of expressed liquid over what would be expressed at room temperature, then allow the sample to warm up to room temperature in the device before filtering. If the waste is 100% solid (see section 11.1.1), slowly increase the pressure to a maximum of 50 psi to force most of the headspace out of the device and proceed to section 11.6.20.

11.6.14. Attach the evacuated preweighed filtrate collection container to the liquid inlet/outlet valve and open the valve. Begin applying gentle pressure of 1-10 psi to force the liquid phase of the sample into the filtrate collection container. If no additional liquid has passed through the filter in any 2 minute interval, slowly increase the pressure in 10 psi increments to a maximum of 50 psi. After each incremental increase of 10 psi, if no additional liquid has passed through the filter in any 2 minute interval, proceed to the next 10 psi increment. When liquid flow has ceased such that continued pressure filtration at 50 psi does not result in any additional filtrate within a 2 minute period, stop the filtration. Close the liquid inlet/outlet valve, discontinue pressure to the piston, and disconnect and weigh the filtrate collection container.

NOTE: Instantaneous application of high pressure can degrade the glass fiber filter and may cause premature plugging.

11.6.15. The material in the ZHE is defined as the solid phase of the waste and the filtrate is defined as the liquid phase.

NOTE: Some wastes, such as oily wastes and some paint wastes, will obviously contain some material that appears to be a liquid. Even after applying pressure filtration, this material will not filter. If this is the case, the material within the filtration device is defined as a solid and is carried through the TCLP extraction as a solid.

11.6.16. If the original waste contained <0.5% dry solids (see section 11.1.12), this filtrate is defined as the TCLP/SPLP extract and is analyzed directly. Proceed to section 11.6.22.

11.6.17. The liquid phase may now be either analyzed immediately (See sections 11.6.21 through 11.6.23) or stored at $4 \pm 2\ ^{\circ}C$ under minimal headspace conditions until time of analysis.

11.6.18. Determine the weight of extraction fluid #1 to add to the ZHE as follows:

Equation 5

$$W_{ef} = \underline{20*(e)}$$

Where W_{ef} = Volume of extraction fluid
(e)= Weight (in grams) of waste filtered (see section 11.1.10)

11.6.19. The following sections detail how to prepare a blank and sample for extraction. For TCLP, Extraction fluid #1 is used in all cases.

11.6.19.1. For volatile analysis, the ZHE is used (extracts from the ZHE cannot be used for non-volatile analysis). Because the ZHE typically has a maximum capacity of 500 mL, and because the amount of extraction fluid must be 20 times the sample weight, the maximum weight of a sample that can be used is 25 grams. A smaller sample may be used but the extraction fluid must still be 20 times the weight of sample used. If less than 25 g is available, notify the PM and if the client approves procedure with a lower amount, follow procedure in 11.6.19.8.

11.6.19.2. Do not allow the waste sample, the liquid phase (if any), or the extract to be exposed for any more time than is necessary.

11.6.19.3. When the ZHE vessel is completely assembled, it needs to be pressurized to eliminate all headspace before transferring the buffer solution. The vessel is connected to nitrogen or compressed air by using the quick-disconnect Swagelok fitting found at the bottom of the vessel. When the quick-disconnect Swagelok is fitted, a distinct "click" should be heard. The two-way valve on the vessel's top plate is opened, and the vent relief valve on the vessel's bottom plate is closed. Approximately 10-20 psi of pressure is applied to push the piston completely to the top of the vessel, causing the vessel to "jump" slightly. The pressure is released in the vessel by venting the relief valve on the vessel's bottom plate. Make sure to shut off the nitrogen or compressed air source before venting.

11.6.19.4. Fill the transfer vessel to its capacity with buffer solution. The vessel's top plate is put on with the two-way valve opened. All the pressure release valves should be closed at this point. The transfer line is then attached tightly to the transfer vessel, and connected to the nitrogen or compressed air source. Apply pressure by turning on the nitrogen source.

11.6.19.5. Slowly open the two-way valve on the transfer vessel. Allow the buffer solution (fluid #1) to flow through the transfer line, thus eliminating the air that is in the line. Close the valve when the solution has reached the end of the transfer line, and loosely connect it to the ZHE vessel. Open both valves (two-way and vent relief) on the ZHE vessel, and open the two-way valve on the transfer vessel. Tighten the transfer line's connection to the ZHE vessel once you see the solution begin the leak. This prevents the addition of headspace to the ZHE vessel.

11.6.19.6. When there is no more flow through the transfer line, close the two-way valve on the ZHE vessel. Monitor the pressure released by the piston being pushed down in the ZHE vessel by quickly tapping the opeing on the lower release valve of the apparatus with a finger tip. When pressure no longer pushes out of the release valve, the piston is at the bottom of the vessel and the extraction fluid flow has stopped.

11.6.19.7. Solid Wastes Sample Preparation (ZHE) After the samples has been determined to contain 100% solids, by definition. The 100% solids sample requires 500 g if buffer solution. (Since the density of the buffer solution is very near 1g/mL, it is assumed that 500g of buffer solution is equivalent to 500mL of buffer solution

11.6.19.8. With the ZHE in the vertical position, pour the extraction fluid until the appropriate amount of fluid has been introduced into the device (20 times the sample weight). After the extraction fluid has been added, immediately close . Check the ZHE to ensure that all valves are in their closed positions. Reposition the ZHE in the vertical position with the liquid inlet/outlet valve on top. Pressurize the ZHE to 10 psi (if necessary) and slowly open the liquid inlet/outlet valve to bleed out any headspace (into a hood) that may have been introduced due to the addition of extraction fluid. This bleeding shall be done quickly and shall be stopped at the first appearance of liquid from the valve. Re-pressurize the ZHE with 10 psi and check all ZHE fittings to ensure that they are closed. Sample data generated from this alternate procedure must be qualified as "estimated due to extraction not being performed according to EPA method recommendations".

11.6.19.9. Place the ZHE in the rotary agitation apparatus (if it is not already there) and rotate at 30 ± 2 rpm for 18 ± 2 hours. Ambient temperature (i.e., temperature of room in which extraction occurs) shall be maintained at 23 ± 2°C during agitation.

11.6.20. Following the 18 ± 2 hour agitation period, check the pressure behind the ZHE piston by quickly opening and closing the gas inlet/outlet valve and noting the escape of gas. If the pressure has not been maintained (i.e., no gas release observed), the device is leaking. Check the ZHE for leaking as specified in sections 11.6.2 – 11.6.5, and perform the extraction again with a new sample of waste. If the pressure within the device has been maintained, the material in the extractor vessel is once again separated into its component liquid and solid phases. If the waste contained an initial liquid phase, the liquid may be filtered directly into the same filtrate collection container holding the initial liquid phase of the waste. A separate filtrate collection container must be used if combining would create multiple phases, or there is not enough volume left within the filtrate collection container. Filter through the glass fiber filter, using the ZHE device as discussed in section 11.6.15. All extract shall be filtered and collected in a glass volumetric syringe and inject into a 40 mL VOA vial, if the extract is multiphasic, or if the waste contained an initial liquid phase.

NOTE: An in-line glass fiber filter may be used to filter the material within the ZHE if it is suspected that the glass fiber filter has been ruptured.

11.6.21. If the original waste contained no initial liquid phase, the filtered liquid material obtained from section 11.6.2.1 is defined as the TCLP/SPLP extract. If the waste contained an initial liquid phase, the filtered liquid material obtained from section 11.6.2.1 and the initial liquid phase (section 11.6.15) are collectively defined as the TCLP/SPLP extract.

11.6.22. Following collection of the TCLP/SPLP extract, immediately prepare the extract for analysis and store with minimal headspace at 4°C±2°C until analyzed. Analyze the TCLP/SPLP extract according to the appropriate analytical methods. If the individual phases are to be analyzed separately (i.e., are not miscible), determine the volume of the individual phases (to 0.5%), conduct the appropriate analyses, and combine the results mathematically by using a simple volume-weighted average:

Equation 6

$$\text{Final Analyte Concentration} = \frac{(V_1)(C_1)+(V_2)(C_2)}{V_1 + V_2}$$

where:

V_1 = The volume of the first phases (L).
C_1 = The concentration of the analyte of concern in the first phase (mg/L).
V_2 = The volume of the second phase (L).
C_2 = The concentration of the analyte of concern in the second phase (mg/L).

11.6.23. Compare the analyte concentrations in the TCLP/SPLP extract with the levels identified in the appropriate regulations. Refer to section 13.0 for quality assurance requirements.

11.7. Proceed to the appropriate analytical procedure.

- ICP Metals
- Mercury
- VOC's
- Semivolatiles
- Pesticides
- Herbicides

12. QUALITY CONTROL

12.1. Maintain all data including quality assurance data and keep it available for reference or inspection.

12.2. A minimum of one blank (using the same extraction fluid as used for the samples) must be analyzed for every 20 extractions that have been conducted in each type of extraction vessel. These blanks are treated as samples. The rotation of reusable vessels must be recorded in a vessel logbook to verify that all vessels are used for extraction of the blank and that there isn’t a higher use of any individual vessel.

12.3. A matrix spike shall be performed for each waste type (e.g., wastewater treatment sludge, contaminated soil, etc.) unless the result exceeds the regulatory level and the data is being used solely to demonstrate that the waste property exceeds the regulatory level. A minimum of one matrix spike must be analyzed for each analytical batch. As a minimum, follow the matrix spike addition guidance provided in each analytical method.

12.3.1. Matrix spikes are to be added after filtration of the TCLP/SPLP extract and as a part of preparation for sample analysis. Matrix spikes should not be added prior to TCLP/SPLP extraction of the sample.

12.3.2. For the metals analysis matrix spike aliquot, the spike should be added prior to sample preservation. The aliquot should be handed off to the metals preparation personnel for spiking and preservation. All standard and acid preservation information should be recorded for traceability.

12.4. All quality control measures described in the appropriate analytical methods shall be followed.

12.5. Rotary Apparatus velocity must be documented. Document velocity check on the TCLP worksheet.

12.6. Room temperature before and after T/S extraction will be documented. Record on the TCLP worksheet.

13. METHOD PERFORMANCE

13.1. There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

13.1.1. The analyst must read and understand this procedure with written documentation maintained in his/her training file which is located in the QA Office.

13.1.2. An initial demonstration of capability (IDC) must be performed per SOP All-Q-020. A record of the IDC will be maintained in his/her file with written authorization from the Laboratory Manager and Quality Manager. Results are stored in the QA office.

13.1.3. Periodic performance evaluation (PE) samples are analyzed to demonstrate continuing competence per SOP All-Q-010. Results are stored in the QA office.

14. POLLUTION PREVENTION AND WASTE MANAGEMENT

14.1. The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

14.2. The Environmental Protection Agency (USEPA) requires that laboratory waste management practice be consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult SOP ALL-S-002.

15. REFERENCES

15.1. Federal Register/Vol. 55, No. 126/Friday, June 29, 1990/Rules and Regulations - Appendix II - Method 1311 Toxicity Characteristic Leaching Procedure (TCLP)

15.2. Federal Register/Vol. 55,

16. TABLES, DIAGRAMS, FLOWCHARTS, APPENDICES, ADDENDA, ETC.

Not applicable.

17. REVISIONS

Revision Number	Reason for Change	Date
MN-I-312-Rev 6	Reformatted. Add min/max thermometer to Equipment list.	10 Mar 2005
MN-I-312-Rev.7	Edited 12.6 to include all ZHE procedures to deliver extraction fluid under pressure using nitrogen or compressed air. Update section 14 to current SOP references Update expiration dates for TCLP/SPLP fluid and that pH should be verified before each use.	06Dec2006
S-MN-I-312 Rev.08	Removed 12.5.4 to 12.5.9 Removed Responsibilities and Distribution Section Attachment of TCLP/SPLP Benchsheet I0104f Clarified Determining Percent Solids (11.1), revised section 11.4 for clarity. Emphasize not adding fluid to sample during ZHE, remove filtrate prior to pumping extraction fluid into ZHE.	16July2008

Attachment 1: TCLP/SPLP
Benchsheet

Pace Analytical

Batch #____________

Metal______ Start Date & Time: ________________
Semi______ End Date & Time: ________________
ZHE_______ Analyst: ______________
Reviewed: ______________

Leachates, TCLP(EPA Method 1311)____
Leachates, SPLP(EPA Method 1312)____

Sample	Sample Wt. (g)	E.F. #	E.F. (mL)	Weights for Total Solids Calculation		% Solids	E. F. # determination			pH of extract	Pres. extract <2	ZHE		
							Initial pH	Acid Proc.*	Final pH			Vessel #	PSI pre	PSI post
				Sample Wt. (a)										
				Container Wt.(b)										
				Fil./Cont. Wt. (c)										
				Filtrate Wt. (d)										
				Solid Phase Wt.(e)										
				Sample Wt. (a)										
				Container Wt.(b)										
				Fil./Cont. Wt. (c)										
				Filtrate Wt. (d)										
				Solid Phase Wt.(e)										
				Sample Wt. (a)										
				Container Wt.(b)										
				Fil./Cont. Wt.(c)										
				Filtrate Wt. (d)										
				Solid Phase Wt.(e)										
				Sample Wt. (a)										
				Container Wt.(b)										
				Fil./Cont. Wt. (c)										
				Filtrate Wt. (d)										
				Solid Phase Wt.(e)										
				Sample Wt. (a)										
				Container Wt.(b)										
				Fil./Cont. Wt. (c)										
				Filtrate Wt. (d)										
				Solid Phase Wt.(e)										

*Acid Procedure - Add 3.5 mLs of 1N HCl (Traceability #_____________________), heat for 10 min. at 50 C., cool to room temp., record pH and temperature.
**If Acid Procedure is performed, enter "yes".

Extraction Fluid pH Criteria
#1 4.93 +/- 0.05 __________ # 1 TN# ____________________
#2 2.88 +/- 0.05__________ # 2 TN# ____________________

	MIN / MAX	LIMITS
Room Temp.	/	23 C +/- 2 C
Room Temp.	/	23 C +/- 2 C
Room Temp.	/	23 C +/- 2 C

#1 Rotations per min.:_______ 30 +/- 2
#2 Rotations per min.:_______ 30 +/- 2
#3 Rotations per min.:_______ 30 +/- 2

Filters Acid Washed: __________YES __________NO

SPLP solution:_____pH TN# ________________

Acid Lot # used for sample preservation:________________

(a) = amount of sample to be filtered (b) = container weight that sample filtrate is collected in (c) = Filtrate and container weight (d) = (c) - (b); (e) = (a) - (d)

I0104f(08Sept2006)

STANDARD OPERATING PROCEDURE
PAINT FILTER LIQUIDS TEST
(EPA METHOD 9095A)

Pace Analytical
www.pacelabs.com

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414

Phone: 612.607.1700
Fax: 612.607.6444

STANDARD OPERATING PROCEDURE

Paint Filter Liquids Test

(EPA Method 9095A)

SOP NUMBER	**S-MN-I-516-Rev. 03**
EFFECTIVE DATE	**Date of final signature**
SUPERSEDES	**S-MN-I-516-Rev. 02**

APPROVAL

	9/18/08
Laboratory General Manager	Date
Melanie Ollila	9/19/08
Quality Assurance Manager	Date

ANNUAL REVIEW
SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date
Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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TABLE OF CONTENTS

1. PURPOSE

This method is used to determine the presence of free liquids in a representative sample of waste as delineated in EPA Method 9095A.

2. SCOPE AND APPLICATION

This SOP measures free liquids in waste with a practical limit of detection of 1.0 ml/5 min.

3. SUMMARY OF METHOD

A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-minute period, the material is deemed to contain free liquids.

4. INTERFERENCES

4.1. Test must be performed above the freezing point of any liquid in the sample.

4.2. The filter media may separate from the filter cone on exposure to alkaline materials.

5. SAFETY

5.1. The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials

5.2. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) and a formal safety plan is made available to all personnel involved in chemical analysis.

5.3. MSDS sheets are located at the front desk and should be consulted prior to handling samples and standards.

5.4. The toxicity or condition of samples analyzed by this method is unknown. Therefore, always wear appropriate personal protective equipment to control exposure to hazards.

6. DEFINITIONS

6.1. Definitions of terms found in this SOP are described in the Pace Analytical Services Quality Manual, Glossary Section.

7. SAMPLE COLLECTION, PRESERVATION AND HANDLING

Samples are collected in glass bottles and stored at 4 °C±2°C. The maximum holding time is 28 days. **Use the Pace GN bottle for analysis.**

8. EQUIPMENT AND SUPPLIES

8.1. Conical paint filter: mesh number 60 ± 5% (fine mesh size). Available at local paint stores.

8.2. Glass funnel (to support the filter if necessary).

8.3. Ring stand and ring, or tripod.

8.4. Graduated cylinder or concentrator tube

9. REAGENTS AND STANDARDS

Not Applicable.

10. CALIBRATION

Not Applicable.

11. PROCEDURE

11.1. Assemble apparatus.

11.2. Place 50 grams of well-mixed sample in the filter.

11.3. Gently tap the sides of the filter to settle the sample into the filter as it is being filled.

11.4. Record start time on bench sheet (Attachment 1).

11.5. Allow the sample to drain for 5 minutes into the graduated cylinder or concentrator tube.

11.6. Record the stop time on the bench sheet.

11.7. Record the amount of collected liquid if any on bench sheet.

12. QUALITY CONTROL

12.1. Duplicate samples should be analyzed on a routine basis.

12.2. The control limit for duplicate samples is <20% RPD.

13. METHOD PERFORMANCE

13.1. There are several requirements that must be met to insure that this procedure generates accurate and reliable data. The analyst must read and understand this procedure with written documentation maintained in his/her training file. The training file is stored in the QA office. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

14. POLLUTION PREVENTION AND WASTE MANAGEMENT

14.1. The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

14.2. The Environmental Protection Agency (USEPA requires that the laboratory waste management practice be consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult SOP ALL-S-002, *Waste Handling*.

15. REFERENCES

15.1. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update I, Method 9095A.

16. ATTACHMENTS

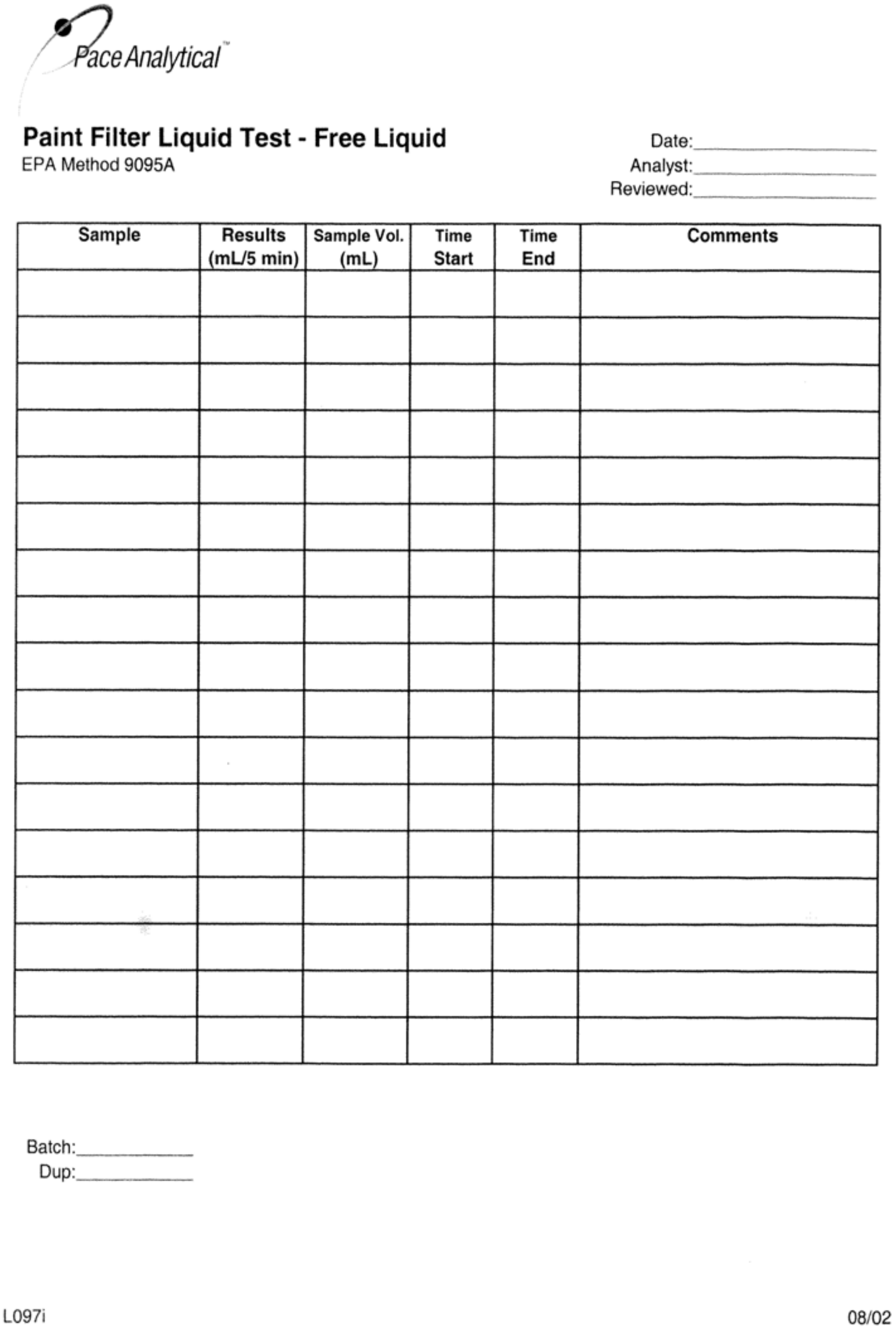
16.1. Example Bench sheet

17. REVISIONS

Document Number	Reason for Change	Date
MN-I-516 rev. 1	Reformatted document to be consistent with corporate model. 6. Deleted Definitions and added reference to Quality Manual glossary. 13. Added control limits for duplicates. 15. Substituted new section from corporate model SOP.	03Mar2006
S-MN-I-516-Rev.02	Updated formatting on page 1 and Section 7	29Oct2007
S-MN-I-516 Rev.03	Removed Responsibilities and Distribution Section Updated the Numbering	18Sep2008

ATTACHMENT 1

Example: Benchsheet



Pace Analytical™

Paint Filter Liquid Test - Free Liquid

EPA Method 9095A

Date:________________
Analyst:________________
Reviewed:________________

Sample	Results (mL/5 min)	Sample Vol. (mL)	Time Start	Time End	Comments

Batch:____________
Dup:____________

L097i 08/02

STANDARD OPERATING PROCEDURE
ANALYSIS OF POLYCHLORINATED BIPHENYLS IN OIL, SOIL, WATER, WIPE MATRICES
REFERENCE METHODS: EPA 8082

www.pacelabs.com

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1700 Elm Street, Suite 200
Minneapolis, MN 55414

Phone: 612.607.1700
Fax: 612.607.6444

STANDARD OPERATING PROCEDURE

ANALYSIS OF POLYCHLORINATED BIPHENYLS IN OIL, SOIL, WATER, WIPE MATRICES

REFERENCE METHODS: EPA 8082

SOP NUMBER:	S-MN-O-432-Rev.14
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	MN-O-432-rev.13

APPROVAL

	12/29/08
General Manager	Date
Melanie Ollila	12/29/08
Quality Assurance Manager	Date

ANNUAL REVIEW

Signatures below indicate no changes have been made since approval. SOP is valid for one year from date of last signature.

Signature	Title	Date
Signature	Title	Date

This is **COPY#_6_** distributed on _12-Feb-09__ by __JAW__and is ______**CONTROLLED or** __X___**UNCONTROLLED.**

Table of Contents

1. Purpose

This method defines criteria used in the analysis of water, soil, oil, and wipe samples for Polychlorinated Biphenyls (PCBs). Specifically, the following PCB aroclors may be routinely analyzed by this method.

Compound	CAS No.
Aroclor (PCB) 1016	12674-11-2
Aroclor (PCB) 1221	11104-28-2
Aroclor (PCB) 1232	11141-16-5
Aroclor (PCB) 1242	53469-21-9
Aroclor (PCB) 1248	12672-29-6
Aroclor (PCB) 1254	11097-69-1
Aroclor (PCB) 1260	11096-82-5
Aroclor (PCB) 1262	37324-23-5
Aroclor (PCB) 1268	11100-14-4

2. Scope and Application

2.1 PCB sample extracts in hexane are analyzed by gas chromatography using a capillary column with an electron capture detector (ECD). Samples will be quantitated using the external standard technique and typically 5 peaks per aroclor. The individual peak results are averaged and the results are reported in proper units.

2.2 Addendum I must be reviewed and followed prior to the analysis of any samples under the TSCA program

3. Summary of Method

PCB samples are received from the Prep Lab. The instrument is calibrated and the samples are then run. The data is checked, reported (soils are corrected for moisture unless otherwise requested) and filed.

4. Interferences

4.1 Solvents, reagents, glassware and other sample processing hardware may yield discrete artifacts and/or elevated baselines causing misinterpretation of the chromatograms. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by running method blanks.

4.2 Interferences by phthalate esters pose a major problem in PCB analysis when using an ECD. These compounds generally appear in the chromatogram as broad eluting peaks. Common flexible plastics contain varying amounts of phthalates, which are easily extracted or leached during the laboratory operation. Avoiding the use of plastics can minimize interferences from phthalates. Exhaustive cleanup of reagents and glassware may be required to eliminate background phthalate contamination. Refer to Pace Analytical Services, Inc. SOP on Glassware Cleaning, MN-O-465.

4.3 Interferences co-extracted from the samples will vary considerably from source to source. Acid cleanup is performed on all oils, soils, and wipe samples Acid cleanup on water extracts is performed upon analyst's discretion.

4.4 Spiked laboratory replicates should be analyzed to validate the precision and accuracy of the analyses.

5. Safety

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials

5.2 The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) and a formal safety plan is made available to all personnel involved in the chemical analysis.

5.3 MSDS sheets are available and should be consulted prior to handling samples and standards.

5.4 The toxicity or condition of samples analyzed by this method is unknown. Therefore, always wear appropriate personal protective equipment to control exposure to hazards.

6. Definitions

Refer to the Glossary Section of the Pace Analytical Services, Inc. Quality Manual.

7. Sample Collection, Preservation and Handling

7.1 Sample collection, preservation, and handling will meet EPA requirements.

7.1.1 Extraction Holding Times: Water - 7 days
Soil - 14 days
Oil - 14 days
Wipe - 14 days

7.1.2 Analysis holding time for all matrices is 40 days from extraction.

7.2 The samples and extracts must be stored in a refrigerator at 4°C ± 2°C from the time of collection until analysis.

8. Equipment and Supplies

8.1 Preparation Equipment

8.1.1 2L separatory funnel with Teflon® stopcock

8.1.2 Teflon® cap

8.1.3 100 ml graduated cylinder

8.1.4 500 mL Erlenmeyer flask with glass stopper or aluminum foil

8.1.5 Ring stand

8.1.6 pH strip, wide range.

8.1.7 2 mL autovials with crimptop caps

8.1.8 Balance - Analytical, capable of accurately weighing 0.00 gm. - top loading.

8.1.9 Ultrasonic cell disrupter, heat systems - Ultrasonics, Inc. Model W-385, Model 3000 or model 2020 Sonicator with #207 3/4 inch disrupter horn or equivalent.

8.1.10 Beakers, 400mL

8.1.11 Tilting dispenser/ pump dispenser

8.1.12 Tongue depressors

8.1.13 1 ml syringes (Hamilton or equivalent)

8.1.14 Collection flasks

8.1.15 Powder funnel

8.1.16 Glass wool

8.1.17 Filter paper

8.1.18 Disposable glass pipettes

8.1.19 Disposable Pasteur pipettes

8.1.20 Soxhlet

8.1.21 Round bottom flask (500 mL or equivalent)

8.1.22 Boiling chips

8.2 Concentration Equipment

8.2.1 Concentrator tube - Kuderna-Danish, 10 ml, graduated. Ground glass stopper is used to prevent evaporation of extracts.

8.2.2 Evaporative flask - Kuderna-Danish, 500mL. Attach to concentrator tube with connectors.

8.2.3 Snyder column - Kuderna-Danish, Three-ball macro.

8.2.4 Water bath - Heated with concentric ring cover, capable of temperature control (± 2°C). The bath should be used in a hood.

8.2.5 Nitrogen evaporation device equipped with a water bath.

8.3 Analytical Equipment

8.3.1 Gas Chromatograph - HP5890 GC or HP6890 GC with dual electron capture detectors and a HP7376 autosampler (or equivalent)

8.3.2 Gas Chromatograph Columns - Two wide-bore (30 m x 0.32 mm ID) fused silica GC columns are required. A separate detector is required for each column. The recommended analytical columns are a DB-35MS or RTX-CLP, 30 m x 0.32 mm ID, 0.25 um film thickness (J&W Scientific or equivalent) and a DB-XLB or RTX-CLP2, 30 m x 0.32 mm ID, .25 um film thickness, (J&W Scientific, Folsum, CA or equivalent).

8.3.3 Columns are mounted in a dual GC/ECD with a single injection port/guard column connected to a glass Y.

8.3.4 Electron Capture Detector (ECD) - The make-up gas must be P-5, P-10 (argon/methane) or nitrogen, according to the instrument specification. The linearity and the response of the ECD may be greatly dependent on the flow rate of the make-up gas to the detector

9. Reagents and Standards

9.1 Calibration Standards

9.1.1 1000 µg/mL stock solutions (AccuStandard or other vendor) of Aroclor 1016/1260 Mix are combined with surrogate stock solutions of tetrachloro-m-xylene (TCMX) and decachlorobiphenyl (DCB) at the following recommended concentration levels in hexane:

Name	Aroclor µg/mL	TCMX µg/mL	DCB µg/mL
Level 1	0.1	0.01	0.01
Level 2	0.5	0.05	0.05
Level 3	1.0	0.10	0.10
Level 4	2.0	0.20	0.20
Level 5	3.0	0.30	0.30
Level 6	4.0	0.40	0.40

9.1.2 All other aroclors are prepared at 2.0 µg/mL. If, based on historical data, a specific aroclor is of interest to a client, a five-point calibration can be made with that aroclor.

9.1.3 Prepare a 1016/1260 external check standard from a second source vendor at 2.0-5.0 µg/mL in hexane. Surrogates are added to the external check standard.

9.1.4 Tetrachloro-m-xylene and decachlorobiphenyl are prepared in a working surrogate spike solution of 1.2 µg/mL in hexane for each of the two compounds.

9.1.5 Tetrachloro-m-xylene and Decachlorobiphenyl stock solution at 20 ug/ml should be used for PCB wipes.

9.1.6 Prepare a matrix spike/duplicate (MS/MSD) and a laboratory control spike (LCS) spike solution of Aroclor 1016 and Aroclor 1260 at 40.0 µg/mL. Aroclor 1016 and Aroclor 1260 are spiked into the MS/MSD and LCS samples.

9.1.7 The LCS/ LCSD and MS/MSD solution for PCB wipes utilizes the stock of Aroclor 1016 and Aroclor 1260 at 500 ug/ml.

9.1.8 All standards are stored in vials consistent with the extracts at 4° ± 2° C. All working solutions have an expiration date of 6 months from the preparation unless the stock solution expires sooner.

9.1.9 Second source external checks are prepared periodically (Annually at a minimum) for all aroclors.

9.2 Reagents

9.2.1 Deionized Water

9.2.2 Sodium Sulfate – Prepared by baking at 400° C for 4 hours

9.2.3 Baked Sand – Prepared by baking at 400° C for 4 hours

9.2.4 Sulfuric Acid (Trace metal grade or equivalent)

9.2.5 Methylene Chloride (Pesticide grade or equivalent)

9.2.6 Acetone (Pesticide grade or equivalent)

9.2.7 Hexane (Pesticide grade or equivalent)

10. Calibration

10.1 Initial Instrument Calibration

10.1.1 A six-point initial calibration is analyzed with the 1016/1260 aroclor combination. Refer to section 10.1.1 for recommended concentration levels.

10.1.2 Single level standards are analyzed for the remaining aroclors and can be analyzed before or after the 1016/1260 calibration. The single level standards are analyzed every time an initial calibration is performed, at a minimum.

10.1.3 Three - Five peaks are selected for each aroclor, and an instrument response factor is calculated for each peak.

10.1.4 The responses for the standard levels are divided by the concentration for each compound, and an average response factor is calculated for each peak. The RSD (relative standard deviation) is calculated as the standard deviation divided by the average response factor. The RSD must be less than 20% or the R^2 must be $\geq$.990 unless specific program requirements are tighter. The low-level standard is used to define the accuracy of quantitation at or near the reporting limit.

10.1.5 The external check standard results are calculated from the average response and must be within ±15% of the true value.

10.2 Daily Calibration Verification

10.2.1 Before samples are analyzed each day, a continuing calibration standard is analyzed. The response must fall within ± 15% of the initial calibration. If the response fails this check, the daily standard is reanalyzed. If the response from the reanalysis does not meet the acceptance criteria, then initial calibration and/or instrument maintenance is performed before samples may be analyzed. All maintenance will be recorded in the corresponding instrument maintenance logbook.

10.2.2 The continuing calibration is then analyzed every 10 injections. The response of each must fall within ± 15% of the initial calibration. If the response is outside that limit, sample reporting may proceed with QA or supervisory approval.

11. Procedure

11.1 Extraction

11.1.1 Extraction Holding Times: Water - 7 days
Soil - 14 days
Oil - 14 days
Wipe - 14 days

The analysis holding time for all matrices is 40 days from extraction.

11.1.2 The following extraction procedures are listed in Attachment I:

11.1.2.1. SW8082-Water Extraction Procedure

11.1.2.2. SW8082-Soil Extraction Procedure – Sonication (30g)

11.1.2.3. SW8082-Soil Extraction Procedure- Soxhlet (30g)

11.1.2.4. SW8082-Wipe Extraction Procedure

11.1.2.5. SW8082-Oil Extraction Procedure

11.1.3 All data is recorded onto an extraction sheet. (Example given in Attachment III)

11.2 Instrumental Analysis

11.2.1 A Hewlett-Packard model 5890 or 6890 gas chromatograph is equipped with a dual electron capture detector. The following operating parameters are recommended, but may be adjusted to optimize the analytical run:

Column Flow:	.32 id = 2 -3 mL/min .53 id = 7 - 10 mL/min
Split Flow:	70 - 80 mL/min
Make up:	70 - 90 mL/min
Injector Temperature:	250°C
Injection:	Split/Splitless
Injection Volume:	1 uL
Detector Temperature:	300°C
Initial Temperature:	160°C
Initial Time:	0 min
Temperature Ramp:	5°C/min to 280°, 30°C to 310°
Final Temperature:	310°C
Final Hold Time:	4 min

11.2.2 Data is reported from the following column: DB-35MS or RTX-CLP: 0.32 micron x 30 meters with 0.5 micron film thickness

11.2.3 A second column is used for confirmation:DB-XLB or RTX-CLP2: 0.32 micron x 30 meters with a 0.25 micron film thickness. Data generated from the second column is used for confirmation, data is reported from the primary column.

11.3 Sample Analysis

11.3.1 Once the initial calibration and external check standards have been analyzed, sample analysis begins. After every 10 injections (or 12 hours), a continuing calibration standard (CCAL) is analyzed. If the CCAL does not meet criteria of ±15% of the true value, the calibration is considered out of control. All samples analyzed since the last valid check must be reanalyzed under acceptable calibration criteria. An ending ccal must also be analyzed.

11.3.2 The surrogate TCMX uses a retention time window ±0.05 min. All aroclors use a retention time window ±0.07 min. The surrogate DCB uses a retention time window of ±0.10 min.

11.3.3 The ECD response for all analytes must be within the established calibration range in order for quantitative measurements to be made.

11.3.4 Failure to meet any of the criteria established in this method must be thoroughly documented, and technical justification for the validity of the data must be presented to the laboratory manager.

11.3.5 The reporting limits for each aroclor are listed in Table I.

11.3.6 Aroclor identification and quantitation for aroclors 1016 and 1260 are based on the six-point initial calibration. Quantitation of the other aroclors is based on one-point calibration standards, unless further calibration is required by the client or regulation agency.

11.3.7 The calculated amount for each of the 3-5 peaks is reported as an average mean concentration.

11.3.8 The choice of the peaks used for multicomponent quantitation and the recognition of those peaks may be complicated by the following: environmental alteration of the aroclors, and by the presence of co-eluting analytes or matrix interferences. The judgment of the analyst will determine the best approach for quantitation. All deviations from this method will be documented with technical justification.

11.3.9 If more than one multicomponent analyte is observed in a sample, the analyst must choose separate peaks to quantitate the different multicomponent analytes. Peaks common to both analytes present in the sample must not be used to quantitate either compound.

11.4 Quantitation of Analytes

11.4.1 OIL

$$\text{mg/kg} = \frac{\text{Cx } (\mu\text{g/mL}) \text{ x Vt (mLs) x 1000 grams x 1 mg x DF}}{\text{V (grams) x 1 kg x 1000 } \mu\text{g}}$$

11.4.2 SOIL

$$\text{mg/kg} = \frac{\text{Cx } (\mu\text{g/mL}) \text{ x Vt (mLs) x 1000 grams x 1 mg x DF}}{\text{V (grams) x 1 kg x 1000 } \mu\text{g}} \text{ x } \frac{[100]}{[100\text{-M}]}$$

11.4.3 WATER

$$\mu\text{g/L} = \frac{\text{Cx } (\mu\text{g/mL}) \text{ x Vt (mLs) x DF}}{\text{V (liters)}}$$

11.4.4 WIPE

$$\mu\text{g} = \text{Cx } (\mu\text{g/mL}) \text{ x Vt (mLs) x DF}$$

Where Cx= Concentration of the peak for the compound to be measured in the sample extract (µg/mL)
Vt = Final volume of the sample extraction (mLs)
V = Initial weight or volume of the sample (grams or liters)
DF= Dilution factor, if necessary
M = Moisture, if applicable

11.4.5 The recovery of the surrogates is calculated according to the following equation:

$$\text{Surrogate Percent Recovery} = \frac{Qd}{Qa} \times 100\%$$

Qd = Concentration determined by analysis
Qa = Concentration added to the sample/blank

12. Quality Control

12.1 Initial and continuing calibration standards not specifically meeting the established method criteria but deemed acceptable will be documented with scientific justification. Supervisor approval is required before proceeding with the analysis. Corrective action reports must be completed and routed as appropriate.

12.2 Quality Control results falling outside established acceptance criteria will be documented with scientific justification for acceptance of data or footnoted regarding reanalysis or re-extraction requirements. Lab Manager approval is required before proceeding with the analysis. Corrective action reports must be completed and routed as appropriate.

12.3 Method Blanks

12.3.1 Method blanks are spiked with surrogate solution, extracted, acid-cleaned and analyzed by following the same procedure that is used with the samples.

13.3.1.1 A method blank must be extracted every time a group of samples is extracted, or every 20 samples, whichever is more frequent.

12.3.2 In order to be acceptable, a method blank analysis cannot contain any of the analytes listed in this method above the reporting limit. The surrogate retention times and recoveries must be within established limits for both tetrachloro-m-xylene and decachlorobiphenyl.

12.3.3 All samples associated with a contaminated method blank must be re-extracted and reanalyzed unless other approval is given directly by the laboratory manager.

12.4 Matrix Spike/ Matrix Spike Duplicate

12.4.1 The percent recoveries and the relative percent difference (RPD) will be calculated and reported by using the following equations:

$$\text{MS/MSD Recovery} = \frac{SSR - SR}{SA} \times 100\%$$

$$RPD = \frac{|MSR - MSDR|}{1/2\,(MSR + MSDR)} \text{ X } 100\%$$

Where: SSR = Spiked-sample result (spiked with aroclors 1016/1260)

SR = Sample result
SA = Spike amount added
MSR = Matrix spike recovery
MSRD = Matrix spike duplicate recovery

The recoveries should be within the internally generated limits. Because of the different types of matrices the lab analyst must look to the LCS/LCSD for data acceptance.

12.5 Laboratory Control Spike/ Laboratory Control Spike Duplicate

12.5.1 A laboratory control spike (LCS) is extracted at least once every 20 samples or every extraction set, whichever is more frequent. If a MS/MSD is not extracted with the set due to insufficient sample, a laboratory control spike duplicate is required.

12.5.2 The percent recoveries and the relative percent differences between recoveries of each of the compounds in the LCS and LCSD will be calculated and reported using the following equation:

$$\text{LCS/LCSD Recovery} = \frac{\text{SSR} \times 100\%}{\text{SA}}$$

$$\text{RPD} = \frac{(\text{LCSR} - \text{LCSDR})}{1/2\,(\text{LCSR} + \text{LCSDR})} \times 100\%$$

Where: SSR = Spiked-sample result (spiked with aroclors 1016/1260)
SA = Spike amount added
LCSR= Laboratory control spike recovery
LCSDR= Laboratory control spike duplicate recovery

12.6 If the percent recovery and RPD limits for the LCS/LCSD and/or MS/MSD compounds are not within internally generated QC limits, the laboratory must take action. Technical justification must be documented in order to accept any out of control data points.

13. Method Performance

13.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

13.1.1 The analyst must read and understand this procedure with written documentation maintained in his/her training file.

13.1.2 An initial demonstration of capability (IDC) must be performed per SOP All-Q-020. A record of the IDC will be maintained in his/her file with written authorization from the Laboratory Manager and Quality Assurance Manager.

13.1.3 An annual minimum detection limit (MDL) study, following All-Q-004, will be completed for this method and whenever there is a major change in personnel or equipment. Results are stored in the QA office.

13.1.4 Periodic performance evaluation (PE) samples are analyzed to demonstrate continuing competence per SOP All-Q-010. Results are stored in the QA office.

14. Pollution Prevention and Waste Management

14.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes reflect anticipated usage and reagent stability.

14.2 The Environmental Protection Agency (USEPA) requires that laboratory waste management practice be conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult MN SOP ALL-S-002, Waste Management.

15. References

15.1 USEPA Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition, Method 8082, Final Update III.

16. Tables, Diagrams, Flowcharts, Attachments, Appendices, Etc.

16.1 Table I: Reporting Limits

16.2 Attachment I: Extraction Procedures

16.3 Attachment II -TSCA Modifications

16.4 Attachment III – Extraction Bench Sheet Example

17. Revisions

Document Number	Reason for Change	Date
MN-O-432-Rev.8	Formatted to reflect corporate numbering system 1.0 Added data to Araclor list 6.0 Referenced MN-Q-241 and removed definitions 9.0 Added equipment 10.1 Updated standard bottle type, added standards 10.2 Added Reagents 12.1.2 Referenced Method 12.1.3 Added section 12.3 Changed frequency of CCAL 14.0 Changed wording of Method Performance 15.0 Updated Waste Management	20Dec2004

	Table 1 - Added data to Araclor list Attachment I – Updated water extraction procedure Attachment I – Updated soil extraction procedure Attachment I – Updated wipe extraction procedure Attachment II – Changed numbering system Attachment III – Added PCB extraction sheet	
MN-O-432-Rev10	1.Changed LCS/LCSD references to LCS/MS/MSD unless insufficient sample volume present- 10.1.6, 10.1.7, 13.5, 13.6, Attachment I 2. 12.3.1 Every 10 injects or 12 hours 3. 12.3.1 added “An ending ccal must also be analyzed” 4. Removed 13.4.1 5. Updated to the current extraction sheet	25Oct2006
MN-O-432-Rev.11	Updated MDL section to include SOP reference Updated Section 17 to list all attachment names Removed the reference to 5 standard levels in 11.1.4	20Nov2006
MN-O-432-Rev.12	Updated ICV limits to 15% in 11.1.5 Update SOP references in section 14 Update Wipe procedure “Put extract in labeled 1mL autovial. Add 0.75 mL of sulfuric acid, cap and vortex. Decant hexane layer into a crimp top autovial labeled with the sample number, analysis, and extraction date. Sulfur cleanup may occur as necessary according to SOP MN-O-531. Make sure crimptops are crimped tightly to the autovial.”	06Dec2006
S-MN-O-432-Rev.13	Update naming format 10.1.3 Surrogates are added to the second source std 12.2.3 Confirm all data on a second column 12.3.6 Analyze 6 point ical not 5 Updated Attachment 1	30Apr2007
S-MN-O-432 Rev.14	Removed Responsibilities and Distribution Section Reworded Sections 5.3 and 9.1.11 Changed the Ratio of Solvent to 80:20 in Attachment I	17Dec3008

TABLE I
REPORTING LIMITS *

Aroclors	Oil	Soil
1016	5.0 mg/kg	0.033 mg/kg
1221	5.0 mg/kg	0.033 mg/kg
1232	5.0 mg/kg	0.033 mg/kg
1242	5.0 mg/kg	0.033 mg/kg
1248	5.0 mg/kg	0.033 mg/kg
1254	5.0 mg/kg	0.033 mg/kg
1260	5.0 mg/kg	0.033 mg/kg
1262	5.0 mg/kg	0.033 mg/kg
1268	5.0 mg/kg	0.033 mg/kg

Aroclors	Water	Wipe
1016	0.10 µg/L	1.0 µg
1221	0.10 µg/L	1.0 µg
1232	0.10 µg/L	1.0 µg
1242	0.10 µg/L	1.0 µg
1248	0.10 µg/L	1.0 µg
1254	0.10 µg/L	1.0 µg
1260	0.10 µg/L	1.0 µg
1262	0.10 µg/L	1.0 µg
1268	0.10 µg/L	1.0 µg

* Individual QAPPs may have different reporting limits.

Attachment I - Extraction Procedure

ANALYSIS: SW8082 – Water Extraction Procedure

Holding Time:	Samples should be extracted within 7 days from sample collection.
QC Requirements:	A method blank (MB) and LCS/MS/MSD (if sufficient sample is available) must be performed each day or every 20 samples, whichever is more frequent.
Extraction Solvent:	Methylene Chloride (MeCl)

Extraction: Rinse each 2L separatory funnel and collection vessel (250 or 500 mL Erlenmeyer flasks) three times with MeCl. Rinse with acetone as needed to remove any water from flasks. Label the collection vessel with the sample number, analysis, and date extracted. Separatory funnels are labeled with the sample ID. Measure the initial volume and pH of each sample and record on the extraction sheet. If the sample container contains 5% or less, dump liquid and sediment into the separatory funnel. If more than 5% sediment is present in the sample container, refer to SOP MN-L-142. Use 1L of DI water for the MB and LCS and pour directly into the funnel. Add 100uL of surrogate solution to each QC and sample, and 50 uL of matrix spike solution to the LCS/MS/MSD. Rinse each sample bottle with 60 mL of Methylene Chloride, transfer to the funnel and shake the funnel for 2 minutes, making sure to properly vent the funnel initially into a hood. After the samples have been shaken, wait 10 minutes before draining the solvent layer into the collection vessel. Repeat 2 more times.

Finalization: Assemble a KD/concentrator tube apparatus. Add sodium sulfate to each extract and transfer only the extract to the KD apparatus. Concentrate on the waterbath to 6-8mL at a temperature of approximately 95°C. Add 15-20 mL of hexane through the top of the macrosynder, and concentrate the extract to approx. 8mLs, shaking the macrosnyder periodically to ensure full conversion. Remove the KD from the bath, disassemble, and transfer the extract to the nitrogen blow-down. Each extract should be concentrated to a 1.0 mL final volume. Put extract in labeled 1mL autovial. Add 0.75 mL of sulfuric acid, cap and vortex. Decant hexane layer into a crimp top autovial labeled with the sample number, analysis, and extraction date. Sulfur cleanup may occur as necessary according to SOP MN-O-531. Make sure crimptops are crimped tightly to the autovial.

Note: Each autovial should be double-checked to ensure there is no acid remaining in the sample extract before it is brought to the analytical area.

Final Volume:	1.0 mL
Final Solvent:	Hexane

Reviewed by:	Date:

Attachment I (Continued)

ANALYSIS: SW8082 – Soil (30 grams) Extraction Procedure - Sonication

Holding Time: Samples should be extracted within 14 days from sample collection.

QC Requirements: A method blank and LCS/MS/MSD (if sufficient sample is available) must be performed with each day or every 20 samples, whichever is more frequent.

Extraction Solvent: Hexane/Acetone 80:20

Extraction: Weigh out 30g of the sample. Add sodium sulfate (enough to have the sample free-flowing). Mix thoroughly. Add 1.0 mL of the surrogate spike to each sample. Add 0.5 mL of matrix spike to the LCS and/or MS/MSD. Add 100 mL of the 1:1 solvent mixture immediately following the spiking procedure. Place samples in the sonicator box and sonicate each sample three times, each at 1.5 minutes. After each sonication filter the sample, pouring the extract into a 500 mL round bottom flask.

Finalization: Samples are concentrated on mantles using a heat setting of 8. Boiling chips are added to the round bottom flasks. Add 3-ball Snyder columns to the flasks. Concentrate to approximately 9 mL final volume.

Label a 10mL amber crimptop vial with the sample number, extraction date, and analysis. Transfer the extract from the round bottom flask into the 10mL vial by pouring and rinsing the tube with small amounts of hexane. Bring the extract to a final volume of 10mLs and fully dispense all the extract from the pipet. Using the same pipet transfer 2mLs of the extract to a 7mL screwtop autovial. Add in 2mLs of sulfuric acid. Vortex this mixture for approx. 30 seconds. A two layer separation should occur. If not, the extract should be centrifuged until separation occurs. Place 1mL of the top layer into a crimptop autovial labeled with the sample number, analysis, and extraction date. Sulfur cleanup max occur as necessary according to MN-O-531. Make sure crimptops are crimped tightly to the autovial.

Note: Each autovial should be double-checked to ensure there is no acid remaining in the sample extract before it is brought to the analytical area.

Final Volume: 10.0mLs

Final Solvent: Hexane

Reviewed by:	Date:

Attachment I (Continued)

ANALYSIS: SW8082 – Soil (30 grams) Extraction Procedure -Soxhlet

Holding Time:	Samples should be extracted within 14 days from sample collection.
QC Requirements:	A method blank and LCS/MS/MSD (if sufficient sample is available) must be performed with each day or every 20 samples, whichever is more frequent.
Extraction Solvent:	Hexane/Acetone 80:20
Extraction:	Assemble a soxhlet with sufficient hexane/acetone (1:1) to cycle. Weigh out 30g of the sample into a rinsed 400 mL beaker. Add sodium sulfate (enough to have the sample free-flowing). Mix thoroughly. Add sample to filter paper. Add filter paper with sample to the top of the soxhlet. Add 1.0 mL of the surrogate spike to each sample and add 0.5 mL of matrix spike solution to the LCS and MS/MSD. Let run 16-24 hours.
Finalization:	Connect a rinsed Snyder column to the round bottom flask. Concentrate the extract to approximately 9mL final volume on the heating mantle. Label a 10mL crimp top vial with the sample number, extraction date, and analysis. Transfer the extract from the round bottom flask into the 10mL vial by pouring and rinsing the tube with small amounts of hexane. Bring the extract to a final volume of 10mLs and fully dispense all the extract from the pipet. Using the same pipet transfer 2mLs of the extract to a 7mL screwtop autovial. Add in 2mLs of sulfuric acid. Vortex this mixture for approx. 30 seconds. A two-layer separation should occur. If not, the extract should be centrifuged until separation occurs. Sulfur cleanup may occur as necessary after acid cleaning, Refer to SOP MN-O-531. Place 1mL of the top layer into a crimptop autovial labeled with the sample number, analysis, and extraction date. Make sure crimptops are crimped tightly to the autovial.
Note:	Each autovial should be double-checked to ensure there is no acid remaining in the sample extract before it is brought to the analytical area.
Final Volume:	10.0mLs
Final Solvent:	Hexane

Reviewed by:	Date:

Attachment I (Continued)

ANALYSIS: SW8082 – Wipe Extraction Procedure

HOLDING TIME:	Samples should be extracted within 14 days from sample collection.
QC Requirements:	A method blank (MB) and LCS/LCSD must be performed each day or every 20 samples, whichever is more frequent.
Extraction Solvent:	Hexane
Extraction:	Extract each wipe in the amber jar it was received by the laboratory. A single gauze pad can be used for each QC. Add sufficient Hexane to each GN to extract to total. Mblk and samples should have a total volume of 9.5 mL hexane. LCS, LCSD, MS and MSD should have a total volume of 9.25 mL hexane. Make sure each wipe is submersed into the hexane. Inject 250ul of matrix spike into the LCS/LCSD (MS/MSD if necessary), and 500ul of surrogate spike into each sample.
Finalization:	Add 5 mL of sulfuric acid to each jar shake vigorously for 2 minutes. If wipe still has not dissolved in acid shake until it does. Decant 1 mL of hexane layer into labeled autovial and cap vial. Additional sulfur cleanup may be needed per SOP MN-O-531. Place one ml of the top layer into a labeled crimptop autovial, labeled with the sample number, analysis, and extraction date. IMPORTANT NOTICE: Each autovial should be double-checked to ensure there is no acid remaining in the sample before it is checked into the analytical area.
Final Volume:	10.0mL
Final Solvent:	Hexane

Reviewed by:	Date:

Attachment I (Continued)

ANALYSIS: SW8082 – Oil Extraction Procedure EPIC Procedure

HOLDING TIME:	Samples should be extracted within 14 days from sample collection.
QC Requirements:	A method blank (MB) and LCS/MS/MSD must be performed each day or every 20 samples, whichever is more frequent.
Extraction Solvent:	Hexane (Hex)
Extraction:	Weigh out 0.1g of sample into a tared 7ml vial. Use two significant figures on the bench sheet. MB/LCS should be standard PCB-free cooking oil. Add 4.5mls of hexane to the MB and samples. The LCS should have 4.0mls of Hexane. Spike 0.5mls of surrogate into all samples. Add 0.5ml of matrix spike to the LCS/MS/MSD. The final volume of each sample should TOTAL 5.0mls. Vortex each extract approx. 10 seconds after spikes and hexane have been added.
Finalization:	Aliquot two mls of the hexane extract, along with two mls of sulfuric acid into a 7ml screwtop autovial. Vortex this mixture for approx. 30 seconds. A two layer separation should occur. If not, then extract should be centrifuged until separation occurs. Place one ml of the top layer into a labeled crimptop autovial, labeled with the sample number, analysis, and extraction date. IMPORTANT NOTICE: Each autovial should be double-checked to ensure there is no acid remaining in the sample extract before it is checked into the analytical area.
Final Volume:	5.0mL
Final Solvent:	Hexane

Reviewed by:	Date:

Attachment II -TSCA Modifications

1. Multi-Phasic Samples - Multi-phasic samples will be separated into individual phases prior to PCB extraction and analysis. This will be accomplished only after contacting the client and discussing all options. A complete separation must be accomplished by the use of a centrifuge between oil and water.

2. The holding times for TSCA soil, oil and wipes samples will not be applied. The data will then be reported as SW8082 (modified/TSCA) or equivalent. Since the applicability of these holding times, which are a RCRA requirement, will not affect the usability of the data for TSCA samples, they will be disregarded.

3. All TSCA samples will be reported on a dry weight basis.

4. In addition to the PCBs noted in Table I, PCB 1262 and PCB1268 will be monitored. Prior to analysis standards of these PCBs will be analyzed and MDLs will be obtained.

5. Wipe samples will be extracted utilizing 25-50 mL of hexane. The extracted will be filtered and concentrated to a final volume, which is dependent on the action level requested by the client. All surrogate and matrix spikes should be adjusted to ensure the final concentration will be at the midpoint of the analytical curve.

6. The 6th point in the calibration curve (10µg/mL) will not be used to quantitate the data.

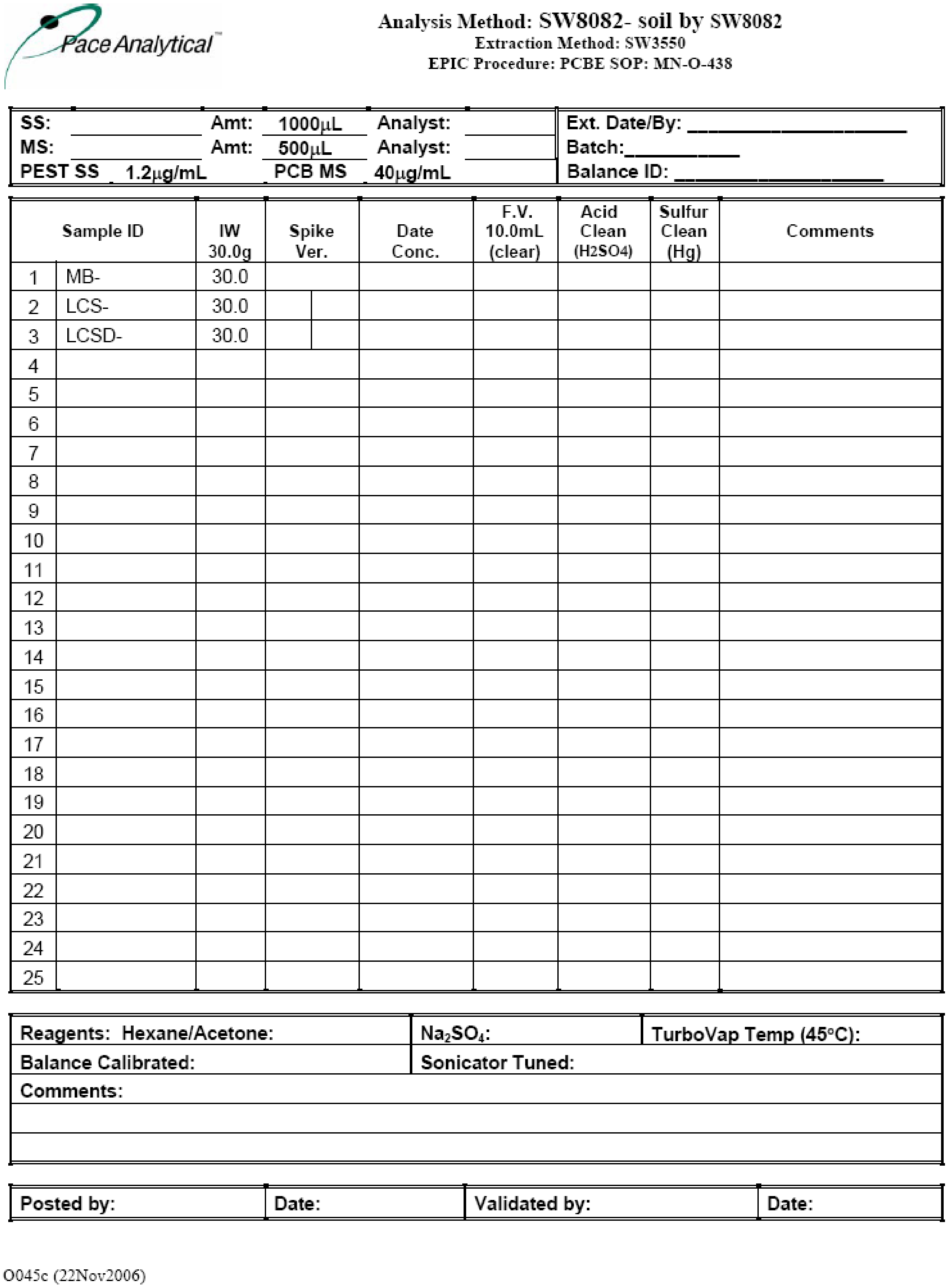
7. Oil – Initial volumes may be increased depending on action level requested by the client. All surrogate and matrix spikes should be adjusted to ensure the final concentration will be at the midpoint of the analytical curve.

8. The following table represents the extraction amounts that should be utilized to achieve a specific action level. If the action level has not been specified on the chain of custody, the client must be contacted and this level noted. If an action level is not communicated, the extraction procedure for an action level of 1 ppm must be utilized with a full understanding by the client that the surrogates may be diluted out.

Action Level	**Extract Amount**	**Final Volume**	**Surr conc|amt spiked**	**QC conc|amt spiked**
1 ppm	**10g**	**5 mL**	**2 ug/mL| 0.2mL**	**50 ug/mL | 0.2 mL**
10 ppm	**10g**	**50 mL**	**20 ug/mL| 0.2 mL**	**500 ug/mL | 0.2 mL**
25 ppm	**10g**	**125 mL**	**20 ug/mL| 0.5 mL**	**500 ug/mL| 0.5 mL**
50 ppm	**10g**	**250 mL**	**20 ug/mL | 1.0 mL**	**500 ug/mL | 1.0 mL**

*** The final volume will be a combination of dilutions. The acid cleanup will be performed on an aliquot from the final dilution prior to finalization.**

Attachment III – Extraction Bench Sheet Example



Pace Analytical

Analysis Method: SW8082- soil by SW8082
Extraction Method: SW3550
EPIC Procedure: PCBE SOP: MN-O-438

SS:		**Amt:** 1000µL	**Analyst:**		**Ext. Date/By:**
MS:		**Amt:** 500µL	**Analyst:**		**Batch:**
PEST SS 1.2µg/mL		**PCB MS** 40µg/mL			**Balance ID:**

	Sample ID	IW 30.0g	Spike Ver.	Date Conc.	F.V. 10.0mL (clear)	Acid Clean (H2SO4)	Sulfur Clean (Hg)	Comments
1	MB-	30.0						
2	LCS-	30.0						
3	LCSD-	30.0						
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
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15								
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22								
23								
24								
25								

Reagents: Hexane/Acetone:	**Na_2SO_4:**	**TurboVap Temp (45°C):**
Balance Calibrated:	**Sonicator Tuned:**	
Comments:		

Posted by:	**Date:**	**Validated by:**	**Date:**

O045c (22Nov2006)

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SW 846 8270C

SOP NUMBER:	MN-O-436-Rev.12
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	MN-O-436-Rev.11

APPROVAL

Laboratory General Manager ______ Date 24 JUL 2008

Quality AssuranceManager ______ Date 24 Jul 2008

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date
Signature	Title	Date

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Table of Contents

1. PURPOSE

1.1 The purpose of this Standard Operating Procedure (SOP) is to set forth the procedure used for the determination of a number of organic compounds that are partitioned into an organic solvent and are amendable to gas chromatography/mass spectrometry.

2. SCOPE AND APPLICATION

2.1 This method is used to determine the concentration of semivolatile organic compounds in extracts prepared from all types of water, soil, and solid waste matrices. Direct injection of a sample may be used in limited applications.

3. SUMMARY OF METHOD

3.1 A measured amount of sample is extracted, dried, and concentrated to a specific final volume, and analyzed by GC/MS. Qualitative identification of the analyte of interest in the extract is performed using the retention time and relative abundance of at least two characteristic masses. Quantitation is performed using the internal standard technique with a single characteristic mass in coordination with the average relative response factor from the initial calibration.

3.2 This method can be used to quantitate most neutral, acidic, and basic organic compounds that are soluble in methylene chloride and capable of being eluted without derivatization from a gas chromatographic fused-silica capillary column coated with a slightly polar silicone. Such compounds include polynuclear aromatic hydrocarbons, chlorinated hydrocarbons and pesticides, phthalate esters, organophosphate esters, nitrosamines, haloethers, aldehydes, ethers, ketones, anilines, pyridines, quinolines, aromatic nitro compounds, and phenols, including nitrophenols.

3.3 The following compounds may require special treatment when being determined by this method. Benzidine can be subject to oxidative losses during solvent extraction and exhibits poor chromatographic behavior. Under the alkaline conditions of the extraction step, a-BHC, g-BHC, endosulfan I and II, and endrin are subject to decomposition. Hexachlorocyclopentadiene is subject to thermal decomposition in the inlet of the gas chromatograph, chemical reaction in acetone solution, and photochemical decomposition. N-nitrosodiphenylamine decomposes in the gas chromatographic inlet and can not be separated from diphenylamine. Pentachlorophenol, 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, benzoic acid, 2-nitroaniline, 3-nitroaniline, 4-chloroaniline, and benzyl alcohol are subject to erratic chromatographic behavior, especially if the GC system is contaminated with high boiling material.

4. INTERFERENCES

4.1 Matrix interferences may be caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the ion current profiles. All of these materials must be routinely demonstrated to be free from interferences under the conditions of the analysis by running laboratory reagent blanks.

4.2 Matrix interferences may be caused by contaminants that are coextracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the environment being sampled.

4.3 An interference that is unique to selected ion monitoring techniques can arise from the presence of an interfering compound which contains the quantitation mass ion. This event results in a positive interference to the reported value for the compound of interest. This interference is controlled to some degree by acquiring data for a confirmation ion. If the ion ratios between the quantitation ion and the confirmation ion are not within the specified limits, then interferences may be present.

5. SAFETY

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials.

5.2 A reference file of Material Safety Data Sheets (MSDS) is made available to all personnel involved in the chemical analysis, and is located at the front desk. A formal safety plan has been prepared and is distributed to all personnel with documented training.

6. DEFINITIONS

6.1 Refer to the "Glossary" section of the PASI Quality Manual

7. SAMPLE COLLECTION, PRESERVATION AND HANDLING

7.1 CONTAINERS

7.1.1 Soil samples should be collected in 40mL amber glass bottles with Teflon-lined lids.

7.1.2 Water samples should be collected in 1 liter amber glass bottles with Teflon-lined lids.

7.2 STORAGE

7.2.1 The samples must be refrigerated at 4^{o}C (+/- 2°C) from the time of collection until extraction. The extracts must also be kept refrigerated at 4^{o}C (+/- 2°C) until analysis.

7.3 HOLDING TIME

7.3.1 Soil samples must be extracted within 14 days from date of collection.

7.3.2 Water samples must be extracted within 7 days from date of collection.

7.3.3 Leachate samples must be extracted within 7 days from date leached.

7.3.4 The sample extracts must be analyzed within 40 days of sample extraction.

8. EQUIPMENT AND SUPPLIES

8.1 Apparatus

8.1.1 Syringe, 10 µL, Hamilton or equivalent.

8.1.2 See Attachments and associated preparatory standard operating procedures.

8.2 Hewlett-Packard gas chromatograph model 5890, Hewlett Packard mass spectrometer model 5972 (or equivalent) and Hewlett-Packard Autosampler model 7673A (or equivalent).

8.3 Column - DB-5MS, 30 m x 0.25 mm (ID) bonded-phase silicone coated fused silica capillary column, 0.25 – 0.5 µm film thickness (or equivalent).

8.4 Data system

8.4.1 Acquisition: Hewlett Packard Chemstation Version B.02.04 (or equivalent)

8.4.2 Processing: Target, Version 3.2, or equivalent.

9. REAGENTS AND STANDARDS

9.1 Target analyte solutions, surrogate solutions, and matrix spike solutions are obtained from various vendors and verified for accuracy. Internal standard solutions are also obtained from vendors in solution form.

9.2 The initial calibration stock standard can be prepared as follows:

VENDOR	**Solution Name**	**Catalog Number**	**µg/mL**	**Amount Added**	**Final Concentration**
Restek	8270 Mega Mix	31850	500-1000	1.6 mL	80-160 µg/mL
Restek	605 Benzidine	31030	2,000	0.80 mL	160 µg/mL
AccuStd	Benzoic Acid	2-0140-1	2,000	0.80 mL	160 µg/mL
	BNA SS	Pace Lab ID	750-100	1.6 mL	120/160 µg/mL

Final Volume in Methylene Chloride is 10mL.

9.3 Custom BNA SS Mix should be prepared as follows diluting in acetone:

VENDOR	**Solution Name**	**Catalog Number**	**µg/mL**	**Amount Added**	**Final Concentration**
Restek	BNA SS Acid Surrogate Mix	31086	10,000	5.0 mL	1000 µg/mL
Restek	B/N Surrogate Mix	31087	5,000	7.5 mL	750 µg/mL

Final Volume in Acetone is 50.0 mL.

9.4 The initial calibration working standards should be prepared as follows using the stock standard:

Solution Name	**Conc. of Parent Sol'n (µg/mL)**	**Aliquot Volume (mL)**	**Internal Std (µL)**	**Diluent Vol. (mL)****	**Final Conc. (µg/mL)**
7	160	0.200	10	.800	32
6	160	1.0	10	----	160
5	160	0.75	10	0.25	120
4	160	0.5	10	0.50	80
3	160	0.25	10	0.75	40
2	160	0.125	10	0.875	20
8270-1	160	0.625	10	0.9375	10

** Diluent is Methylene Chloride.

9.5 The initial calibration verification (ICV) (also called 8270 external check) may be prepared from a separate vendor source from the initial calibration as follows:

Vendor	Solution Name	Concentration µg/mL	Amount Added	Final Conc.
AccuStd	Acid Comp Mix	2000	0.040	80
AccuStd	B/N Comp Mix	2000	0.040	80
AccuStd	Comp Mix #2	2000	0.040	80
AccuStd	1-Methylnapthalene	2000	0.040	80
AccuStd	Carbazole	2000	0.040	80
Chem Serv	Mix #7 Benzidine	2000	0.040	80
Chem Serv	SV Calibration Mix #7	2000	0.040	80
Chem Serv	Internal Standard Mix	4000	0.010	40
Diluent is $MeCl_2$		Final Volume	1.0 mL	

The CCV (continuing calibration verification) working standard should be prepared as follows:`

Solution Name	Conc. of Parent Sol'n (µg/mL)	Aliquot Volume (mL)	Diluent Vol. (mL)**	Final Conc. (µg/mL)
8270-4	160	0.5	0.5	80
** Diluent is Methylene Chloride				

Periodically use any mid level concentration from the Ical for the CCV standard

10. CALIBRATION

10.1 INITIAL CALIBRATION

10.1.1 Prior to the analysis of samples and after tuning criteria have been met (See section 12.3), the GC/MS system must be initially calibrated at a minimum of five concentrations to determine the linearity of response utilizing target compound standards.

10.1.1.1 The system should be set up to analyze the six calibration levels from 10.3.

10.1.1.2 Inject an aliquot (1-3uL) of each calibration standard and tabulate the area of the primary characteristic ion against concentration for each compound (as indicated in Table IV).

10.1.2 Calculate response factors (RFs) for each compound in each calibration level:

Equation 1: $$RF = \frac{(A_x)(C_{is})}{(A_{is})(C_x)}$$

Where:
A_x = Area of the characteristic ion for the compound being measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_{is} = Concentration of the specific internal standard (ng/µL).
C_x = Concentration of the compound being measured (ng/µL).

10.1.3 The average RF should be calculated for each compound.

10.1.4 The percent relative standard deviation should be calculated for each compound.

Equation 2:

$$\%RSD = \frac{SD}{\overline{RF}} x100$$

Where: $\overline{RF}$ = Mean of the Response Factors mentioned above.
SD = Standard Deviation of initial response

(Equation 3).

Equation 3:

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(RF_1 - \overline{RF}\right)^2}{n-1}}$$

Where: RF_1 = Each individual response factor
$\overline{RF}$ = Mean of the Response Factors mentioned above.
n = Number of response factors

10.1.4.1 The %RSD should be less than or equal to 15% for each target analyte, except the Calibration Check Compounds (CCC) (see Table V) which MUST be less than 30%.

10.1.4.1.1 Note: For GC/MS calibration, Method 8270C requires 15% RSD as evidence of sufficient linearity to employ an average response factor. For the following compounds, some project QAPs may allow 25% RSD:

Benzyl alcohol	4-Chloroaniline
Hexachlorocyclopentadiene	3,3-Dichlorobenzidine

10.1.4.1.2 When target analytes are >15% RSD, (or 25% for the above compounds), performing a linear regression (0.995 or better) or a weighted least squares regression (0.99 or better) must be employed to achieve linearity.

10.1.4.1.3 It should be noted that clients may specify other criteria.

10.4.1.2 The relative retention times of each compound in each calibration run should agree within 0.06 relative retention time units.

10.1.5 A system performance check must be performed to ensure that minimum average RFs are met before the calibration curve is used.

10.1.5.1 The System Performance Check Compounds (SPCCs) (See Table VI) have a minimum acceptable average RF of 0.050.

10.1.5.2 These SPCCs typically tend to decrease in response as the chromatographic system begins to deteriorate or the standard material begins to deteriorate. They are usually the first to show poor performance. Therefore, they must meet the minimum requirement when the system is calibrated.

10.1.6 The initial calibration is valid only after the the requirements in sections 10.1.4. and 10.1.5 have been met or justification is given that would support valid generation of data.

Note: Sample analysis can only begin after these criteria are met.

10.2 CONTINUING GC/MS CALIBRATION VERIFICATION or EXTERNAL CHECK

10.2.1 If the External Check is not the CCV it must, at a minimum, be analyzed after the initial calibration for verification and utilizes the criteria found in the corporate SOP ALL-Q-025.

10.2.2 Prior to the analysis of samples and after tuning criteria have been met, the initial calibration must be verified by analyzing an aliquot (1-3uL) of the CCV working standard.

10.2.3 Compare the response factor data from the standards every 12 hours with the average response factor from the initial calibration and calculate the percent difference as follows:

Equation 4:

$$\%Difference = \frac{(RF_i - RF_c)}{RF_i} x100$$

Where: RF_i = Average response factor from initial calibration
RF_c = Response factor from current verification check standard

10.2.3.1 The %D MUST be less than or equal to 20% for each Calibration Check Compounds (CCC) (see standard traceability SOP ALL-Q-025).

10.2.3.2 If the CCC compounds are not on the reporting list, all analytes of interest must have a %D less than 20%.

10.2.3.3 If the CCC compounds are on the list, all other target analytes must be evaluated utilizing a criterion of 40% with technical justification and footnoting of sample data to all outliers.

10.2.4 The internal standard responses and retention times in the CCV must be evaluated immediately after or during data acquisition.

10.2.4.1 If the retention time for any internal standard changes by more than 30 seconds from the midpoint calibration standard of the initial calibration, the analytical system must be inspected for malfunctions and corrections must be made.

10.2.4.2 If the EICP area for any of the internal standards changes by a factor of two, (-50% to +100%) from the midpoint calibration standard of the initial calibration, the MS must be inspected for malfunctions and corrections must be made.

10.2.4.3 Internal standard recoveries out low (high bias) – if compounds associated with the internal standard(s) that are outside the control limits are non-detect, the sample can be reported without re-analysis, however, if the outlier is not indicative of a system drift (i.e. If only one sample has internal standard drift, which is dissimilar from other samples around the injection time), re-analysis should be performed to rule out matrix effects.

10.2.4.4 Internal standard recoveries out high (low bais) – re-analysis should be performed assuming there is sufficient sample volume remaining. Appropriate footnoting practices are also observed.

10.2.5 The CCV is valid only after both the %D for CCC compounds, and the minimum RF for SPCC have been met or justification is given that would support valid generation of data. Only after both these criteria are met may sample analysis begin.

11. PROCEDURE

11.1 SAMPLE PREPARATION

11.1.1 EPA method 3550, Sonication Extraction Technique.

11.1.1.1 Method -Attachment I.

11.1.1.2 Extraction bench sheet - Attachment II.

11.1.2 EPA method 3540, Soxhlet Extraction Technique.

11.1.2.1 Method - Attachment III.

11.1.2.2 Extraction bench sheet - Attachment IV.

11.1.3 EPA method 3580A, Waste Dilution Technique.

11.1.3.1 Method - Attachment V.

11.1.3.2 Extraction bench sheet - Attachment VI.

11.1.4 EPA method 3520, Continuous Liquid-Liquid Technique.

11.1.4.1 Method - Attachment VII.

11.1.4.2 Extraction Bench sheet - Attachment VIII

11.2 GC/MS OPERATING CONDITIONS

11.2.1 The recommended GC/MS operating conditions:

Mass Range:	35-500 amu
Scan Time:	1 sec/scan
Initial Temperature:	50° C
Temperature Program:	45-290°C at 7-10° C/min
Final Temperature:	290°C
Injector Temperature:	250° C
Transfer Line Temperature:	300° C
Source Temperature:	210 to 250° C
Injector:	Split, splitless
Sample Volume:	2 µL
Carrier Gas:	Helium at 30 mL/min

NOTE: These values may change to optimize the efficiency of the GC/MS system.

11.2.2 Refer to Table X for specific operating conditions of present instrumentation.

11.3 GC/MS HARDWARE TUNING

11.3.1 Each GC/MS system must be hardware-tuned to meet the criteria in Table I for a 50 ng injection of decafluorotriphenylphosphine (DFTPP).

11.3.1.1 The DFTPP is purchased from Supelco, Catalog Number 47387 (or equivalent).

11.3.1.1.1 DDT, Pentachlorophenol, and Benzidine should also be evaluated during the tuning process.

11.3.1.1.2 Degradation of DDT to DDE and DDD should not exceed 20%.

11.3.1.1.3 Benzidine and Pentachlorophenol should be present with no apparent peak tailing as calculated within the Target Software.

11.3.1.1.4 Whenever the laboratory takes corrective action which may change the tuning criteria for DFTPP (e.g., ion source cleaning or repair, etc.) the tune must be verified irrespective of the 12-hour tuning requirements.

11.3.1.1.5 Analyses should not begin until all these criteria are met.

11.3.2 The twelve-hour time period for GC/MS system tuning and standards calibration (initial or continuing calibration criteria) begins at the moment of injection of the DFTPP analysis that the laboratory submits as documentation of compliant tune. The time period ends after twelve hours have elapsed according to the system clock.

12.3.2.1 The analysis of DFTPP may be performed by:

11.3.2.1.1 Injection of 50 ng of DFTPP

11.3.2.1.2 By adding 50 ng to continuing calibration standard.

11.4 GC/MS SAMPLE ANALYTICAL PROCEDURE

11.4.1 Sample Analysis

11.4.1.1 Extracts may be screened on a GC/FID using the same type of capillary column. This will minimize contamination of the GC/MS system from unexpectedly high concentrations of organic compounds.

11.4.1.2 The one mL extract obtained from sample preparation laboratory should be fortified with 10 µL of internal standard solution just prior to analysis such that 40 ng of each internal standard is injected on the column.

11.4.1.3 Analyze each extract by GC/MS by injecting 1-3 µL onto the column.

11.4.1.4 Store the extracts at less than 4°C ± 2°C protected from light in crimp-top vials equipped with unpierced Teflon lined septa.

11.4.2 Qualitative Analysis - Target Analytes

11.4.2.1 Two criteria must be satisfied to verify the identifications of compounds in the sample:

11.4.2.1.1 Elution of the sample component at the same GC relative retention time as the standard component. The sample component RRT must compare within ± 0.06 RRT units of the RRT of the preceding CCV.

11.4.2.1.2 Correspondence of the sample component and standard component mass spectra.

11.4.2.2 For comparison of standard and sample component mass spectra, mass spectra obtained on each PACE GC/MS system are required usually from the preceding CCV.

11.4.2.3 The requirements for qualitative verification by comparison of mass spectra are as follows:

11.4.2.3.1 All ions present in the standard mass spectra at a relative intensity greater than 30% (most abundant ion in the spectrum equals 100%) must be present in the sample spectrum.

11.4.2.3.2 The relative intensities of must agree within plus or minus 30% between the standard and sample spectra.

11.4.2.3.3 Ions greater than 10% in the sample spectrum must be considered and accounted for by the analyst making the comparison.

11.4.3 Quantitative Analysis - Target Analytes

11.4.3.1 The internal standard used shall be the one nearest the retention time to that of a given analyte. See Table III for guidelines.

11.4.3.2 The EICP area of characteristic ions of analytes listed in Tables IV and VII are used.

11.4.3.2.1 Secondary ions may be used if interferences are present.

11.4.3.2.2 The area of a secondary ion cannot be substituted for the area of a primary ion unless an average response factor is calculated using the secondary ion.

11.4.3.3 The average response factor from the initial calibration is used to calculate the concentration in the sample. All soil samples are corrected for moisture by the LIMs unless there are state or contractual differences.

Equation 5:

$$Concentration\ (ug / L) = \frac{(A_x)(I_s)(V_t)}{(A_{is})(\overline{RF})(W_o)(V_i)}$$

Where: A_x = Area of the characteristic ion for the compound to be measured
A_{is}= Area of the characteristic ion for the internal standard
I_s = Amount of internal standard injected in nanograms (ng)
W_o= Volume of sample extracted in liters (or weight in g)
V_i = Volume of extract injected (mL)
V_t = Final volume of total extract
$\overline{RF}$ = Average response factor from initial calibration

11.4.4 Qualitative Analysis - Non-Target Analytes (TICs)

11.4.4.1 A library search may be executed for non-target sample components for the purpose of tentative identification. For this purpose, the NIST05 Mass Spectral Library should be used.

11.4.4.2 Up to 10 substances (Contract Specific) of greatest apparent concentration not listed in Table II, Table IIA, Table IIB (depending on the client request) for the combined base/neutral/ acid fraction shall be tentatively identified via a forward search of the NIST05 mass spectral library. (Substances with responses less than 10% of the nearest internal standard are not required to be searched in this fashion).

11.4.4.3 Only after visual comparison of sample spectra with the nearest library searches will the analyst assign a tentative identification.

11.4.4.3.1 Relative intensities of major ions in the reference spectrum (ions greater than 10% of the most abundant ion) should be present in the sample spectrum.

11.4.4.3.2 The relative intensities of the major ions should agree within ± 20%.

11.4.4.3.3 Molecular ions present in reference spectrum should be present in sample spectrum.

11.4.4.3.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

11.4.4.4 If in the opinion of the analyst, no valid tentative identification can be made, the compound should be reported as unknown.

11.4.4.5 The mass spectral specialist should give additional classification of the unknown compound, if possible (i.e. unknown phthalate, unknown hydrocarbon, unknown acid type, unknown chlorinated compound). If probable molecular weights can be distinguished, include them.

11.4.5 Quantitative Analysis - Non -Target Analytes (TICs)

11.4.5.1 For quantitation, the nearest internal standard free of interferences shall be used.

11.4.5.2 When calculating concentration for non-calibrated components, total area counts from the total ion chromatograms are to be used for both the compound to be measured and the internal standard.

11.4.5.3 An average response factor of 1.0 is to be assumed.

11.4.5.4 The value from this quantitation shall be qualified as estimated and the nearest resolved internal standard used to quantitate shall be identified.

11.4.5.5 This estimated concentration should be calculated for all tentatively identified compounds as well as those identified as unknowns.

11.4.6 Data Reduction, Validation, and Reporting may be referred in the most current version of SOP MN-L-132.

12. QUALITY CONTROL

12.1 QA/QC

12.1.1 Method Blank - A method blank is a blank matrix that is carried through the entire analytical scheme (extraction, concentration, and analysis).

12.1.1.1 The control matrices include:

12.1.1.1.1 Leachate = Solution used to leach samples. A method blank is leached with each set and is continued through extraction process.

12.1.1.1.2 Water = Deionized water

12.1.1.1.3 Soil = Sand (sifted, baked, and solvent washed)

12.1.1.1.3.1 The initial volume/weight used for the method blank must be approximately equal to the sample aliquots being processed.

12.1.1.2 Method blank analysis must be performed at the following frequency:

12.1.1.2.1 Once each batch.

12.1.1.2.2 With every twenty (20) samples of similar concentration and/or sample matrix.

12.1.1.2.3 Whenever samples are extracted by the same procedure

12.1.1.3 It is the laboratory's responsibility to ensure that method interferences caused by contaminants in solvents, reagents, glassware, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in gas chromatograms be minimized.

12.1.1.4 An acceptable laboratory method blank should meet the following criteria:

12.1.1.4.1 The reagent blank must not contain greater than five times (5x) the quantitation limit of any phthalate ester.

12.1.1.4.2 For all other target compounds not listed above, the reagent blank must contain less than the quantitative limit of any single target analyte.

12.1.1.4.2.1 If a laboratory reagent blank exceeds criteria, the laboratory must consider the analytical system out of control. The source of the contamination investigated and appropriate corrective measures must be taken and documented.

12.1.1.4.2.2 All sample processed with an unacceptable method blank must be reprepared (if additional raw sample is available) and reanalyzed. unless they are non-detect for analytes present in the method blank.

12.1.1.5 The laboratory will report <u>ALL</u> sample concentration data as UNCORRECTED for blanks.

12.1.2 Laboratory Control Samples (LCS)

12.1.2.1 An LCS shall be analyzed at a frequency of each analytical batch or once per 20 samples, whichever is more frequent, and consists of a control matrix injected with target analytes. An LCSD is prepared ONLY when an MS/MSD is not available to analyze.

12.1.2.1.1 The control matrices include:

12.1.2.1.2 Leachate = Solution used to leach samples.

12.1.2.1.3 Water = Deionized water

12.1.2.1.4 Soil = Sand (sifted, baked, and solvent washed)

12.1.2.2 The recoveries and RPDs are calculated as follows and are used to verify that the precision and bias of the analytical process are within control limits.

Equation 6:

$$\%Recovery = \frac{SSR - SR}{SA} x100$$

Where: SSR = Spike Sample Results
SR = Sample Result
SA = Spike Added from spiking mix

Equation 7:

$$RPD = \frac{|A - B|}{(A + B)/2} x100$$

Where: RPD = Relative Percent Difference
A = First Sample Value
B = Second Sample Value (duplicate)

12.1.2.2.1 The LCS is evaluated against method or laboratory derived acceptance criteria. Any compound that is outside of the limits is considered to be “out of control” and must be qualified appropriately. See Pace Analytical Services Quality Manual for futher information.

12.1.3 Surrogates are used to determine extraction and analytical efficiencies of all samples blanks, and QC.

12.1.3.1 Surrogate recoveries must be evaluated for acceptance by determining whether the concentration (measured as percent recovery) fall inside the recovery limits established by the laboratory. QC limits are updated annually by the QA office and the most current limits are distributed and entered into LIMS for evaluation.

12.1.3.1.1 If the surrogate recovery for any surrogate is outside the annually derived surrogate recovery limits, the laboratory should take corrective actions:

12.1.4 MATRIX SPIKE/MATRIX SPIKE DUPLICATE ANALYSIS (MS/MSD)

12.1.4.1 In order to evaluate the matrix effects of the sample upon the analytical methodology, a matrix spike and matrix spike duplicate are prepared like the laboratory control sample with a designated sample being the control matrix.

12.1.4.2 MS/MSD Frequency of Analysis - A matrix spike and matrix spike duplicate must be performed with every twenty (20) samples of similar concentration and/or similar sample matrix. (Note: If sample is not available, an LCS and an LCS duplicate should be analyzed.)

12.1.4.3 The matrix spike/matrix spike duplicate samples, should be analyzed at the same dilution as the original unspiked sample.

12.1.4.4 Individual component recoveries of the matrix spike are calculated using Equation 6. The relative percent difference (RPD) between the MS and MSD are calculated using Equation 7. The recoveries and RPD should fall between the limits updated annually. If a recovery fails criteria, it is the responsibility of the analyst and supervisor to determine if the outliers are related to the matrix of the unspiked sample.

Equation 6: $$\% Recovery = \frac{SSR - SR}{SA} x100$$

Where: SSR = Spike Sample Results
SR = Sample Result
SA = Spike Added from spiking mix

Equation 7: $$RPD = \frac{|A - B|}{(A + B)/2} x100$$

Where: RPD = Relative Percent Difference
A = First Sample Value
B = Second Sample Value (duplicate)

12.2 SYSTEM MAINTENANCE

12.2.2 Any major system maintenance, such as a source cleaning or installation of a new column, necessitates a retune and recalibration and is recorded in the instrument maintenance log (Attachment X).

12.2.3 Minor or routine maintenance should be recorded on each instrument specific run log page (Attachment X).

13. METHOD PERFORMANCE

13.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual and specific Standard Operating Procedures.

13.1.1 The analyst must read and understand this procedure with written documentation maintained in his/her training file which is located in the QA Office.

13.1.2 An initial demonstration of capability (IDC) must be performed. A record of the IDC will be maintained in his/her file with written authorization from the Laboratory Manager and Quality Manager. Results are stored in the QA office.

13.1.3 An annual minimum detection limit (MDL) study following SOP ALL-P-004 will be completed for this method and whenever there is a major change in personnel or equipment. Results are stored in the QA Office.

13.1.4 Periodic performance evaluation (PE) samples are analyzed to demonstrate continuing competence. Results are stored in the QA office.

14. POLLUTION PREVENTION AND WASTE MANAGEMENT

14.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

14.2 The Environmental Protection Agency (USEPA) requires that laboratory waste management practice be consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management consult SOP ALL-S-002 or its equivalent.

15. REFERENCES

15.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update III, Method 8270C.

15.2 All Pace Analytical Services, Inc. SOP references are to the current issue of the document available at the time this procedure was prepared. As these documents are revised, they will supersede the reference documents. The requirements of the most current approved copy shall be implemented for compliance with the requirements of the procedure.

15.3 USEPA Contract Laboratory Program Statement of work for Organics Analysis, OLMO3.0, Exhibit D Semivolatiles.

16. TABLES, DIAGRAMS, FLOWCHARTS, APPENDICES, ADDENA, ETC.

16.1 Table I: DFTPP Key Ions and Ion Abundance Criteria

16.2 Table IIa: Analytes and Quantitation Limits – Standard 8270 Reporting Limit

16.3 Table IIb: Analytes and Quantitation Limits – Additional Extractable 8270 Analytes

16.4 Table IIc: Analytes and Quantitation Limits –Extractable 8270 TCLP Analytes

16.5 Table III: Internal Standard Method of Quantitation

16.6 Table IV: Characteristic Ions for Target Compounds

16.7 Table V: Calibration Check Compounds (CCC)

16.8 Table VI: System Performance Check Compounds (SPCC)

16.9 Table VII: Characteristic Ions for Internal Standards

16.10 Table VIII: Characteristic Ions for Surrogates

16.11 Table IX: Surrogate Compounds

16.12 Table X: Instrument Conditions

16.13 Attachment I: Sonication Extraction Technique - Method

16.14 Attachment II: Sonication Extraction Technique – Benchsheet

16.15 Attachment III: Soxhlet Extraction Technique – Method

16.16 Attachment IV: Soxhlet Extraction Technique – Benchsheet

16.17 Attachment V: Waste Dilution Technique – Method

16.18 Attachment VI: Waste Dilution Technique – Benchsheet

16.19 Attachment VII: Continuous Liquid – Liquid Technique – Method

16.20 Attachment VIII: Continuous Liquid – Liquid Technique – Benchsheet

16.21 Attachment IX: Instrument Run Log (example)

17. REVISIONS

Document Number	Reason for Change	Date
MN-O-436-Rev.9	Reformatted SOP body from alphanumeric to numbering system Added revisions section to include historical account of document. 13.1.1.3 Changed from (and throughout SOP) CLP grade sand to sand, and changed sand characteristics to “sifted, baked, and solvent washed” added up to date versions of attachments (extraction sheets and methods) Changed wording to Section 14 and 15 Corrected page numbering. Changed injection volume to 2 uL	25 Mar 2005
MN-O-436-Rev.10	Table IV: Updated primary/secondary ion references and analyte list Table VIII: Update Secondary ion reference Table X: Delete a duplicate column Attachments I-X: Update Lims reference, solvent traceability Update formatting	07Sep2006

	Deleted Table IX: TCLP Extraction Sheet	
MN-O-436-Rev.11	Update standard tables 10.2, 10.3 and 10.4 Updated LCS outliers allowed in 13.1.2.2.1 Removed section 7 (responsibilities and distribution) and updated numbering to comply with corporate SOP format. Changed 10.2.1 to refer to corporate SOP for standard traceability Deleted section 12.3.1.1.4, 12.4.1.5 Changed 12.4.4.1 (now 11.4.4.1) to read NIST05. Changed 13.1.1.4.2.2 (now 12.1.1.4.4.2) to allow ND samples to be reported. Deleted 13.1.4.1.2.	09Jan2007
S-MN-O-436-Rev.12	Added Internal standard acceptance criteria to 10.2.4.3 and 10.2.4.4	24Jul2008

TABLE I: DFTPP Key Ions And Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	30.0 - 60.0 percent of mass 198
68	less than 2.0 percent of mass 69
69	Mass 69 relative abundance
70	less than 2.0 percent of mass 69
127	40.0 - 60.0 percent of mass 198
197	less than 1.0 percent of mass 198
198	base peak, 100 percent relative abundance
199	5.0 - 9.0 percent of mass 198
275	10.0 - 30.0 percent of mass 198
365	greater than 1.00 percent of mass 198
441	present but less than mass 443
442	Greater than 40.0 percent of mass 198
443	17.0 - 23.0 percent of mass 442

TABLE IIa: Analytes And Quantitation Limits-Standard 8270 reporting list

Compound	**CAS Number**	**Quantitation Limit,**	
		µg/L	**µg/kg**
Phenol	108-95-2	10	330
bis(2-Chloroethyl)ether	111-44-4	10	330
2-Chlorophenol	95-57-8	10	330
1,3-Dichlorobenzene	541-73-1	10	330
1,4-Dichlorobenzene	106-46-7	10	330
Benzyl alcohol	100-51-6	10	330
1,2-Dichlorobenzene	95-50-1	10	330
2-Methylphenol (o-cresol)	95-48-7	10	330
bis(2-Chloroisopropyl)ether	108-60-1	10	330
3 & 4 - Methylphenol	106-44-5	20	660
N-Nitroso-di-n-propylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-Nitrophenol	88-75-5	10	330
2,4-Dimethylphenol	105-67-9	10	330
Benzoic acid	65-85-0	50	1700
bis(2-Chloroethoxy)methane	111-91-1	10	330
2,4-Dichlorophenol	120-83-2	10	330
1,2,4-Trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-Chloroaniline	106-47-8	50	1700
Hexachlorobutadiene	87-68-3	10	330
4-Chloro-3-methylphenol (p-chloro-m-cresol)	59-50-7	10	330
2-Methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	50	1700
2,4,6-Trichlorophenol	88-06-2	10	330
2,4,5-Trichlorophenol	95-95-4	50	1700
2-Chloronaphthalene	91-58-7	10	330
2-Nitroaniline	88-74-4	50	1700
Dimethylphthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
3-Nitroaniline	99-09-2	50	1700
Acenaphthene	83-32-9	10	330
2,4-Dinitrophenol	51-28-5	50	1700

TABLE IIa Continued

Compound	CAS Number	Quantitation Limit,	
		µg/L	µg/kg
4-Nitrophenol	100-02-7	50	1700
Dibenzofuran	132-64-9	10	330
2,4-Dinitrotoluene	121-14-2	10	330
2,6-Dinitrotoluene	606-20-2	10	330
Diethylphthalate	84-66-2	10	330
4-Chlorophenyl phenyl ether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-Nitroaniline	100-01-6	50	1700
4,6-Dinitro-2-methylphenol	534-52-1	50	1700
N-Nitrosodiphenylamine	86-30-6	10	330
4-Bromophenyl phenyl ether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	23	760
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butyl benzyl phthalate	85-68-7	10	330
3,3'-Dichlorobenzidine	91-94-1	20	660
Benzo(a)anthracene	56-55-3	10	330
bis(2-Ethylhexyl)phthalate	117-81-7	10	330
Chrysene	218-01-9	10	330
Di-n-octylphthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

(1) Cannot be separated from Diphenylamine

TABLE IIb: Analytes & Quantitation Limits - Additional Extractable 8270 Analytes

Compound	CAS Number	PQL
Pyridine	110-86-1	50
N-Nitrosodimethylamine	62-75-9	10
2-Picoline	109-06-8	10
N-Nitrosomethylethylamine	10595-95-6	10
Methyl methanesulfonate	66-27-3	10
N-Nitrosodiethylamine	55-18-5	10
Ethyl methanesulfonate	62-50-0	10
Pentachloroethane	76-01-7	10
Aniline	62-53-3	10
N-Nitrosopyrrolidine	930-55-2	10
Acetophenone	98-86-2	10
o-Toluidine	95-53-4	10
N-Nitrosomorpholine	59-89-2	10
N-Nitrosopiperidine	100-75-4	10
o,o,o-Triethylphosphorthioate	126-68-1	10
a,a-Dimethylphenethylamine	122-09-8	10
2,6-Dichlorophenol	87-65-0	10
N-Nitrosodi-n-butylamine	924-16-3	10
p-Phenylenediamine	106-50-3	10
Hexachloropropene	1888-71-7	10
Safrole	94-59-7	10
1-Methylnaphthalene	90-12-0	10
1,2,4,5-Tetrachlorobenzene	95-94-3	10
Isosafrole	120-58-1	10
1,4-Naphthoquinone	130-15-4	10
1,3-Dinitrobenzene	99-65-0	10
Pentachlorobenzene	608-93-5	10
2-Aminonaphthalene	91-59-8	10
2,3,4,6-Tetrachlorophenol	58-90-2	10
1-Aminonaphthalene	134-32-7	10
Thionazin	297-97-2	10
2-Methyl-5-nitroaniline	99-55-3	10
Diphenylamine	122-39-4	10
Sulfotepp	3689-24-5	10
Diallate (cis- and trans-)	2303-16-4	10
1,3,5-Trinitrobenzene	99-35-4	10

TABLE IIb Continued

Compound	CAS Number	PQL
Phorate	298-02-2	10
Phenacetin	62-44-2	10
1,2-Diphenylhydrazine (Azobenzene)	122-66-7	50
Benzidine	92-87-5	50
Dimethoate	60-51-5	10
Pentachloronitrobenzene	82-68-8	10
4-Aminobiphenyl	92-67-1	10
Pronamide	23950-58-5	10
2-sec-Butyl-4,6-dinitrophenol	88-85-7	10
Dinoseb	88-85-7	10
Disulfoton	298-04-4	10
Carbazole	86-74-8	20
Methyl Parathion	298-00-0	10
Parathion	56-38-2	10
4-Nitroquinoline-1-oxide	56-57-5	10
Methapyrilene	91-80-5	10
Isodrin	465-73-6	10
Aramite	140-57-8	10
4-Dimethylaminoazobenzene	60-11-7	10
Chlorobenzilate	510-15-6	10
Famphur	52-85-7	100
Kepone	143-50-0	50
3,3'-Dimethylbenzidine	119-93-7	50
2-Acetamidofluorene	53-96-3	10
7,12-Dimethylbenz(a)anthracene	57-97-6	10
3-Methylcholanthrene	56-49-5	10
Hexachlorophene	70-30-4	100

TABLE IIc: Analytes & Quantitation Limits -Extractable 8270-TCLP Analytes

Compound	CAS Number	TCLP µg/L
Pyridine	110-86-1	100
1,4-Dichlorobenzene	106-46-7	100
2-Methylphenol	95-48-7	100
3&4-Methylphenol	109-39-4 & 106-44-5	200
Hexachloroethane	67-72-1	100
Nitrobenzene	98-95-3	100
2,4-Dinitrotoluene	121-14-1	100
2,4,6-Trichlorophenol	88-06-2	100
2,4,5-Trichlorophenol	95-95-4	500
Hexachlorobenzene	118-74-1	100
Pentachlorophenol	87-86-5	500

TABLE III: Internal Standard Method Of Quantitation (Standard 8270 list)**

1,4-Dichlorobenzene-d4	Naphthalene-d8	Acenaphthene-d10	Phenanthrene-d10	Chrysene-d12	Perylene-d12
Phenol	Nitrobenzene	Hexachlorocyclo-pentadiene	4,6-Dinitro-2-methylphenol	Pyrene	Di-n-octylphthalate
bis(2-Chloroethyl)ether	Isophorone	2,4,6-Trichlorophenol	N-nitrosodi-phenylamine	Butylbenzylphthalate	Benzo(b)fluoranthene
2-Chlorophenol	2-Nitrophenol	2,4,5-Trichlorophenol	4-Bromophenylphenyl ether	3,3'-Dichloro-benzidine	Benzo(k)fluoranthene
1,3-Dichlorobenzene	2,4-Dimethylphenol	2-Chloronaphthalene	Hexachlorobenzene	Benzo(a)anthracene	Benzo(a)pyrene
1,4-Dichlorobenzene	bis(2-Chloro-ethoxy)methane	2-Nitroaniline	Pentachlorophenol	bis(2-Ethylhexyl)-phthalate	Indeno(1,2,3-cd)-pyrene
1,2-Dichlorobenzene	2,4-Dichloro phenol	Dimethylphthalate	Phenanthrene	Chrysene	Dibenz(a,h)anthracene
2-Methylphenol	1,2,4-Trichlorobenzene	Acenaphthylene	Fluoranthene	Terphenyl-d14(ss)	Benzo(g,h,i)perylene
Benzyl alcohol	Naphthalene	3-Nitroaniline	Anthracene	Benzidine	
4-Methylphenol	4-Chloroaniline	Acenaphthene	Di-n-butylphthalate		
Phenol-d5 (ss)	Hexachlorobutadiene	2,4-Dinitrophenol	2,4,6-Tribromo-phenol(ss)		
N-Nitrosi-di-n-propylamine	4-Chloro-3-methylphenol	4-Nitrophenol	Carbazole		
Hexachloroethane	2-Methylnaphthalene	Dibenzofuran			
2-Fluorophenol (ss)	Nitrobenzene-d5 (ss)	2,4-Dinitrotoluene			
2-Chlorophenol-d4(ss)	Benzoic acid	2,6-Dinitrotoluene			
1,2-Dichlorobenzene-d4(ss)	1-Methylnaphthalene	Diethylphthalate			
bis(2-chloroisopropyl)ether		4-Chlorophenyl phenyl ether			
N-Nitrosodimethelyamine		Fluorene			
Pyridine		4-Nitroaniline			
		2-Fluorobiphenyl(ss)			

ss = surrogate compound

** = Additional extractable analytes are quantitated against the nearest associated internal standard.

TABLE IV: Characteristic Ions For Target Compounds – (Standard 8270 List)**

Compound	Primary Ion	Secondary Ions
1,2 Diphenylhydrazine	77	
N-nitrosodimethylamine	42	44
Pyridine	79	52
Phenol	94	66, 65
bis(2-Chloroethyl) ether	93	95, 63
2-Chlorophenol	128	64, 130
1,3-Dichlorobenzene	146	148, 111
1,4-Dichlorobenzene	146	148, 111
Benzyl Alcohol	108	79, 77
1,2-Dichlorobenzene	146	148, 111
2-Methylphenol	107	108, 77
bis-(2-Chloroisopropyl) ether	45	77, 121
3&4-Methylphenol	107	108, 77
N-Nitroso-di-n-propylamine	70	42, 101, 130
Hexachloroethane	117	201, 199
Nitrobenzene	77	123, 65
Isophorone	82	138, 95
2-Nitrophenol	139	65, 109
2,4-Dimethylphenol	122	107, 121
Benzoic Acid	105	102, 77
bis(2-Chloroethoxy)methane	93	95, 123
2,4-Dichlorophenol	162	164, 98
1,2,4-Trichlorobenzene	180	182, 145
Naphthalene	128	129, 127
4-Chloroaniline	127	129, 65
Hexachlorobutadiene	225	223, 227
4-Chloro-3-methylphenol	107	142, 144
2-Methylnaphthalene	142	141
1-Methylnaphthalene	142	141
Hexachlorocyclopentadiene	237	235, 272
2,4,6-Trichlorophenol	196	198, 200
2,4,5-Trichlorophenol	196	198, 97
2-Chloronaphthalene	162	127, 164
2-Nitroaniline	65	138, 92
Dimethylphthalate	163	194, 164
Acenaphthylene	152	151, 153
3-Nitroaniline	138	92, 108
Acenaphthene	154	152, 153

TABLE IV Continued

Compound	Primary Ion	Secondary Ions
2,4-Dinitrophenol	184	63, 154
4-Nitrophenol	109	139, 65
Dibenzofuran	168	139
2,4-Dinitrotoluene	165	89, 63
2,6-Dinitrotoluene	165	63, 89
Diethylphthalate	149	177, 150
4-Chlorophenyl phenyl ether	204	206, 141
Fluorene	166	165, 167
4-Nitroaniline	138	65, 108
4,6-Dinitro-2-methylphenol	198	51, 105
N-nitrosodiphenylamine	169	168, 167
4-Bromophenyl phenyl ether	248	250, 141
Hexachlorobenzene	284	142, 249
Pentachlorophenol	266	264, 268
Phenanthrene	178	179, 176
Anthracene	178	176, 179
Carbazole	167	166
Di-n-butylphthalate	149	150, 104
Fluoranthene	202	101, 203
Benzidine	184	92
Pyrene	202	200, 203
Butyl benzyl phthalate	149	91, 206
3,3'-Dichlorobenzidine	252	254, 126
Benzo(a)anthracene	228	229, 226
bis-(2-ethylhexyl)phthalate	149	167, 279
Chrysene	228	226, 229
Di-n-octyl phthalate	149	167, 43
Benzo(b)fluoranthene	252	253, 125
Benzo(k)fluoranthene	252	253, 125
Benzo(a)pyrene	252	253, 125
Indeno(1,2,3-cd)pyrene	276	138, 277
Dibenz(a,h)anthracene	278	279, 139
Benzo(g,h,i)perylene	276	138, 277

** Please reference SW-846 method 8270C for quantitation ions for the additional analytes.

TABLE V: Calibration Check Compounds (CCC)

Base/Neutral Fraction	Acid Fraction
Acenaphthene	4-Chloro-3-methylphenol
1,4-Dichlorobenzene	2,4-Dichlorophenol
Hexachlorobutadiene	2-Nitrophenol
N-Nitrosodiphenylamine	Phenol
Di-n-octyl phthalate	Pentachlorophenol
Fluoranthene	2,4,6-Trichlorophenol
Benzo(a)pyrene	

TABLE VI System Performance Check Compounds (SPCC)

Base/Neutral Fraction	Acid Fraction
N-Nitroso-di-n-propylamine	2,4-Dinitrophenol
Hexachlorocyclopentadiene	4-Nitrophenol

TABLE VII: Characteristic Ions For Internal Standards

I.S. Compound	Primary Ion	Secondary Ion(s)
1,4-Dichlorobenzene-d_4	152	150,115
Naphthalene-d_8	136	68
Acenaphthene-d_{10}	164	162, 160
Phenanthrene-d_{10}	188	94, 80
Chrysene-d_{12}	240	120, 236
Perylene-d_{12}	264	260, 265

TABLE VIII: Characteristic Ions For Surrogates

Surrogate Compound	Primary Ion	Secondary Ion(s)
Phenol-d_6	99	71, 42
Fluorophenol	112	64
Nitrobenzene-d_5	82	128, 54
Fluorobiphenyl	172	171
Tribromophenol	330	332, 141
Terphenyl-d_{14}	244	122, 212

TABLE IX: Surrogate Compounds*

Compound	Fraction	Concentration, µg/L
Nitrobenzene-d_5	BN	50
2-Fluorobiphenyl	BN	50
Terphenyl-d_{14}	BN	50
Phenol-d_6	Acid	75
2-Fluorophenol	Acid	75
2,4,6-Tribromophenol	Acid	75

*at the time of injection

TABLE X: Instrument Conditions

Mass Range	35-550
Scan Time	1.4
Initial Temperature	50°C
Temperature Program	50°C for 1.75 min 35°/min to 130/15°min →280 hold 5 min 5°/min to 320 hold 3.0 min.
Final Temperature	325°C
Injector Temperature	250°C
Source Temperature	290°C
Injector Temperature	250˚C
Sample Volume	2µl
Carrier Gas	Helium
Solvent Delay	~2.50
Threshold	500
tune file	ATUNE.U

ATTACHMENT I: Sonication Extraction Technique – Method

Analysis Method: SW8270C - Soil

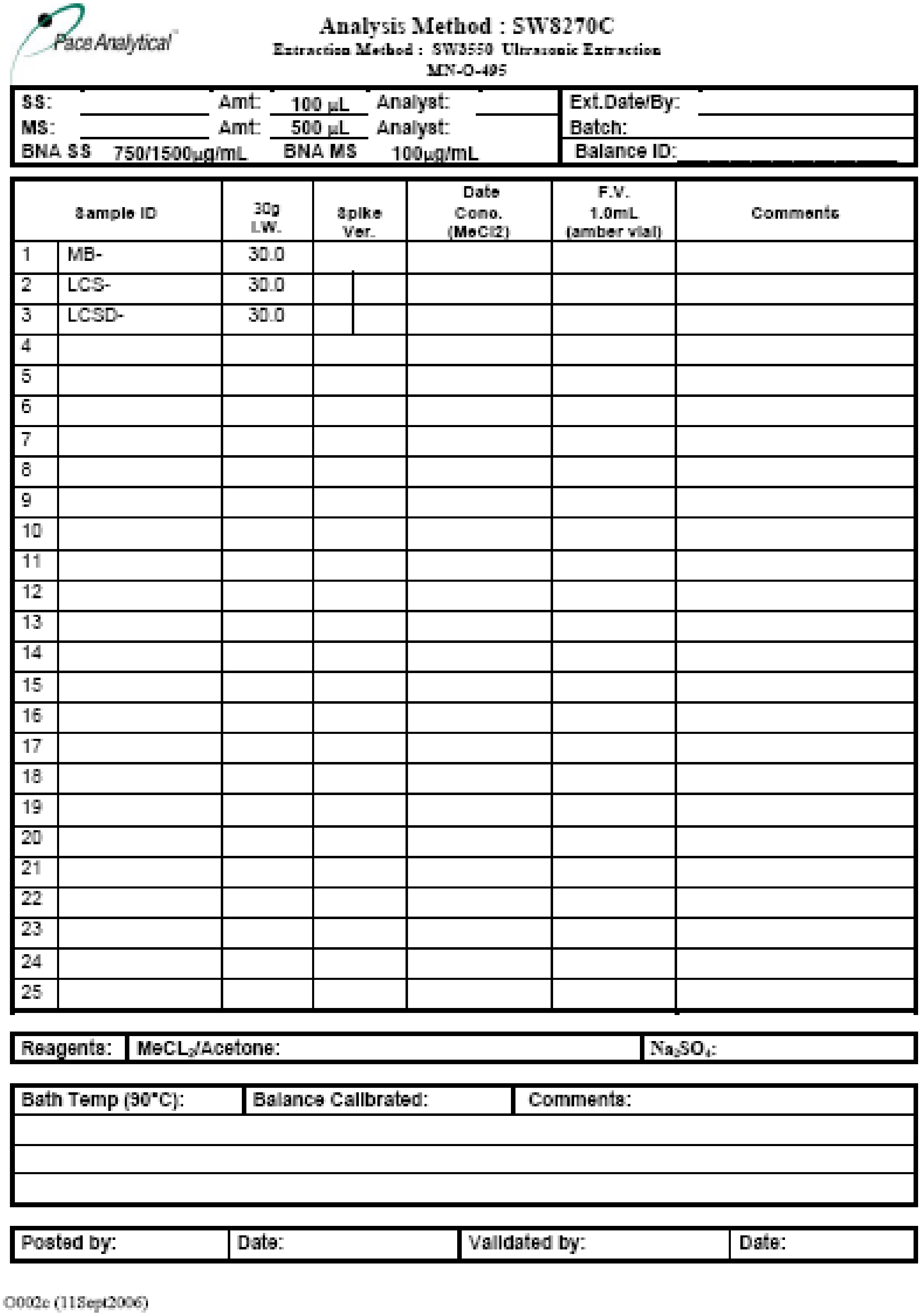
Extraction Method: SW3550

LIMS Procedure: 8270S_P

Holding Time:	Samples should be extracted within 14 days from sample collection.
QC Requirements:	A method blank (MB) must be performed each day or every 20 samples, whichever is more frequent. If sufficient sample is not provided to perform an MS/MSD, a LCS/LCSD is performed.
Extraction Solvent:	Methylene Chloride/Acetone 1:1
Extraction:	Weigh out 30 g of the sample. Add enough sodium sulfate and mix thoroughly to make sample free-flowing and dry. Add 100 up of the BNA surrogate solution at a concentration of 750/1500 µg/ml to each sample. Add 500 uL of BNA matrix spike at a concentration of 100 mg/mL to the LCS/LCSD (MS/MSD as needed). Add 100 mLs of the 1:1 solvent mixture immediately following the spiking procedure. Place samples in the sonicator box and sonicate each sample three times each at setting “3”. Filter the sample between each sonication.
Finalization:	Assemble a KD/concentrator tube apparatus. Transfer the extract to the KD apparatus. Concentrate on the waterbath to 4-6 mL. Transfer to nitrogen blow down and concentrate to approximately 1 mL. Label a 2 mL amber crimptop autovial with the sample number, extraction date, and analysis. Using a 1 mL disposable pipette bring the extract into the disposable pipette. Add enough methylene chloride into the concentrator tube to bring the total final volume to 1 mL. Transfer to the previously labeled 2 mL autovial and cap.
Final Volume:	1 mL
Final Solvent:	Methylene Chloride

O001a, 10-Jul-03

ATTACHMENT II: Sonication Extraction Technique – Extraction Bench Sheet (example)



Pace Analytical

Analysis Method : SW8270C
Extraction Method : SW3550 Ultrasonic Extraction
MN-O-495

SS: ____________ Amt: 100 µL Analyst: ____________
MS: ____________ Amt: 500 µL Analyst: ____________
BNA SS 750/1500µg/mL BNA MS 100µg/mL

Ext.Date/By: ____________
Batch:
Balance ID: ____________

Sample ID		30g I.W.	Spike Ver.	Date Conc. (MeCl2)	F.V. 1.0mL (amber vial)	Comments
1	MB-	30.0				
2	LCS-	30.0				
3	LCSD-	30.0				
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Reagents:	$MeCL_2$/Acetone:	Na_2SO_4:

Bath Temp (90°C):	Balance Calibrated:	Comments:

Posted by:	Date:	Validated by:	Date:

O002c (11Sept2006)

ATTACHMENT III: Soxhlet Extraction Technique – Method

Analysis Method: SW8270C BNA Soil

Extraction Method: SW3540 Soxhlet Extraction

MN-O-495 EPIC Procedure: 8270S_P

Holding Time: Samples should be extracted within 14 days from sample collection.

QC Requirements: A method blank (MB) must be performed each day or every 20 samples, whichever is more frequent. If sufficient sample is not provided to perform an MS/MSD, a LCS/LCSD is performed.

Extraction Solvent: Methylene Chloride/Acetone 1:1

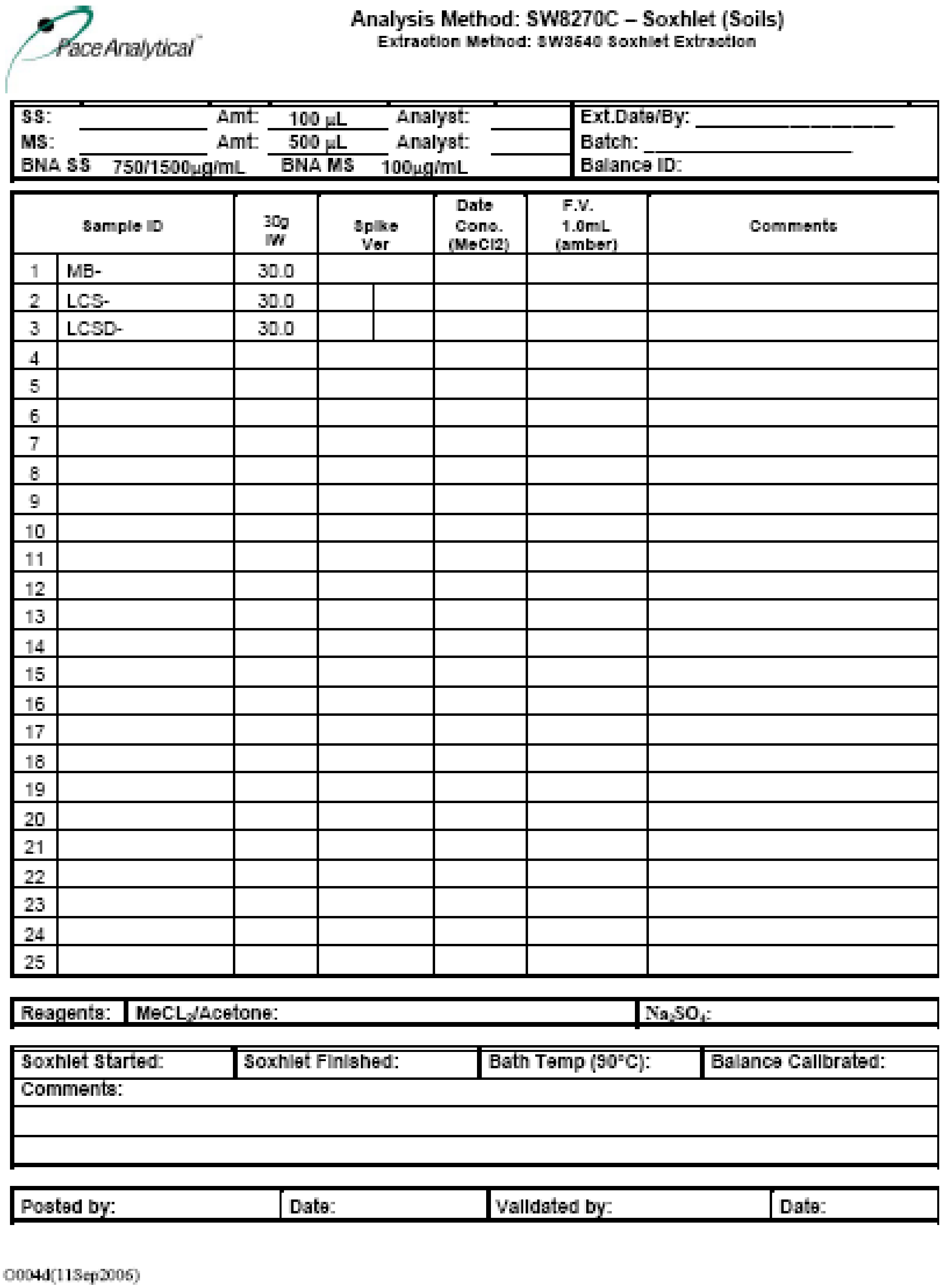
Extraction: Turn on the chiller so condensers cool. Rinse the Soxhlet extractor and round bottom flask with acetone and MeCl three times each. Add 200 mL of MeCl to the round bottom flask containing a few clean boiling chips. Weigh out 30 g of the sample into a solvent rinsed 400 mL beaker. Add sodium sulfate until the sample is dry. Mix thoroughly. Rinse fluted filter paper (approximately 20 cm). Pour the soil/sodium sulfate mixture into the rinsed filter paper. Add 0.1 mL of the surrogate spike to each sample. Add 0.5 mL of matrix spike to the LCS/LCSD (MS/MSD as needed). Attach the condenser to the Soxhlet extractor. Extract for 16-24 hours at 4-6 cycles/hour. (The heater dial should be set at 5). Allow the extract to cool after the extraction is complete.

Finalization: Assemble a KD/concentrator tube apparatus. Record the tube number on the extraction sheet. Transfer the extract to the KD apparatus. Concentrate on the waterbath to 4-6 mL. Transfer to nitrogen blow down to approximately 0.8 mL. Label a 2 mL crimptop autovial with the sample number, extraction date, and analysis. Add enough methylene chloride into the concentrator tube to bring the total final volume to 1.0 mL using a disposable pipette. Transfer to the previously labeled 2 mL autovial and cap. Ensure cap is tightly crimped by trying to twist the autovial cap

Final Volume: 1.0 mL

Final Solvent: Methylene Chloride

ATTACHMENT IV: Soxhlet Extraction Technique – Extraction Bench Sheet (example)



Pace Analytical

Analysis Method: SW8270C – Soxhlet (Soils)
Extraction Method: SW3540 Soxhlet Extraction

SS: ____________	Amt: 100 µL	Analyst: ________	Ext.Date/By: ______________
MS: ____________	Amt: 500 µL	Analyst: ________	Batch: ______________
BNA SS 750/1500µg/mL	BNA MS 100µg/mL		Balance ID:

Sample ID		30g IW	Spike Ver	Date Conc. (MeCl2)	F.V. 1.0mL (amber)	Comments
1	MB-	30.0				
2	LCS-	30.0				
3	LCSD-	30.0				
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Reagents:	MeCL$_2$/Acetone:	Na$_2$SO$_4$:

Soxhlet Started:	Soxhlet Finished:	Bath Temp (90°C):	Balance Calibrated:
Comments:			

Posted by:	Date:	Validated by:	Date:

O004d(11Sep2006)

ATTACHMENT V: Waste Dilution Technique – Method

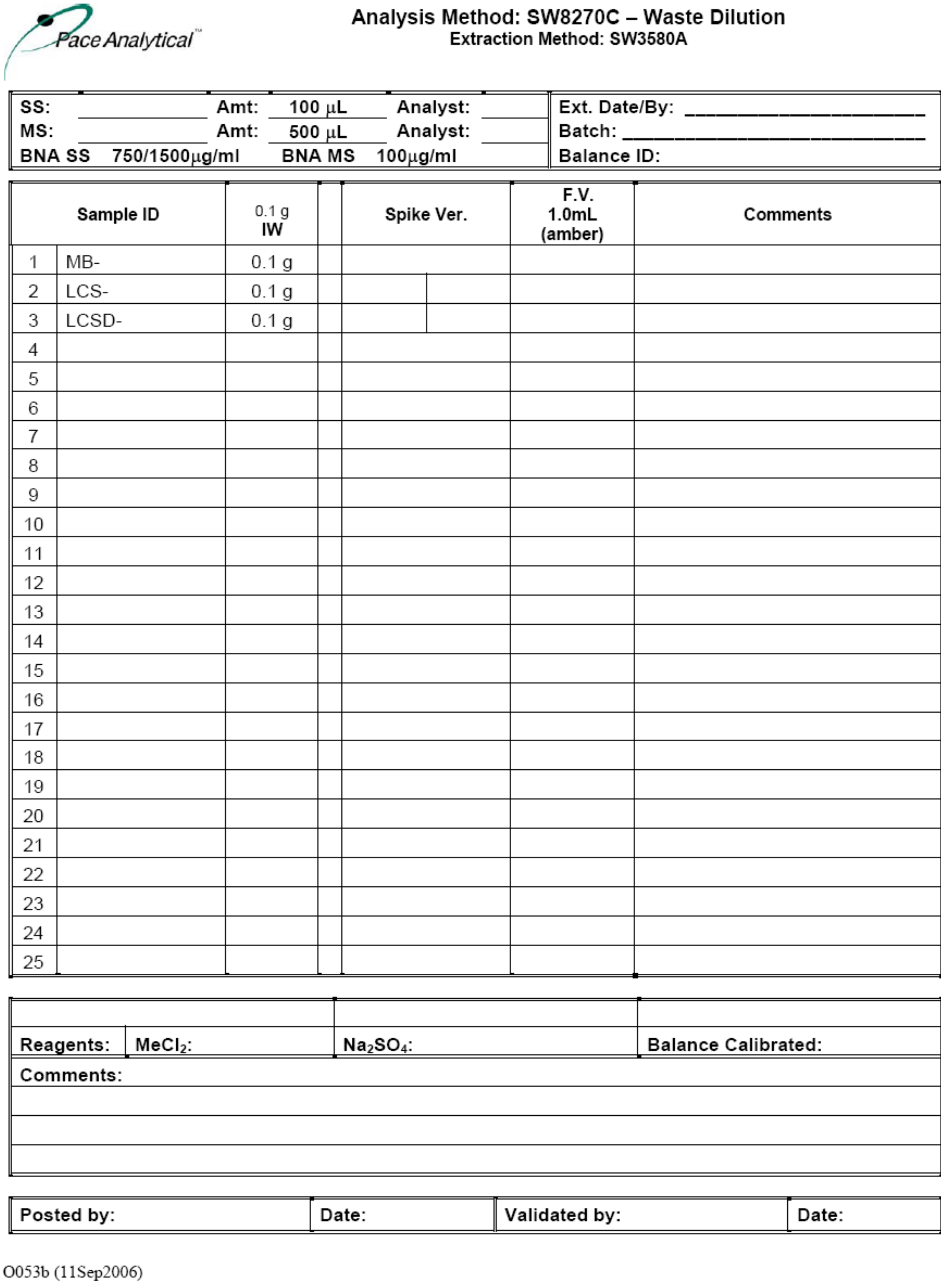
Analysis Method: SW8270C Waste Dilution

Extraction Method: SW3580A

Holding Time:	Samples should be extracted within 14 days from sample collection.
QC Requirements:	A method blank (MB) must be performed each day or every 20 samples, whichever is more frequent. If sufficient sample is not provided to perform an MS/MSD, a LCS/LCSD is performed.
Extraction Solvent:	Methylene Chloride
Extraction:	Weigh 0.1 g into a 2 mL autosampler vial and add 0.1 mL of surrogate. Add 0.5 mL of MS to the appropriate QC. Finalize each sample at 1.0 mL with methylene chloride. Vortex each sample for approximately 1 minute each.

Final Volume:	1.0 mL
Final Solvent:	Methylene Chloride

ATTACHMENT VI: Waste Dilution Technique – Extraction Bench Sheet (example)



Pace Analytical™

Analysis Method: SW8270C – Waste Dilution
Extraction Method: SW3580A

SS:		**Amt:** 100 µL	**Analyst:**		**Ext. Date/By:**	
MS:		**Amt:** 500 µL	**Analyst:**		**Batch:**	
BNA SS 750/1500µg/ml		**BNA MS** 100µg/ml			**Balance ID:**	

	Sample ID	0.1 g **IW**		**Spike Ver.**	**F.V. 1.0mL (amber)**	**Comments**
1	MB-	0.1 g				
2	LCS-	0.1 g				
3	LCSD-	0.1 g				
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Reagents:	**$MeCl_2$:**	**Na_2SO_4:**	**Balance Calibrated:**

Comments:

Posted by:	**Date:**	**Validated by:**	**Date:**

O053b (11Sep2006)

ATTACHMENT VII: Continuous Liquid-Liquid Technique – Method

Extraction Procedure: SW3520 MN-O-496
EPIC Procedure: 8270S_P

HOLDING TIME: Samples should be extracted within 7 days of sample collection.

QC Requirements: A method blank (MB) must be performed each day or every 20 samples, whichever is more frequent. If sufficient sample is not provided to perform an MS/MSD, a LCS/LCSD is performed.

Extraction Solvent: Methylene Chloride

Extraction: Turn on Chiller so condensers will be cool.

Rinse the liquid/liquid extractor (LLE) with methylene chloride. Add 250mL of methylene chloride to the round bottom flask and approximately 250mL to the LLE. Label the round bottom flask with the sample number, analysis, and date extracted, and add boiling chips.

Take the initial volume and pH of each sample and record on extraction sheet.

1. If >5% sediment is present in the bottom of the glass container, the following steps should be taken:
   a. Decant aqueous portion into a graduated cylinder. Record the volume.
   b. Record that there is greater than 5% sediment present on the extraction sheet and contact the PM.
   c. Retain and store the remaining sediment portion in the cooler for possible soil extraction per client request.
2. If <5% sediment is present, extract the aqueous and sediment layer together.

Pour sample into the LLE.

Use one liter of DI water for the MB and LCS/LCSD. Pour directly into LLE.

Acidify each sample, MB, and LCS/LCSD to a pH of 2 using about 2 mLs of sulfuric acid. Stir the sample using a disposable pipette and check pH by touching the tip of the pipette to wide range pH paper. Add additional 1:1 sulfuric acid as needed to achieve a pH of 2.

Add 100 uL of BNA surrogate solution at a concentration of 750/1500 ug/ml to each QC and sample. Add 500 uL of BNA matrix spike solution at a concentration of 100 ug/mL to the LCS/LCSD.

Attach condenser to LLE and turn on heating mantle to a setting of 5.

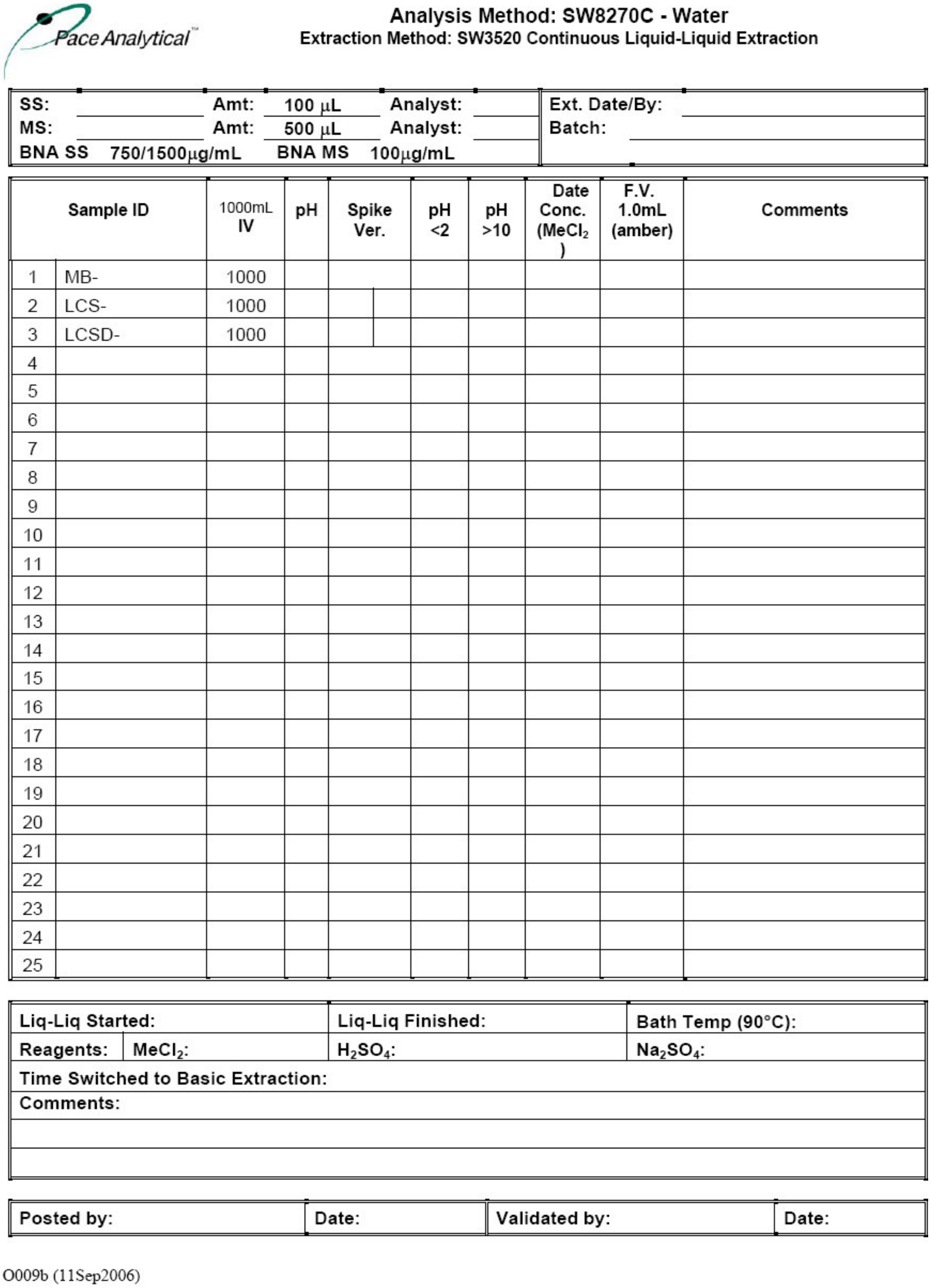
Extract for 18-24 hours.

Finalization: Add sodium sulfate to the round bottom flask to absorb any water in extract. Sodium sulfate should be free flowing and no water droplets should be present. Assemble a KD/concentrator tube apparatus. Transfer the extract to the KD. Concentrate on the waterbath to 4-6 mL. Transfer to nitrogen blow down and take to a 1 mL final volume. Put in an amber crimp top autovial labeled with the sample number, analysis, and extraction date.

Final Volume: 1 mL

Final Solvent: Methylene Chloride

ATTACHMENT VIII: Continuous Liquid-Liquid Technique – Extraction Bench Sheet (example)



Pace Analytical™

Analysis Method: SW8270C - Water

Extraction Method: SW3520 Continuous Liquid-Liquid Extraction

SS:		Amt:	100 µL	Analyst:		Ext. Date/By:	
MS:		Amt:	500 µL	Analyst:		Batch:	
BNA SS	750/1500µg/mL	BNA MS	100µg/mL				

	Sample ID	1000mL IV	pH	Spike Ver.	pH <2	pH >10	Date Conc. ($MeCl_2$)	F.V. 1.0mL (amber)	Comments
1	MB-	1000							
2	LCS-	1000							
3	LCSD-	1000							
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
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24									
25									

Liq-Liq Started:		Liq-Liq Finished:	Bath Temp (90°C):
Reagents:	$MeCl_2$:	H_2SO_4:	Na_2SO_4:

Time Switched to Basic Extraction:

Comments:

Posted by:	Date:	Validated by:	Date:

O009b (11Sep2006)

ATTACHMENT IX: TCLP Technique – Extraction Bench Sheet (example)

Pace Analytical™

Analysis Method: SW8270C - TCLP
Extraction Method: SW3520 MN-O-496

SS:		**Amt:** 100 µL	**Analyst:**	**Ext. Date/By:**	
MS:		**Amt:** 500 µL	**Analyst:**	**Batch:**	
BNA SS 750/1500µg/ml		**BNA MS** 100µg/ml			

Sample ID		100* ml **IV**	**pH**	**Spike Ver.**	**F.V. 1.0mL (amber)**	**Comments**
1	MB-	100*				
2	LCS-	100*				
3	LCSD-	100*				
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

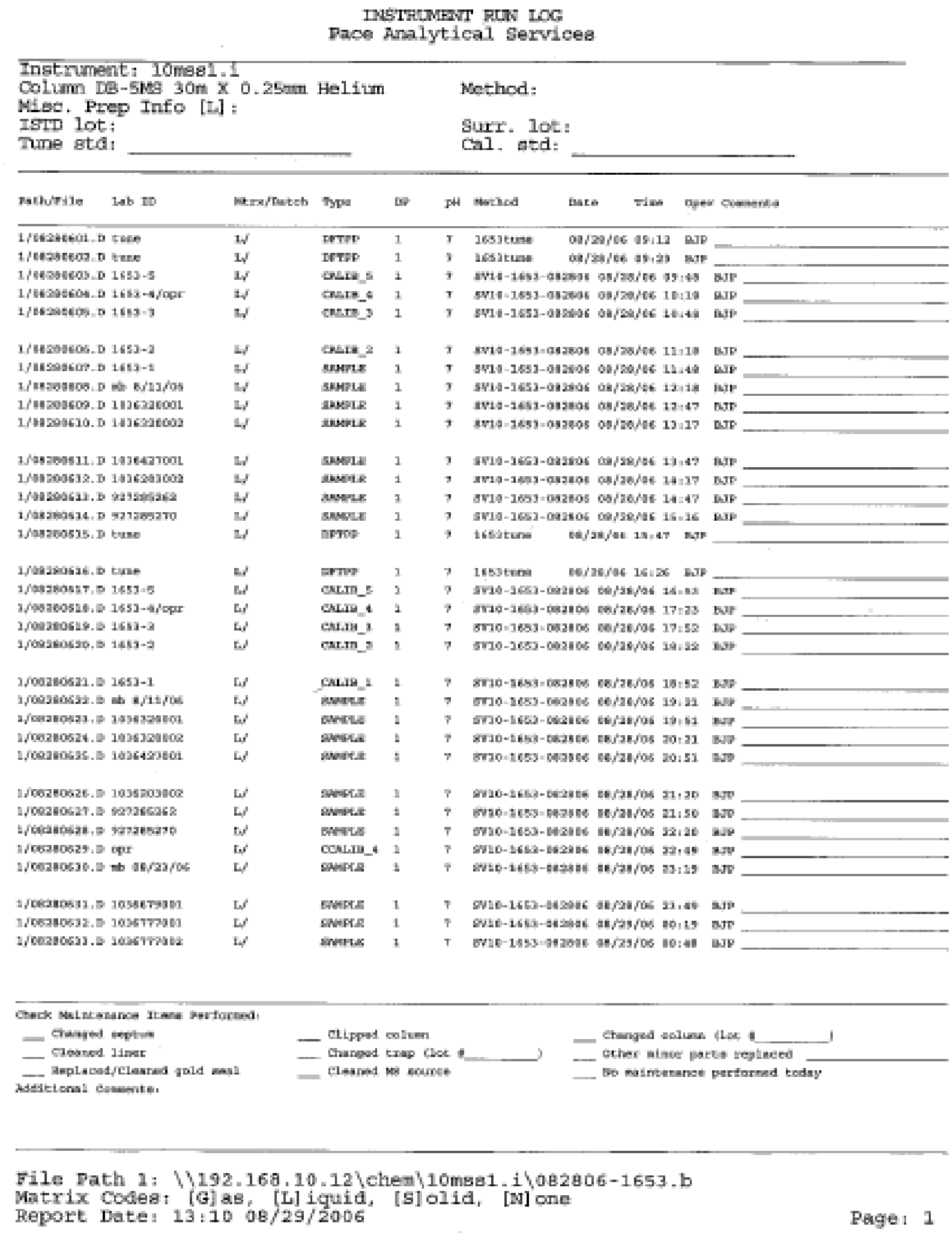
Liq-Liq Started:		**Liq-Liq Finished:**	**Bath Temp (90°C):**
Reagents:	**MeCl$_2$:**	**Na$_2$SO$_4$:**	

Comments: * Initial volume of 100 mls of sample was brought to 1000 mls with DI water.

Posted by:	**Date:**	**Validated by:**	**Date:**

O062c (11Sep2006)

ATTACHMENT X: Instrument and Maintenance Run Log (example)



INSTRUMENT RUN LOG
Pace Analytical Services

Instrument: 10mss1.i
Column DB-5MS 30m X 0.25mm Helium Method:
Misc. Prep Info [L]:
ISTD lot: Surr. lot:
Tune std: ____________ Cal. std: ____________

Path/File	Lab ID	Mtrx/Batch	Type	DF	pH	Method	Date	Time	Oper	Comments
1/08280601.D	tune	L/	DFTPP	1	7	1653tune	08/28/06	09:12	BJP	
1/08280602.D	tune	L/	DFTPP	1	7	1653tune	08/28/06	09:29	BJP	
1/08280603.D	1653-5	L/	CALIB_5	1	7	SV10-1653-082806	08/28/06	09:48	BJP	
1/08280604.D	1653-4/opr	L/	CALIB_4	1	7	SV10-1653-082806	08/28/06	10:18	BJP	
1/08280605.D	1653-3	L/	CALIB_3	1	7	SV10-1653-082806	08/28/06	10:48	BJP	
1/08280606.D	1653-2	L/	CALIB_2	1	7	SV10-1653-082806	08/28/06	11:18	BJP	
1/08280607.D	1653-1	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	11:48	BJP	
1/08280608.D	mb 8/11/06	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	12:18	BJP	
1/08280609.D	1036328001	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	12:47	BJP	
1/08280610.D	1036328002	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	13:17	BJP	
1/08280611.D	1036427001	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	13:47	BJP	
1/08280612.D	1036283002	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	14:17	BJP	
1/08280613.D	927285262	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	14:47	BJP	
1/08280614.D	927285270	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	15:16	BJP	
1/08280615.D	tune	L/	DFTPP	1	7	1653tune	08/28/06	15:47	BJP	
1/08280616.D	tune	L/	DFTPP	1	7	1653tune	08/28/06	16:26	BJP	
1/08280617.D	1653-5	L/	CALIB_5	1	7	SV10-1653-082806	08/28/06	16:53	BJP	
1/08280618.D	1653-4/opr	L/	CALIB_4	1	7	SV10-1653-082806	08/28/06	17:23	BJP	
1/08280619.D	1653-3	L/	CALIB_3	1	7	SV10-1653-082806	08/28/06	17:52	BJP	
1/08280620.D	1653-2	L/	CALIB_2	1	7	SV10-1653-082806	08/28/06	18:22	BJP	
1/08280621.D	1653-1	L/	CALIB_1	1	7	SV10-1653-082806	08/28/06	18:52	BJP	
1/08280622.D	mb 8/11/06	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	19:21	BJP	
1/08280623.D	1036328001	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	19:51	BJP	
1/08280624.D	1036328002	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	20:21	BJP	
1/08280625.D	1036427001	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	20:51	BJP	
1/08280626.D	1036283002	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	21:20	BJP	
1/08280627.D	927285262	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	21:50	BJP	
1/08280628.D	927285270	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	22:20	BJP	
1/08280629.D	opr	L/	CCALIB_4	1	7	SV10-1653-082806	08/28/06	22:49	BJP	
1/08280630.D	mb 08/23/06	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	23:19	BJP	
1/08280631.D	1036679001	L/	SAMPLE	1	7	SV10-1653-082806	08/28/06	23:49	BJP	
1/08280632.D	1036777001	L/	SAMPLE	1	7	SV10-1653-082806	08/29/06	00:19	BJP	
1/08280633.D	1036777002	L/	SAMPLE	1	7	SV10-1653-082806	08/29/06	00:48	BJP	

Check Maintenance Items Performed:
___ Changed septum
___ Cleaned liner
___ Replaced/Cleaned gold seal
___ Clipped column
___ Changed trap (Lot #________)
___ Cleaned MS source
___ Changed column (Lot #________)
___ Other minor parts replaced ____________
___ No maintenance performed today
Additional Comments:

File Path 1: \\192.168.10.12\chem\10mss1.i\082806-1653.b
Matrix Codes: [G]as, [L]iquid, [S]olid, [N]one
Report Date: 13:10 08/29/2006 Page: 1

STANDARD OPERATING PROCEDURE
ANALYSIS OF VOLATILE ORGANIC COMPOUNDS BY GC/MS
SW846 METHOD 8260B

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STANDARD OPERATING PROCEDURE

Analysis of Volatile Organic Compounds by GC/MS
SW846 Method 8260B

SOP NUMBER:	S-MN-O-521-Rev.17
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	S-MN-O-521-Rev.16

APPROVAL

Laboratory General Manager — Date: 09 Feb 2009

Melanie Ollila
Laboratory Assurance Manager — Date: 09 Feb 2009

ANNUAL REVIEW

SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date

Any printed documents in use within a Pace Analytical Services, Inc. laboratory have been reviewed and approved by the persons listed on the cover page. They can only be deemed official if proper signatures are present.

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Table of Contents

1. PURPOSE

This method is used for the determination of volatile organic compounds by gas chromatography / mass spectrometry (GC/MS), capillary column technique per SW-846 method 8260B.

2. SCOPE AND APPLICATION

2.1 Method 8260B is used to determine volatile organic compounds in a variety of matrices. This method is applicable to nearly all types of samples, regardless of water content, including ground water, surface water, aqueous sludges, soils, and sediments. Table I lists target compounds which may be analyzed by this method. Additional compounds may be analyzed if all quality control criteria are met.

2.2 Method 8260B can be used to quantitate most volatile organic compounds that have boiling points below 200° C and that are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique. However, for the more soluble compounds, quantitation limits are approximately two to ten times higher because of poor purging efficiency. Such compounds include low-molecular-weight halogenated hydrocarbons, aromatics, ketones, nitrites, acetates, acrylate, ethers, and sulfides.

2.3 Table II indicates the Pace Reporting Limit (PRL) for each compound. Reporting Limits will be proportionately higher for sample extracts and samples that require dilution or reduced sample size to avoid saturation of the detector.

2.4 Method 8260B is based upon a purge-and-trap, gas chromatographic/mass spectrometric (GC/MS) procedure. This method is restricted to use by, or under the supervision of, analysts experienced in the use of purge-and-trap systems and gas chromatograph/mass spectrometers, and skilled in the interpretation of mass spectra and their use as a quantitative tool.

3. SUMMARY OF METHOD

3.1 The volatile organic compounds are introduced into the gas chromatograph by the purge-and trap method or by direct injection. Purged sample components are trapped in a tube containing suitable sorbent materials. When purging is complete, the sorbent tube is heated and back flushed with helium to desorb trapped sample components. The analytes are directly desorbed onto a narrow bore capillary column connected to a split/splitless injection port. The column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS) interfaced to the gas chromatograph.

3.2 Qualitative identifications are confirmed by analyzing standards under the same conditions used for samples and comparing resultant mass spectra and GC retention times. Each identified component is quantitated by relating the MS response for an appropriate selected ion produced by that compound to the MS response for an appropriately selected ion produced by an internal standard.

4. INTERFERENCES

4.1 Major contaminant sources are volatile materials in the laboratory and impurities in the inert purging gas and in the sorbent trap. The use of non-polytetrafluoroethylene (PTFE) thread sealants, plastic tubing, or flow controllers with rubber components should be avoided since such materials out-gas organic compounds which will be concentrated in the trap during the purge operation. Analyses of blanks provide information about the presence of contaminants. When potential interfering peaks are noted in blanks, the analyst should investigate the source of contamination and correct it. Subtracting blank values from sample results is not permitted. If reporting values not corrected for blanks results in what the laboratory feels is a false positive for a sample, this should be fully explained in text accompanying the uncorrected data.

4.2 Interfering contamination may occur when a sample containing low concentrations of volatile organic compounds is analyzed immediately after a sample containing high concentrations of volatile organic compounds. The preventive technique is rinsing of the purging apparatus and sample syringes with two portions of organic-free reagent water between samples. After analysis of a sample containing high concentrations of volatile organic compounds, one or more method blanks should be analyzed to check for cross contamination. For samples containing large amounts of water soluble materials, suspended solids, high boiling compounds or high concentrations of compounds being determined, it may be necessary to wash the purging device with methanol, rinse it with organic-free reagent water, and then dry the purging device in an oven less than 120°C. In extreme situations, the whole purge and trap device may require dismantling and cleaning, typically a methanol back flush followed by a DI water back flush. Screening the sample prior to analysis is recommended to prevent system contamination. This is especially true for soil and waste samples. Screening may be accomplished with an automated headspace technique using a flame ionization detector or by analyzing the sample at a dilution by purge and trap GC/MS.

4.3 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank prepared using HPLC grade, organic-free, water (or pre-tested, boiled DI water) and carried through the sampling and handling protocol or pre tested, boiled, deionized water can serve as a check on such contamination. Trip blanks may also be purchased premade, refer to the Bottle Preparation SOP, S-MN-C-003, or equivalent replacement.

4.4 Holding blanks consisting of VOA vials of DI water or Ottawa Sand are placed in the refrigerators and freezers used for the storage of samples for volatile analysis. These blank samples are removed every two weeks and analyzed for the target analytes to determine if cross-contamination has occurred during sample storage.

5. SAFETY

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials

5.2 The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) and a formal safety plan available to all personnel.

5.3 MSDS are located in a centralized location and should be consulted prior to handling samples and standards.

6. DEFINITIONS

6.1 Refer to the Glossary Section of the Pace Analytical Quality Manual for general definitions.

7. SAMPLE COLLECTION, PRESERVATION AND HANDLING

7.1 Aqueous

7.1.1 Aqueous samples are collected in 40mL capped vials (actual volume equals 42 mL with no headspace), and stored at 0-6°C.

7.1.2 The size of any bubble should be less than 5-6mm. Even though a minimal bubble is allowed, these vials should not be utilized unless no vials without headspace exist. If a vial is used that does have headspace, this should be footnoted in LIMS.

7.1.3 If samples are properly preserved at pH < 2, they must be analyzed within 14 days from collection. For volatiles, pH is measured after analysis and recorded in the daily sequence log.

7.1.4 For samples not preserved with 1:1 hydrochloric acid to a pH <2, a 7-day holding time from date collected is used. If an improperly preserved sample was reported, a comment must be added that shows up on the final report.

7.2 Solids/Soils – Method 5035/5030

7.2.1 Acceptable sample collection options for low level 5035 soil samples are listed below.

7.2.1.1 Unpreserved tared 40mL vial with stir bar and 5mL DI water

7.2.1.2 40mL tared vial preserved with Sodium Bisulfate. Note- Sodium Bisulfate preserved vials are not recommended or generally supplied by Pace.

7.2.1.3 5g capacity Encore or similar approved sample collection and storage device (i.e. Terracore)

7.2.1.4 Method criteria states that the sample weight should be 5 +/- 0.5g, but due to field sampling the weights may vary. Pace will qualify samples that are received with greater than 7.5 grams of sample. There may also be times due to matrix, such as an ash, that weights lower than 5 grams result in the lab not being able to perform an adequate purge. Pace will notify the clients of the matrix difficulties, analyze and qualify accordingly.

7.2.2 Acceptable sample collection options for medium level 5030 soil samples are listed below.

7.2.2.1 Tared 40mL vial or wide mouth jar with methanol preservative 25g capacity Encore or similar approved sample collection and storage device (Terracore).

7.2.3 A sufficient number of sample containers must be collected to allow for sample re-analysis from an unused vial. If the low-level option is required, samples must also be collected as a medium-level to allow for analysis if concentrations exceed the low-level limits. A typical sample kit includes 2 low-level and 1 medium-level containers.

7.2.4 Samples collected in 40mL unpreserved vials or DI water vials must be frozen at -10 to -20^{o}C until analysis. Holding time is 14 days from collection.

7.2.5 Samples collected with methanol preservation in the field must be stored at 4^{o}C $\pm$ 2$^{o.}$

7.2.6 Samples collected in Encore or similar devices must be extruded within 48 hours of collection. Alternatively, samples may be frozen. The extrusion time and date must be recorded in the extrusion logbook.

7.2.6.1 For low-level soil – extrude the sample into a tared 40mL vial containing 5mL of organic free reagent water and a clean stir bar. Record the weight in the extrusion logbook. Record the date and time of extrusion in the extrusion logbook. Cap the vial and freeze at -10 to -20^{o}C until analysis.

7.2.6.2 For medium-level soils – extrude the sample into a tared 40mL vial. Record the weight in the extrusion logbook. Record the date and time of extrusion in the extrusion logbook. Add the appropriate ratio of methanol to the weight of the soil (e.g. 10mL methanol to 10g of sample) and cap.

7.3 Soil samples must be analyzed within 14 days from sample collection and stored at 4^{o}C$\pm$2^{o}.

7.4 TCLP-Leachate

7.4.1 Leachate samples are stored in 40 mL capped bottles with minimal headspace at 4°C±2°.

7.4.2 Samples must be analyzed no more than 14 days from the end of TCLP preparation.

8. EQUIPMENT AND SUPPLIES

8.1 Purge-and-trap device

8.1.1 Autosampler: Varian Archon 5100 and EST Archon 8100, or Centurion (or equivalent)

8.1.2 Sample Concentrator: Tekmar (Lab Sample Concentrator) LSC 3100, LSC 3000 or equivalent.

8.2 The purging chamber is designed to accept 5mL samples with a water column at least 3cm deep. The gaseous headspace between the water column and the trap should be minimized. The purge gas must pass through the water column as finely divided bubbles with a diameter of less than 3mm at the origin. The purge gas must be introduced no more than 5mm from the base of the water column.

8.3 Trap Packing - A variety of traps are available from manufacturers. Any of these traps may be used if the trap packing materials do not introduce contaminants into the analysis and the data generated using the trap meets the initial and continuing calibration technical acceptance criteria of this method. Some traps used include, but are not limited to a tenax/silica gel/carbon trap, tenax/silica gel/carbon/OV-1 trap, and a Vocarb 3000 trap.

8.4 The desorber (Tekmar LSC-3100, LSC 3000 or equivalent) should be capable of rapidly heating the trap to the manufacturer's recommended temperature for desorption, typically 180°C to 260°C, depending on the trap chosen.

8.5 Sample Heater - Should be capable of maintaining the purging chamber at 40°C for low level soil direct purge analysis.

8.6 Gas chromatography/mass spectrometer/data system.

8.6.1 Gas chromatograph - An analytical system complete with a temperature-programmable gas chromatograph suitable for split/splitless injection (Hewlett Packard HP 6890).

8.6.2 Gas Chromatographic columns.

8.6.2.1 20 m x 0.18 mm ID capillary column coated with DB-624 (J&W Scientific), 1.0 um film thickness, or equivalent.

8.6.2.2 Alternate columns may be used if the analytical results generated using the column meet the initial and continuing calibration acceptance criteria as well as the required reporting limits.

8.6.3 Mass spectrometer - Capable of scanning from 35 to 300 amu every 2 seconds or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for Bromofluorobenzene (BFB) which meets all of the criteria in Table III when 5-50 ng of the GC/MS tuning standard (BFB) are directly injected onto the column. To ensure sufficient precision of mass spectral data, the desirable MS scan rate allows acquisition of at least five spectra while a sample component elutes from the GC (HP5973MSD or equivalent).

8.6.4 GC/MS interface - The GC is interfaced to the MS with an all glass enrichment device and an all glass transfer line. Any GC-to-MS interface that gives acceptable calibration points at 50ng or less per injection for each of the analytes and achieves all acceptable performance criteria may be used. If a 0.18-0.32 mm ID capillary column is used, it is positioned directly into the ion source and this GC/MS interface acts only as a heated connection, not as an enrichment device.

8.6.5 Data system - A computer system that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program must be interfaced to the mass spectrometer. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between specified time or scan-number limits. The most recent version of the EPA/NIST Mass Spectral Library should also be available. This computer system allows the analyst to port the raw data files to Target 4.1 (or equivalent) software on a Hewlett-Packard Chemserver for data work-up and reporting.

8.7 Microsyringes – 5, 10, 25, 50, 100, 250, 500, and 1000uL.

8.8 Syringes - 5, 10, 25mL, 50 uL or gas-tight with shutoff valve.

8.9 Balance - Analytical, 0.0001g, and top-loading, 0.1g.

8.10 Clear glass vials – 2mL with Teflon-lined screw cap

8.11 Disposable pipettes - Pasteur.

8.12 Volumetric flasks, Class A - 5mL, 10mL, 25mL, 50mL, and 100mL, 200mL, 250mL, and 1000mL with ground-glass stoppers.

8.13 Spatula - Stainless steel, wooden.

8.14 40 mL VOA Vials (actual volume = 42 mL)

9. REAGENTS AND STANDARDS

9.1 Organic-free reagent water, deionized (DI water may be boiled to further remove volatile contaminants).

9.2 Methanol, CH_3OH - Fisher Purge and Trap grade or equivalent, demonstrated to be free of analytes. Store apart from other solvents.

9.3 Stock solutions - Stock solutions are typically purchased as certified solutions (O_2Si or equivalent). Multiple stock standards can be combined (diluted) to yield one working standard. (Alternately, stock solutions may be prepared from pure standard materials in methanol, using assayed liquids or gases as appropriate- EPA method SW8260B, Revision 1, 1997 gives detailed instructions).

9.3.1 If a portion of stock standard is to be saved, transfer any remaining stock standard solution into a clear bottle with a Teflon lined screw-cap or crimp cap vial or mininert valves. Store, with minimal headspace, at manufacturers listed conditions and protect from light. This unused portion is only good for 6 months from the date that the ampule is opened.

9.4 Intermediate or working standards - Using stock standard solutions, prepare in purge and trap grade methanol working standards containing the compounds of interest, either singly or mixed together. Working standards must be stored with minimal headspace and should be checked frequently for signs of degradation or evaporation, especially just prior to preparing calibration standards from them. Fresh gas solutions should be prepared every week, unless a comparison to previous standards yield acceptable results. Internal standards and surrogate selection should be prepared every six months or sooner.

9.4.1 If multiple mixes are used, the expiration date for final solution **MUST NOT** exceed the earliest expiration date of any of the parents, or constituents.

9.5 Surrogate standards - The surrogates are listed in Table V. A working surrogate solution in methanol should be prepared at a concentration of 50ug/mL for water analyses.

9.6 Internal standards – The internal standards are listed in Table V. A working internal standard solution in methanol should be prepared at a concentration of 100ug/mL in methanol for all analyses.

9.7 The surrogate standard and internal standard may be combined into one mix for spiking samples if desired.

9.8 Calibration standards - Calibration standards at a minimum of five concentrations should be prepared from the secondary dilution standards, typically at 100ug/mL. Prepare these solutions in organic-free reagent water. One of the concentrations should be at the reporting limit. The remaining concentrations should correspond to the expected range of concentrations found in real samples but should not exceed the working range of the GC/MS system. Each standard should contain each analyte for detection by this method. Calibration standards must be prepared just prior to loading on the autosampler. The typical calibration levels are described in section 10.1.3.

10. CALIBRATION

10.1 Initial calibration for purge-and-trap procedure

10.1.1 Each GC/MS system must be hardware-tuned using perfluorotetrabutylamine (PFTBA) and must also meet the criteria in Table III for a 5-50ng injection of 4-bromofluorobenzene. Analyses must not begin until these criteria are met.

10.1.2 All standards, blanks, spikes, and samples must be analyzed using the same conditions. A set of at least five calibration standards containing the method analytes and surrogates is needed (six standards are necessary for quadratic curve fits). One calibration standard should contain each analyte at a concentration at or below the reporting limit for that compound; the other calibration standards should contain analytes at concentration that define the range of the method. To prepare a calibration standard, add an appropriate volume of standard solution to organic-free reagent water in a volumetric flask. Using a microsyringe, rapidly inject the standard into the expanded area of the filled volumetric flask. Remove the needle as quickly as possible after injection. Mix by inverting the flask three times. Transfer the standard to a 40 mL VOA vial and load into Autosampler.

10.1.3 The following is an example of standard preparation for an initial calibration. Standard preparation is determined by client and project requirements. Unless a reporting limit of 0.4ug/L is required, the low standard will typically be prepared at 1.0ug/L. A “soil” curve to reflect the chromatography conditions of medium level soils (1:50 ratio of MeOH:water) is prepared by adding 2mL of methanol into the calibration standards and reducing the volume of reagent water accordingly. Additional levels may be performed.

Working STD. Conc. (ug/mL)	Aliquot (uL)	Vol. of Reagent Water (mL)	Calibration STD Conc. (ug/L)*
100	0.4	100	0.4
100	1.0	100	1
100	4.0	100	4
100	20	100	20
100	50	100	50
100	100	100	100
100	200	100	200

* Some analytes are at higher concentrations; see COAs.

10.1.4 Tabulate the area response of the characteristic ions (see Table IV) against concentration for each compound and each internal standard (Table V). Calculate response factors (RF) for each compound relative to one of the internal standards. The internal standard selected for the calculation of the RF for a compound should be the internal standard that has a retention time closest to the compound being measured.

The RF is calculated as follows:

Equation 1

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

where:

A_x = Area of the characteristic ion for the compound being measured.
A_{is} = Area of the characteristic ion for the specific internal standard.

C_{is} = Concentration of the specific internal standard (mg/L).
C_x = Concentration of the compound being measured (mg/L).

10.1.5 The average RF must be calculated and evaluated for each compound.

10.1.6 A system performance check should be made before this calibration curve is used. Five compounds (System Performance Check Compounds, or SPCCs) are checked for a minimum average response factor. The minimum response factors for volatile SPCCs are as follows:

Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
Chlorobenzene	0.30
1,1,2,2-Tetrachloroethane	0.30

If the minimum response factors are not met, the system must be evaluated, and corrective action must be taken before sample analysis begins. Some possible problems are standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system.

10.1.7 Using the RFs from the initial calibration, calculate the percent relative standard deviation (%RSD) for Calibration Check Compounds (CCCs).

The percent RSD is calculated following Equation 2:

Equation 2

$$\% RSD = \frac{SD}{\overline{X}} x100$$

Where: **RSD** = Relative standard deviation.
SD = Standard deviation of average RFs for a compound
$\overline{X}$ = Mean of 5 initial RFs for a compound.

The standard deviation is calculated following Equation 3.

Equation 3

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(RF_1 - \overline{RF}\right)^2}{n-1}}$$

Where: $\mathbf{RF_1}$ = Each individual response factor
$\overline{\text{RF}}$ = Mean of the Response Factor
n = The total number of values

The % RSD for each individual analyte should be less than or equal to 15%. The %RSD for each individual CCC must be less than 30%. The **method-specified CCCs** are:

1,1-Dichloroethene	1,2-Dichloropropane
Chloroform	Toluene
Ethylbenzene	Vinyl Chloride
NOTE: Additional CCCs may be specified on a client and project-specific basis.	

10.1.8 When target analytes are >15% RSD, a linear regression (criteria of 0.995 or greater) or quadratic regression (criteria of 0.990 or greater, must have 6 points present) may be applied to achieve linearity.

10.1.9 Initial Calibration Verification (ICV): a second source standard must be analyzed following an initial calibration curve which contains all the analytes of interest. The spike level of the ICV should be near the midpoint level of the calibration curve. If the second source standard meets continuing calibration criteria, the initial calibration is verified. Analyst experience and professional judgment may be applied if these criteria are not met.

10.1.10 Surrogate Calibration

10.1.10.1 Surrogates are spiked into the sample utilizing the Archon. A single point calibration is employed for water analysis.

10.2 DAILY GC/MS CALIBRATION

10.2.1 Prior to the analysis of samples, purge 5-50ng of the 4-bromofluorobenzene (BFB) standard. The resultant mass spectra for the BFB must meet all of the criteria given in Table III before sample analysis begins. These criteria must be demonstrated every 12 hours during sample analysis.

10.2.2 The initial calibration curve for each compound of interest must be checked and verified once every 12 hours of analysis time. This is accomplished by analyzing a calibration verification standard near a midpoint level of calibration curve.

10.2.3 System Performance Check Compounds (SPCCs) - A system performance check must be made each 12 hours. If the SPCC criteria are met, a comparison of response factors is made for all compounds. This is the same check that is applied during the initial calibration. If the minimum response factors are not met, the system must be evaluated, and corrective action should be taken before sample analysis begins

10.2.3.1 Some possible problems are standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system.

10.2.4 Calibration Check Compounds (CCCs) - After the system performance check is met, CCCs are used to check the validity of the initial calibration. Calculate the percent difference using the following equation:

Equation 4

$$\%\,Difference = \frac{RF_1 - RF_c}{RF_1} x100$$

Where: **RF_1** = Average response factor from initial calibration.
RF_c = Response factor from current verification check standard.

If the percent difference for any non-CCC analyte is greater than 40%, the laboratory should consider this a warning limit. If the percent difference for each CCC is less than 20%, the initial calibration is assumed to be valid. If the criterion is not met (>20% difference), for any one CCC, corrective action should be taken. Problems similar to those listed under SPCCs could affect this criterion. If no source of the problem can be determined after corrective action has been taken, a new five-point calibration should be generated. This criterion should be met before quantitative sample analysis begins.

Alternate criteria may be applied on a client or program specific basis. Any requirements outlined in Quality Assurance Project Plans (QAPPs) will supersede these criteria.

10.2.5 If a CCV is evaluated using a sublist that does not include all the CCCs, CCC criteria applies to all the compounds in the list. If the CCCs are included and evaluated in the list, so long as the calibration passes any sublist may be processed per 10.2.4.

10.2.6 The internal standard responses and retention times in the check calibration standard must be evaluated as soon as possible after acquisition. If the retention time for any internal standard changes by more than 30 seconds or the response changes by a factor of two (-50% to +100%) from the mid-point of the initial calibration, the chromatographic system must be inspected for malfunctions and corrections must be made.

10.2.7 When changes are made, reanalysis of samples analyzed while the system was malfunctioning is necessary.

11. PROCEDURE

11.1 GC/MS ANALYSIS

11.1.1 Water samples/Leachate samples

11.1.1.1 Screening of the sample prior to purge-and-trap analysis will provide guidance on whether sample dilution is necessary and will prevent contamination of the purge-and-trap system. Screening can be accomplished by using a headspace GC PID or by analyzing the sample at a dilution by GC/MS. When available, historical data may be used to perform dilutions prior to analysis.

11.1.1.2 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

11.1.1.3 BFB tuning criteria and daily GC/MS calibration criteria must be met before analyzing samples. (See Table III).

11.1.1.3.1 The BFB and calibration verification standard may be combined into a single analysis as long as both tuning and calibration verification acceptance criteria for the project can be met without interferences.

11.1.1.4 Sample vials are loaded onto the autosampler. All leachate samples are analyzed at 1:10 based on action limits.

11.1.1.5 The following procedure is appropriate for diluting purgeable samples. All steps must be performed without delays until the diluted sample vial is sealed.

11.1.1.5.1 Dilutions may be made in volumetric flasks of various sizes. Select the volumetric flask that will allow for the necessary dilution. Intermediate dilutions may be necessary for extremely large dilutions. Calculate the approximate volume of organic-free reagent water to be added to the volumetric flask selected and add slightly less than this quantity of organic-free reagent water to the flask. See attachments I and II.

11.1.1.5.2 Inject the proper aliquot of sample into the flask. Dilute the sample to the mark with organic-free reagent water. Cap the flask and invert three times. Once sample dilution is completed, the pH of the un-diluted sample must be taken with pH paper. If the pH is greater than 2 the sample must be footnoted. Repeat above procedure for additional dilutions.

11.1.1.5.3 Fill the vial with diluted sample and load onto the autosampler.

11.1.1.6 For sample analysis: 1uL of a 50ug/mL surrogate spiking solution and 1uL of a 100ug/mL internal standard spiking solution are added to the 5mL sample aliquot by the autosampler. The addition of 1uL of each solution to 5mL of sample is equivalent to concentration of 10 ug /L of each surrogate and 20 ug/L for internal standard.

11.1.1.7 Analyze the samples using the same autosampler and GC conditions used to pass BFB, standard, and blank criteria.

11.1.1.8 If the initial analysis of sample or a dilution of the sample has a concentration of analytes that exceeds the initial calibration range, the sample must be reanalyzed at a higher dilution. When a sample is analyzed that has saturated ions from a compound, this analysis must be followed by a blank organic-free reagent water analysis. If the blank analysis is not free of interferences, the system must be decontaminated. Sample analysis may not resume until a blank can be analyzed that is free of interferences. Alternately, samples loaded on an autosampler can be accepted after a subsequent sample is shown to be free of carry-over contamination.

11.1.1.9 All samples must be thoroughly reviewed when sample concentrations exceed 50ug/L to ensure low-level carryover is not occurring into subsequent analyses.

11.1.1.10 For matrix spike analysis, add 8.4uL of a 100ug/mL matrix spike solution to the aqueous sample vial (42 mL actual volume). This is equivalent to a concentration of 20 ug/L of each matrix spike standard. Add the spiking solution through the septa of the vial as the vial should not be opened to maintain sample integrity.

11.1.1.11 All dilutions should keep the response of the major constituents (previously saturated peaks) in the upper calibration range for compounds which were previously over range.

11.1.1.12 Once sample analysis is completed, the pH of the sample must be taken pH paper and recorded in the instrument run logbook. If the pH is greater than 2 and the holding time is past 7 days, the sample will be footnoted accordingly. The report number must be documented in the instrument run log and the sample data footnoted.

11.1.2 Sediment/soil and waste samples - It is recommended that all samples of this type be screened prior to analysis. These samples may contain percent quantities of purgeable organics that will contaminate the purge-and trap system, and require extensive cleanup and instrument downtime. Use the screening data to determine whether to use the low-concentration method (0.004-0.2 mg/Kg) or the mid-concentration method (>0.2 mg/Kg).

11.1.2.1 Low-concentration method - This is designed for samples containing individual purgeable compounds of < 0.2mg/Kg. It is limited to sediment/soil samples and waste that is of a similar consistency (granular and porous). The low-concentration method is based on purging a heated sediment/soil sample mixed with organic-free reagent water containing the surrogate and internal standards. Analyze all blanks and standards under the same conditions as the samples.

11.1.2.1.1 A heated purge calibration curve must be prepared and used for the quantitation of all samples analyzed at the low-concentration method. Follow the initial and daily calibration instructions, except for the addition of 30 seconds of preheat at 40°C and purge temperature of 40°C.

11.1.2.1.2 Use a 5g sample if the expected concentration is less than 200µg/kg. Use a smaller weight if expected concentrations are >200µg/kg or <1000µg/kg. A 1.0g aliquot is the smallest allowed.

11.1.2.1.2.1 If 'closed system' method 5035 is requested, the sample vial is loaded onto the Archon autosampler. The autosampler will add 1uL of the surrogate and internal spiking solutions to the sample for a final concentration of 20ug/kg for internal standard and 10 ug/Kg for internal standard (wet weight).

11.1.2.1.3 When a sample arrives and low level analysis is required (non-5035), a 5 gram aliquot of sample is weighed directly into a tared sample vial. Note and record the weight to the nearest 0.1 g. Add 5 mL deionized water to the vial and a stir bar The sample is then loaded onto autosampler.

11.1.2.1.4 Heat the sample to 40° C and purge the sample for 9 minutes.

11.1.2.1.5 If saturated peaks occurred or would occur if a 1g sample were analyzed, the mid concentration method must be followed.

11.1.2.1.6 Use 5mL of the same organic-free reagent water with 5gms of clean sand for the method blank and a stir bar.

11.1.2.1.7 For the LCS/D, add 5.0mL of the 20ug/L calibration standard to 5gm clean sand sample. The concentration is equivalent to 20ug/Kg for the majority of analytes.

11.1.2.2 Mid-concentration method - A sample is either extracted or diluted with methanol, depending on its solubility. An aliquot of the extract, with surrogates added during the extraction, is added to organic-free reagent water containing internal standards. This is purged at ambient temperature. All samples with an expected concentration of > 1.0mg/Kg should be analyzed by this method.

NOTE: The following steps must be performed rapidly and without interruption to avoid loss of volatile organics. These steps must be performed in a laboratory free from solvent fumes.

11.1.2.2.1 To prepare the laboratory method blank, laboratory control sample and duplicate weigh out 10 grams of Ottawa sand and add 10mL of methanol to a 40 mL VOA vial (42 mL actual volume). They should be uniquely labeled by QC batch numbers to ensure they are analyzed with the correct batch of samples. Add 10 uL of the 2500ug/mL surrogate standard to the method blank, LCS, and LCSD. The LCS/LCSD are also spiked with the 100 uL of 100ug/mL of the matrix spiking standard to achieve a final contration of 20 ug/mL after the 1:50 dilution.

11.1.2.2.2 To prepare the matrix spike and matrix spike duplicate, weigh the vial and record the weight to the nearest 0.1g. Subtract the vial weight prior to sampling and record the final weight. If the weight is greater than the expected 5g, 10g, or 25g weight, the addition of methanol is necessary in order to maintain the 1:1 sample to solvent ratio. Add the appropriate amount of 2500 ug/mL surrogate standard and 100 ug/mL of the matrix spiking standard to achieve a final concentration of 20 ug/mL after the 1:50 dilution. If insufficient sample volume was received to prepare the MS/MSD, the project must be footnoted and the project manager must be notified.

11.1.2.2.3 To prepare samples that arrive preserved in methanol, weigh the vial and record to the nearest 0.1g. Subtract the vial weight prior to sampling and record the final weight. If the weight is greater than the expected 5g, 10g, or 25g weight, the addition of methanol is necessary in order to maintain the 1:1 sample to solvent ratio. If the weight is less than expected 5g, 10g or 25g weight, record the difference and apply a dilution factor. Add the appropriate amount of 2500 ug/mL surrogate standard to achieve a final concentration of 50 ug/mL after the 1:1 dilution. If the weight is less than expected 5g, 10g, or 25g weight, spike 5 uL, 10uL, or 25 uL of the 2000 ug/mL surrogate standard, respectively.

11.1.2.2.4 To prepare samples that are not preserved in methanol, the sample consists of entire contents of sample container. Mix the contents of the sample container with a narrow spatula, including any supernatant liquids. Using a top-loading balance, weigh 10 grams (wet weight) of the sample into a tared 40 mL vial (for waste samples use 1 gram). Record the weight to 0.1g. Quickly add 10 mL of methanol and 10 uL of 2500 ug/mL surrogate standard to achieve a final concentration of 50 ug/mL after the 1:50 dilution. Samples not preserved within 48 hours must be appropriately footnoted.

11.1.2.2.5 The LCS/LCSD, MS/MSD, method blank, and all associated samples within the batch must be shaken for two minutes, then sonicated for 20 minutes. After sonicating, prepare the samples by adding 1000 uL of the methanol extract to a 50 mL volumetric flask containing DI water. Dilute to a final volume of 1:50 using DI water. Fill a 40 mL VOA vial with the prepared sample for analysis.

11.1.2.2.6 The following procedure is appropriate for diluting purgeable samples. All steps must be performed without delays until the diluted sample vial is sealed.

11.1.2.2.6.1 Dilutions may be made in volumetric flasks of various sizes. Select the volumetric flask that will allow for the necessary dilution. Intermediate dilutions may be necessary for extremely large dilutions.

11.1.2.2.6.2 Calculate the approximate volume of organic-free reagent water to be added to the volumetric flask selected and add slightly less than this quantity of organic-free reagent water to the flask. See attachment III for common dilution factors.

11.1.2.2.6.3 Inject the proper aliquot of sample extract into the flask and the proper amount of P&T methanol, so that the same amount of methanol is added to all samples and QC. Dilute the sample to the mark with organic-free reagent water. Cap the flask and invert three times.

11.1.2.2.7 The extracts must be stored at <6°C.

11.2 DATA INTERPRETATION

11.2.1 Qualitative Analysis: An analyte is identified by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference should be obtained on the user's GC/MS. These standard reference spectra may be obtained through analysis of the calibration standards. Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC relative retention time (RRT) as those of the standard component, and (2) correspondence of the sample component and the standard component mass spectrum.

11.2.1.1 The sample component RRT must compare within ± 0.06 RRT units of the RRT of the standard component. For reference, the standard must be run within the same 12 hours as the sample. If co-elution of interfering components prohibits accurate assignment of the sample component RRT from the total ion chromatogram, the RRT should be assigned by using extracted ion current profiles for ions unique to the component of interest

11.2.1.1.1 All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) must be present in the sample spectrum. (2) The relative intensities of ions specified in (1) must agree within ± 30% between the standard and sample spectra. Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80 percent.

11.2.2 For samples containing components not associated with the calibration standards, a library search using the most recent NIST/EPA Library may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the type of analyses being conducted. Guidelines for making tentative identification are:

11.2.2.1 Relative intensities of major ions in the reference spectrum (ions > 10% of the most abundant ion) should be present in the sample spectrum.

11.2.2.2 The relative intensities of the major ions should agree within ± 20%.

11.2.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.2.2.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

11.2.2.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the sample spectrum because of background contamination or coeluting peaks. Data system library reduction programs can sometimes create these discrepancies.

11.2.2.6 Computer generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual comparison of sample with the nearest library searches will the mass spectral interpretation specialist assign a tentative identification.

11.2.3 Quantitative Analysis: When a compound has been identified, the quantitation of that compound will be based on the integrated abundance from the EICP of the primary characteristic ion. Quantitation will take place using the internal standard technique. The internal standard used should be the one nearest the retention time of that of a given analyte or as specified in the method.

Calculate the concentration of each identified analyte in the sample as follows:

Water and Water-Miscible Waste: Equation 6

$$Concentration(mg / L) = \frac{(A_x)(I_s)}{(A_{is})(RRF)(V_o)}$$

Where:
A_x = Area of characteristic ion for compound being measured.
I_s = Amount of internal standard injected (mg/L).
A_{is} = Area of characteristic ion for the internal standard.
RRF = Average Relative Response factor for compound being measured.
V_o = Volume of water purged (mL), taking into consideration any dilutions made.

Sediment/Soil, Sludge, and Waste:

Equation 7

$$High\ Conc.\ (ug / kg) = \frac{(A_x)(I_s)(V_t)}{(A_{is})(RRF)(V_i)(W_s)}$$

Equation 8

$$Low\ Conc.\ (ug / kg) = \frac{(A_x)(I_s)}{(A_{is})(RRF)(W_s)}$$

Where:
A_x, I_s, A_{is}, RRF = Same as in water and water-miscible waste above.
V_t = Volume of total extract (mL) (use 10,000mL of a factor or this when dilutions are made).
V_i = Volume of extract added (mL) for purging.
W_s = Weight of sample extracted or purged (g). The wet weight or dry weight may be used, depending upon the specific applications of the data.

S_v = Volume of diluted extract.

11.2.3.1 Sediment/soil samples are generally reported on a dry weight basis, while sludges and wastes are reported on a wet weight basis. The percent dry weight of the sample should be reported along with the data in either instance.

11.2.3.2 When applicable, an estimate of concentration for noncalibrated components in the sample can be made. The formula given above should be used with the following modifications: The areas A_x and A_{is} should be from the total ion chromatograms, and the RF for the compound should be assumed to be 1. The concentration obtained should be reported indicating (1) that the value is an estimate and (2) which internal standard was used to determine concentrations. Use the nearest internal standard free of interferences.

12. QUALITY CONTROL

12.1 Required instrument QC is found in the following sections:

12.1.1 The GC/MS system must be tuned to meet the BFB specifications listed in Table III.

12.1.1.1 There must be an initial calibration of the GC/MS system as specified in Section 11.1.

12.1.1.2 The GC/MS system must meet the SPCC criteria specified in Section 11 and the CCC criteria in Section 11, each 12 hours.

12.2 Method Blank, which is free of contamination. If contamination exists in the system, all samples must be reanalyzed. If there is insufficient sample volume to reanalyze, all subsequent samples reporting a positive identification for that analyte must be footnoted with a **B-flag** to indicate the method blank contamination. Exception would be if all associated samples are non-detect for contamination.

12.3 Laboratory Control Sample (LCS), which is within internally generated limits. Limits are generated on an annual basis at a minimum. All outliers must be footnoted on the final report and clearly outlined on the data review checklist (see MN-L-132, Data Review, Validation, and Reporting).

12.4 Surrogate

12.4.1 For aqueous and soil matrices, surrogate recoveries should be compared with the internally generated control limits.

12.4.2 If recovery is not within limits, the following procedures are required.

12.4.2.1 Check to be sure that there are no errors in the calculations, surrogate solutions or internal standards. If errors are found, recalculate the data accordingly.

12.4.2.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and re-analyze the sample.

12.4.2.3 If no problem is found, re-analyze the sample.

12.4.2.4 If, upon re-analysis, the recovery is again not within limits, report the initial run and footnote appropriately. If the recovery is now within limits, report the second run (if within holding time).

12.4.2.5 At a minimum the laboratory will update surrogate recovery limits on a matrix-by-matrix basis, annually.

12.5 Matrix Spike samples (MS/MSD) are analyzed with every batch 20 samples if there is sufficient sample volume. The percent recoveries are compared to internal generated limits. If there is an outlier, the corresponding laboratory control spikes must be evaluated. If the same outlier occurs in the LCS, a system problem may be assumed. In this instance, samples may have to be reanalyzed. If the LCS reports an acceptable recovery, matrix interferences are assumed. In either instance, the data on the final report must be footnoted with the outliers and possible reason if known.

12.5.1 Matrix spikes will be performed when more than three containers (except soil received in packed jars) have been received to ensure that sufficient sample remains for any re-analysis (i.e., dilutions, instrument problems). An MS and DUP will be analyzed if insufficient sample is received.

12.6 Internal standards should be monitored against the internal standard responses and retention times from the daily continuing calibration verification. If the retention time for any internal standard changes by more than 30 seconds and the responses changes by a factor of two (-50% to +100%), the chromatographic system should be inspected for malfunctions and corrections should be made. If, in the interpretation of an experienced analyst, an outlier is due to matrix or other contributing issue, data may be utilized.

12.6.1 Internal standard recoveries out low (high bias) – if compounds associated with the internal standard(s) that are outside the control limits are non-detect, the sample can be reported without re-analysis, however, if the outlier is not indicative of a system drift (i.e. If only one sample has internal standard drift, which is dissimilar from other samples around the injection time), re-analysis should be performed to rule out matrix effects.

12.6.2 Internal standard recoveries out high (low bais) – re-analysis should be performed assuming there is sufficient sample volume remaining. Appropriate footnoting practices are also observed

13. METHOD PERFORMANCE

13.1 There are several requirements that must be met to insure that this procedure generates accurate and reliable data. A general outline of requirements has been summarized below. Further specifications may be found in the Laboratory Quality Manual.

13.1.1 The analyst must read and understand this procedure with written documentation maintained in his/her training file. Documentation is maintained in the Quality office.

13.1.2 An initial demonstration of capability (IDC) must be performed per SOP All-Q-020, or equivalent replacement. A record of the IDC will be maintained in his/her file with written authorization from the Laboratory Manager and Quality Manager. Results are filed in the Quality office

13.1.3 A method detection limit (MDL) study will be completed for this method every 12 months or whenever there is a major change in personnel or equipment per SOP All-Q-004, or equivalent replacement. Results are filed in the Quality office.

13.1.4 Periodic proficiency testing (PT) samples are analyzed to demonstrate continuing competence per SOP All-Q-010, or equivalent replacement. Results are filed in the Quality office.

14. POLLUTION PREVENTION AND WASTE MANAGEMENT

14.1 The quantity of chemicals purchased is based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes reflect anticipated usage and reagent stability.

14.2 Excess reagents, samples and method process wastes are characterized and disposed of in an acceptable manner. For further information on waste management, refer to SOP ALL-S-002.

15. REFERENCES

15.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update III, Method 8260B.

15.2 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update III, Method 5035.

15.3 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update III, Method 5030A.

15.4 All PACE SOP references are to the current issue of the document available at the time this procedure was prepared. As these departments are revised, they will supersede the reference documents. The requirements of the most current approved copy shall be implemented for compliance with the requirements of this procedure.

16. TABLES, DIAGRAMS, ETC.

16.1 Table I, Method 8260B Target Analyte List

16.2 Table II, 8260B Practical Reporting Limits with EPIC Procedure

16.3 Table III, BFB Key Ions and Ion Abundance Criteria

16.4 Table IV, Characteristic masses (m/z) for Purgeables

16.5 Table V, Characteristic Ions for System Monitoring Compounds and Internal Standards

16.6 Table VI, Characteristic Ions for TCLP Target Compounds

16.7 Table VII, Analytes, Quantitation Limits and Regulatory Levels

16.8 Table VIII, Method 465f Target List

16.9 Attachment I: Common Dilution Factors for Water Samples

16.10 Attachment II: Common Dilution Factors for TCLP Samples

16.11 Attachment III: Common Dilution Factors for Soil Samples

17. REVISIONS

Revision Number	Reason for Change	Date
MN-O-521-rev.9	1. Reformatted for consistency. 2. Omitted definitions and added reference to definitions SOP. 3. Deleted “one gram of sodium bisulfate” in section 8.2.1. 4. Section 8.5 adds samples can be frozen from -10 to -20 degrees C until analysis. 5. Surrogate and internal standards are prepared at a concentration of 100ug/mL. 6. PFTBA and BFB standards are a 20ng injection. 7. Section 12.1.1.12 Once sample analysis is complete….sample will be footnoted accordingly. 8. Precept II changed to Archon autosampler. 9. Table II: removed mid level 4 gram soil/10 ml Methanol PRLs.	10/25/2004
MN-O-521-rev.10	1. General comment: changed PQLs throughout document to PRLs. 2. Section 7: revised/condensed responsibilities and added in Volatiles Manager. Also changed ‘biennial’ to ‘annual’ review and changed ‘QA Office’ to ‘Quality Manager’ where appropriate. 3. Added sentence to section 8.1.2 and deleted section 8.1.3. 4. Added sentence to new section 8.1.4 about commenting improperly preserved samples. 5. Added sentence to new section 8.1.3 about measuring pH in VOA samples. 6. Added sentence to section 8.4.1 to address use of Tedlar bags. 7. Section 8.4.2: holding time begins at the end of TCLP prep not at the beginning. 8. Deleted section 10.9 (repetitive). 9. Section 11.1.2: added sentence about quadratic requiring six standards. 10. Reworded old sections 11.1.7 and section 11.1.9 for clarity and moved old section 11.1.7 (ICV) to the end of the section. 11. Sections 12.1.1.10 and 12.1.2.5.4: removed reference to 42mL. 12. Section 12.1.2.1.2: changed 3 minutes to 30 seconds to reflect current practice; then switched 12.1.2.1.1 and 12.1.2.1.2 (calibration before samples). 13. New section 12.1.2.1.4: changed 11 minutes to 9 minutes to reflect current practice. 14. Removed sections at end of 12.1.2.1 (repetitive) 15. Section 12.1.2.2.1: reworded section to clarify insoluble waste sample weight. 16. Section 13.2.4.4: added language for clarity. 17. Table II: removed EPIC references. 18. Added section 4.4 (holding blanks). 19. Reworded section 10.3 and 10.4 (standard expiration dates) for clarity and method and BP compliance. 20. Added wording to sections 12.1.2.5.3 and 12.1.2.5.4 for clarity and for method compliance.	6/27/2006
MN-O-521-Rev.11	Made corrections to 2.3, 4.2, 8.1.1, 8.2.6, 9.12, 10.3.1, 10.4, 11.2.2, 12.1.1.5.3, 12.1.1.11 Complete change to 12.1.2.2 Addition of 10 level of ical.	03Nov2006
S-MN-O-521-Rev.12	Updated formatting on first page. Added single point calibration of surrogate to 11.1.10. Added attachments I , I, and III Added step for shaking soil samples prior to sonication to section 12. Clarified 12.1.2.2.6 to read that additional methanol must be added when samples are diluted.	05Dec2007

	Updated reporting limits for methylene chloride and bromoform Removed Tert-amethyl ether and ethyl-tert-butyl-ether from Table I. Reworded sections 12.1.1.5, 12.1.2.1.7,and 12.1.2.2.6. Changed all references to 20ng of BFB to -50ng. Changed reporting limit of vinyl chloride to 0.4, m&p Xylene and allyl chloride to 2.0, 2Methylnaphthalene, acrolein, and acrylonitrile to 5.0.	
S-MN-O-521-Rev.13	12.6.1 and 12.6.2 Internal Standard Corrective Action added	21Jul2008
S-MN-O-521 Rev.14	Added to Internal Standards to Table V	19Sep2008
S-MN-O-521-Rev.15	Updated RLs Updated Mblk info Updated standard concentrations throughout document	20Oct2008
S-MN-O-521-Rev.16	Added CCV criteria for short list of analytes to 10.2.5 Added LL soil weight criteria to 7.2.1	30Dec2008
S-MN-O-521-Rev.17	Added BFB and CCV combining to 11.1.1.3.1 Removed “Be sure trap temperatue is 30-35 C in 11.1.2.1.4 Added 5 uL syringe to 8..7 Added additional working standard info to 9.4 Corrected calibration levels in 11.1.2 and 11.1.2.1	02Feb2009

TABLE I
Method 8260B Target Analyte List

Analyte	CAS Number	Analyte	CAS Number
Isopropyl benzene (Cumene)	98-82-8	1,1-Dichloroethene	75-35-4
Bromochloromethane	74-97-5	Acetone	67-64-1
Bromobenzene	108-86-1	Methylene Chloride	75-09-2
n-Butylbenzene	104-51-8	trans-1,2-Dichloroethene	156-60-5
n-Propylbenzene	103-65-1	1,1-Dichloroethane	75-34-3
2-Chlorotoluene	95-49-8	Vinyl Acetate	108-05-4
1,3,5-Trimethylbenzene	108-67-8	2-Butanone	78-93-3
4-Chlorotoluene	106-43-4	cis-1,2-Dichloroethene	156-59-2
tert-Butylbenzene	98-06-6	2,2-Dichloropropane	590-20-7
1,2,4-Trimethylbenzene	95-63-6	Dichlorofluoromethane	75-43-4
sec-Butylbenzene	135-98-8	Chloroform	67-66-3
p-Isopropyltoluene	99-878-6	1,1,1-Trichloroethane	71-55-6
Hexachlorobutadiene	87-68-3	1,1-Dichloropropene	563-58-6
Dichlorodifluoromethane	75-71-8	Carbon Tetrachloride	56-23-5
Chloromethane	74-87-3	1,2-Dichloroethane	107-06-2
Vinyl Chloride	75-01-4	Benzene	71-43-2
Bromomethane	74-83-9	Trichloroethene	79-01-6
Chloroethane	75-00-3	Dibromomethane	74-95-3
Trichlorofluoromethane	75-69-4	Bromodichloromethane	75-27-4
1,1,2-Trichloroethane	79-00-5	cis-1,3-Dichloropropene	10061-01-5
1,3-Dichloropropane	142-28-9	4-Methyl-2-pentanone	108-10-1
Tetrachloroethene	127-18-4	Toluene	108-88-3
2-Hexanone	591-78-6	trans-1,3-Dichloropropene	10061-02-6
Dibromochloromethane	124-48-1	1,2-Dichloropropane	78-87-5
1,2-Dibromoethane	106-93-4	Bromoform	75-25-2
Chlorobenzene	108-90-7	1,1,2,2-Tetrachloroethane	79-34-5
1,1,1,2-Tetrachloroethane	630-26-6	1,2,3-Trichloropropane	96-18-4
Ethylbenzene	100-41-4	1,3-Dichlorobenzene	541-73-1

TABLE I (Continued)
Method 8260B Target Analyte List

Analyte	CAS Number	Analyte	CAS Number
Acetonitrile	75-05-8	Iodomethane	74-88-4
Methyl Methacrylate	80-62-6	Trans-1,4-Dichloro-2-butene	110-57-6
2-Methylnaphthalene	91-57-6	Ethyl Methacrylate	97-63-2
Chloroprene	126-99-8	1,4-Dioxane	123-91-1
Propionitrile	107-12-0	Trichlorotrifluoroethane	76-13-1
Ethanol	64-17-5	Methacrylonitrile	126-98-7
Cyclohexane	110-82-7	Xylene (total)	1330-20-7
m,p-Xylene	106-42-3	Cis-1,4-Dichloro-2-butene	1476-11-5
o-Xylene	95-47-6	1-Methylnaphthalene	90-12-0
Styrene	100-42-5	1,4-Dichlorobenzene	106-46-7
Methyl-tert-butyl Ether	1634-04-4	1,2-Dichlorobenzene	95-50-1
Naphthalene	91-20-3	1,2-Dibromo-3-chloropropane	96-12-8
1,2,4 Trichlorobenzene	120-87-1	Tetrahydrofuran	109-99-9
Acrolein	107-2-8	1,2,3 Trichlorobenzene	87-61-6
Diethyl Ether	69-29-7	Carbon Disulfide	75-15-0
Cyclohexanone	108-94-1	Acrylonitrile	107-13-1
n-Butanol	71-36-3	Allyl Chloride	107-05-1
4-Methyl-2-pentanol	108-11-2	2-Chloroethylvinyl Ether	110-75-8
2-Propanol	67-63-0	Ethyl Acetate	141-78-6
2-Nitropropane	79-46-9	Diisopropyl ether	108-20-3
3-Pentanone	96-22-0	Isobutanol	78-83-1
Ethyl acrylate	140-88-5	2-Methyl-2-propanol (TBA)	75-65-0
		Sec-Butyl alcohol	15892-23-6

TABLE II
Pace Reporting Limits (PRL)
For Volatile Organic Compounds

Analyte	Waters (ug/L)	Low-Level Soils (ug/kg)	Medium Level Soils (ug/kg)*
Dichlorodifluoromethane	1	10	200
Chloromethane	1	10	200
Vinyl Chloride	0.4	10	50
Bromomethane	4	10	500
Chloroethane	1	10	200
Trichlorofluoromethane	1	10	200
1,1-Dichloroethene	1	5	200
Methylene Chloride	4	5	200
trans-1,2-Dichloroethene	1	5	200
1,1-Dichloroethane	1	5	200
2,2-Dichloropropane	1	5	200
cis-1,2-Dichloroethene	1	5	200
Chloroform	1	5	200
Bromochloromethane	1	5	200
1,1,1-Trichloroethane	1	5	200
Carbon Tetrachloride	1	5	200
1,1-Dichloropropene	1	5	200
Benzene	1	5	50
1,2-Dichloroethane	1	5	200
Trichloroethene	1	5	200
1,2-Dichloropropane	1	5	200
Bromodichloromethane	4	5	200
Dibromomethane	4	5	200
trans-1,3-Dichloropropene	4	5	200
Toluene	1	5	50
cis-1,3-Dichloropropene	1	5	200
1,1,2-Trichloroethane	4	5	200
1,2-Dibromoethane	1	5	200

*Reporting limit for a 25g/10g soil preserved with 25mL/10mL methanol

TABLE II (Continued)
Pace Reporting Limits (PRL)

For Volatile Organic Compounds

Analyte	Waters (ug/L)	Low-Level Soils (ug/kg)	Medium Level Soils (ug/kg)*
Tetrachloroethene	1	5	200
1,3-Dichloropropane	1	5	200
Dibromochloromethane	1	5	200
Chlorobenzene	1	5	200
1,1,1,2-Tetrachloroethane	1	5	200
Ethylbenzene	1	5	50
m,p-Xylene	2	10	100
o-Xylene	1	5	50
Styrene	1	5	200
Bromoform	8	5	400
Isopropyl benzene (Cumene)	1	5	200
1,1,2,2-Tetrachloroethane	1	5	200
Bromobenzene	1	5	200
1,2,3-Trichloropropane	1	5	200
n-Propylbenzene	1	5	200
2-Chlorotoluene	1	5	200
1,3,5-Trimethylbenzene	1	5	200
4-Chlorotoluene	1	5	200
tert-Butylbenzene	1	5	200
1,2,4-Trimethylbenzene	1	5	200
sec-Butylbenzene	1	5	200
p-Isopropyltoluene	1	5	200
1,3-Dichlorobenzene	1	5	200
1,4-Dichlorobenzene	1	5	200
n-Butylbenzene	1	5	200
1,2-Dichlorobenzene	1	5	200
1,2-Dibromo-3-chloropropane	4	10	200
Hexachlorobutadiene	4	5	200
Naphthalene	4	5	200
2-Methylnaphthalene	5	25	200
Acetonitrile	40	NA	200
Iodomethane	4	5	200
Methyl Methacrylate	1	NA	200
Ethyl Methacrylate	4	NA	200
1,.4-Dioxane	80	200	4000
Chloroprene	1	NA	200

*Reporting limit for a 25g/10g soil preserved with 25mL/10mL methanol

TABLE II (Continued)
Pace Reporting Limits (PRL)
For Volatile Organic Compounds

Analyte	Waters (ug/L)	Low-Level Soils (ug/kg)	Medium Level Soils (ug/kg)*
Acetone	10	25	500
2-Butanone	4	25	500
Methyl-tert-butyl Ether	1	5	200
Trichlorotrifluoroethane	1	5	200
2-Hexanone	4	25	500
4-Methyl-2-Pentanone	4	25	500
1,2,3-Trichlorobenzene	1	5	200
1,2,4-Trichlorobenzene	1	5	200
Carbon Disulfide	1	5	200
Allyl Chloride	4	50	200
Acrolein	40	50	2000
Acrylonitrile	10	50	2000
2-Chloroethyl Vinyl Ether	10	25	500
Diethyl Ether	4	50	500
Isobutanol	400	NA	NA
Tetrahydrofuran	10	50	2000
Vinyl Acetate	20	50	200
Methacrylonitrile	40	NA	NA
Propionitrile	40	NA	NA
Xylene (total)	3	15	150
Ethanol	400	NA	NA
Cis-1,4-Dichloro-2-butene	4	NA	NA
Trans1,4Dichloro-2-butene	4	25	500
Cyclohexane	4	5	200
Dichlorofluoromethane	1	5	200
Ethyl acetate	4	NA	NA
2-Propanol	40	NA	NA
2-Nitropropane	10	NA	NA
n-Butanol	1	NA	NA
4-Methyl-2-pentanol	40	NA	NA
Diisopropyl ether	4	NA	NA
2-Methyl-2-propanol (TBA)	40	NA	NA
3-Pentanone	4	NA	NA
Sec-Butyl alcohol	40	NA	NA
Ethyl Acrylate	4	NA	NA

*Reporting limit for a 25g/10g soil preserved with 25mL/10mL methanol

TABLE III
BFB Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
95	Base Peak, 100% relative abundance
50	15.00 - 40.00% of mass 95
75	30.00 - 60.00% of mass 95
96	5.00 - 9.00% of mass 95
173	Less than 2.00% of mass 174
174	Greater than 50.00% of mass 95
175	5.00 - 9.00% of mass 174
176	>95.00 and < 101.00% of mass 174
177	5.00 - 9.00% of mass 176

Note: All ion abundance must be normalized to m/z 95, the nominal base peak, even though the ion abundance of m/z 174 may be up to 120 percent.

TABLE IV
Characteristic Masses (M/Z) For Purgeable Organic Compounds

Analyte	Primary Ion	Secondary Ion(s)
Dichlorodifluoromethane	85	87
Chloromethane	50	52
Vinyl Chloride	62	64
Bromomethane	94	96
Chloroethane	64	66
Trichlorofluoromethane	101	103
1,1-Dichloroethene	96	61, 63
Methylene Chloride	84	86, 49
trans-1,2-Dichloroethene	96	61, 98
1,1-Dichloroethane	63	65, 83
2,2-Dichloropropane	77	97
cis-1,2-Dichloroethene	96	61, 98
Chloroform	83	85
Bromochloromethane	128	49, 130
1,1,1-Trichloroethane	97	99, 61
Carbon Tetrachloride	117	119
1,1-Dichloropropene	75	110, 77
Benzene	78	
1,2-Dichloroethane	62	98
Trichloroethene	95	130, 132

TABLE IV (Continued)
Characteristic Masses (M/Z) For Purgeable Organic Compounds

Analyte	Primary Ion	Secondary Ion(s)
1,2-Dichloropropane	63	
Bromodichloromethane	83	85, 127
Dibromomethane	93	95, 174
trans-1,3-Dichloropropene	75	110
Toluene	92	91
cis-1,3-Dichloropropene	75	110
1,1,2-Trichloroethane	83	97, 85
1,2-Dibromoethane	107	109, 188
Diethyl Ether	74	45, 59
1,1,2-Trichlorotrifluoroethane	151	101
Acetone	58	43
Allyl Chloride	76	41, 39
2-Hexanone *	43	58,41
Acrolein	56	55,58
Vinyl Acetate	43	
Methyl-tert-butyl Ether	73	57
Dichlorofluoromethane	67	69
Xylene (total)	106	91
2-Butanone *	43	72
Tetrahydrofuran	42	41, 72
4-Methyl-2-Pentanone *	43	58
Tetrachloroethene	166	168, 129
1,3-Dichloropropane	76	78
Dibromochloromethane	129	127
Chlorobenzene	112	77, 114
1,1,1,2-Tetrachloroethane	131	133, 119
Ethylbenzene	91	106
m,p-Xylene	106	91
o-Xylene	106	91
Styrene	104	78
Bromoform	173	175
Isopropyl benzene	105	120
1,1,2,2-Tetrachloroethane	83	131, 85
Bromobenzene	156	77, 158
1,2,3-Trichloropropane	75	77
n-Propylbenzene	91	120
2-Chlorotoluene	91	126
1,3,5-Trimethylbenzene	105	120
4-Chlorotoluene	91	126
tert-Butylbenzene	119	91, 134
1,2,4-Trimethylbenzene	105	120

TABLE IV (Continued)
Characteristic Masses (M/Z) For Purgeable Organic Compounds

Analyte	Primary Ion	Secondary Ion(s)
Carbon Disulfide	76	78
Acrylonitrile	53	52,51
Isobutanol	43	41,42
Methacrylonitrile	41	39,52
Propionitrile	54	55,52
Ethanol	45	46
Cis-1,4-Dichloro-2-butene	75	77,53
Trans-1,4-Dichloro-2-butene	53	88,75
Cyclohexane	56	84,41
sec-Butylbenzene	105	134
p-Isopropyltoluene	119	134, 91
1,3-Dichlorobenzene	146	111, 148
1,4-Dichlorobenzene	146	111, 148
n-Butylbenzene	91	92, 134
1,2-Dichlorobenzene	146	111, 148
1,2-Dibromo-3-chloropropane	75	155, 157
Hexachlorobutadiene	225	227
2-Chloroethylvinyl Ether	63	106
1,2,4 Trichlorobenzene	180	182, 145
Naphthalene	128	
1,2,3 Trichlorobenzene	180	182, 145
2-Methylnaphthalene	142	141
Acetonitrile	41	40,39
Iodomethane	142	127
Methyl Methacrylate	69	41,100
Ethyl Methacrylate	69	41,99
Chloroprene	53	88,90
1,4-Dioxane	88	43,58
Ethyl acetate	43	61,70
2-Propanol	45	43
2-Nitropropane	43	41,39
Cyclohexanone	55	98,42
n-Butanol	56	41,43
4-Methyl-2-pentanol	45	69,87
Diisopropyl ether	45	69,87
2-Methyl-2-propanol (TBA)	59	41
3-Pentanone	57	86
Sec-Butyl alcohol	45	59
Ethyl acrylate	55	56

Note: Due to low area counts for the primary ions for analytes, Acetone, 2-Butanone and 4-Methyl-2-Pentanone, Mass 43 is used as the quantitation ion.. The qualifying ions are Mass 58 for Acetone, Mass 72 for 2-Butanone and Mass 58 for 4-Methyl-2-Pentanone

TABLE V
Characteristic Ions For System Monitoring Compounds And Internal Standards For Volatile Organic Compounds

Compound	*CAS Number*	*Primary Ion*	*Secondary Ion(s)*
Surrogate			
4-Bromofluorobenzene	4600-00-4	95	
Dibromofluoromethane (optional)	1868-53-7	113	
1,2-Dichloroethane-d_4	17060-07-0	65	67, 51
Toluene-d_8	2037-26-5	98	100, 41
Internal Standards			
Chlorobenzene-d_5	3114-55-4	117	
1,4-Dichlorobenzene-d_4	3855-82-1	152	
1,4-Diflurobenezene	540-36-3	114	
Pentafluorobenzene	363-72-4	168	

TABLE VI
CHARACTERISTIC IONS FOR TCLP TARGET COMPOUNDS

Parameter	Primary Ion	Secondary Ions
Vinyl chloride	62	64
1,1-Dichloroethene	96	61, 98
Chloroform	83	85
1,2–Dichloroethene	62	64, 100, 98
2-Butanone	72	57
Carbon tetrachloride	117	119, 121
Trichloroethene	130	95, 97, 132
Benzene	78	-
Tetrachloroethene	164	129, 131, 166
Chlorobenzene	112	114

*** The primary ion should be used unless interferences are present, in which case, a secondary ion may be used.**

TABLE VII
ANALYTES, QUANTITATION LIMITS AND REGULATORY LEVELS FOR TCLP COMPOUNDS

Parameter	CAS Number	Quantitation Limit (ug/L)	Regulatory Level, ug/L
Vinyl chloride	75-01-4	50	200
1,1-Dichloroethene	75-35-4	50	700
Chloroform	67-66-3	50	6,000
1,2-Dichloroethane	107-06-2	50	500
2-Butanone	78-93-3	250	200,000
Carbon tetrachloride	56-23-5	50	500
Trichloroethene	79-01-6	50	500
Benzene	71-43-2	50	500
Tetrachloroethene	127-18-4	50	700
Chlorobenzene	108-90-7	50	100,000

TABLE VIII
MN DOH VOA TARGET LIST

ANALYTE NAME	ANALYTE NAME
1,1-Dichloroethane	1,1-Dichloroethene
1,1-Dichloropropene	1,1,1-Trichloroethane
1,1,1,2-Tetrachloroethane	1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane	1,1,2-Trichlorotrifluoroethane
1,2-Dichlorobenzene	1,2-Dichloroethane
1,2-Dichloropropane	1,2,3-Trichlorobenzene
1,2,3-Trichloropropane	1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene	1,3-Dichlorobenzene
1,3-Dichloropropane	1,3,5-Trimethylbenzene
1,4-Dichlorobenzene	2,2-Dichloropropane
2-Chlorotoluene	4-Chlorotoluene
Acetone	Allyl chloride
Bromochloromethane	Benzene
Bromobenzene	Bromoform
Bromomethane	Cis-1,2-Dichloroethene
Cis-1,3-Dichloropropene	Carbon Tetrachloride
Chlorodibromomethane	Chlorobenzene
Chloroethane	Chloroform
Chloromethane	1,2-Dibromo-3-chloropropane
Dibromomethane	Dichlorodifluoromethane
Dichlorofluoromethane	1,2-Dibromoethane
Ethylbenzene	Ethyl ether
Hexachlorobutadiene	Isopropylbenzene
Methylene chloride	Methyl ethyl ketone
Methyl isobutyl ketone	Methyl tertiary butyl ether
n-Butylbenzene	Naphthalene
n-Propylbenzene	o-Xylene
p&m-Xylene	p-Isopropyltoluene
Sec-Butylbenzene	Styrene
Tert-Butylbenzene	Trans-1,2-Dichloroethene
Trans-1,3-Dichloropropene	Trichloroethene
Trichlorofluoromethane	Tetrachloroethene
Tetrahydrofuran	Toluene
Vinyl chloride	Bromodochloromethane

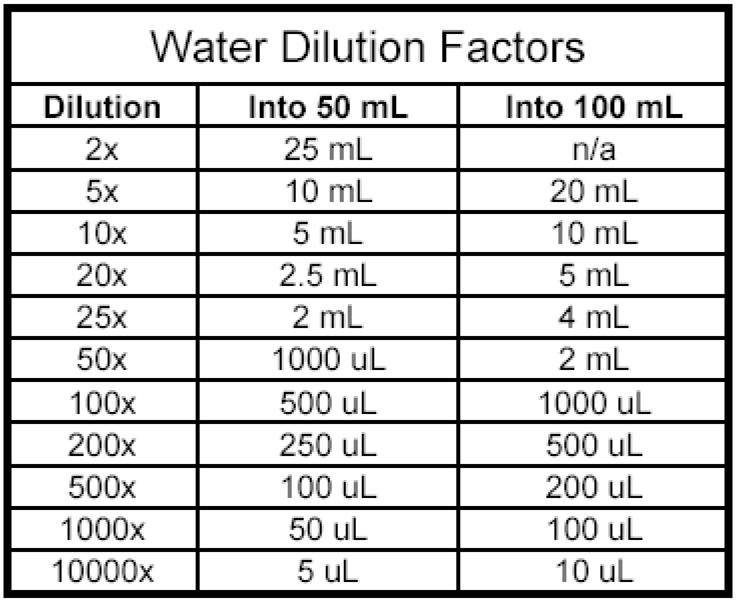
Table IX:
Internal Standard and Analyte Relationship

Analyte	Pentafluorobenzene	1,4-Difluorobenzene	Chlorobenzene-d_5	1,4-Dichlorobenzene-d_4
Dichlorodifluoromethane	X			
Chloromethane	X			
Vinyl chloride	X			
Bromomethane	X			
Chloroethane	X			
Trichlorofluoromethane	X			
Methylene Chloride	X			
1,1-Dichloroethene	X			
trans-1,2-Dichloroethene	X			
1,1-Dichloroethane	X			
2,2-Dichloropropane	X			
cis-1,2-Dichloroethene	X			
Chloroform	X			
Bromochloromethane	X			
1,1,1-Trichloroethane	X			
Carbon tetrachloride	X			
1,1-Dichloropropene	X			
Benzene	X			
1,2-Dichloroethane	X			
Trichloroethene		X		
1,2-Dichloropropane		X		
Bromodichloromethane		X		
Dibromomethane		X		
trans-1,3-Dichloropropene		X		
Toluene			X	
cis-1,3-Dichloropropene			X	
1,1,2-Trichloroethane			X	
Tetrachloroethene			X	
1,3-Dichloropropane			X	
Dibromochloromethane			X	
1,2-Dibromoethane (EDB)			X	
Chlorobenzene			X	
1,1,1,2-Tetrachloroethane			X	
Ethylbenzene			X	
m&p-Xylene			X	
Xylene (Total)			X	
o-Xylene			X	
Styrene			X	
Bromoform			X	
Isopropylbenzene (Cumene)			X	
1,1,2,2-Tetrachloroethane			X	

Table IX (continued):
Internal Standard and Analyte Relationship

Bromobenzene				X
1,2,3-Trichloropropane				X
n-Propylbenzene				X
2-Chlorotoluene				X
1,3,5-Trimethylbenzene				X
4-Chlorotoluene				X
tert-Butylbenzene				X
1,2,4-Trimethylbenzene				X
sec-Butylbenzene				X
p-Isopropyltoluene				X
1,3-Dichlorobenzene				X
1,4-Dichlorobenzene				X
n-Butylbenzene				X
1,2-Dichlorobenzene				X
1,2-Dibromo-3-chloropropane				X
1,2,4-Trichlorobenzene				X
Hexachloro-1,3-butadiene				X
Naphthalene				X
1,2,3-Trichlorobenzene				X
2-Butanone (MEK)	X			
Allyl chloride	X			
Acetone	X			
Dichlorofluoromethane	X			
Diethyl ether (Ethyl ether)	X			
Methyl-tert-butyl ether	X			
4-Methyl-2-pentanone (MIBK)		X		
Tetrahydrofuran	X			
1,1,2-Trichlorotrifluoroethane	X			
Dibromofluoromethane (S)	X			
Toluene-d8 (S)			X	
4-Bromofluorobenzene (S)				X
1,2-Dichloroethane-d4 (S)	X			

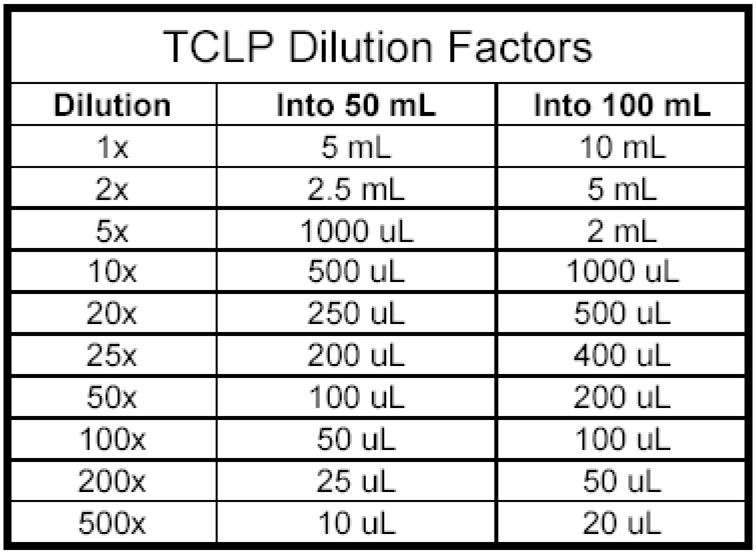
ATTACHMENT I
Common Dilution Factors for Water Samples



Water Dilution Factors

Dilution	Into 50 mL	Into 100 mL
2x	25 mL	n/a
5x	10 mL	20 mL
10x	5 mL	10 mL
20x	2.5 mL	5 mL
25x	2 mL	4 mL
50x	1000 uL	2 mL
100x	500 uL	1000 uL
200x	250 uL	500 uL
500x	100 uL	200 uL
1000x	50 uL	100 uL
10000x	5 uL	10 uL

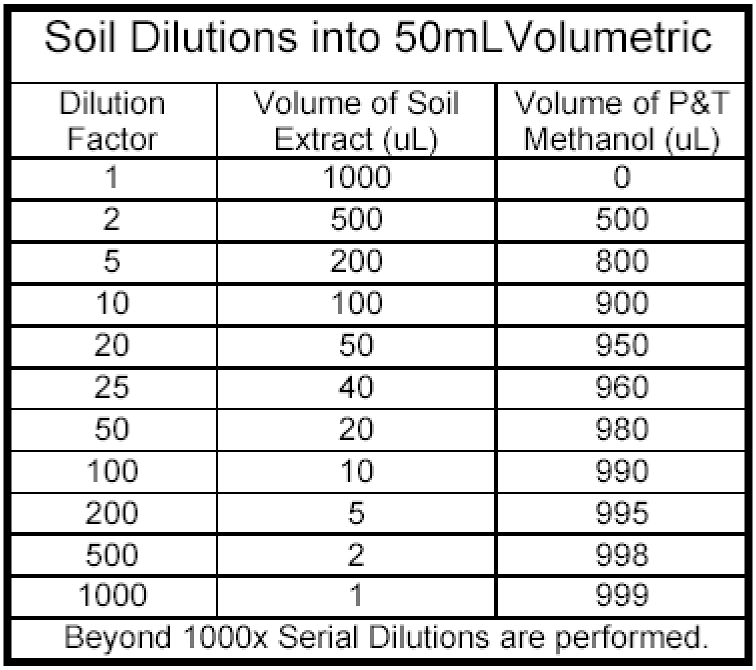
ATTACHMENT II
COMMON DILUTION FACTORS FOR TCLP SAMPLES



TCLP Dilution Factors

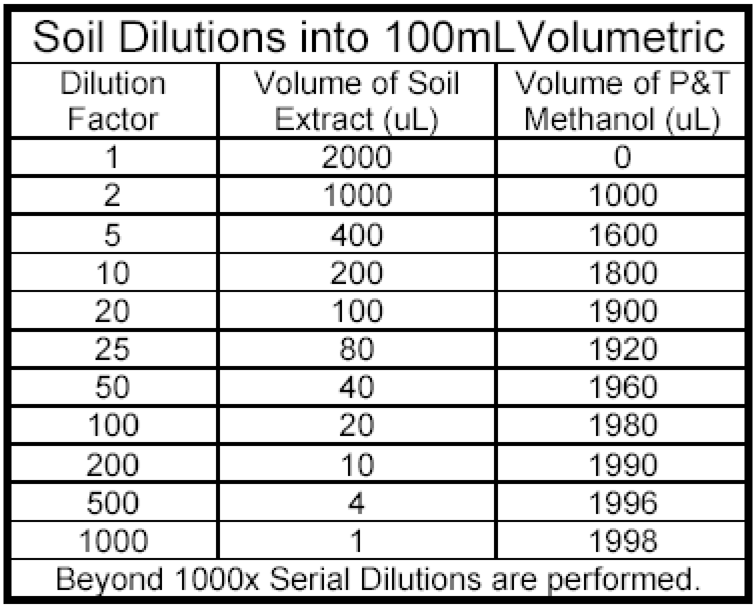
Dilution	Into 50 mL	Into 100 mL
1x	5 mL	10 mL
2x	2.5 mL	5 mL
5x	1000 uL	2 mL
10x	500 uL	1000 uL
20x	250 uL	500 uL
25x	200 uL	400 uL
50x	100 uL	200 uL
100x	50 uL	100 uL
200x	25 uL	50 uL
500x	10 uL	20 uL

ATTACHMENT III
COMMON DILUTION FACTORS FOR SOIL SAMPLES



Soil Dilutions into 50mLVolumetric

Dilution Factor	Volume of Soil Extract (uL)	Volume of P&T Methanol (uL)
1	1000	0
2	500	500
5	200	800
10	100	900
20	50	950
25	40	960
50	20	980
100	10	990
200	5	995
500	2	998
1000	1	999
Beyond 1000x Serial Dilutions are performed.		



Soil Dilutions into 100mLVolumetric

Dilution Factor	Volume of Soil Extract (uL)	Volume of P&T Methanol (uL)
1	2000	0
2	1000	1000
5	400	1600
10	200	1800
20	100	1900
25	80	1920
50	40	1960
100	20	1980
200	10	1990
500	4	1996
1000	1	1998
Beyond 1000x Serial Dilutions are performed.		

STANDARD OPERATING PROCEDURE
IGNITABILITY (FLASH POINT) BY PENSKY-MARTENS CLOSED CUP OR ASTM D92 OPEN CUP

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STANDARD OPERATING PROCEDURE

IGNITABILITY (FLASH POINT) BY PENSKY-MARTENS CLOSED CUP OR ASTM D92 OPEN CUP

REFERENCE METHODS: SW-846, METHOD 1010

LOCAL SOP NUMBER:	S-KS-I-030-rev.6
EFFECTIVE DATE:	Date of Final Signature
SUPERSEDES:	KS-I-030-rev.5

LOCAL APPROVAL

	12-10-08
Laboratory General Manager	Date
Charles E Guzon	12-11-08
Laboratory Quality Manager	Date
Kathleen McClint	12/10/08
Department Manager	Date

ANNUAL REVIEW
SIGNATURES BELOW INDICATE NO CHANGES HAVE BEEN MADE SINCE APPROVAL. SOP IS VALID FOR ONE YEAR FROM DATE OF LAST SIGNATURE.

Signature	Title	Date
Signature	Title	Date
Signature	Title	Date

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S-KS-I-030-rev.6

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1. Purpose

The purpose of this SOP is to provide a laboratory specific procedure for determining Ignitability (flash point) in liquid samples meeting the requirements specified in SW-846 Chapter 7.

2. Summary of Method

Closed Cup: The sample is heated at a slow, constant rate with continual stirring. A small flame is directed into the cup at regular intervals with simultaneous interruption of stirring. The flash point is the lowest temperature at which application of the test flame ignites the vapor above the sample.

Open Cup: The sample is heated at a slow, constant rate. A small flame is directed over the cup at regular intervals. The flash point is the lowest temperature at which application of the test flame ignites the vapor above the sample.

3. Scope and Application

This SOP includes the measurement of flash point in drinking and surface waters, and domestic and industrial wastes, hazardous waste, and soils. The Practical Reporting Range for this test is ambient temperature to 210 ºF.

The objective of the ignitability characteristic is to identify wastes that either present fire hazards under routine storage, disposal, and transportation or are capable of severely exacerbating a fire once started.

A solid waste exhibits the characteristic of ignitibility is a representative sample of the waste has the following property:

It is a liquid, other than an aqueous solution, containing less than 24% alcohol by volume, and has a flash point less than 60°C (140°F), as determined by a Pensky-Martens Closed Cup Tester, using the test method specified in ASTM Standard D-93-79 or D-93-80.

Method 1010 utilizes the Pensky-Martens closed-cup tester to determine the flash point of fuel oils, lube oils, suspensions of solids, liquids that tend to form a surface film under test conditions, and other liquids.

4. Interferences

Ambient pressure, sample homogeneity, drafts, and operator bias can affect flash point values.

5. Safety

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials.

5.2 Each laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of Material Safety Data Sheets (MSDS) is made available to all personnel involved in the chemical analysis

5.3 MSDS sheets are located in the Quality Assurance Office and should be consulted prior to handling samples and standards.

5.4 Samples should be considered biological contact hazards. Use appropriate protective equipment (lab coat, gloves and lab glasses) and aseptic techniques when handling these samples. Wash hands with soap and water upon completion of the procedure and clean the work surface with a disinfectant.

5.5 Samples - Although sample management personnel should be notified of any and all hazardous samples, samples shall always be considered as unknowns. The use of personal protective equipment (gloves, lab coats and safety glasses) is required when handling samples.

5.6 Ensure that the area around the flashpoint apparatus is clear of combustible materials and reagents (36”minimum).

6. Definitions

6.1 Accuracy – The degree of agreement between a measured value and the true or expected value.

6.2 Aliquot – A measured portion of a sample taken for analysis.

6.3 Analyte – The specific entity an analysis seeks to determine.

6.4 Batch – A grouping of no more than twenty samples of similar matrix which are prepared and/or analyzed together with the same method and the same lots of reagents within the same time frame, as designated by the method.

6.5 Blank – A blank is a sample designed to detect and/or monitor the contribution of analyte and non-analyte contamination, instrumental background and sample processing to the measurement system.

6.6 Calibration – The process of establishing the relationship between instrument response and know, traceable quantities of analytes of interest.

6.7 Calibration Check – Verification of the ratio of instrument response to analyte amount. A calibration check is performed by analyzing a solution containing the analyte in an appropriate solvent. Calibration check solutions are made from a stock solution different from the stock used to prepare standards.

6.8 Continuing Calibration – The process of analyzing standards periodically to verify the maintenance of calibration of the analytical system.

6.9 Detection Limit – The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, expressed either as a method detection limit or instrument detection limit.

6.10 Dry Weight – The weight of a sample based on percent solids. The weight after drying in an oven at a specified temperature.

6.11 Duplicate Analysis – A second measurement made on the same sample extract or digestate to assist in the evaluation of precision of analysis.

6.12 Duplicate Sample – A second aliquot of the same sample that is treated the same as the original sample in order to determine the precision of the method.

6.13 Environmental Sample – An environmental sample or field sample is a representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows:

6.13.1 Surface and Ground Water

6.13.2 Drinking Water – Delivered (treated or untreated) water designated as potable water.

6.13.3 Water/Wastewater – Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents.

6.13.4 Sludge – Municipal sludges and industrial sludges.

6.13.5 Soil – Predominately inorganic matter ranging in classification from sands to clays.

6.13.6 Waste – Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes.

6.14 EPIC (PRO) – LIMS developed by Pace Analytical (Environmental Project Information Control)

6.15 Holding Time – The elapsed time from the date/time of sample collection by the field personnel until the date/time of its processing/analysis. Holding time requirements are dictated by the method or QAPP.

6.16 Homogeneity – The degree to which a property or substance is evenly distributed throughout a material.

6.17 Initial Calibration – The process of analyzing standards prepared at specified concentrations, to define the quantitative response, linearity and dynamic range of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a continuing calibration do not conform to the requirements of the method in use or at a frequency specified in the method.

6.18 Laboratory Control Sample – A control sample of known composition spiked with a known concentration of analytes of interest. Aqueous and solid laboratory control samples are analyzed using the same preparation, reagents, and analytical methods employed for field samples.

6.19 LIMS – Laboratory Information Management System.

6.20 Lot – A quantity of bulk material of similar composition processed or manufactured at the same time.

6.21 Matrix – The predominant material of which the sample to be analyzed is composed.

6.22 Matrix Spike – Aliquot of sample fortified (spiked) with known quantities of specified target compounds or analytes and subjected to the entire sample preparation and analysis procedure in order to assess the appropriateness of the method for the sample matrix by measuring recovery.

6.23 Matrix Spike Duplicate – A second aliquot of the sample that is treated the same as the original matrix spike sample. The relative percent difference between the matrix spike and matrix spike duplicate is calculated and used to assess analytical precision.

6.24 Method Blank – An analytical control consisting of a blank matrix containing all reagents, internal standards and surrogate standards that are carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and contamination, and to demonstrate that this level does not exceed acceptance limits. Acceptable levels of contamination are defined by project specific data quality objectives.

6.25 Method Detection Limit (MDL)– The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Method Detection Limits are determined using replicate spike samples prepared by the lab and taken through all preparation and analysis steps of the method. The method detection limit is calculated using the appropriate Student’s t-parameter times the standard deviation of a series of spiked samples.

6.26 Precision – The measurement of agreement of a set of replicate results among themselves without any prior information as to the true result. Precision is assessed by means of duplicate/replicate sample analysis.

6.27 PQL – The practical quantitation limit (PQL) is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

6.28 Quality Assurance – A system of policies and procedures whose purpose is to ensure, confirm and document that the product or service rendered fulfills the requirements of Pace Analytical and it client. Quality Assurance includes quality planning, quality control, quality assessment (auditing), quality reporting and corrective action.

6.29 Reagent Grade – Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

6.30 Replicate Samples – Samples collected at the same time, from the same place, for the same analysis, as the original sample in order to determine precision between samples.

6.31 Reporting Limit (RL) – The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the statistically determined MDL, but may be higher based on any of the above considerations. Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. Reporting limits are generally two times the MDL.

6.32 Standard – A substance or material, the properties of which are known with sufficient accuracy, to permit its use to evaluate the same property in a sample.

6.33 Standard Curve – A standard curve is a graph which plots concentrations of a known analyte standard versus the instrument response to that analyte.

6.34 Standard Operating Procedure –A procedure adopted for repetitive use when performing specific measurement or sampling operation. It may be an industry accepted standard method or one developed by the user.

6.35 Traceability – The ability to trace the source and accuracy of a material (i.e. standard) to a recognized primary reference source such as the National Institute of Standards and Technology (NIST) or USEPA.

6.36 Validation **–** The process by which a sample, measurement, method or piece of data is deemed useful for a specified purpose as based upon the DQOs established for quality control measurements such as accuracy, precision, representativeness, and completeness.

7. Responsibilities and Distribution

7.1 Corporate Officers

7.1.1 **Chief Operating Officer (COO) –** The COO has oversight responsibility for Pace Analytical environmental laboratory operations, including compliance with all quality system requirements.

7.1.2 **Director of QST** – The Director of Quality, Safety, and Technology has oversight responsibility for PASI's quality programs, including establishing and monitoring compliance with all quality system requirements.

7.1.3 **Corporate Quality Office** - It is the responsibility of the Corporate QA Office and/or designee to ensure that all new and revised company-wide documents are distributed to QA Offices at each PASI facility, that an original document is maintained on file and that distribution records are updated accordingly. Staff must be informed of new or revised document distribution through written notification.

7.1.4 **Corporate QM** – Corp QM is responsible for ensuring that all revisions to this SOP template are distributed to all PASI QA offices and for maintaining the original and complete distribution records.

7.2 **General Manager (GM)**

The General Manager is responsible for ensuring adherence to this SOP and for reporting any required revisions to the local Quality Assurance Office. The GM must also approve other controlled documents as necessary prior to local distribution.

7.3 **Quality Manager (QM)**

The QM or designee is responsible for ensuring that all revisions to the SOP are implemented and for maintaining the original and complete distribution records at a local level.

7.4 **Department Manager/Supervisor**

The Department Manager/Supervisor is responsible for ensuring all staff members are reading, following, and adequately trained in the use of this SOP. The department manager/supervisor provides initial approval of all Laboratory SOPs and Training Documents within the department. The department manager/supervisor will make recommendations for SOP and Training Document revisions to the QM in writing.

7.5 **Individual Staff**

Individual staff members are responsible for adherence to the specific policies and procedures contained in this SOP. Individual staff members will only use a signed, controlled copy of this SOP. A controlled copy will be available for review and consultation within the Laboratory Department and Quality Assurance department. Personnel are responsible for ensuring that any deviations to this SOP are reported to management. Each person may make recommendations in writing to their manager/supervisor for revising this SOP as the need arises.

7.6 **Revision** - This SOP will be reviewed biennially at a minimum or sooner if procedures or methods change. In the event no changes have been made to the procedures, the cover page of this SOP will be signed and the expiration date will be extended for one year from the date of the reviewer's signature.

7.7 **Distribution** - The official version of this SOP is the signed hardcopy version found in the laboratory, with current applicable addenda. A copy of the SOP shall be kept in the appropriate department for reference.

8. Sample Collection, Preservation, and Handling

Table 8.1 – Sample Collection, Preservation, Storage and Hold time.

Sample type	Collection per sample	Preservation	Storage	Hold time
Solid	Wide-mouth glass (8-oz)	None	≤6°C	28 days
Liquid	Plastic or glass (500-mL)	None	≤6°C	28 days

9. Equipment and Supplies

Table 9.1 – Instrumentation

Equipment	Description	Vendor / Item # / Description
Closed Cup Flash Tester	Pensky-Martens	Koehler / K16200
Thermometer	ASTM Type 9C	Fisher / 13-501
Barometer	Digital	Fisher / 02-400

Table 9.2 – Miscellaneous

Item	Description	Vendor / Item # / Description
Lighter	Long nozzle, BBQ-type	N/A
Fire Extinguisher	Multi-purpose, Dry Chemical	

10. Reagents and Standards

Table 10.1 – Reagents

Reagent	Concentration/ Description	Requirements/ Vendor/ Item #
p-Xylene	≥99%	Certified / Fisher / O5082-500
Deionized water	ASTM Type II	

11. Calibration

11.1 See SOP S-ALL-Q-013, Support Equipment for thermometer traceability requirements.

11.2 Barometer Calibration

11.2.1 Obtain the barometric pressure at New Century Aircenter from the following National Weather Service (NWS) website: http://weather.noaa.gov/weather/current/KIXD.html

11.2.2 This value has been compensated for the airport's altitude (1087') and must be "uncompensated" to get the true barometric pressure. Multiply the compensated barometric pressure (inches of Hg) by 0.963 to get the true barometric pressure, (Eq. 1, Section 17).

11.2.3 Record the true barometric pressure at the Aircenter and then record the reading of the barometer to be calibrated. Wait one to two hours, and then record a second reading for both barometers. Follow the above procedure for a third and fourth reading. Optimally, the calibration process should take place over a period of several days in order encompass the widest range of barometric pressures possible.

11.2.4 Calculate the average readings for the NWS barometer and the working barometer. Record the difference between these averages in the appropriate metrology logbook.

11.2.5 Create a unique label for the barometer to identify the serial number, date calibrated, initials of the analyst who calibrated the barometer and the proper correction factor. Affix this label to the barometer.

12. Procedure

12.1 Closed Cup - Sample Preparation

12.1.1 Samples that do not contain volatile contaminants shall be prepared in the following manner. NOTE: If the sample is suspected of containing volatile contaminants, the treatment described below should be omitted.

12.1.2 Samples of very viscous materials may be warmed until they are reasonably fluid before they are tested. However, no sample should be heated more than is absolutely necessary, and no sample should ever be heated to a temperature that exceeds 17 °C (30 °F) below the expected flash point of the sample.

12.2 Closed Cup - Analysis

12.2.1 Thoroughly clean and dry all parts of the cup and its accessories before starting the test. Be sure to remove any solvent that was used to clean the apparatus.

12.2.2 Ensure that the tester and cup are at ambient temperature.

12.2.3 Fill the cup with the sample to be tested to the level indicated by the filling mark.

12.2.4 Place the lid on the cup and set the cup in the stove. Be sure to properly engage the locking device.

12.2.5 Insert the thermometer. Allow the thermometer to equilibrate. Light the test flame and adjust it to a diameter of 5/32 in. (4mm). Apply test flame and record the initial temperature. Supply the heat at such a rate that the temperature as indicated by the thermometer increases 5° to 6°C/min. NOTE: Turning the rheostat up to the maximum setting, full turn clockwise, achieves the desired rate of increase.

12.2.6 Turn the stirrer assembly on.

12.2.7 Turn the stirrer to 250 ±10 rpm, stirring in a downward direction. Raise the temperature near the end of the test at a rate of 2 to 3 °C/min. With the exception of these requirements for rates of stirring and heating, proceed as prescribed above.

12.2.8 At every 2 °C interval apply the test flame by operating the mechanism on the cover which controls the shutter and test flame burner so that the flame is lowered into the vapor space of the cup in 0.5 sec, left in its lowered position for 1 sec, and quickly raised to its high position. Do not stir the sample while applying the test flame.

12.2.9 The observed flash point is the temperature read on the thermometer (± any correction factor) at the time the test flame application causes a distinct flash in the interior of the cup. Do not confuse the true flash point with the bluish halo that sometimes surrounds the test flame at applications preceding the one that causes the actual flash. The actual flash will have occurred when a large flame propagates itself over the surface of the sample.

12.2.10 Record the corrected flash point, to the nearest 1 °C, in the Ignitablility logbook.

12.2.11 Barometric pressure is also recorded in the logbook. If the barometric pressure differs from 760 mm Hg, the flash point temperature must be corrected as follows:

$$\text{Corrected flash point} = \text{Temp } ^{\circ}\text{F} + 0.06(760 - \text{BP in mmHg})$$

Record both the observed flash point and the corrected result.

12.2.12 A positive flash point (<140 ºF) must be duplicated by a different analyst for confirmation. The reproducibility criteria for the duplicate is ± 10 °C.

12.3 Open Cup - Sample Preparation

None required.

12.4 Open Cup - Analysis

12.4.1 Thoroughly clean and dry all parts of the cup and its accessories before starting the test. Be sure to remove any solvent that was used to clean the apparatus.

12.4.2 Ensure that the tester and cup are at ambient temperature.

12.4.3 Fill the cup about two-thirds full with sample.

12.4.4 Insert the thermometer. Allow the thermometer to equilibrate. Light the test flame and adjust it to a length of about one inch. Apply test flame and record the initial temperature. Supply the heat at such a rate that the temperature as indicated by the thermometer increases 5 to 6 °C/minute.

12.4.5 Apply the test flame by moving the flame arm over the cup and back into position such that it takes about 2 seconds for each complete sweep.

12.4.6 The observed flash point is the temperature read on the thermometer (± any correction factor) at the time the test flame application causes a distinct flash just above the surface of the sample. The actual flash will have occurred when a large flame propagates itself over the surface of the sample.

12.4.7 Record the corrected flash point, to the nearest 1°C, in the Ignitability logbook.

12.4.8 Barometric pressure is also recorded in the logbook. If the barometric pressure is differs from 760 mm Hg, the flash point temperature must be corrected as follows:

$$\text{Corrected flash point} = \text{Temp } ^\circ\text{F} + 0.06(760 - \text{BP in mm Hg})$$

Record both the observed flash point and the corrected result.

12.4.9 Every sample that flashes (ignites) must be verified by another analyst using a fresh aliquot of sample. The reproducibility criteria for the duplicate is ± 10 °C.

12.5 EPIC Posting

12.5.1 This is a one-step acode and allows text.

12.5.2 If the sample does not flash under 94 °C report ">210 °F".

12.5.3 Post the flash point (corrected for barometric pressure) in °F.

13. Quality Control

QA Sample	Components	Frequency	Acceptance Criteria	Corrective Action
Method Blank (MB)	Reagent water	One (1) per batch of up to ten samples. Analyze after the first LCS.	Must not flash	1) Re-clean sample cup.
Laboratory Control Sample (LCS)	p-Xylene	Two (2) per batch of up to ten samples. Analyze one at the beginning and end of the batch.	27.2 ± 1.1 ºC	1) Reanalyze the LCS only once to verify failure 2) If problem persists, review entire system 3) Re-analyze affected samples

14. Method Performance

14.1 Demonstration of Capability (DOC): Every analyst who performs this method must first document acceptable accuracy and precision by passing a demonstration of capability study (DOC) per ALL-Q-

020, Training Procedures.

14.1.1 Analyze a certified reference material or p-Xylene for Ignitability.

14.1.2 If the result meets the acceptance criteria, system performance is acceptable and analysis of samples may begin. If, however, the result falls outside the range for recovery, system performance is unacceptable. In this event, correct the problem and repeat the test.

15. Pollution Prevention and Waste Management

15.1 Procedures for handling waste generated during this analysis are addressed in the Pace Environment Management Manual.

15.2 In order to minimize the amount of waste generated during this procedure, analyst should prepare reagents in an amount which may be used in a reasonable amount of time (i.e. before a reagent expires)

15.3 The company wide Chemical Hygiene and Safety Manual contains additional information on pollution prevention.

16. References

16.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update IV, Method 1010.

16.2 ASTM D92-77 (1981),”Standard Test Method for Flash and Fire Points by Cleveland Open Cup,” ASTM International.

16.3 http://www.dnr.state.wi.us/org/es/science/lc/OUTREACH/BODresource/Pressure.html

17. Tables, Diagrams, Flowcharts, Attachments, Appendices, etc.

Equation 1 – True Barometric Pressure[1]

$$\text{True Barometric Pressure (in.Hg)} = \text{Compensated Barometric Pressure (in.Hg)} \times \frac{760 - [1087\text{ft} \times 0.026]}{760}$$

18. Revisions

Document Number	Reason for Change	Date
KS-I-2348-D	Grammatical/Removal of outdated information.	June 27, 2001
KS-I-2348-E	Grammatical/Removal of outdated information.	June 16, 2003
KS-I-030-rev.5	SOP – Changed SOP number. Section 5.3 – Changed location of MSDS library. Section 5.5 – Added precaution. Section 7 – Updated responsibilities. Section 10 – Changed definition of deionized water. Section 12.5 – Removed Celsius conversion formula. Section 12.5.2 – Added “corrected for barometric pressure”.	November 3, 2006
S-KS-I-030-rev.6	Restructured document format. Section 9 – Added lighter to supply list Section 12 – Added true barometric pressure derivation, added initial temperature reading, changed the rate at which to heat sample, removed stirrer section from open-cup analysis. Section 14 – Added DOC section. Section 16 – Added WI DNR reference for pressure equation. Section 17 – Added equation derivation.	October 6, 2008

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[1] Reference 16.3

EXHIBIT B

WESTON SOPs

EXHIBIT B.1

DECONTAMINATION STANDARD OPERATING PROCEDURES

DECONTAMINATION
STANDARD OPERATING PROCEDURE B.1

1.0 Scope and Application

1.1 This standard operating procedure (SOP) is applicable to the development and application of a decontamination program to reduce the potential for uncontrolled distribution of potential field contaminants and the potential exposure of sample media to secondary contaminant sources.

2.0 Summary of Method

2.1 This document has been prepared to serve as default procedures to assist personnel with the performance of specific tasks and procedures related to the collection of surface soil samples. These procedures have been developed to address quality control requirements specific to the evaluation of perfluorochemicals and other constituents as outlined below. The procedures addressed in this SOP include the following:

- Personnel Decontamination Procedures.
- Decontamination of Drilling Equipment.
- Decontamination of Sampling Equipment.
- Decontamination of Support Equipment.
- Management of Investigation Derived Waste.

3.0 Health and Safety Issues

3.1 As with any activities associated with potential contaminants, work tasks should be conducted in strict accordance with U.S. Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA), the 3M Company (3M), and WESTON safety policy and procedures. This will include at a minimum, preparation of a Site-Specific Security, Health and Safety Plan (SSHASP) to ensure that all aspects of potential risk are evaluated. In addition to the potential chemical hazards associated with this activity, the following potential hazards should also be considered:

- Pressurized Hoses.
- Slips, Trips, and Falls.

4.0 Personnel Qualifications

4.1 All field personnel with potential for exposure to contaminated media on site are required to take the 40-hour Health and Safety Training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize hazards associated with the field work and fully familiar with provisions of the SSHASP.

5.0 Equipment and Supplies

5.1 The equipment necessary for decontamination in the field will vary depending on the activities being conducted. A general list of equipment that may be utilized is as follows:

- Pressurized steam cleaner.
- Polyethylene containers.
- Low phosphate soap solution.
- Potable water source.
- Distilled Water.
- De-ionized Water.
- Methanol (Scientific Grade).
- Plastic Sheeting.
- Paper Towels.
- Garbage Bags.
- Permanent Markers.
- Brushes.
- Spray Bottles.
- Hazard Labels.
- Nitrile gloves.

6.0 Decontamination Activities

6.1 The following are the steps to be taken for proper decontamination of equipment and personnel during field investigation activities. The effectiveness of the decontamination process will be evaluated as part of the Quality Assurance (QA) program through the collection of equipment rinsate blanks for analytical testing.

7.0 Personnel Decontamination

7.1 Personnel decontamination during investigation activities is critical for reducing exposure of site personnel to potential field contaminant and to reduce the potential for cross-contamination between sampling locations. Based on anticipated hazards expected in the field, personnel will conduct field activities in Modified Level D Protection to include safety boots, safety glasses, hard hat, and nitrile gloves. Should conditions warrant, disposable boot covers and Tyvek cover-alls may also be used. The following steps should be followed for personnel decontamination:

- Remove any gross debris from gloves and place it in the designated waste accumulation point.

- If boot covers or Tyvek suits are worn, remove them taking care to avoid the outside of the material. Place the items into the designated waste accumulation point.
- Remove nitrile gloves, taking care not to contact the outside of the gloves, and place the gloves in the designated waste accumulation point.
- Thoroughly wash hands with a non-phosphate soap solution (Alconox or Liquinox).
- Thoroughly wash hands with a potable water rinse.
- Dry hands.

8.0 Decontamination of Drilling Equipment

8.1 Decontamination of drilling equipment will be conducted at a designated site designed to contain all fluids and cuttings. This may include a wash pad with a drain directing the fluids to the on-site treatment facility, or a temporary decontamination pad specifically constructed for this purpose. The pad should be provided with an adequate potable water source. The following steps should be followed during the decontamination process:

- Position the equipment on the pad to avoid release of debris or overspray to adjacent areas.
- Don nitrile gloves and a face shield over safety glasses.
- Remove gross debris from equipment and contain at a designated waste accumulation point.
- Start the steam pressure washer and thoroughly wash the equipment.
- Rinse the equipment with potable water and allow it to air dry.

Additional Steps for Sampling Equipment

- Rinse the equipment with methanol.
- Rinse the equipment with potable or distilled water.
- Allow the equipment to air dry.
- Dispose of expendables and debris at the designated waste accumulation point.

9.0 Decontamination of Field Monitoring Equipment

- Don nitrile gloves.
- Remove any gross debris and place it into the designated waste accumulation point.
- Wipe the outside of the equipment with a moist towel.
- Allow the equipment to air dry.
- Dispose of expendables and debris at the designated waste accumulation point.

10.0 Decontamination of Field Sampling Equipment

- Don nitrile gloves.
- Remove any gross debris and place it into the designated waste accumulation point.
- Wash the equipment in a low-phosphate soap solution (Alconox or Liquinox).
- Thoroughly rinse the equipment in potable water.
- Thoroughly rinse the equipment with de-ionized water.
- Rinse the equipment with methanol.
- Allow the equipment to air dry.
- Place the equipment in clean plastic sheeting or bags until next use.
- Dispose of expendables and debris at the designated waste accumulation point.

11.0 Decontamination of Pumps and Electrical Equipment

11.1 Equipment involving internal components sensitive to decontamination fluids or electrical equipment, such as well pumps and water level indicators, that may be damaged by standard decontamination procedures will be decontaminated as follows:

- Place the pump into a low-phosphate soap solution and operate the pump for approximately one minute to ensure adequate rinsing of the internal pump assembly. For water level measurement devices, unreel the tape into the soap solution and agitate aggressively.
- Place the equipment into a potable water rinse. Operate pumps as described above to remove any residual soap solution. When done, lift feed line while operating to purge the pump. Thoroughly rinse measurement tapes by agitating aggressively in potable water.
- Rinse outside of pump or measuring tape with de-ionized water, shake excess water off, and allow equipment to air dry.
- Dispose of expendables and debris at the designated waste accumulation point.

12.0 Investigation Derived Waste Management

Investigation Derived Wastes (IDW) generated during the investigation activities should be properly managed to ensure safety to site personnel and to reduce the potential of impact to other areas of the Site by the wastes. Wastes may include expendable sampling items such as gloves, booties, plastic sheeting, paper towels, pump tubing, or bailers; media solids including soil cuttings, decontamination debris, or sediment residuals; or liquids such as well purge fluids or decontamination fluids. Should media be encountered that potentially meets the classification as a hazardous waste, these materials should be properly contained, labeled and stored until a formal waste characterization may be achieved. Final disposition will be based on the classification of the waste. It is not anticipated that hazardous wastes will be encountered as part of the proposed field tasks. Personnel should segregate all IDW according to the classifications identified above for final disposition. The following procedures should be used to ensure proper management of IDW:

12.1 Expendable Materials

Expendable items are commercially acquired materials used in support of field activities. These materials may include but are not limited to:

- Gloves.
- Boot covers.
- Pump tubing.
- Well sampling bailers.
- Plastic sheeting.
- Well material packaging.
- Rope.

These materials should be put into plastic garbage bags placed within the areas of activity or carried on the vehicle. Upon completion of the activity or when the bag has been filled, the wastes should be placed into a designated dumpster on-site for disposal as solid waste.

12.2 Solid Media Waste

Sampling-derived waste included in this category would include the following:

- Soil cuttings.
- Drilling mud.
- Sediment residuals.
- Solids accumulated during decontamination.

Soil cuttings and drilling muds may be spread at the location of drilling provided there are not obvious features such as photo-ionizing detector screening data, sheen, or odors to suggest significant impact. If it is deemed necessary by the site geologist to contain the cuttings, the material should be placed into lined steel 55-gallon drums, sealed, labeled with the date, contents, and location; and subsequently transferred to the soil staging pad until it can be adequately characterized.

Soil cuttings generated during soil disposal profile sampling will be used to backfill the constructed sampling borehole and placed adjacent to the borehole.

Solids accumulated during decontamination will be placed into lined steel 55-gallon drums. Once filled, each drum will be sealed, identified with the contents and date, and transferred to the on-site staging area for subsequent testing.

Disposal methods applied to each media should be recorded in the field logbook, including the location of disposal and estimated quantity.

12.3 Liquid Media Waste

Liquid wastes potentially generated during site activities may include the following:

- Drilling fluids.
- Purged well water.
- Decontamination fluids.
- Construction water.

Liquid wastes will be contained for testing prior to transfer to the MCES sewer. This may be by way of pails, 55-gallon drums, or polyethylene tanks. Quantities discharged to the sewer will be documented in the field logbook. If the fluid exhibits significant impact from potential contaminants of concern or exceeds MCES requirements, it will be treated prior to discharge to the MCES sewer or will be disposed at a permitted off-site facility.

13.0 Data and Records Management

13.1 All data and information (e.g., location of decontamination pad, water source, site conditions) should be documented within site logbooks with permanent ink.

14.0 References

Remedial Design/Response Action Plan (RD/RA Plan) for the Oakdale Site. WESTON. February 2009.

Construction Sampling Plan for the Oakdale Site. Attachment 2 to the RD/RA Plan for the Oakdale Site. WESTON. February 2009.

Site-Specific Health and Safety Plan. (SSHASP). Attachment 5 to the *RD/RA Plan for the Oakdale Site*. WESTON. February 2009.

EXHIBIT B.2

SOIL SAMPLING STANDARD OPERATING PROCEDURES

SOIL SAMPLING
STANDARD OPERATING PROCEDURE B.2

1.0 Scope and Application

1.1 This SOP is applicable to the development and application of a soil sampling program including discussion of methodology and equipment. Sampling systems vary depending on the objectives of the soil sampling program and soil conditions. The procedures discussed herein focus on the collection of surface soil samples (within approximately 5 feet from ground surface) utilizing manual hand-operated equipment and the collection of subsurface soil samples using mechanical drilling techniques.

2.0 Summary of Method

2.1 This document has been prepared to serve as default procedures to assist personnel with the performance of specific tasks and procedures related to the collection of surface soil samples. The procedures set forth herein are supported by the following American Society for Testing and Materials (ASTM) Standard Practices:

- D5911-96. *Practice for a Minimum Set of Data Elements to Describe a Soil Sampling Site*.
- D2487-93 *Classification of Soils for Engineering Purposes (Unified Soil Classification System.*
- D2488-93. *Practice for Description and Identification of Soils (Visual-Manual Procedures).*

2.2 These standards are amended to address quality control requirements specific to the evaluation of PFCs and other constituents as outlined below.

The procedures addressed in this SOP include the following:

- Sampling with a scoop or trowel.
- Sampling with a hand-operated bucket auger.

3.0 Health and Safety Issues

3.1 As with any activities associated with potential contaminants, work tasks should be conducted in strict accordance with EPA, OSHA, 3M, and WESTON safety policy and procedures. This will include at a minimum, preparation of a Site-Specific Health and Safety Plan (SSHASP) to ensure that all aspects of potential risk are evaluated. In addition to the potential chemical hazards associated with this activity, the following potential hazards should also be considered:

- Chemical Contaminants.
- Foreign Debris in Soil.
- Remote Work Areas.
- Biological Hazards.
- Unstable Terrain .

4.0 Interferences

4.1 Primary potential interferences with soil sampling include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to the Decontamination SOP (Appendix B.1).

- Improper sample collection can involve using contaminated equipment, disturbance of the soils in the horizon or interval being sampled, and sampling in an obviously disturbed area.

4.2 It is important to note that sampling for PFCs requires special procedures including the type of equipment used and handling procedures. Even if PFCs are not included in the analyte suite, these procedures will be followed for any sample collected at a site where PFCs are being remediated to maintain sample integrity. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided. Prior to sample collection, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix B.1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- When possible, all sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

5.1 All field personnel with potential for exposure to contaminated media on site are required to take the 40-hour Health and Safety Training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize hazards associated with the field work and fully familiar with provisions of the SSHASP.

6.0 Equipment and Supplies

6.1 Soil sampling equipment used for sampling trace contaminants should be constructed of inert materials such as stainless steel. Ancillary equipment such as auger flights or post hole diggers may be constructed of other materials since this equipment does not come in contact with the samples.

6.2 Selection of equipment is usually based on the depth of the samples to be collected, but it is also controlled to a certain extent by the characteristics of the material. Manual techniques and equipment such as hand augers, are usually used for collecting surface or shallow, subsurface soil samples. Equipment and supplies that may be required as part of this SOP include the following:

- Stainless steel hand-operated bucket auger.
- Stainless steel scoops.
- Stainless steel bowls.
- Stainless steel split-barrel sampler.
- Plastic sheeting.
- Plastic zip-sealed bags.
- Survey stakes or survey flags.
- Permanent markers.
- Field logbook.
- Area maps, ruler, waterproof pens.
- Measuring tape (100-foot).
- Munsell Soil Color Reference Guide.
- Nitrile gloves.
- Leather gloves.
- Shovel or post-hole diggers.
- Safety equipment (safety shoes, safety glasses, hard hat, first aid kit).
- Sample bottles, preservatives, labels.
- Chain-of-custody forms.
- Coolers.
- Ice.
- Approved QAPP.
- Approved SSHASP.
- Radio or cell phone.

- Truck or suitable off-road vehicle.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the SSHASP and facility requirements.

5. Use stakes or flags to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

1. Soil characterization data should be collected during soil sampling. Visual observations of soil color and texture, descriptions of soil horizons, moisture, the presence of any sludge or discolored layers and any disturbed areas should be recorded on field data sheets or in the field logbook.

9.0 Sampling Methodology

9.1 Surface Sampling Procedures

1. This discussion of soil sampling methodology is applicable to the collection of surface soil samples using scoops or hand augers.

2. Sampling locations may be tentatively located prior to mobilization to the Site based on historic records, aerial photographs, and site drawings. Upon entering the field, the proposed area should be evaluated to confirm that samples collected from the area meet the objectives of the investigation. Final sample locations should be designated by the field geologist. The following procedures may be applied to the Site for sampling:

   - Using mapped locations, locate the sample site.
   - Conduct reconnaissance of the area to select an appropriate sample location deemed representative of the area investigated.
   - Clear an area around the sample site to reduce potential for vegetative debris in the sample.

- Designate the location with a unique sample identifier and place a stake or survey flag at the location with the sample site identification.
- Place plastic sheeting adjacent to the sample site to provide a clean work place.
- Don nitrile gloves and prepare equipment. If hand augers are to be used, leather gloves are permitted provided there is no contact with the sampling media.
- Begin construction of the sample boring by removing the soil horizon (upper soil horizon containing the vegetative root mat generally high in organic debris).
- Continue the boring until the desired depth is achieved.
- Don nitrile gloves.
- Collect soil from the sampling interval using decontaminated stainless steel equipment (scoop or auger).
- Place soil into a decontaminated stainless steel bowl.
- When adequate volume is achieved, don fresh nitrile gloves and blend the soil in the bowl until the soil is adequately homogenized.
- Using a stainless steel scoop, place the soil media into appropriately prepared laboratory containers.
- Seal, label, and place the containers into plastic zip-sealed bags and into a cooled ice chest.
- Adequately describe the sample site including site setting, vegetation, drainage conditions, depth to sampling location, and a soil description.
- Complete the chain-of-custody.
- Decontaminate the sampling equipment (according to the procedures outlined in to the Decontamination SOP (Appendix B.1).
- Dispose of expendable items in the waste allocation area and backfill sampling site.
- Conduct personal decontamination per the Decontamination SOP (Appendix B.1) and proceed to the next sample location.

9.2 Subsurface Soil Sampling

1. This discussion of soil sampling methodology is applicable to the collection of subsurface soil samples using hollow-stem drilling techniques and stainless steel split-barrel samplers.

2. Soil samples may be retrieved at designated depths within soil borings using split-barrel samplers. The following procedures may be applied to the Site for sampling:

    - Upon advancing the soil boring to the desired sampling depth, attach a decontaminated split-barrel sampler to the sampling rods and lower the sampler into augers within the borehole. For decontamination procedures, see the Decontamination SOP (Appendix B.1).
    - When the sampler is positioned at the bottom of the boring, place the hammer above and attach the anvil to the top of the sampling rods.

- Mark the sampling rods from the top of the augers with three successive 6-inch intervals and begin hammering the rods with the hammer. Once the third 6-inch mark is equal to the top of augers, cease hammering and retrieve the sampler.
- Prepare an area for the sampler by spreading plastic sheeting in an area that will not be affected by the drilling activities.
- Don nitrile gloves and open the sampler by removing the shoe. Pull the split barrels apart exposing the soil sample.
- Determine the extent of sluff (loose soil) in the barrel and discard.
- Don fresh nitrile gloves.
- If sample interval is below the water table and the sample is coated with mud, carefully remove the outer portion of the sample core using decontaminated stainless steel scoops. Place the cleaned soil core into a decontaminated stainless steel bowl.
- Place soil into a decontaminated stainless steel bowl.
- When adequate volume is achieved, don fresh nitrile gloves and blend the soil in the bowl until the soil is adequately homogenized.
- Using a stainless steel scoop, place the soil media into appropriately prepared laboratory containers.
- Seal, label, and place the containers into plastic zip-sealed bags and into a cooled ice chest.
- Adequately describe the sample site including sample depth, soil color and texture, moisture content, and a soil description.
- Complete the chain-of-custody.
- Decontaminate the sampling equipment (according to the procedures outlined in to the Decontamination SOP (Appendix B.1).
- Continue drilling to the next sampling interval.
- Upon completion of the soil boring, conduct personal decontamination per the Decontamination SOP (Appendix B.1) and proceed to the next boring location.

9.3 Special Techniques and Considerations

Sampling for PFCs requires special handling requirements to reduce the potential for cross-contamination between sample locations or contamination of the samples by secondary sources. Even if PFCs are not included in the analyte suite, these precautions should be taken for any sample collected at a Site where PFCs are being remediated to maintain sample integrity. The following steps should be followed:

- Avoid fluoropolymers. Do not use aluminum foil during the sampling activities**.**
- Avoid blue ice.
- Avoid pre-wrapped food items and “fast foods.”
- Wear clothing that has been washed at least 6 times.
- Do not use any items containing Teflon.

- If PFCs are part of a larger sampling suite, the samples should be maintained in a cooler separate from other samples that may have Teflon-lined lids.

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Transfer the sample(s) into suitable, labeled sample containers.
2. Preserve the samples or use pre-preserved sample bottles, when appropriate.
3. Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.
4. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.
5. Record all pertinent data in the site logbook and on a field data sheet.
6. Complete the chain-of-custody form.
7. Attach custody seals to the cooler prior to shipment.
8. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

12.1 All field QC samples required in the QAPP must be followed; these may involve field blanks, rinsate (equipment) blanks, and collection of replicate samples.

13.0 References

Remedial Design/Response Action Plan (RD/RA Plan) for the Oakdale Site. WESTON. February 2009.

Construction Sampling Plan for the Oakdale Site. Attachment 2 to the RD/RA Plan for the Oakdale Site. WESTON. February 2009.

Site-Specific Health and Safety Plan. (SSHASP). Attachment 5 to the *RD/RA Plan for the Oakdale Site*. WESTON. February 2009.

EXHIBIT B.3

SURFACE WATER SAMPLING STANDARD OPERATING PROCEDURES

SURFACE WATER SAMPLING
STANDARD OPERATING PROCEDURE B.3

1.0 Scope and Application

1.1 This Standard Operating Procedure (SOP) is applicable to the collection of representative aqueous samples from streams, rivers, lakes, ponds, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

2.0 Summary of Method

2.1 Sampling situations vary widely and, therefore, no universal sampling procedure will be applicable for all possible conditions. However, sampling of liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle.
- Peristaltic pump.
- Direct method.

2.2 These sampling techniques will allow for the collection of representative samples from the majority of surface waters and impoundments encountered.

2.3 Sampling depth will be determined on the basis of total water depth. For sampling locations less than 10 feet deep, samples will be collected at the 0.6 depth (six-tenths of the total depth of water). If the depth is too shallow to prevent disturbing substrate during sample collection, direct collection at the surface will be performed. For sampling locations greater than or equal to 10 feet deep, samples will be collected from the 0.2 and 0.8 depths (two-tenths and eight-tenths of the total depth of water) and composited in equal volumes.

3.0 Health and Safety Issues

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the Site Specific Security Health and Safety Plan (SSHASP).

3.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the SSHASP.

4.0 Interferences

4.1 There are two primary potential interferences with surface water sampling. These include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to the Decontamination SOP (Appendix B.1).
- Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed area.

4.2 It is important to note that sampling for PFCs requires special procedures including the type of equipment used and handling procedures. Even if PFCs are not included in the analyte suite, these procedures will be followed for any sample collected at a Site where PFCs are being remediated to maintain sample integrity. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.
- Prior to sample collection, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP Appendix (B.1).
- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.
- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.
- When possible all sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

5.1 All surface water sample collection will be performed by WESTON personnel. All field sampling personnel are required to take the 40-hour health and safety training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize the hazards associated with field work, and specifically working from a boat, as well as be fully understanding of the provisions of the (SSHASP).

6.0 Equipment and Supplies

6.1 Equipment needed for collection of surface water samples includes:

- Kemmerer bottles*.
- Line and messengers.
- Sample bottle preservatives as specified by the analyses to be performed.
- Plastic zip-sealed bags.
- Ice.
- Cooler(s).
- Chain-of-custody forms, field data sheets.
- Decontamination equipment and reagents specified in the Decontamination SOP (Appendix B.1).
- Maps/plot plans.
- Safety equipment.
- Compass.
- Tape Measure.
- Global Positioning System (GPS).
- Survey stakes, flags, or buoys and anchors.
- Logbook and waterproof pen.
- Sample bottle labels.
- Approved Work Plan.
- Approved QAPP.
- Approved SSHASP.

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or polyvinyl chloride (PVC) should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the SSHASP and facility requirements.

5. Use stakes, flags, or buoys to identify and mark all sampling locations until positional data have been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

1. Water quality data should be collected in impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, and temperature can indicate if strata exist which would affect analytical results. Measurements should be collected at 1-meter intervals from the substrate to the surface using an appropriate instrument calibrated in accordance with the instrument manufacturer’s instructions.

2. Water quality measurements such as dissolved oxygen, pH, temperature, and conductivity can assist in the interpretation of analytical data and the selection of sampling sites.

3. Generally, the deciding factors in the selection of a sampling device for sampling liquids in streams, rivers, lakes, ponds, lagoons, and surface impoundments are:

    - Will the sample be collected from the shore or from a boat?

    - What is the desired depth at which the sample is to be collected?

    - What is the overall depth and flow direction of the river or stream?

9.0 Sample Collection – Method Options

9.1 Kemmerer Bottle

A Kemmerer bottle may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

1. Using a properly decontaminated Kemmerer bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing water to be sampled to pass through this tube.

2. Lower the pre-set sampling device to the pre-determined depth. Avoid bottom disturbance.

3. When the Kemmerer bottle is at the required depth, send down the messenger closing the sampling device.

4. Retrieve the sampler and discharge the first 10 to 20 ml to clear any potential contamination on the valve. Transfer the sample to the appropriate sample container.

9.2 Peristaltic Pump

Peristaltic pumps may be considered for samples requiring specific sampling depths or for samples requiring high volume of media. The peristaltic pump utilizes a revolving cam to extract the media through a sampling tube, and thereby eliminating potential impact to the media by contact with pump. The steps in using the peristaltic pump are as follows:

1. Setup the pump in an area free of obstruction to allow the tubing to fall freely to the point of media extraction. If a desired depth is required, the tubing may be premeasured to ensure proper sample depth.

2. Place plastic sheeting in the area of sample acquisition to act as a clean work area.

3. Lock the tubing into the pump cam assembly.

4. Turn on the pump using a low flow setting so as not to disturb the sampling zone.

5. Once water is received at the discharge point, continue pumping to purge the tubing of at least one sample tube volume.

6. Collect the sample in laboratory-prepared containers. Seal, label, and place the containers into an ice chest cooled to approximately 4° C.

7. Remove the tubing from the pump cam assembly and place it within the wastes accumulation point, along with the plastic sheeting and any expendable items.

8. Complete the sample log data and chain-of-custody forms.

9. Proceed to the next sample location.

9.3 Direct Method

For shallow waters where Kemmerer or other techniques are unsuitable, the direct method may be utilized to collect water samples from the surface.

Using adequate protective clothing, obtain access to the sampling station by appropriate means. For shallow stream stations, collect the sample under the water surface pointing the sample container upstream. The container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface avoiding surface debris and the boat wake. The following procedure should be used to prepare the sampling container:

1. Moisten a Chem-wipe^{tm} or equivalent with methanol and wipe the exterior of the sampling bottle with the cap in place.

2. Submerge the sample bottle below the surface and remove the cap.

3. Fill the sample bottle below the water surface and recap under water.

4. Wipe the bottle with methanol-moistened Chem-wipe^{tm} or equivalent and apply sample label.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Transfer the sample(s) into suitable, labeled sample containers.

2. Preserve the samples or use pre-preserved sample bottles, when appropriate.

3. Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.
4. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.
5. Record all pertinent data in the site logbook and on a field data sheet.
6. Complete the chain-of-custody form.
7. Attach custody seals to the cooler prior to shipment.
8. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

12.1 Representative samples are required. In order to collect a representative sample, the hydrology and morphometrics, (e.g., measurements of volume and depth) of a stream or impoundment should be determined prior to sampling. This will aid in determining flow patterns in streams and appropriate sample locations, depths, and sampling methods.

12.2 Field quality control samples will be collected by the sampling team to determine whether data are of suitable quality. They include blanks, duplicates and/or background samples.

13.0 References

Remedial Design/Response Action Plan (RD/RA Plan) for the Oakdale Site. WESTON. February 2009.

Construction Sampling Plan for the Oakdale Site. Attachment 2 to the RD/RA Plan for the Oakdale Site. WESTON. February 2009.

Site-Specific Security, Health and Safety Plan. (SSHASP). Attachment 5 to the *RD/RA Plan for the Oakdale Site*. WESTON. February 2009.

ATTACHMENT 4

SOIL TRANSPORTATION PLAN

SOIL TRANSPORTATION PLAN

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

WESTON SOLUTIONS, INC.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

TABLE OF CONTENTS

Section **Page**

LIST OF FIGURES

Title

LIST OF ACRONYMS

3M	3M Company
CRZ	Contaminant Reduction Zone
DOT	U.S. Department of Transportation
EZ	Exclusion Zone
MPCA	Minnesota Pollution Control Agency
O&M	operation and maintenance
PCB	polychlorinated biphenyl
PFC	perfluorochemical
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Response Action
SRV	Soil Reference Value
SSHASP	Site-Specific Security Health and Safety Plan
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
VOC	volatile organic compound
WESTON®	Weston Solutions, Inc.

1. INTRODUCTION

This Soil Transportation Plan is a supporting document to the Remedial Design/Response Action (RD/RA) Plan that has been prepared by the 3M Company (3M) for the Oakdale Site in Oakdale, Minnesota, to address the presence of perfluorochemicals (PFCs) in soil and groundwater. The primary focus of the Soil Transportation Plan is the soil excavation area north of Highway 5, since the work south of Highway 5 involves only minor handling of PFC-containing material during construction. However, elements of this plan may be applicable to the construction and operation and maintenance (O&M) activities for the groundwater treatment system.

This plan presents the overall procedures and steps that will be taken for transport of excavated soil/materials from the Site and clean fill to the Site. Minor modifications and additions may be made to this plan before and during implementation that will not involve regulatory review and approval.

1.1 OVERVIEW

As specified in the RD/RA Plan, soil removal will be conducted in the defined excavation area to prevent contact with accessible surface soil and to reduce the mass of PFCs in the soil. Throughout the area defined in the RD/RA Plan, the upper 4 feet of soil will be removed and transported to an existing permitted off-site landfill to provide engineered isolation and containment of PFCs. Additional soil below the 4-foot zone has also been defined and will be removed. The soil excavation locations and depths are provided in Figure 1-1. Soil from the excavation area will be sampled and profiled and the appropriate disposal facility identified. It is anticipated that three categories of soil profiles are possible: (1) non-hazardous soil; (2) soil that meets hazardous waste criteria and exceeds the Minnesota Industrial Soil Reference Values (SRVs), exceeds Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits, or exhibits ignitability or reactivity; and (3) soil with polychlorinated biphenyl (PCB) concentrations greater than 50 parts per million (ppm). Materials will be handled and transported to permitted off-site disposal locations based on the resulting soil profile.

1.2 PURPOSE OF THE SOIL TRANSPORTATION PLAN

This Soil Transportation Plan the procedures that will be used to transport excavated soil from the Oakdale Site to permitted off-site disposal facilities. It also addresses the transport of clean borrow soil from off-site locations to the Site for backfilling excavations.

Figures referenced in the text can be found at the end of each respective section of this Soil Transportation Plan.

WESTON SOLUTIONS

Legend

🟨	Water Table Monitoring Well
—	Fenceline
▨	Potential Stockpile Area
🟩	Excavate to 4 Feet Below Grade
⬚	Area of Soil (PFOS > 1.0 ppm)
▨	Excavation to Groundwater Table

N
W E
S

0 100 200
Feet

Figure 1-1
Excavation Area

Oakdale Site
Oakdale, Minnesota

File: \\Fsfed01\TIG\Oakdale\mxd\soil excavation area.mxd, 12-Feb-09 14:59, ricksc

2. SOIL DISPOSAL PROFILING

Prior to conducting any excavation activities, the soil within the limits of excavation will be sampled in situ for disposal profiling and acceptance at identified disposal facilities. The primary disposal facility is the SKB Environmental Landfill in Rosemount, Minnesota; however, it can accept only non-hazardous material. Soils that do not meet non-hazardous acceptance criteria may be stockpiled during excavation for additional ex situ profiling. The Construction Sampling Plan describes this process in detail. Based on the results of in situ and ex situ sampling, three categories of soil profiles are possible. These materials will be handled, transported, and disposed as described below:

1. **Non-Hazardous Soil—**Areas with non-hazardous soil, which is defined as material that is below the TCLP limits for volatile organic compounds (VOCs) and metals, contains total concentrations that are less than the applicable industrial SRV, and is not Resource Conservation and Recovery Act (RCRA) characteristic ignitable or reactive, will be excavated and can be direct-loaded into haul trucks for non-hazardous disposal. Some non-hazardous soil also may be stockpiled on-site based on ex situ sampling results as described in the Construction Sampling Plan and may be loaded from the stockpile into the haul truck. Pending facility acceptance, non-hazardous soil will be transported to:

   - SKB Environmental
     Rosemount Industrial Waste Facility
     13425 Courthouse Blvd.
     Rosemount, MN 55068

   A shipping document, such as a bill of lading or shipping papers from the hauler, will accompany each truckload of non-hazardous soil transported off-site.

   To minimize truck traffic and reduce the carbon footprint, it is anticipated that the same trucks that haul PFC-containing soil to SKB may be used to haul clean borrow soil from the SKB site to the Oakdale Site. The clean borrow fill will be used to backfill the excavation. This type of hauling will depend on the use of environmental controls such as inspections, documentation and lining of truck bed procedures (see

Section 3), to prevent possible cross contamination of the clean backfill being hauled in these trucks.

2. **Soils That Meet Hazardous Waste Criteria—**Following any ex situ sampling and final profiling, soils that meet hazardous waste criteria and contain certain VOCs and/or metal concentrations that exceed industrial SRVs, TCLP criteria, or exhibit the RCRA characteristic of ignitability or reactivity will be stockpiled in a designated area on-site. Soil will be loaded from the stockpile into the haul truck. Pending facility acceptance, soils that meet hazardous waste criteria will be transported to a RCRA-permitted facility. The following facilities may be used; however, other RCRA-permitted facilities may also be considered:

   - Chemical Waste Management
     1550 Balmer Road
     Model City, NY 14107

   - Clean Harbors Lone Mountain
     Route 2, Box 170
     Waynoka, OK 73860

   - Wayne Disposal, Inc.
     49350 North I-94 Service Drive
     Belleville, MI 48111

   In accordance with RCRA and U.S. Department of Transportation (DOT) regulations, a Uniform Hazardous Waste Manifest and required documentation will accompany each truckload of soils meeting hazardous waste criteria and transported off-site. The document will be signed by the hauler and the 3M designated representative.

3. **Soil Containing PCBs > 50 ppm—**Following any ex situ sampling and final profiling, soil that contains PCB concentrations greater than 50 ppm will be stockpiled in a designated area on-site. Soil will be loaded from the stockpile into the haul truck. Pending facility acceptance, soil will be transported to a Toxic Substances Control Act (TSCA)-permitted facility. The following facilities may be used; however, other TSCA-permitted facilities may also be considered.

- Wayne Disposal, Inc.
  49350 North I-94 Service Drive
  Belleville, MI 48111

- Clean Harbors Lone Mountain
  Route 2, Box 170
  Waynoka, OK 73860

In accordance with TSCA and U.S. DOT regulations, a Uniform Hazardous Waste Manifest and required documentation will accompany each truckload of TSCA-regulated soil transported off-site. The document will be signed by the hauler and the 3M designated representative.

A copy of each shipping form/manifest and required documentation will be retained by Weston Solutions, Inc. (WESTON®) at the Site. At a minimum, the following information will be included on the shipping forms/manifests:

- Name and address of the generator.
- Name and address of the transporter.
- Name and address of the disposal facility.
- Waste description and quantity or weigh ticket.
- Date of shipment.

3. SOIL TRANSPORTATION

The following sections provide a description of the soil transportation procedures that will be followed during the implementation of soil removal and backfill RA activities. All excavation, transport and disposal activities will be conducted in compliance with local, state and federal regulations.

3.1 TRANSPORTER REQUIREMENTS

The selected transporters will be licensed, and insured or otherwise approved to transport the excavated soils. For transportation of soils that meet hazardous waste criteria, the selected transporter will be a registered hazardous waste hauler.

3.2 ON-SITE TRAFFIC FLOW AND TRUCK LOADING

As shown in Figure 3-1, all vehicles will enter and exit the northern portion of the Site from Granada Avenue at the gated entrance, which will be approximately 200 feet north of Highway 5. An improved all-weather access road will be constructed on-site approximately 25 feet wide to allow access to the excavation area and minimize the tracking of mud and debris onto the public roadway. Although no excavation and removal activities will occur on the southern portion of the Site, there will be construction activities involved with groundwater treatment system construction and O&M activities. Vehicles will enter and exit the southern portion of the Site at the gated entrance on Granada Avenue south of Highway 5 as shown in Figure 3-1.

For excavation activities on the northern portion of the Site, a traffic control station will be established at the access road where each entering and exiting vehicle will stop for approval to proceed. All haul trucks will be stationed on-site and no trucks or vehicles will be permitted to park or idle off-site on a local street. Traffic will be coordinated so that no more than approximately three trucks will be at the Site at one time. This measure will control off-site truck traffic and reduce dust generation during on-site transportation. Additionally, all vehicles will be required to maintain slow speeds on-site (i.e., less than 5 miles per hour) for safety and for dust control. Water spray or mist, as appropriate, will be applied during soil loading operations to control dust.

Haul trucks arriving on-site will proceed from the traffic control station to the excavation area for direct loading or to a stockpile for loading from the stockpile. Trucks containing clean borrow soil will proceed from the traffic control station to the excavation area for unloading and loading. The trucks will remain on the access road and will remain within the Support Zone in clean areas outside the Contaminant Reduction Zone (CRZ) and Exclusion Zone (EZ) as specified in the Decontamination Plan (Attachment 6 to the RD/RA Plan).

The following procedures will be conducted for truck loading:

1. If required (see Section 3.3), an approved disposable liner will be placed in each truck bed prior to the truck being loaded with soil from the Site.
2. Soils that are excavated will either be directly loaded from the excavation onto trucks or placed into an on-site stockpile. Haul trucks will remain in the clean Support Zone on the stone access road for loading.
3. From the stockpile, soil will be directly loaded into trucks. The haul road will be constructed to allow truck loading directly from the stockpile, such that the truck can remain in the clean Support Zone on the stone road.
4. No soil may be loaded higher than the sides of the transport truck. This includes soil at the center of the truck bed.
5. Soil will not be loaded if free water is present in the excavation or stockpile, based on visual observation.
6. A tarp will be placed over the soil in the truck bed and will be secured to cover the soil at all times during transport off-site.
7. Prior to leaving the Site, each truck will stop at the traffic control station and be inspected to check that:
   - The liner is in place (if required).
   - The tarp is in place and secured for transport. The tarp will be in good condition with no leaks, holes, rips, in order to prevent any soil release or precipitation entry.
   - The tires, undercarriage and truck body are clean.
   - No water is leaking from the tailgate. The tailgate is secure and tight.
   - Documentation (manifests, bills of lading) of the shipment has been exchanged with the driver and copies obtained for retention.

  - Placarding is visible on the truck as required.

8. The trucks will transport the soil to the disposal facility where the soil will be unloaded. For each load that is disposed, a weight ticket (using a certified scale) will be obtained.

3.3 CLEAN BORROW SOIL UNLOADING

It is anticipated that clean borrow soil will be obtained from the SKB site for use as backfill at the Site, although other off-site sources also may be used. Trucks hauling clean borrow soil from SKB or from another off-site source will stop at the traffic control station upon entering the Site and following approval will proceed to the designated location for unloading. The soil will be inspected to confirm that it contains no debris, roots, large rocks or free water and is suitable for backfilling and compaction. If the soil is found to be unsuitable, it will be returned to the source. Haul trucks will remain in the clean Support Zone on the stone access road for unloading at the edge or adjacent to the excavation.

Once the clean backfill is unloaded and the truck bed is completely empty, the haul truck will be loaded with non-hazardous excavated soil for the return trip to the SKB Landfill. If the same truck will be used to haul both clean borrow and excavated soil, then the empty truck bed will be fitted with an approved disposable liner. This liner will be sufficient to prevent soil contact with the truck bed during loading, transit, and unloading and prevent leakage. The remaining Items 2 through 8 (see Section 3.2) would then be conducted. Haul trucks from other off-site clean borrow sources will not be loaded with excavated or stockpiled soil and will return to the source empty.

3.4 HOURS OF OPERATION AND TRUCK TRAFFIC ROUTE

Truck traffic entering or leaving the Site will be restricted to the hours of 9 am to 3 pm, Monday through Friday. There will be no truck traffic on weekends or holidays.

Transportation of soils will be conducted on streets and/or highways approved for truck traffic, and will be directed to minimize any potential impact on the local neighborhood. Trucks will not use residential roads adjacent to the facility, except to enter and leave the Site at Granada Avenue.

As shown in Figure 3-1 , the transport trucks will exit the northern portion of the Site and turn south onto Granada Avenue. At the intersection of Granada and Highway 5, trucks will turn left onto the eastbound lane of Highway 5 and proceed east on Highway 5 for approximately 0.7 mile to Interstate 694.

From that point, there are numerous alternate routes that can be taken to the designated facility. Trucks going to the SKB Landfill will proceed south on Interstate 694, to south on Highway 494, to south on Highway 52, and exit at Courthouse Boulevard (Highway 55). All other trucks will proceed south on Interstate 694, to other interstate highways, as required. No other routing will occur unless approved in advance.

3.5 RECORDKEEPING

Records that will be maintained include the following:

- Shipping papers, bills of lading, or manifest for each load, as well as weigh tickets.
- A log of all vehicles entering and leaving the Site.
- Inspection logs for all trucks hauling soil for disposal.

3.6 HEALTH AND SAFETY

A Site-Specific Security, Health and Safety Plan (SSHASP) has been prepared and included as Attachment 5 to the RD/RA Plan. All personnel working at the Site will be required to be familiar with the SSHASP.

3.7 CONTINGENCY PLAN

The excavation and transportation contractor will have a contingency plan for emergency situations (vehicle breakdown, accident, soil spill or leak) that occur during transportation of excavated soils from the Site to the disposal facility or clean borrow soil to the Site. The contractor will have a spill response crew available in the event of an accidental release or spill.

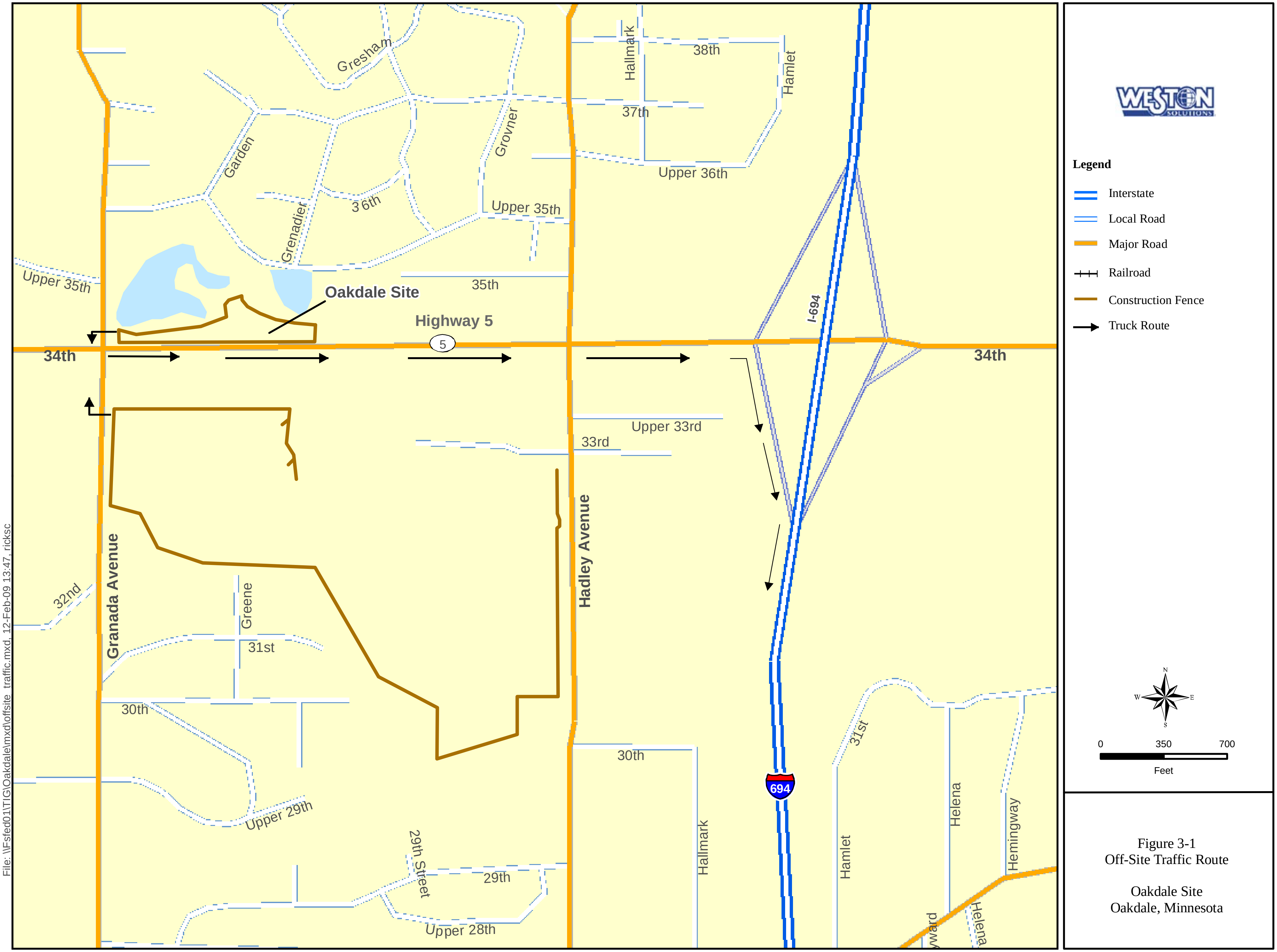

Figure 3-1
Off-Site Traffic Route

Oakdale Site
Oakdale, Minnesota

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ATTACHMENT 5

SITE-SPECIFIC SECURITY HEALTH AND SAFETY PLAN

DRAFT

SITE-SPECIFIC SECURITY, HEALTH AND SAFETY PLAN

OAKDALE SITE
OAKDALE, MINNESOTA

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

Weston Solutions, Inc.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

TABLE OF CONTENTS

INTRODUCTION

INTRODUCTION

This site-specific Security Health and Safety Plan (SSHASP) defines the safety and health requirements necessary to perform field and response activities related to the Remedial Design/Response Action (RD/RA) program for the Oakdale Site, Oakdale, MN. The Oakdale Site is located along Highway 5 in Oakdale, MN. A site location map and the specific areas of proposed work are presented in the RD/RA Plan.

This SSHASP presents the minimum requirements for health and safety that must be met by site personnel engaged in site operations. This document is intended to serve as a general guidance document for on-site activities and does not in any way relieve site personnel, contractors, or subcontractors from the responsibility for the health and safety of their personnel. This is a working document, and as such will be updated as needed to remain current. The document as it stands now should be considered **draft** until contractors are selected, pre-mobilization sampling is complete, and final project implementation phasing has been defined (in consultation with the selected contractors).

This document has been prepared to set forth the minimum standards for contractor safety and health programs while working at the site. Contractors will be required to review this document and incorporate these requirements into their respective Safety Programs to ensure safe working conditions at the site. Any visitors to the site will be required to comply with the approved SSHASP to gain entry into all controlled work areas. This SSHASP has been prepared by Weston Solutions, Inc. (WESTON) on behalf of the 3M Company (3M). This document has been prepared in accordance with all applicable federal, state, and local health and safety requirements, including policies developed by 3M addressing specific work tasks. Specific references consulted in assembling this SSHASP include the following:

- 29 Code of Federal Regulations (CFR) 1910 and 1926 (Occupational Safety and Health Administration (OSHA) General Industry and Construction Standards, respectively).
- National Institute for Occupational Safety and Health (NIOSH) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.
- 40 CFR 260-270 (U.S. Environmental Protection Agency (EPA) Solid Waste Standard).
- EPA Standard Operating Safety Guides, Office of Solid Waste and Emergency Response (OSWER), June 1992.
- Applicable state and local regulations.
- Current version of the 3M Contractor Safety Requirements.
- WESTON Corporate Health and Safety Program.
- RD/RA Plan submitted February 2009.

This document with its attachments has been developed to address the work tasks presented and described in the Oakdale Remedial Design/Response Action Plan submitted to the Minnesota Pollution Control Board (MPCA) in February 2009.

STAFF ORGANIZATION

Personnel must be aware of the staff organization, and the responsibilities and qualifications of each organization member. The general health and safety responsibilities of key RD/RA team members are discussed in the following subsections. Prior to field mobilization, all personnel will be reviewed to ensure that they have the necessary qualifications, including sufficient knowledge gained through experience and training, to effectively execute the duties of their position.

3M Project Manager

Mr. James Kotsmith will act as the 3M Project Manager. The 3M Project Manager will act as the primary contact for all on-site activities. The 3M Field Manager will be responsible for coordinating clearance for all field activities as detailed throughout the RD/RA Work Plan and this SSHASP, and serve as the primary Point-of-Contact for distribution of information to the public and applicable government agencies.

3M Designated Representative

A 3M Designated Representative will be assigned to this project. It will be the responsibility of the 3M Designated Representative to manage the activities of all prime contractors, and to ensure that these contractors conduct the RA in accordance with all plans, drawings, and contract documents. The 3M Designated Representative will be responsible for:

- Enforcement of policy actions regarding work requirements and deviation from the SSHASP.
- Maintaining site security and access control.
- Ensure compliance with 3M policy.

WESTON Project Manager

Mr. Robert Junnier will serve as the WESTON Project Manager. As the WESTON Project Manager, Mr. Junnier will serve as the primary contact for the WESTON Site Manager and the 3M Project Manager, and be responsible for ensuring that all field personnel have the necessary qualifications and perform their work in conformance with the SSHASP. The WESTON Project Manager will also be responsible for reviewing and approving any modifications to the Work Plan or SSHASP, and interfacing with the project team regarding resolution of health and safety problems or concerns.

WESTON Site Manager

The WESTON Site Manager position will be staffed by WESTON personnel experienced in the supervision and implementation of project field activities. This position may be staffed by multiple individuals depending on the specific work schedule. The WESTON Site Manager will work and coordinate with the WESTON Health and Safety Officer to implement applicable SSHASP requirements for daily work tasks and to enforce corrective measures for any deviations to the SSHASP. The Site Manager will be responsible for the following:

- Coordination and scheduling of daily work activities.
- Supervision of work crews and trucks.

- Implementation and maintenance of the Site Stormwater Management Plan, Construction Sampling Plan, on-site waste management, and active permits and licenses.
- Enforcement of policy actions regarding WESTON work activities and deviation from the SSHASP.

The WESTON Site Manager will not directly supervise any contractors (other than WESTON personnel). Rather, they will coordinate with the 3M Designated Representative.

WESTON Health and Safety Officer

The WESTON Health and Safety Officer will consist of qualified WESTON personnel with adequate training and experience necessary to implement the SSHASP. This position may be staffed by multiple personnel depending on the specific work schedule. The WESTON Health and Safety Officer will focus on compliance with the requirements of the SSHASP as it applies to all field activities associated with the RD/RA Program, and be responsible for implementation of defined safety action levels and initiating modifications to the SSHASP should site conditions warrant. The Health and Safety Officer will also be responsible for the following duties:

- Maintaining personnel records and reviewing training requirements for specific site duties.
- Conducting daily hazard analysis and safety briefings to address hazards and concerns.
- Briefing the Site Manager of safety concerns or violation and notifying the Site Manager of any modification to the SSHASP or safety protocol.
- Documenting incidents or near-miss issues, evaluating and establishing appropriate response.
- Conducting ambient air monitoring during excavation and backfilling activities to ensure compliance with the SSHASP.
- Providing health and safety consultation as needed.
- Air and media sampling during site activities, including personnel air monitoring.
- Sample management.

This person may also be the WESTON Site Manager.

Contractor Site Supervisor

Each on-site contractor will provide a Site Supervisor experienced in the supervision and implementation of project field activities. This position may be staffed by multiple individuals depending on the specific work schedule. The Contractor Site Supervisor will coordinate with the 3M Designated Representative and the WESTON Site Manager to implement applicable SSHASP, contractor-specific Safety Plans, and other requirements for daily work tasks and to enforce corrective measures for any deviations. The Contractor Site Supervisor will be responsible for the following:

- Coordination and scheduling of daily work activities.
- Supervision of work crews and trucks.
- Conformance to the Site Stormwater Management Plan, on-site waste management requirements, and active permits and licenses.

- Enforcement of policy actions regarding contractor work activities and deviation from the SSHASP and the contractor-specific Safety Plans.

Each contractor shall provide a Contractor Health and Safety Officer(s) who will be on-site during all field activities. This person may also be the Contractor Site Supervisor.

SSHASP ORGANIZATION

This SSHASP addresses the anticipated work tasks and potential hazards associated with the basic Scope-of-Work as defined in the Oakdale Remedial Design/Response Action Plan (submitted February 2009). The following sections are included:

- Introduction
- SSHASP Orientation and Approval
- Emergency Information
- SSHASP Approval, General Site Information, Personnel and Contractor Services
- Hazard Analysis and Work Tasks
- Personnel Protection Plan
- Air and Hazard Monitoring Program
- Attachment A Safety Forms, Plans and Checklists
- Attachment B Material Safety Data Sheets (MSDSs)
- Attachment C Site-Specific Hazard Communication Program
- Attachment D Traffic Control Plan
- Attachment E Chemical Contaminants

SSHASP ORIENTATION AND APPROVAL

TRAINING AND BRIEFING TOPICS	
The following items will be covered during the initial SSHASP Orientation and as necessary as part of site-task specific briefings, or daily/periodic safety meetings:	
☐ Site Organization I	☐ Level A
☒ Physical hazards, HASP Form 07	☐ Level B
☒ Chemical hazards, HASP Form 04	☒ Level C
☒ Animal bites, stings, and poisonous plants	☒ Level D
☒ Etiologic (infectious) agents	☒ Safety Monitoring, 29 CFR 1910.120 (h)
☒ Site control, 29 CFR 1910.120 d	☒ Decontamination, 29 CFR 1910.120 (k)
☒ Engineering controls and work practices, 29 CFR 1910.120 (g)	☒ Emergency response, 29 CFR 1910.120 (l)
☒ Heavy machinery	☒ Elements of an emergency response, 29 CFR 1910.120 (l)
☐ Forklift	☒ Procedures for handling site emergency incidents, 29 CFR 1910.120 (l)
☐ Backhoe	☒ Off-site emergency response, 29 CFR 1910.120 (l)
☐ Equipment	☒ Handling drums and containers, 29 CFR 1910.120 (j)
☒ Tools	☐ Opening drums and containers
☐ Ladder, 29 CFR 1910.27 (d)/29 CFR 1926	☐ Electrical material handling equipment
☒ Overhead and underground utilities	☐ Radioactive waste
☐ Scaffolds	☐ Shock-sensitive waste
☐ Structural integrity	☐ Laboratory waste packs
☐ Unguarded openings - wall, floor, ceilings	☐ Sampling drums and containers
☐ Pressurized air cylinders	☐ Shipping and transport, 49 CFR 172.101, IATA
☒ Personal protective equipment, 29 CFR 1910.120 (g); 29 CFR 1910.134	☒ Excavations
☐ Respiratory protection, 29 CFR 1910.120 (g); ANSI Z88.2	☐ Illumination, 29 CFR 1910.120 (m)
☒ Traffic Control and Vehicle Safety	☐ Sanitation, 29 CFR 1910.120 (n)
☐ Site characterization and analysis, Sec. 3.0, 29 CFR 1910.120 I	☐ Soil/Waste Management
☐	☐
☐	☐

WESTON HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM

Site Name: OAKDALE RESPONSE ACTION, OAKDALE, MN

WO#: 02181-202-011

Address: At the Intersection of Highway 5 and Granada Avenue
Oakdale, MN

I understand, agree to, and will conform with the information set forth in Oakdale Remedial Design/Response Action Plan and this Site Specific Security, Health and Safety Plan (including attachments) and any specific requirements as discussed in the personnel health and safety briefing(s).

Name	Signature	Date

Contractor Acknowledgement: Supervisory Personnel, Competence of Personnel, and Task Understanding

Site: **OAKDALE RESPONSE ACTION, HIGHWAY 5, OAKDALE, MN**

Work Order Number**: 02181.202.011** Date:_______________________________________

1) In accordance with Contract terms, contractor acknowledges it is responsible for performance of work in accordance with contract documentation. Contractor further acknowledges and agrees that it bears sole responsibility for implementing an Environmental Health and Safety (EHS) Plan. Contractor shall implement the EHS Plan in one of the following ways:

- **Option A**: Prepare and submit to 3M an Environmental Health and Safety (EHS) Plan. Contractor shall acknowledge by signing below that all programs and documentation required by applicable law, rules and regulations are maintained and implemented in conjunction with contractor's performance of its work.

- **Option B**: Implement WESTON's SSHASP for the work to be accomplished. Notwithstanding contractor's use of WESTON's SSHASP, contractor shall still be responsible for maintaining all programs and documentation required by applicable law, rules and regulations.

2) Contractor is responsible for supervising its employees (as defined by 29 CFR 1904) and providing qualified and competent personnel as and where required by law, rules and regulation. Unless otherwise agreed to in writing, contractor will be responsible for managing and recording all injuries and incidents involving its employees as required by OSHA or other applicable laws, rules and regulations. A listing of OSHA standards requiring the services of a competent person is presented below.

Contractor Name:	***Contractor Address:***	
Contractor Services:		
Safety Plan Option Selected	***( ) Option A***	***( ) Option B***
Contractor Supervisor Name:		
Contractor Safety Officer Name:		
Contractor Competent Person (s) and role (as necessary		

Comments:

This document is to be completed, filed on-site, and maintained up to date.

Contractor Site Supervisory Personnel, Competent Persons, and Task Understanding (continuation)

Listing of OSHA (29 CFR) Standards currently requiring a competent person.

General Industry:
1910.66 (Powered Platforms for building Maintenance)
1910.66 Appendix C (Powered Platforms, Manlifts, and Vehicle Mounted work platforms, Personal Fall Arrest System)
1910.109 (Explosives and Blasting Agents)
1910.139 (Respiratory Protection for M. tuberculosis)
1910.183 (Helicopters); 1910.184 (Slings)
1910.268 (Telecommunications)

Construction Industry:
1926.20 (General safety and health provisions)
1926.53 (Ionizing Radiation)
1926.62 (Lead)
1926.101 (Hearing Protection)
1926.251 (Rigging Equipment for material handling)
1926.354 (Welding, cutting and heating in way of preservative coatings);
1926.404 (Wiring design and protection)
1926.451 (Scaffolds)
1926.454 (Scaffolds, Training Requirements)
1926.500 (Fall Protection, Scope, application, and definitions)
1926.502 (Fall protection systems criteria and practices)
1926.503 (Training requirements)
1926.550 (Cranes and derricks)
1926.552 (Material hoists, personnel hoists, and elevators)
1926 Subpart P, Appendix A (Excavations, Soil classifications)
1926 Subpart P, Appendix B (Excavations, Sloping and Benching)
1926.651 (Specific excavation requirements)
1926.652 (Excavations, requirements for protective systems)
1926.705 (Concrete and Masonry construction)
1926.752 (Steel Erection, bolting, riveting, fitting-up, and plumbing up)
1926.800 (Underground construction)
1926.803 (Underground construction, caissons, cofferdams, and compressed air)
1926.850 (Demolition, preparatory operations)
1926.859 (Mechanical demolition)
1926.900 (Blasting and use of explosives)
1926.1053 (Ladders)
1926.1060 (Stairways and Ladders, Training requirements)
1926.1101 (Asbestos)
1926.1127 (Cadmium)

CONTRACTOR HEALTH AND SAFETY PLAN APPROVAL/SIGNOFF FORM

Site Name: OAKDALE RESPONSE ACTION, OAKDALE, MN	**WO#:** 02181-202-011

The Contractor Site Manager is responsible for ensuring full compliance of all employees or contracted services as identified below to their company's health and safety program, WESTON's Site-Specific Health and Safety Plan (including attachments and referenced documents), and all applicable regulations.

As the **Contractor Health and Safety Officer** or **contractor employee,** I will follow our company's safety program and will comply with all applicable regulatory work practices. In addition, I understand, agree to, and will conform to the information set forth in this WESTON Site-Specific Security, Health and Safety Plan (including attachments and referenced documents), and as discussed in daily health and safety briefing(s) as part of our overall contractor safety program. If our company's requirements are more stringent than those defined in this document, I will inform WESTON and follow the more stringent procedures.

CONTRACTOR NAME:	**CONTRACTOR ADDRESS:**
CONTRACTOR SITE MANAGER AND PHONE	

Printed Name	**Signature**	**Date**

EMERGENCY INFORMATION

EMERGENCY INFORMATION

This section presents the Emergency Response Plan and pertinent information necessary to properly address incidents occurring at the site. Incidents may include:

- Security issues
- Potential issues of concern for health and safety
- Incidents requiring on-site medical treatment
- Incidents requiring off-site medical treatment
- Spill response
- Air release issues
- Fire response

SECURITY ISSUES

Any issues regarding entry to the project site by unauthorized personnel, either during working hours or off-hours, should be reported to the WESTON Site Manager immediately. This may include discovery of missing equipment, breaches in the security fence, cut locks, or unfamiliar personnel on-site. In accordance with the SSHASP, any visitors to the site will be escorted by WESTON personnel. Work requiring temporary workers on-site will be announced during the daily safety meetings and will be restricted to only those areas relevant to their work tasks.

If a security incident is discovered or suspected, the following procedures should be followed:

Unauthorized Access:

1. Any unauthorized personnel observed on-site should be reported immediately to the 3M Designated Representative or WESTON Site Manager. If said person is within a restricted work area, work should stop immediately until the person is identified and authorization is established.

2. If a person is unauthorized to access the site, the WESTON Site Manager will notify the 3M Designated Representative who will take appropriate measures to correct the incident. All details regarding the matter will be recorded. WESTON will identify the breach in security and measures will be implemented to address the concern.

3. The WESTON Site Manager will notify the 3M Designated Representative and WESTON Project Manager of all incidents, and of any corrective measures implemented to control the situation.

Security Issues During Off-hours

1. If theft or vandalism is suspected, the WESTON Site Manager will be notified immediately. WESTON will in turn notify the 3M Designated Representative.

2. WESTON staff will work with the 3M Designated Representative to investigate the incident, documenting all the information. The security systems will be inspected to identify any potential access points. The 3M Designated Representative will be responsible for addressing security issues.

3. WESTON will follow the direction of the 3M Designated Representative regarding changes in security measures resulting from the incident. If needed, WESTON will amend the SSHASP to indicate the changes. If a police report is prepared, WESTON will request a copy to be included as part of the SSHASP records for the Site.

Security Issues with On-Site Personnel

The following items are restricted from the site and cannot be brought onto the Site without prior authorization by the WESTON Site Manager:

- Cameras – Prohibited
- Camera phones – Restricted
- Alcohol – Prohibited
- Illegal drugs or controlled substances – Prohibited
- Prescription or non-prescription drugs – Restricted
- Firearms, ammunition, explosives, unauthorized flammable substances – Prohibited

Procedures

1. Prohibited items will not be allowed on-site. Prohibited items discovered in a vehicle, should be removed <u>before</u> entry to the site. Cameras accidentally brought to the site must be turned in to the WESTON Site Manager or 3M Designated Representative who will secure the item until the end of the work day.

2. Restricted Items must be reported to the WESTON Site Manager immediately upon entry to the site. No photographs are allowed on-site. Camera phones must be used solely for phone services and may be checked periodically by WESTON personnel if it is suspected that photographs have been taken.

   Any prescription or non-prescription drugs must be reported immediately to the WESTON Site Manager. The WESTON Site Manager will evaluate whether restrictions to the type of work or equipment operation is warranted and make recommendations to the Contractor Site Supervisor. Ultimately, any action taken will be the responsibility of the Contractor Site Supervisor for the contractor employees.

   Medications for chronic conditions, such as diabetes, or medical response, such as treatments for allergic reactions must be reported to the WESTON Site Manager during the SSHASP Orientation. At a minimum, the WESTON Site Manager and the Contractor Site Supervisor must be briefed on the location and use of these items.

3. Any personnel observed in possession of restricted items without prior authorization will be subject to immediate removal from the site. Anyone

observing a violation should report the incident immediately to the Contractor Site Supervisor or WESTON Site Manager. The incident will be investigated and appropriate action taken. The WESTON Site Manager will notify the WESTON Project Manager of the incident and any actions taken.

Fighting or Horseplay will not be tolerated at the site. Any persons caught fighting will be permanently removed from site. Anyone conducting themselves in a manner deemed by the WESTON Site Manager as unsafe, such as wrestling, practical jokes, etc., will be verbally reprimanded, the Contractor Site Supervisor will be notified, and the incident will be documented. If the behavior continues, upon the third incident, the person will be removed from the site and will not be allowed to return.

POTENTIAL HEALTH OR SAFETY CONCERNS

WESTON encourages a behavior-based safety philosophy. WESTON recognizes that <u>everyone</u> is responsible for site health and safety to ensure a successful project completion. Although there may be concerns in reporting violations of fellow workers, when it comes to the Health and Safety of site personnel, reporting should be viewed as a tool to improve our system and to ensure a safe work site for all workers. In that light, WESTON strongly encourages input from on-site personnel regarding potential issues of concern or suggestions for improvement to on-site systems or procedures. As a member of our site safety program, the following may apply:

1. Any personnel observing actions on-site that may result in an issue of immediate danger should stop work and report the issue to the 3M Designated Representative, Contractor Site Supervisor or WESTON Site Manager. If warranted, the issue will be discussed with the 3M Designated Representative. The WESTON Site Manager will evaluate the concern, and if warranted, modify field procedures, as necessary, to eliminate the concern.

2. Personnel may report other issues of concern either directly to the WESTON Site Manager at the time of the incident, or as suggestions during the daily safety briefings. If the employee desires to remain anonymous, the employee may write up a brief description of the issue of concern and submit it to WESTON for consideration. WESTON will evaluate the issues of concern and determine if a response is warranted to correct the matter. WESTON's intent is not to punish violators but to ensure safe working conditions for all employees.

INCIDENT REPORTING

All incidents or "near-miss" incidents resulting (or potentially resulting) in damage to equipment or property, or in physical injury, regardless of the severity must be reported to the 3M Designated Representative or the WESTON Health and Safety Officer. Near-miss incidents or incidents resulting in minor injury may be indicators of more serious safety issues that warrant response. As a result, it is the responsibility of all personnel to report all incidents so that we may identify areas for improvement.

Incidents may include but are not limited to such conditions as the following:

- Backing into a sign post, equipment, or fence.

- Cuts on the hands from handling supplies or equipment.
- Burns from on-site equipment, or use of torches, welders, or cutting tools.
- Debris in the eyes from on-site activities.
- Injury to joints due to repetitive work tasks.
- Injury to joints or the back due to improper lifting.
- Injury due to falls or due to slips and trips.

Near-miss incidents may include but are not limited to such conditions as the following:

- Failure of a cable or chain under load without incident.
- Almost hitting a person or object when backing or operating a vehicle.
- Vehicle sliding due to muddy conditions.
- Failure of an excavation wall without incident.

All incidents will be evaluated and tracked by the WESTON Health and Safety Officer to determine whether corrective measures are warranted. Issues of concern will be topics of discussion for daily safety briefings to make sure everyone is aware of the concerns and proper measures to avoid future incidents. The WESTON Health and Safety Officer will also be responsible for reporting requirements to the 3M Project Manager, WESTON management and Corporate Health and Safety.

Injury Requiring On-Site Treatment

Incidents such as minor sprains, cuts, or burns may be treated on-site. WESTON will maintain a First Aid Kit at the Site Office. Contractors will also maintain First Aid Kits in their vehicles. Once an incident occurs and is reported, the Contractor Site Supervisor, with the support of the WESTON Health and Safety Officer, will document the incident and evaluate proper medical treatment. If warranted, the injured party may be taken to a designated medical service provider for evaluation and treatment. If the injury is treated on-site, the Contractor Site Supervisor will provide treatment and work with the WESTON Health and Safety Officer to determine if the worker can return to work, work at a different task, or should be removed from work duties temporarily. Any individual with an injury treated on-site will be monitored periodically to ensure that the injury is healing properly.

Following treatment, an Incident Report will be completed by the WESTON Health and Safety Officer and submitted to WESTON Corporate Health and Safety for evaluation. Any response measures put in place as a result of the incident will be documented.

Incident Requiring Off-Site Treatment

In the event an incident occurs requiring off-site medical treatment, the following procedures should be followed:

1. All work in the area of the incident must stop. Personnel must evacuate any areas of potential danger until it is deemed safe by the Contractor Site Supervisor to enter the area. Evacuation points will be designated at the work site. No vehicles or equipment may be removed from the site unless it is necessary as part of the medical response. All personnel in the area of the incident are required to stay on-site and will be required to provide statements

regarding the events leading to the incident. Personnel will be notified by the 3M Designated Representative or WESTON Health and Safety Officer when they can leave the site.

2. The 3M Designated Representative, Contractor Site Supervisor and WESTON Health and Safety Officer will be notified immediately.
3. The Contractor Site Supervisor, with support from WESTON, will notify appropriate medical response services and initiate initial medical treatment. Medical Contacts are provided in this section of the SSHASP and will also be maintained at the Site Office as separate sheets including driving directions to the designated medical service provider.
4. The WESTON Health and Safety Officer will contact the WESTON Project Manager and WESTON Corporate Health and Safety immediately after the incident has been stabilized. This will be followed by submittal of a completed Incident Report within 24 hours. The WESTON Project Manager will contact 3M and coordinate any further action required by 3M as a result of the incident.
5. All information associated with the events leading to the incident, witnesses, conditions at the site (including weather), and response actions taken will be recorded. Although incident response will ultimately be the responsibility of the relevant contractor, WESTON will conduct an independent incident evaluation to determine the potential cause(s) of the incident and whether additional safety measures are warranted.
6. The injured party will either be carried by ambulance to the appropriate medical treatment facility or transported by on-site personnel to one of the designated treatment facilities identified below. A WESTON employee will accompany the individual to the facility to monitor conditions and to document the event.

OAKDALE EMERGENCY INFORMATION SHEET

Emergency Contacts and Phone Numbers

Agency	Contact	Phone Number
Local Medical Emergency Facility (LMF)	St Johns Hospital	651-232-7000
WESTON Medical Emergency Contact	Dr. Frank Mitchell	404-898-4723
WESTON's Medical Director	Dr. Patrice Marshall	800-874-4676 (8-5; M-F)
WESTON Health and Safety	Corporate Health and Safety	(610) 701-3000
Fire Department	Oakdale Fire Department	911
Police Department	Oakdale Police Department	911
WESTON Health and Safety Officer	Tim Frinak Gary Witmer Dave Cairns Rob Junnier John Hunter	334-332-9123 717-823-3583 484-888-8268 302-438-0718 651-587-9681
Contractor Health and Safety Officer		
3M Oakdale Point-of-Contact	Jim Kotsmith	651-737-3635
3M Security		651-458-2300 651-458-2244
3M Designated Representative	Tyrone Levesque	651-458-2016 CL: 651-271-4713
Site Telephone	See On-Site SHSO Contacts	
Nearest Telephone	See On-Site SHSO Contacts	

Local Medical Emergency Facility(s)

Name of Hospital: **St. John's Hospital - Maplewood**

Address: **1575 Beam Avenue**
Maplewood, MN

Phone No.: 651-232-7000

Name of Contact: **Emergency Room**

Phone No.: 651-232-7348

Type of Service:

☐ Physical trauma only

☐ Chemical exposure only

☒ Physical trauma and chemical exposure

☒ Available 24 hours

Route to Hospital (written detail):

From Site go west on Highway 5 east, ENTER I-694 North

Continue approximately 5 miles to White Bear Avenue N (EXIT 50), TAKE EXIT

Drive south (left) on White Bear Avenue approximately ½-mile to Beam Avenue

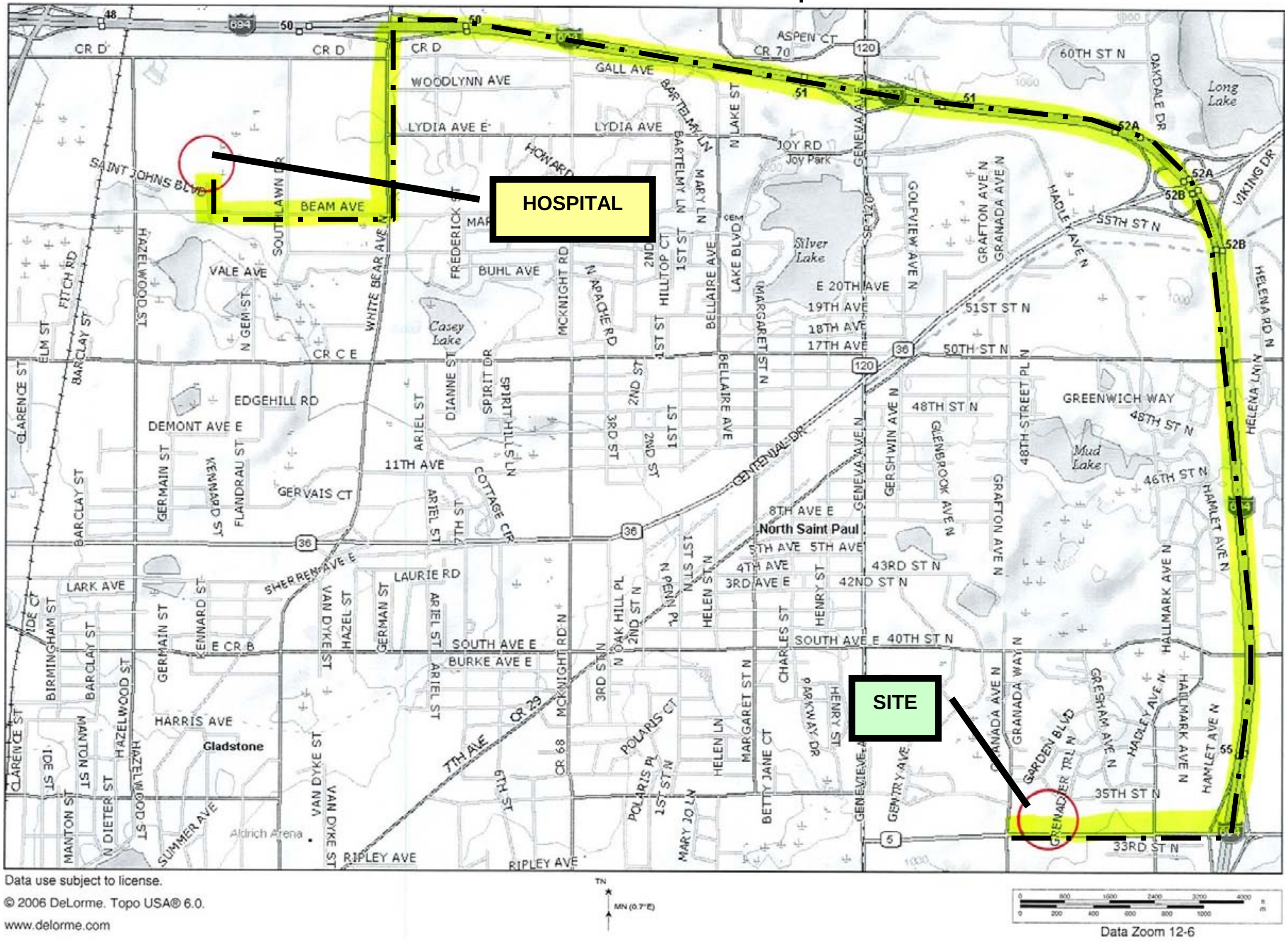
TURN RIGHT (west) on Beam and continue about ½ mile to St. Johns Blvd., TURN RIGHT (north) to enter Hospital.

Travel time from site: 15 Minutes

Distance to hospital: **6** Miles

Name/no. of 24-hr ambulance service: **911/**

Route to St. John’s Hospital



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OAKDALE ALTERNATE EMERGENCY ROUTE

Emergency Contacts and Phone Numbers

Agency	Contact	Phone Number
Local Medical Emergency Facility (LMF)	Woodwinds Health Campus Hospital	651-232-0010
WESTON Medical Emergency Contact	Qualisys – Dr. Sandra Dorsey	1-800-874-4676
WESTON Health and Safety	Corporate Health and Safety	(610) 701-3000
Fire Department	Woodbury Fire Department	911
Police Department	Woodbury Police Department	911
WESTON Health and Safety Officer	Tim Frinak Gary Witmer Dave Cairns Rob Junnier John Hunter	334-332-9123 717-823-3583 484-888-8268 302-438-0718 651-587-9681
Contractor Health and Safety Officer		
3M Oakdale Point-of-Contact	Jim Kotsmith	651-737-3635
3M Security		651-458-2300 651-458-2244
3M Designated Representative	Tyrone Levesque	651-458-2016 CL: 651-271-4713
Site Telephone	See On-site SHSO Contacts	
Nearest Telephone	See On-site SHSO Contacts	

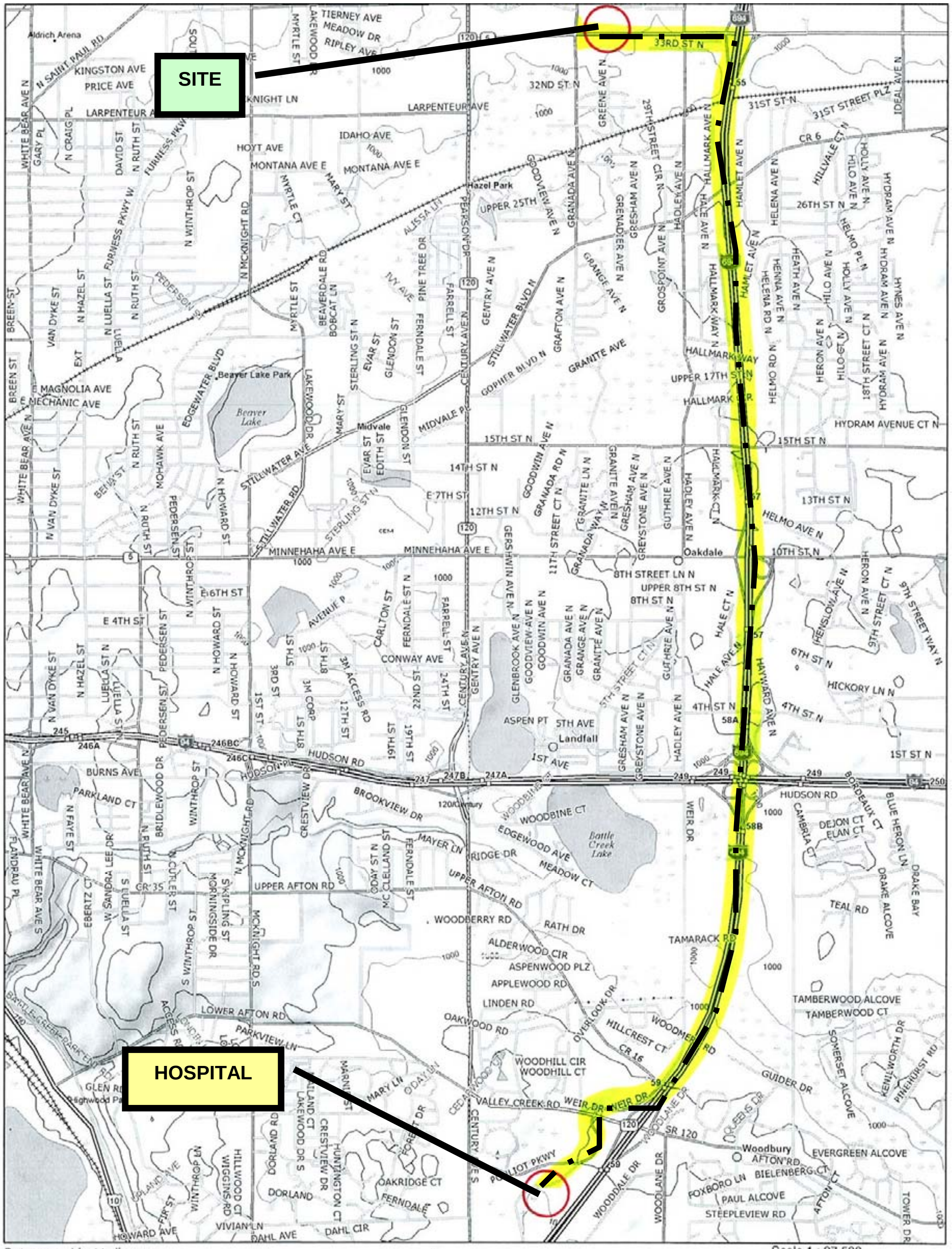
Local Medical Emergency Facility(s)

Name of Hospital: **Woodwinds Health Campus Hospital**

Address:	**1925 Woodwinds Drive** **Woodbury, MN 55125**	**Phone No.:** 651-232-0010
Name of Contact:	**Emergency Room**	**Phone No.:** 651-232-0348

Type of Service:	**Route to Hospital (written detail):**	**Travel time from site:**
☐ Physical trauma only ☐ Chemical exposure only ☒ Physical trauma and chemical exposure ☐ Available 24 hours	**From site go on Highway 5 east, ENTER I-694 South** **Follow I-694 south approximately 5 miles to EXIT 59, Valley Creek Road. (NOTE: I-694 becomes I-494 south of the I-94 Interchange.)** **From exit turn right and immediately left (south) onto POULIOT PKWY, continue approximately ¼ mile, Hospital is on left.**	20 Minutes **Distance to hospital:** 8 Miles **Name/no. of 24-hr ambulance service:** **911/**

Route to Woodwinds Hospital



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SITE EMERGENCY RESPONSE EQUIPMENT

CONTINGENCIES

MEDICAL RESPONSE

Response Protocol for Medial Incident

1. Provide first aid, if trained; assess and determine need for further medical assistance.
2. If Warranted, Transport or arrange for transport after appropriate decontamination.
3. Evaluate cause of incident to determine appropriate response. Document incident and make appropriate notifications.
4. If Necessary, amend SSHASP and make appropriate changes to field procedures.
5. Make sure all involved personnel are notified of any changes to site procedures and follow up to ensure compliance.

	Type	Location
First Aid Kit: **First Responder Kit** **Bloodborne Pathogen Kit**		**On-site Office**
Eyewash required ☒ Yes ☐ No **Disposable Eyewash Bottles**		**On-site Office**
Shower required ☐ Yes ☒ No		

Special First-Aid Procedures:
Cyanides on-site
☐ Yes ☒ No

If yes, contact LMF. Do they have antidote kit?
☐ Yes ☐ No

HF on-site
☐ Yes ☒ No

If yes, need neutralizing ointment for first-aid kit. Contact LMF.

Plan for Response to Spill/Release

In the event of a spill or release, ensure safety, assess situation, and perform containment and control measures, as appropriate.

Small spills contained with sand, sand shoveled into drums.

a. Cleanup per MSDSs if small; or sound alarm, call for assistance, notify Emergency Coordinator
b. Evacuate to pre-determined safe place
c. Account for personnel
d. Determine if team can respond safely
e. Mobilize per Site Spill Response Plan

Description of Spill Response Gear	Location
Gloves, sand	Site Office

Plan for Response to Fire/Explosion

In the event of a fire or explosion, ensure personal safety, assess situation, and perform containment and control measures, as appropriate:

a. Sound alarm and call for assistance, notify Emergency Coordinator
b. Evacuate to predetermined safe place
c. Account for personnel
d. Use fire extinguisher only if safe and trained in its use
e. Stand by to inform emergency responders of materials and conditions

Fire Extinguishers

Type/Location
20# BC
/
/
/
/
/
/

Description (Other Fire Response Equipment)	Location
Water	Site Office
Sand	Site Office

NOTE: Extinguishers will be stored at site office for general activities

For spark related activities, extinguishers will be at immediate job site.

Plan to Respond to Security Problems

Equipment inside gated area and locked at night; work areas are supervised by site manager and cordoned off with barrier tape if necessary. Respond to violations as follows:.

1. Notify 3M Security, 3M Designated Representative, and WESTON Project Manager
2. Contact the Oakdale City Police if warranted and complete a Police Report (Request Information to get Copy)
3. Follow direction of 3M and WESTON PM to address situation or to modify security procedures to avoid future incidents
4. Document everything.

SSHASP APPROVAL

GENERAL SITE INFORMATION

PERSONNEL AND CONTRACTOR SERVICES

SITE HEALTH AND SAFETY PLAN (HASP)

Prepared by: TIM FRINAK

W.O. Number: 02181.202.011

Date: 28 January 2009

Project Identification OAKDALE RD/RA ACTIVITIES
Office: WCH 5-2
Site Name: OAKDALE RESPONSE ACTION
Client: CONFIDENTIAL
Work Location Address: HWY 5, OAKDALE, MN

Site History:
FORMER DISPOSAL FACILITY FOR INDUSTRIAL WASTE

Scope of Work:
ACTIVITIES ASSOCIATED WITH THE REMOVAL OF VOC- AND PFC-IMPACTED SOIL TO A DEPTH OF UP TO 12 FEET BELOW GRADE AND BACKFILLING WITH CLEAN SOIL

☐ Site visit only; SSHASP not necessary. List personnel here and sign off below:

Regulatory Status:

Site regulatory status:

CERCLA/SARA	**RCRA**	**Other Federal Agency**
☐ U.S. EPA	☐ U.S. EPA	☐ DOE
☒ State	☒ State	☐ USACE
☐ NPL Site	**NRC**	☐ Air Force
☐ OSHA	☐ 10 CFR 20	☐ _______

Hazard Communication (Req'd See Attachment D)
☒ 1910 ☒ 1926 ☒ State

Safety Officer Manual (Required to be On-Site)
Based on the Hazard Assessment and Regulatory Status, determine the Standard HASP(s) applicable to this project. Indicate below which Standard HASP will be used and append the appropriate pages of this form along with the Standard Plan.

☐ Stack Test	☐ _______________
☐ Air Emissions	☐ _______________
☐ Asbestos	☐ _______________
☐ Industrial Hygiene	☐ _______________
☐ _______________	☐ _______________

Review and Approval Documentation:

Reviewed by:
SO/DSM/CHS George Crawford Date: ____________
Name (Print) Signature

Project Director Jai Kesari Date: ____________
Name (Print) Signature

Approved by:
Project Manager Rob Junnier Date: ____________
Name (Print) Signature

HASP Activation and Renewal Schedule:

Project start date:
APRIL 2009

End date: **APRIL 2010**

This SSHASP **must** be r**eissued/reapproved** for any activities conducted after:

Date: **01 APRIL 2010**

Amendment Date:	**Amended By:**	**Description of Modification**

SITE MANAGER

In accordance with WESTON’s Personal Protective Equipment Program and 29 CFR 1910.132, at the site prior to personnel beginning work, the SHSO and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this SSHASP is appropriate for the hazards known or expected to exist. (Refer to Safety Officer Manual Section 2, Personal Protection Program, for guidance.)

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

Site Health and Safety Officer

In accordance with WESTON’s Personal Protective Equipment Program and 29 CFR 1910.132, at the site prior to personnel beginning work, the Site Health and Safety Officer (SHSO) and/or the Site Manager have evaluated conditions and verified that the personal protective equipment selection outlined within this SSHASP is appropriate for the hazards known or expected to exist. (Refer to Safety Officer Manual Section 2, Personal Protection Program, for guidance.)

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

☐ SHSO ☐ Site Manager ____________________ ________ Date: __________
Name (Print) Signature

SITE-SPECIFIC HEALTH AND SAFETY PERSONNEL

The Site Health and Safety Officer (SHSO) for activities to be conducted at this site is: Tim Frinak

The SHSO has total responsibility for ensuring that the provisions of this SSHASP are adequate and implemented in the field.

Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSOs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.

Qualifications: 40-hour OSHA HAZWOPER certification; annual 8-hour OSHA HAZWOPER refresher certification; 8-hour Site Health and Safety Officer certification; current Adult First Aid and CPR certification; familiarity with jobs of similar scope.

Designated alternate Site Health and Safety Officers include:

Tim Frinak

Dave Cairns

Gary Witmer

Rob Junnier

John Hunter

WESTON REPRESENTATIVES

Organization/Branch	Name/Title	Address	Telephone
West Chester, PA	Rob Junnier Project Manager/Engineer	1400 Weston Way, Building 5-2, West Chester, PA 19380	610-701-3679
Roles and Responsibilities: Site Manager, Project Manager, SHSO, Project Engineer			
West Chester, PA	Gary Witmer	1400 Weston Way, Building 5-2, West Chester, PA 19380	610-701-3141
Roles and Responsibilities: Site Manager, SHSO			
West Chester, PA	Dave Cairns	1400 Weston Way, Building 5-2, West Chester, PA 19380	610-701-3676
Roles and Responsibilities: Site Manager, SHSO			
West Chester, PA	Dana Armstrong	1400 Weston Way, Building 5-2, West Chester, PA 19380	610-701-3091
Roles and Responsibilities: SHSO			
Auburn, Alabama	Tim Frinak	1635 Pumphrey Ave. Auburn, AL 36832-4303	334-319-0517
Roles and Responsibilities: Site Manager, SHSO			
St. Paul, MN	John Hunter	St. Paul, MN	651-587-9681
Roles and Responsibilities: Site Manager, SHSO			
Roles and Responsibilities			
Roles and Responsibilities:			
COMMENTS:			

WESTON REPRESENTATIVES			
Organization/Branch	**Name/Title**	**Address**	**Telephone**
Roles and Responsibilities:			
Roles and Responsibilities			
Roles and Responsibilities:			
Roles and Responsibilities			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
COMMENTS:			

WESTON PERSONNEL AND CERTIFICATION STATUS

WESTON	
Name: Rob Junnier **Title: PM, Project Engineer** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name: Gary Witmer** **Title: Project Geologist** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: Dave Cairns **Title: Project Geologist** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name: Dana Armstrong** **Title: Project Geologist** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: Tim Frinak **Title: Project Geologist** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name: John Hunter** **Title: Project Geologist** **Task(s): All** **Certification Level or Description: C.S.** ☒Medical Current ☒Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description: .** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:.** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)
Name: **Title** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐Medical Current ☐Training Current ☐Fit Test Current (Qual.) ☐Fit Test Current (Quant.)

TRAINING RECORDS MUST BE REVIEWED UPON ENTRY TO THE SITE TO ENSURE THAT THEY ARE CURRENT.

TRAINING CURRENT - Training: All personnel, including visitors, entering the exclusion or contamination reduction zones must have certifications of completion of training in accordance with OSHA 29 CFR 1910, 29 CFR 1926, or 29 CFR 1910.120.

FIT TEST CURRENT - Respirator Fit Testing will not be required for personnel entering designated controlled areas or exclusion zones unless action levels have warranted Level C Personal Protection. All persons, including visitors, entering any area requiring the use or potential use of any negative pressure respirator must have had, as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI, within the last 12 months. If site conditions require the use of a full-face, negative-pressure, air-purifying respirator for protection from asbestos or lead, employees must have had a qualitative fit test, administered according to OSHA 29 CFR 1910.1001 or 1025/1926, within the last 6 months.

MEDICAL CURRENT - Medical Monitoring Requirements: All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/1910, or 29 CFR 1910.120.

The Site Health and Safety Officer is responsible for verifying all certifications and fit tests. Records will be monitored to ensure that expiration dates are not exceeded by on-site personnel.

LIST OF CONTRACTORS

3M CONTRACTORS			
Organization/Branch	**Contact Name/Title**	**Address**	**Telephone**
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			
Roles and Responsibilities:			

CONTRACTOR PERSONNEL AND CERTIFICATION STATUS

Contractor's Health and Safety Program Evaluation

Name of Contractor:

ADDRESS:	**PHONE:**

Activities To Be Conducted by Contractor:

Evaluation Criteria

Medical program meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Personal protective equipment available ☐ Acceptable ☐ Unacceptable Comments:	On-site monitoring equipment available, calibrated, and operated properly ☐ Acceptable ☐ Unacceptable Comments:
Safe working procedures clearly specified ☐ Acceptable ☐ Unacceptable Comments:	Training meets OSHA/WESTON criteria ☐ Acceptable ☐ Unacceptable Comments:	Emergency procedures ☐ Acceptable ☐ Unacceptable Comments:
Decontamination procedures ☐ Acceptable ☐ Unacceptable Comments:	General health and safety program evaluation ☐ Acceptable ☐ Unacceptable Comments:	Additional comments: ☐ The Contractor agrees to comply with the WESTON SSHASP as part of the Contractor Health and Safety Program. ☐ Contractor will work under his own HASP, which has been accepted by project PM.

Evaluation Conducted by: **Date:**

Contractor (May Be Filled Out During SSHASP Orientation)

Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)
Name: **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)	**Name:** **Title:** **Task(s):** **Certification Level or Description:** ☐ Medical Current ☐ Training Current ☐ Fit Test Current (Qual.) ☐ Fit Test Current (Quant.)

HAZARD ANALYSIS AND WORK TASKS

HAZARD ANALYSIS AND WORK TASKS

The following presents a preliminary evaluation of the work tasks associated with the Oakdale Remedial Design/Response Action Plan and the anticipated work hazards associated with each task. Specific issues related to individual work tasks will be evaluated at the time of implementation by the Health and Safety Officer to ensure compliance with the SSHASP and to ensure that all issues and concerns associated with the work task are addressed. The following supplemental forms will be implemented by the Health and Safety Officer during the execution of the project tasks to enhance implementation of the site safety program.

Site Safety Briefing Form

The Site Safety Briefing Form will be used to document the topics of discussion and signatures of all personnel included in the meeting. A copy of this form is provided in **Attachment A**. This form will be maintained in the Site Office. Safety Topics will include:

- An overview of the scheduled daily activities and any potential issues of concern associated with the tasks, including weather and specific work activities.
- Discussion of the EHS Analysis Checklists for each scheduled work task.
- Safety concerns or violations encountered during the previous day’s work.
- General safety topics to enhance the overall safety management program.

EHS Analysis Checklist

Prior to initiation of a new work task, the Health and Safety Officer will complete an EHS Analysis Checklist and brief all applicable personnel about the anticipated hazards associated with the work. A copy of the checklist is presented in **Attachment A.** The checklist will be kept at the specific job site for reference. If site conditions change or if new procedures are introduced to complete the task, the Site Manager must notify the Health and Safety Officer so that the workplace can be re-evaluated and the checklist modified to include the new conditions or procedures. The completed checklist will be filed with the daily Site Safety Briefing form(s).

Other forms that may be utilized during the execution of the Scope-of-Work may include:

- Excavation/Trenching Audit Checklist (**Attachment A**)
- Excavation Inspection Permit Checklist (**Attachment A**)
- Traffic Control Plan Checklist (**Attachment A**)
- Equipment/Trucking Inspection Checklist (**Attachment A**)

GENERAL HAZARD ASSESSMENT AND WORK TASKS

Hazard Assessment

Background Review: ☒ Complete ☐ Partial If partial why?

Activities Covered Under This Plan:

No.	Task/Subtask	Description	Schedule
1	Drilling	Subsurface soil or groundwater sampling	**See site specific schedule.**
2	Surface Soil Sampling	Collection of soil from wastepiles or excavations	**See site specific schedule.**
3	Surface Water/Groundwater Sampling	Collection of water samples	**See site specific schedule.**
4	Excavation	Excavation and Backfilling Activities	**See site specific schedule.**
5	Vehicle Usage	Heavy Equipment and Truck Activities	**See site specific schedule.**

Types of Hazards:

1 Numbers refer to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate hazard class.

Physiochemical 1

☒ Flammable
☐ Explosive
☐ Corrosive
☐ Reactive
☐ O_2 Rich
☐ O_2 Deficient

Chemically Toxic 1

☒ Inhalation
☒ Ingestion
☒ Contact
☐ Absorption
☒ Carcinogen
☐ Mutagen
☐ Teratogen

☒ OSHA 1910.1000 Substance (Air Contaminants)

☒ OSHA Specific Hazard Substance Standard (Refer to following page for listing)

Radiation 3

Ionizing:

☐ Internal exposure
☐ External exposure

Non-ionizing:

☒ UV
☐ IR
☐ RF
☐ MicroW
☐ Laser

Biological 2

☐ Etiological Agent
☒ Other (plant, insect, animal)

☒ **Physical Hazards 4**

☒ Construction Activities
☒ Temperature/Climate
☐ ___________________

Source/Location of Contaminants and Hazardous Substances:

Directly Related to Tasks

☒ Air
☐ Other Surface
☒ Groundwater
☒ Soil and Sediment
☐ Surface Water
☐ Sanitary Wastewater
☐ Process Wastewater

Indirectly Related to Tasks — Nearby Process(es) That Could Affect Team Members:

☒ None

or

☐ Client Facility/WESTON Work Location
☐ Nearby Non-Client Facility

Describe:

☐ Have activities (task[s]) been coordinated with facility?

HAZARD GROUP 1 - CHEMICAL HAZARDS OF CONCERN

ON-SITE CONTAMINANTS	ON-SITE MATERIALS
☐ **N/A** Chemical Contaminants of Concern Provide the data requested for chemical contaminants on HASP Form 25 or attach data sheets from an acceptable source such as NIOSH pocket guide, condensed chemical dictionary, ACGIH TLV booklet, etc. List chemicals and concentrations below and locate data sheets in Attachment B of this HASP.	☐ **N/A** Identify hazardous materials used or on-site and attach Material Safety Data Sheets (MSDSs) for all reagent type chemicals, solutions, or other identified materials that in normal use in performing tasks related to this project could produce hazardous substances. Ensure that all contractors and other parties working nearby are informed of the presence of these chemicals and the location of the MSDSs. Obtain from contractors and other parties, lists of the hazardous materials they use or have on-site and identify location of the MSDSs here. List chemicals and quantities below and locate MSDSs in Attachment B of this HASP.

Chemical Name	Concentration (if known)	Chemical Name	Quantity
Volatile Organic Compounds (VOCs)	See Note 1	Liquinox, Alconox	64 oz.
Perfluorochemicals (PFCs)	See Note 1	Gasoline	5 gals.
		Diesel Fuel	5 gals.
		Methanol	4 Liters

Note 1: A List of identified compounds and analytical results are provided in Attachment E.

OSHA-SPECIFIC HAZARDOUS SUBSTANCES

The following substances may require specific medical, training, or monitoring based on concentration or evaluation of risk. See the appropriate citation listed under 29 CFR 1910 or 1926 for additional information.

☐ 1910.1001 Asbestos
☐ 1910.1005 [Reserved]
☐ 1910.1009 beta-Naphthylamine
☐ 1910.1013 beta-Propiolactone
☐ 1910.1017 Vinyl chloride
☒ 1910.1028 Benzene
☐ 1910.1045 Acrylonitrile
☐ 1910.1051 1,3 Butadiene

☐ 1910.1002 Coal tar pitch volatiles
☐ 1910.1006 Methyl chloromethyl ether
☐ 1910.1010 Benzidine
☐ 1910.1014 2-Acetylaminofluorene
☐ 1910.1018 Inorganic arsenic
☐ 1910.1029 Coke oven emissions
☐ 1910.1047 Ethylene oxide
☐ 1910.1052 Methylene chloride

☐ 1910.1003 4-Nitrobiphenyl, etc.
☐ 1910.1007 3,3'-Dichlorobenzidine (and its salts)
☐ 1910.1011 4-Aminodiphenyl
☐ 1910.1015 4-Dimethylaminoazobenzene
☐ 1910.1025 Lead (Att. FLD# 46)
☐ 1910.1043 Cotton dust
☐ 1910.1048 Formaldehyde

☐ 1910.1004 alpha-Naphthylamine
☐ 1910.1008 bis-Chloromethyl ether
☐ 1910.1012 Ethyleneimine
☐ 1910.1016 N-Nitrosodimethylamine
☐ 1910.1027 Cadmium
☐ 1910.1044 1,2-Dibromo-3-chloropropane
☐ 1910.1050 Methylenedianiline

HAZARD GROUP 2 - BIOLOGICAL HAZARDS OF CONCERN

☒ **Poisonous Plants** (FLD 43)
Location/Task No(s).:
Source: ☒ Known ☐ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☒ Contact ☐ Direct Penetration
Team Member(s) Allergic: ☒ Yes ☐ No
Immunization required: ☐ Yes ☒ No

☒ **Insects** (FLD 43)
Location/Task No(s).:
Source: ☒ Known ☐ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration
Team Member(s) Allergic: ☐ Yes ☒ No
Immunization required: ☐ Yes ☒ No

☐ **Snakes, Reptiles** (FLD 43)
Location/Task No(s).:
Source: ☐ Known ☐ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration
Team Member(s) Allergic: ☐ Yes ☒ No
Immunization required: ☐ Yes ☒ No

☒ **Animals** (FLD 43)
Location/Task No(s).:
Source: ☐ Known ☒ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☒ Direct Penetration
Team Member(s) Allergic: ☐ Yes ☒ No
Immunization required: ☐ Yes ☒ No

FLD 43 — WESTON Biohazard Field Operating Procedures: Att. OP ☐

☐ **Sewage**
Location/Task No(s).:
Source: ☐ Known ☐ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration
Team Member(s) Allergic: ☐ Yes ☐ No
Immunization required: ☐ Yes ☐ No
Tetanus Vaccination within Past 10 yrs: ☐ Yes ☐ No

☐ **Etiologic Agents (List)**
Location/Task No(s).:
Source: ☐ Known ☐ Suspect
Route of Exposure: ☐ Inhalation ☐ Ingestion
☐ Contact ☐ Direct Penetration
Team Member(s) Allergic: ☐ Yes ☐ No
Immunization required: ☐ Yes ☐ No

FLD 44 — WESTON Bloodborne Pathogens Exposure Control Plan – First Aid Procedures: Att. OP ☒

FLD 45 — WESTON Bloodborne Pathogens Exposure Control Plan – Working with Infectious Waste: Att. OP ☐

TICKS –
Depending on the time of the year work is conducted, Wood and Deer Ticks may be abundant. Make sure to notify site personnel and monitor any detection and occurrence of ticks on-site. Request notification from anyone bitten for monitoring purposes.

MAMMALS
Site is forest and pasture. Animals that may be encountered include deer, pheasant, turkey, dogs, and rodents. If an animal is in the proximity of the work site or approaches the work site in a manner no considered normal, stop work, take measures to avoid the animal, and report the incident immediately to the Site Manager or Site Safety Officer. If bitten, report the incident immediately to the Site Manager or Site Safety Officer.

INSECTS
Hornets, yellowjackets, and bees have been observed at the site. Any nests observed by site personnel should be reported immediately so notification and action may be taken. Any personnel who are allergic to insect bites should notify the Site Safety Office of the type and location of response medication along with directions for use.

PLANTS
Poison Ivy and Poison Sumac are documented for the work area. Any personnel allergic to these plants should notify the Site Safety Officer. Any plants identified in the work area should be identified with flagging or signs to avoid contact.

HAZARD GROUP 3 - RADIATION HAZARDS OF CONCERN

NONIONIZING RADIATION

Task No.	Type of Nonionizing Radiation	Source On-Site	TLV/PEL	Wavelength Range	Control Measures	Monitoring Instrument
	Ultraviolet	**Sun**			**Clothing, Sun Block**	
	Infrared					
	Radio Frequency					
	Microwave					
	Laser					

IONIZING RADIATION

Task No.	Radionuclide	Major Radiations	Radioactive Half-Life (Years)	DAC (µCii/mL)			Surface Contamination Limit	Monitoring Instrument
				D	W	Y		

HAZARD GROUP 4 - PHYSICAL HAZARDS OF CONCERN

Physical Hazard Condition	Physical Hazard	Attach OP	WESTON OP Titles
Loud noise	Hearing loss/disruption of communication	☒	Section 7.0 - ECH&S Program Manual Occupational Noise & HC Program
Inclement weather	Rain/humidity/cold/ice/snow/lightning	☒	FLD02 - Inclement Weather
Steam heat stress	Burns/displaced oxygen/wet working surfaces	☐	FLD03 - Hot Process - Steam
Heat stress	Burns/hot surfaces/low pressure steam	☐	FLD04 - Hot Process - LT3
Ambient heat stress	Heat rash/cramps/exhaustion/heat stroke	☒	FLD05 - Heat Stress Prevention/Monitoring
Cold stress	Hypothermia/frostbite	☒	FLD06 - Cold Stress
Cold/wet	Trench/paddy/immersion foot/edema	☒	FLD07 – Wet feet
Confined spaces	Falls/burns/drowning/engulfment/electrocution	☐	FLD08 - Confined Space Entry
Industrial Trucks	Fork Lift Truck Safety	☐	FLD09 – Powered Industrial Trucks
Improper lifting	Back strain/abdomen/arm/leg muscle/joint injury	☒	FLD10 - Manual Lifting/Handling Heavy Objects
Uneven surfaces	Vehicle accidents/slips/trips/falls	☒	FLD11 - Rough Terrain
Poor housekeeping	Slips/trips/falls/punctures/cuts/fires	☒	FLD12 - Housekeeping
Structural integrity	Crushing/overhead hazards/compromised floors	☐	FLD13 - Structural Integrity
Improper cylinder. handling	Mechanical injury/fire/explosion/suffocation	☒	FLD16 - Pressure Systems - Compressed Gases
Water hazards	Poor visibility/entanglement/drowning/cold stress	☐	FLD17 - Diving
Water hazards	Drowning/heat/cold stress/hypothermia/falls	☐	FLD18 - Operation and Use of Boats
Water hazards	Drowning/frostbite/hypothermia/falls/electrocution	☐	FLD19 - Working Over Water
Vehicle hazards	Struck by vehicle/collision	☒	FLD20 - Traffic
Explosions	Explosion/fire/thermal burns	☐	FLD21 - Explosives
Moving mechanical parts	Crushing/pinch points/overhead hazards/electrocution	☒	FLD22 – Earth Moving Equipment
Moving mech. parts	Overhead hazards/electrocution	☐	FLD23 – Cranes, Rigging, and Slings
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD24 - Aerial Lifts/Man lifts
Working at elevation	Overhead hazards/falls/electrocution	☐	FLD25 - Working at Elevation
Working at elevation	Overhead hazards/falls/electrocution/slips	☐	FLD26 - Ladders
Working at elevation	Slips/trips/falls/overhead hazards	☐	FLD27 - Scaffolding
Trench cave-in	Crushing/falling/overhead hazards/suffocation	☐	FLD28 - Excavating/Trenching
Physiochemical	Explosions/fires from oxidizing, flam./corr. material	☐	FLD30 - Hazardous Materials Use/Storage
Physiochemical	Fire and explosion	☒	FLD31 - Fire Prevention/Response Plan Required
Physiochemical	Fire	☒	FLD32 - Fire Extinguishers Required
Structural integrity	Overhead/electrocution/slips/trips/falls/fire	☐	FLD33 - Demolition
Electrical	Electrocution/shock/thermal burns	☒	FLD34 - Utilities
Electrical	Electrocution/shock/thermal burns	☒	FLD35 - Electrical Safety
Burns/fires	Heat stress/fires/burns	☒	FLD36 - Welding/Cutting/Brazing/Radiography
Impact/thermal	Thermal burns/high pressure impaction/heat stress	☒	FLD37 - Pressure Washers/Sand Blasting
Impaction/electrical	Smashing body parts/pinching/cuts/electrocution	☒	FLD38 - Hand and Power Tools
Poor visibility	Slips/trips/falls	☐	FLD39 - Illumination
Fire/explosion	Burns/impaction	☐	FLD40 - Storage Tank Removal/Decommissioning
Communications	Disruption of communications	☒	FLD41 - Std. Hand/Emergency Signals
Energy/release	Unexpected release of energy	☐	FLD42 - Lockout/Tag-out
Biological Hazards	Biological Hazards at site	☐	FLD43 - Biological Hazards
Biological Hazards/BBP	Biological Hazards/BBP at site/First Aid Providers	☐	FLD44 - Biological Hazards – Bloodborne Pathogens Exposure Control Plan – First Aid Providers
Infectious Waste	Infectious Waste at site/BBP/ at site/Infectious Waste	☐	FLD45 – Biological Hazards – Bloodborne Pathogens Exposure Control Plan – Work With Infectious Waste
Lead Contaminated sites	Lead poisoning	☐	FLD46 - Control of Exposure to Lead
Puncture/cuts	Cuts/ dismemberment/gouges	☒	FLD47 - Clearing, Grubbing and Logging Operations

* Field Operation Procedures will be maintained on-site as a separate document.

HAZARD GROUP 4 - PHYSICAL HAZARDS OF CONCERN (Continued)

Physical Hazard Condition	Physical Hazard	Attach OP	WESTON OP Titles
Not applicable	Not applicable	☐	FLD48 – Federal, State, Local Regulatory Agency Inspections
Not applicable	Exposure to hazardous materials/waste	☐	FLD49 – Safe Storage of Samples
Cadmium	Exposure Control	☐	FLD50 – Cadmium Exposure Control Plan
Process Safety Procedure	Safety Procedure	☐	FLD51 – Process Safety Procedure
Asbestos	Asbestos Exposure	☐	FLD52 – Asbestos Exposure Control Plan
Hexavalent Chromium	Exposure Control Plan	☐	FLD53 – Hexavalent Chromium Exposure Control Plan
Benzene	Exposure Control Plan	☒	FLD54 - Benzene Exposure Control Plan
Hydrofluoric acid	Working with HF	☐	FLD55 – Working with Hydrofluoric Acid
Moving drill rig parts	Crushing/pinch points/overhead hazards/electrocution	☒	FLD56 – Drilling Safety
Vehicles/driving	Accidents,/fatigue/cell phone use	☒	FLD 57 – Motor Vehicle Safety
Improper material handling	Back injury/crushing from load shifts/equipment/tools	☒	FLD 58 – Drum Handling Operations
COC decontamination	COCs/slip,trip, and falls/waste generation/environmental compliance/PPE	☒	FLD59 - Decontamination
Drilling hazards	Electrocution/overhead hazards/pinch points	☒	Environmental Remediation Drilling Safety Guideline - 2005
Fatigue	Long work hours	☐	FLD60 – Employee Duty Schedule
Benzene/Gasoline	Benzene exposure	☐	FLD61 – Gasoline Contaminant Exposure

TASK 1 – DRILLING – SUBSURFACE SAMPLING

Work may include the installation of soil borings for :

- Soil/waste collection for analysis to characterize waste for excavation and disposal.
- Installation of additional SVE vents or piezometers for monitoring purposes.

TASK-BY-TASK RISK ASSESSMENT

TASK 1 -- DRILLING – SUBSURFACE SAMPLING

Issues of Concern	**USE OF HEAVY EQUIPMENT** **HOISTING AND RIGGING** **DRILLING ACTIVITIES** **HEAVY LIFTING** **IDW MANAGEMENT**	**UTILITIES** **VOCs and PFCs** **HIGH PRESSURE HOSES** **BENTONITE POWDER/CEMENT/DUST**

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

DRILL RIG STEAM CLEANER PRESSURE WASHER BOBCAT	HAND TOOLS GENERATOR MODIFIED D PPE PID	DRUMS

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Drilling within areas of waste deposition with potential for VOCs and PFCs.
NOTE: Work area has been treated with an SVE system. Previous investigation at the site did not indicate any significant methane associated with the site.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?
Uneven and undeveloped terrain and working with drilling equipment. **Implement protocols in the Field Operating Procedure, 2.5 Drilling Safety Guide.**

Biological

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?
Area is in un-maintained pasture with potential for ticks, bees, vegetation, and small mammals.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
What justifies risk level?
No history of use or disposal of radiological materials at the site.

LEVELS OF PROTECTION/JUSTIFICATION

Contact Activities Modified D for drilling and sampling activities (nitrile gloves, safety boots, hard hat, safety glasses, (safety shield for decon activities), hearing protection). Soil will be monitored for VOCs.	**Non-Contact Activities** Level D for non-contact activities (appropriate winter clothing, safety shoes, safety glasses).

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Drilling Safety Guide; Section 7.0 ECH&S Occupational Noise; FLD 02, 05, 06, 07, 10, 11, 12, 16, 20, 22, 31, 32, 34, 35, 36, 37, 38, 41, 43, 47, 56, 57, 58, 59

TASK 2 – SURFACE SOIL SAMPLING

Work may include the following:

- Soil/waste collection from excavations to evaluate conditions.
- Soil/waste collection from excavated materials for analytical testing.

TASK-BY-TASK RISK ASSESSMENT

TASK 2 – SOIL SAMPLING

Issues of Concern	**UTILITIES** **DECON SOLUTIONS** **HEAVY LIFTING**	**IDW MANAGEMENT**

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

HAND AUGER SOIL SCOOPS STAINLESS BOWLS DISPOSIBLE TRAYS	HAND TOOLS MODIFIED D PPE PID	DRUMS

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Sampling within areas of waste deposition with potential for VOCs and PFCs.
NOTE: Work area has been treated with an SVE system. Previous investigation at the site did not indicate any significant methane associated with the site.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?
Uneven and undeveloped terrain and working with sampling equipment.

Biological

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?

Area is in un-maintained pasture with potential for ticks, bees, vegetation, and small mammals.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
What justifies risk level?

No history of use or disposal of radiological materials at the site.

LEVELS OF PROTECTION/JUSTIFICATION

Contact Activities Modified D for sampling activities (nitrile gloves, safety boots, hard hat, safety glasses, (safety shield for decon activities), hearing protection). Soil will be monitored for VOCs.	**Non-Contact Activities** Level D for non-contact activities (appropriate winter clothing, safety shoes, safety glasses).

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Section 7.0 ECH&S Occupational Noise; FLD 02, 05, 06, 07, 10, 11, 12, 16, 20, 22, 31, 32, 34, 35, 36, 37, 38, 41, 43, 47, 56, 57, 58, 59

TASK 3 – SURFACE WATER/GROUNDWATER SAMPLING

Work may include the following :

- Collection of surface water or groundwater for laboratory analysis.
- Collection of surface water or groundwater for on-site monitoring purposes.

TASK-BY-TASK RISK ASSESSMENT

TASK 3 – SURFACE WATER/GROUNDWATER SAMPLING

Issues of Concern	**SAMPLE POINT ACCESS** **ELECTRICAL ISSUES** **DECON SOLUTIONS**	**IDW MANAGEMENT** **TEMPERATURE (AMBIENT)**

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

PUMPS BAILERS ROPE GENERATOR	HAND TOOLS MODIFIED D PPE WATERPROOF BOOTS EXTENSION CORD	DRUMS HOSE OR TUBING

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Sampling within areas of waste deposition with potential for VOCs and PFCs.
NOTE: Work area has been treated with an SVE system. Previous investigation at the site did not indicate any significant methane associated with the site.

Physical

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?
Uneven and undeveloped terrain and heavy lifting.

Biological

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?

Area is in un-maintained pasture with potential for ticks, bees, vegetation, and small mammals.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
What justifies risk level?

No history of use or disposal of radiological materials at the site.

LEVELS OF PROTECTION/JUSTIFICATION

Contact Activities Modified D for sampling activities (nitrile gloves, safety boots, hard hat, safety glasses, (safety shield for decon activities), hearing protection). Soil will be monitored for VOCs.	**Non-Contact Activities** Level D for non-contact activities (appropriate winter clothing, safety shoes, safety glasses).

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Section 7.0 ECH&S Occupational Noise; FLD 02, 05, 06, 07, 10, 11, 12, 16, 20, 22, 31, 32, 34, 35, 36, 37, 38, 41, 43, 47, 56, 57, 58, 59

TASK 4 – EXCAVATION ACTIVITIES

Field activities will be completed by 3M Contractors that report to the 3M Designated Representative. This section describes the minimum requirements that all on-site contractors must comply with.

Work may include the following tasks:

- Excavation of soil, impacted soil, or manufacturing waste to an approximate depth of up to 12 feet below grade.
- Stockpiling material on-site or loading trucks for disposal off-site.
- Unloading clean backfill material.
- Backfilling activities and site restoration.

Excavation activities will be conducted in accordance with the *Oakdale RD/RA Plan*. Separate documents were also prepared as attachments to the RD/RA Plan to address work at the site. Relevant attachments include:

- Stormwater Management (Attachment 1 to the Oakdale RD/RA Plan).
- Construction Sampling Plan (Attachment 2 to the Oakdale RD/RA Plan).
- Soil Transportation Plan (Attachment 4 to the Oakdale RD/RA Plan).

Excavation is proposed to an approximate depth of 8 to 12 feet below grade using an excavator or other similar equipment for the purpose of stockpiling and/or subsequent transportation to a designated receiving site. Excavation activities will be conducted in accordance with applicable regulations, including 29CFR 1926, Subpart P and WESTON's Field Operating Procedure (FLD) 28 – Excavating and Trenching.

The procedures outlined herein are based on the premise that excavations will not be occupied at any time. Under no circumstances should any excavation or trench at the site be entered by site personnel. Excavation areas will be restricted and monitored to ensure that access does not occur. This assumption may change following selection of a contractor. If so, the SSHASP will be updated accordingly.

Excavation Sites

Excavation areas will be delineated as restricted areas for authorized personnel only. These areas will be demarcated by visible barriers and signs indicating authorized entry only. Work conducted within the areas will be supervised by a designated competent person capable of identifying existing and predictable hazards or potential safety issues. This may be the Contractor Health and Safety Officer. For the purpose of the work, the competent person may be the Contractor Site Supervisor or an employee designated by the Contractor Site Supervisor. This person will coordinate excavation activities with the WESTON Site Manager and WESTON Health and Safety Officer to ensure that safe working conditions are maintained.

Prior to initiating excavation activities each day, the designated competent person will inspect the site for conditions that may warrant concern during excavation, such as unstable sidewalls. Conditions may result in additional preparation of the existing excavation, such as sloping or terracing of sidewalls, or modification of site exclusion zones. The person will complete an Excavation Inspection-Permit (Attachment A) for each day excavation or backfilling activities will be conducted. The permit will be maintained at the work site and turned into the WESTON Health and Safety Officer at the end of the day. If conditions change during the day, such as a rain event, or a significant change in the soil/waste encountered, the competent person will be responsible for re-evaluating the excavation and recommending any modification to the excavation procedures. The WESTON Health and Safety Officer will also conduct periodic safety audit of the excavation area and complete a WESTON Excavating/Trenching Audit Checklist as provided in WESTON Field Operating Procedure – FLD 28.

Measures will be implemented to prohibit entry into the excavation or access to the edge of the excavation to ensure no entry into the excavation occurs. If work is deemed necessary at the edge of the excavation, workers will be required to don fall protection in the form of a harness and lifeline, and be accompanied by a second person capable of initiating emergency procedures if required. Emergency rescue equipment will be provided and readily available, properly functioning, and attended by qualified personnel in the event an incident occurs requiring entry into the excavation or trench. A ladder will also be maintained at the site as part of the emergency equipment, if needed. Emergency procedures are outlined in the Field Operating Procedure – FLD 28.

The Contractor will monitor excavation atmospheric conditions periodically for volatile organic vapor concentrations and potential combustible gas concentrations. WESTON will also monitor volatile organic vapor concentrations and suspended particulate within the breathing zone along the perimeter of the exclusion zone of the excavation where personnel are permitted. The designated competent person will notify WESTON of any noticeable changes in site conditions that may warrant modification to safety procedures or monitoring protocol.

If stockpiling of soil is to be conducted, staging areas will be designated a minimum distance of 6 feet from the excavation wall to prevent loading on the face of the excavation. If soil is staged adjacent to the excavation, site personnel will be prohibited from entering areas between soil stockpiles and the excavation.

In the event of significant rain events or if the excavation is to remain open for an extended period methods to minimize the accumulation of rain water will be used (e.g., the use of tarps). Any water accumulated that has not come in contact with impacted soils will be directed away from work areas. During periods of inactivity, barricades and warning signs will remain in place to restrict access to the excavation zone. A fence is constructed around the entire project site and the gate will be locked during periods of inactivity. 3M Security and the Oakdale City Police will also be requested to check security at the site routinely.

TASK 4 --- EXCAVATION ACTIVITIES

Issues of Concern	**UTILITIES** **HEAVY MACHINERY** **EXCAVATIONS** **TRAFFIC** **DECONTAMINATION**	**IDW MANAGEMENT** **ODOR/DUST CONTROL** **AIR MONITORING** **STORMWATER MANAGEMENT**

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

EXCAVATOR FRONT END LOADER BULDOZER BACKHOE DUMP TRUCKS	BARRACADES TRAFFIC CONES AIR MONITORING PUMPS DREAGER TUBES AND PUMPS DUST MONITORING EQUIPMENT	WATER TRUCK MEASURING TAPE

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Sampling within areas of waste deposition with potential for VOCs and PFCs.
NOTE: Work area has been treated with an SVE system. Previous investigation at the site did not indicate any methane associated with the site.

Physical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Activities associated with excavations and heavy equipment. **SEE EXCAVATION PLAN**.

Biological

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?

Area is in un-maintained pasture with potential for ticks, bees, vegetation, and small mammals.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
What justifies risk level?

No history of use or disposal of radiological materials at the site.

LEVELS OF PROTECTION/JUSTIFICATION

Contact Activities	**Non-Contact Activities**
Modified D for sampling activities (nitrile gloves, safety boots, hard hat, safety glasses, (safety shield for decon activities), hearing protection). Soil will be monitored for VOCs.	Level D for non-contact activities (appropriate winter clothing, hardhat, safety shoes, safety glasses).

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Section 7.0 ECH&S Occupational Noise; FLD 02, 05, 06, 07, 10, 11, 12, 16, 20, 22, 28, 31, 32, 34, 35, 36, 37, 38, 41, 43, 47, 56, 57, 58, 59
Stormwater Management Plan

TASK 5 – VEHICLE USAGE

Field activities will be completed by 3M Contractors that report to the 3M Designated Representative. This section describes the minimum requirements that all on-site contractors must comply with.

Work may include the following tasks:

- On-site use of heavy equipment.
- On-site dump truck traffic.
- Preparation of vehicles for off-site transport of excavated material.
- Off-site transport of excavated material.
- Use of other vehicles.

NO EQUIPMENT WILL BE OPERATED BY ANY PERSON WHO IS NOT FULLY TRAINED AND QUALIFIED IN THE OPERATION OF SAID EQUIPMENT.

Vehicle activities will be conducted in accordance with:

- WESTON SSHASP and relevant Standard Operating Procedures.
- The *Oakdale RD/RA Plan* and associated attachments.
- Applicable federal, state, and local regulations.
- Minnesota Department of Transportation requirements.
- 3M Policy and Procedures.

It is ultimately the responsibility of the contractor to ensure that its employees comply with all of the requirements of this project. Contractors will be notified of any violations or issues of non-compliance and expected to respond to these issues promptly.

All equipment and vehicles to be used specifically at the Site will be subjected to inspections to evaluate the overall condition of the equipment and to identify potential safety concerns warranting response. It will be the responsibility of the equipment operator to ensure that the equipment is in good working order and in full compliance with applicable standards and regulations. Inspections will be documented daily by the equipment operator, and copies of the inspection forms will be provided to WESTON for site records. Equipment with noted inspection deficiencies will be taken out of service until repairs are made or issues of concern are fully addressed by the appropriate contractor. The equipment will be identified in such a way that it may not be unintentionally operated prior to correction of the identified issues of concern.

Operators of vehicles or construction equipment on-site will be fully briefed as part of the SSHASP Orientation on the traffic control procedures established for the site.

Only personnel properly trained and experienced may operate specific vehicles and equipment on-site as follows. See the Vehicle Use Assessment table following this section for specific personnel qualifications and authorizations.

DESIGNATOR GROUP	DESCRIPTION
1	Standard vehicles including automobiles, vans, 2wd and 4wd pickup trucks (1 ton rating or below) and SUVs.
2	Tandem Axle Vehicles
3	General Heavy Equipment
4	Training-Required Equipment (fork-lifts, man-lifts, etc.)
5	Cranes and Other Load-Bearing Equipment

GROUP 1 – STANDARD VEHICLES

Personnel must have a valid driver's license approved for use in the United States and the State of Minnesota. Under no circumstances should WESTON personnel operate vehicles owned, leased, or rented by subcontracted services. Also, subcontracted services should not be allowed to operate WESTON vehicles. Personal vehicles will not be allowed on-site with the exception of parking areas designated by WESTON outside of restricted work areas.

GROUP 2 – TANDEM-AXLE VEHICLES

This group consists of all Tandem-Axle Vehicles, including fixed cab trucks and tractor - trailer rigs. Operators will be fully trained and carry an active Commercial Driver's License.

Transporters of impacted waste must provide documentation of HAZWOPER Training, Medical Clearance, Drug Test Clearance, a minimum of 1 year of experience in transportation of hazardous material, and an EPA Transporter License. Copies of pertinent documents will be provided to WESTON and maintained at the Site Office. Transporters must also provide a copy of their company's Emergency Response Plan, and confirm knowledge of the emergency procedures, including reporting, spill containment, and contact information. If the driver's activities result in the contact or handling of impacted materials, then the transporter must also provide documentation of HAZWOPER Training.

GROUP 3 – GENERAL HEAVY EQUIPMENT

This group consists of all construction-related equipment that does not require specific training under OSHA or state regulation to operate. Examples are:

(a) Drilling rigs
(b) GeoProbe rigs
(c) Bulldozers
(d) Backhoes
(e) Excavators

Personnel must demonstrate a competent knowledge of the proper operation of the equipment and have at least 1 year of experience in the operation of each piece of equipment to operate the equipment on-site.

GROUP 4 – TRAINING-REQUIRED EQUIPMENT

This group includes equipment requiring specialized training to operate such as fork-lifts or man-lifts. Applicable personnel must be able to demonstrate competent operation of the equipment and provide documentation of current training certifying that the designated individual is a competent person.

GROUP 5 – CRANES AND OTHER LOAD-BEARING EQUIPMENT

This group consists of cranes or other load-bearing equipment. Applicable personnel must be able to demonstrate competent operation of the equipment and provide a copy of current training certifying that person as a competent person. Hoisting and Rigging Training is required for all operators.

Other issues and criteria associated with the operation of vehicles at the site are as follows:

- All operators will provide copies of their operator licenses and training documents to WESTON. Expiration dates will be recorded and monitored during the course of the project. Personnel will be required to renew any documents approaching expiration prior to the expiration date. No personnel will be allowed to operate equipment at the site with expired documents. **There will be no grace period**.
- Personnel under a training period with their respective company will not operate equipment at the site. Personnel must be able to show that they are fully trained AND have one year's experience operating a specific piece of equipment to be qualified to operate the equipment on-site.
- All personnel responsible for the operation of equipment on the site will be required to show that they have recently passed a drug screening. All personnel will be subject to the 3M and WESTON drug policies in addition to that of their own company. Copies of these policies will be available at the Site Office upon request. Personnel suspected to have entered the site under the influence of alcohol or controlled substances will be reported to their employer and potentially suspended from any work on-site. If abuse is confirmed, the individual will be permanently dismissed from the site.
- Any operators taking medication, prescription or otherwise, will be required to report the reason and type of medication to the WESTON Health and Safety Officer at the beginning of each day. The ability of the individual to operate equipment on-site may be restricted while using the medication.
- WESTON reserves the right to control the operation of any equipment by individuals who are <u>perceived</u> to be unable to operate the equipment safely regardless of their experience, background, or apparent condition.
- Under no circumstances will any personnel enter the work site with explosives, firearms, alcohol, drugs, or other regulated substances. Discovery of said items will result in immediate dismissal from the site. Individuals discovering such items in a vehicle must report it immediately to the 3M Designated Representative or Health and Safety Officer who will take appropriate action to remove the items from the Site.

Vehicle Use Assessment and Selection

The following Project Team Member's qualifications and experience in driving these types of vehicles was evaluated and found to be acceptable (indicate vehicle type(s) number next to employee name).

NAME	Qualified On-Site Vehicle Usage	Company
John Hunter	**1**	**Weston Solutions Inc.**
Dave Cairns	**1**	**Weston Solutions Inc.**
Rob Junnier	**1**	**Weston Solutions Inc.**
Gary Witmer	**1**	**Weston Solutions Inc.**
Tim Frinak	**1**	**Weston Solutions Inc.**
Janet Savage	**1**	**Weston Solutions Inc.**
Mike Corbin	**1**	**Weston Solutions Inc.**
Jai Kesari	**1**	**Weston Solutions Inc.**

The project site was evaluated and a Traffic Control Plan ☒ is required ☐ is not required.

TASK 5 --- VEHICLE USAGE

Issues of Concern	**UTILITIES** **HEAVY MACHINERY** **EXCAVATIONS** **TRAFFIC** **DECONTAMINATION**	**IDW MANAGEMENT** **ODOR/DUST CONTROL** **AIR MONITORING** **STORMWATER MANAGEMENT**

EQUIPMENT REQUIRED/USED
(Be specific, e.g., hand tools, heavy equipment, instruments, PPE)

EXCAVATOR FRONT END LOADER BULDOZER BACKHOE TANDEM AXLE TRUCKS	BARRACADES TRAFFIC CONES AIR MONITORING PUMPS DREAGER TUBES AND PUMPS DUST MONITORING EQUIPMENT	WATER TRUCK MEASURING TAPE

POTENTIAL HAZARDS/RISKS

Chemical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Sampling within areas of waste deposition with potential for VOCs and PFCs.
NOTE: Work area has been treated with an SVE system. Previous investigation at the site did not indicate any methane associated with the site.

Physical

☒ Hazard Present Risk Level: ☒ H ☐ M ☐ L
What justifies risk level?
Activities associated with excavations and heavy equipment.

Biological

☒ Hazard Present Risk Level: ☐ H ☒ M ☐ L
What justifies risk level?

Area is in un-maintained pasture with potential for ticks, bees, vegetation, and small mammals.

RADIOLOGICAL

☐ Hazard Present Risk Level: ☐ H ☐ M ☒ L
What justifies risk level?

No history of use or disposal of radiological materials at the site.

LEVELS OF PROTECTION/JUSTIFICATION

Contact Activities	**Non-Contact Activities**
Modified D for activities with potential contact with impacted media (nitrile gloves, safety boots, hard hat, safety glasses, (safety shield for decon activities), hearing protection). Soil will be monitored for VOCs.	Level D for non-contact activities (appropriate winter clothing, hardhat, safety shoes, safety glasses).

SAFETY PROCEDURES REQUIRED AND/OR FIELD OPS UTILIZED

Section 7.0 ECH&S Occupational Noise; FLD 20, 57

PERSONNEL PROTECTION PLAN

PERSONNEL PROTECTION PLAN

All personnel working at the site must have current HAZWOPER Training and Medical Clearance. Copies of current documents must be filed with the WESTON Health and Safety Officer before an individual is allowed to work on-site. Based on historic data for the site, Personal Protective Equipment protocol has been developed to promote safe working conditions. The protective levels selected for site activities are as follows:

- Level D Personal Protective Equipment
- Modified Level D Personal Protective Equipment

Level D Personal Protective Equipment

With the exception of specific areas designated by WESTON, all personnel within non-restricted areas will be required to wear Level D Personal Protective Equipment. The minimum equipment required in Level D designated areas will include the following:

- Hard hat
- Safety glasses
- Safety boots
- Sleeved shirts and long pants, coveralls (if desired)
- Bright colored safety vest (orange or safety yellow)
- Leather work gloves (as necessary)

It is the responsibility of the designated Contractor Site Supervisor to ensure that employees comply with this requirement.

Modified Level D Personal Protective Equipment

Personnel working within restricted work zones as designated by WESTON with the potential for contact with impacted soil or waste materials, will be required to wear nitrile gloves and comply with the SSHASP protocol for decontamination procedures when entering or leaving the designated areas. Ultimately, it is the responsibility of the Contractor Site Supervisor to ensure that employees comply with these requirements and to provide the appropriate Personal Protective Equipment.

Depending on-site conditions and the work duties involved, boot covers or rubber boots may also be required.

Areas designated as restricted work areas will be subject to periodic air monitoring to ensure that proper Personal Protective Equipment is being used. Action levels established for equipment upgrade are based on the potential presence of contaminants of concern, such as volatile organic compounds, PFCs, dust, or potential explosive conditions. If a specific action level is encountered, work will stop and site conditions will be evaluated to determine whether additional engineering controls may be implemented to continue work. Action levels established for this project are provided in Air and Hazard Monitoring section of this SSHASP and the Construction Sampling Plan provided in the Oakdale RD/RA Plan.

If action levels cannot be avoided, the Personal Protective Equipment will be upgraded to Level C. If such conditions arise, work will be temporarily stopped until Level C protocol can be properly implemented at the Site.

PERSONNEL PROTECTION PLAN

Engineering Controls
Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s)	
1, 4	Air monitoring during drilling, and sampling if elevated readings are recorded during well installation and development, site air monitoring and personnel air sampling during project activities
All Tasks	Reconnaissance of area to identify local physical hazards for each work location.
4	Stormwater management (**See Stormwater Management Plan**)
4	Monitor excavations daily and prior to approach with heavy equipment

Administrative Controls
Describe Administrative Controls used as part of Personnel Protection Plan:

All tasks	Conduct hazard analysis of all work tasks and brief site personnel prior to work initiation and daily.
All tasks	Conduct safety briefings prior to performing daily tasks to discuss safety hazards and controls taken to minimize or eliminate hazard. Follow SSHASP. Amend as necessary if site conditions vary.
All tasks	Action level based on benzene sustained in the breathing zone during drilling activities.

Personal Protective Equipment
Action Levels for Changing Levels of Protection. Refer to HASP Form 13, Site Air Monitoring Program—Action Levels. Define Action Levels for up or down grade for each task:

Task(s)	
1, 4	Air Monitoring (VOCs, LEL, particulate) for media, ambient site readings, and personnel, Modified D PPE, (hard hat, safety glasses, safety shoes, hearing protection (as necessary), face shield (as necessary)
2,3	No air monitoring, Modified D PPE when potential to contact sampled media.

DESCRIPTION OF LEVELS OF PROTECTION

Level D		**Modified Level D**	
Task(s): All (Non-Contact Activities)		**Task(s): All (Potential Contact Activities)**	
☒ Head	Hard hat when near heavy equipment/drill rig	☒ Head	Hard hat
☒ Eye and Face	Safety glasses	☒ Eye and Face	Safety glasses, face shield/goggles (as necessary)
☒ Hearing	Ear plugs in designated areas	☒ Hearing	Ear plugs in designated areas
☐ Arms and Legs Only	Warm Clothing	☒ Arms and Legs Only	Warm Clothing
☒ Appropriate Work Uniform	Coveralls or long pants and appropriate shirt, Safety Vest	☒ Whole Body	Coveralls or long pants and appropriate shirt, Safety Vest
☒ Hand - Gloves	Leather or cotton (handling tools)	☐ Apron	
☒ Foot - Safety Boots	Steel-toed boots	☒ Hand - Gloves	Nitrile (for contact with media)
☐ Fall Protection		☐ Gloves	Leather (handling tools)
☐ Flotation		☐ Gloves	
☒ Foot -	Safety Boots	☒ Foot -	Safety Boots
		☒ Over Boots	As necessary

LEVEL C PERSONAL PROTECTIVE EQUIPMENT

Note: HASP has established action levels for upgrade to Level C Personal Protective Equipment. If Action Levels are exceeded, work will stop and site conditions will be evaluated to develop appropriate Level C protocol for the specific work tasks.

DESCRIPTION OF LEVELS OF PROTECTION	
Level C	**Level B**
Task(s):	**Task(s):**
☐ Head	☐ Head
☐ Eye and Face	☐ Eye and Face
☐ Hearing	☐ Hearing
☐ Arms and Legs Only	☐ Arms and Legs Only
☐ Whole Body	☐ Whole Body
☐ Apron	☐ Apron
☐ Hand - Gloves	☐ Hand - Gloves
☐ Gloves	☐ Gloves
☐ Gloves	☐ Gloves
☐ Foot - Safety Boots	☐ Foot - Safety Boots
☐ Outer Boots	☐ Outer Boots
☐ Boots (Other)	☐ Boots (Other)
☐ Half Face	☐ SAR - Airline
☐ Cart./Canister	☐ SCBA
☐ Full Face	☐ Comb. Airline/SCBA
☐ Cart./Canister	☐ Cascade System
☐ PAPR	☐ Compressor
☐ Cart./Canister	☐ Fall Protection
☐ Type C	☐ Flotation
☐ Fall Protection	☐ Other
☐ Flotation	
☐ Other	

AIR AND HAZARD MONITORING PROGRAM

AIR AND HAZARD MONITORING PROGRAM

Air and hazard monitoring will be conducted in accordance with the Construction Sampling Plan and this SSHASP. Hazard evaluation will be conducted daily or as deemed necessary by the WESTON Health and Safety Officer based on-site conditions. If warranted, the referenced plans will be amended to ensure safe working conditions in the field. Tasks associated with the air monitoring program may include the following:

- Drilling activities resulting in exposure of impacted soil or waste material.
- Soil/waste sampling activities
- Excavation activities
- Storage, handling, and management of impacted soil or waste
- Backfilling activities

Identified potential hazards are identified in the following table.

Potential Hazard Concerns	Soil	Water	Air	Monitoring Required
Volatile Organic Compounds	X	X	X	1,2,3
Perfluorochemicals	X	X	X (as dust)	2
Dust	X	X	X	1,2
Odors	X		X	1,2
Combustible Gas	X		X	1
Monitoring Required 1 – Ambient Air Monitoring (Work Area) 2 – Ambient Air Monitoring (Perimeter) 3 – Personnel Sampling				

Volatile Organic Compounds

Volatile organic compounds (VOCs) have been identified associated with waste and impacted soil at the site. The monitoring protocol has been based on the potential presence of benzene. The action level is established as a sustained photoionizing detector (PID) reading in the designated breathing zone. Monitoring for these compounds will include the use of a PID, a combustible gas indicator (CGI) and Draeger Tubes (if ambient levels require speciation and general quantification). Draeger tubes will be on hand for benzene and general chlorinated compounds.

Perfluorochemicals/Dust

Perfluorochemicals (PFCs) have been identified associated with waste and impacted soil at the site. Permissible Exposure Limits have not been established for this group of compounds. Due to the physical properties of these compounds, suspended particulate associated with air and water has been identified as the primary exposure pathway. As a result, measures will be implemented to monitor and control dust and stormwater runoff from impacted areas. Air monitoring with a particulate monitoring device, such as a personalDataRAM (pDR) or E-BAM or equivalent will be conducted to determine whether dust control measures are necessary. Dust control measures are outlined in the Oakdale RD/RA Plan.

Odor

Although not a direct safety concern, perceived issues associated with odor warrant on-site monitoring and control. As odor will likely be associated with volatile organic compounds, monitoring may consist of PID readings and subjective evaluations of the presence and level of odor present.

Combustible Gas

The potential for accumulation of combustible gas will be monitored at excavation sites using a Combustible Gas Indicator (CGI). An action level Lower Explosive Limit (LEL) of 10% has been established whereby any readings exceeding 10% will require stoppage of work and implementation of engineering controls.

SITE OR PROJECT HAZARD MONITORING PROGRAM

Air Monitoring Instruments

Instrument Selection and Initial Check Record

Reporting Format: ☒ Field Notebook ☐ Field Data Sheets* ☐ Air Monitoring Log ☐ Trip Report ☐ Other

Instrument	Task No.(s)	Number Required	Number Received	Checked Upon Receipt	Comment	Initials
☒ CGI	4	1		☐		
☐ O_2				☐		
☐ CGI/O_2				☐		
☐ CGI/O_2/tox-PPM, H_2S,H_2S/CO				☐		
☐ RAD				☐		
☐ GM (Pancake)				☐		
☐ NaI (Micro R)				☐		
☐ ZnS (Alpha Scintillator)				☐		
☐ Other ______				☐		
☒ PID	1,2,4			☐	For monitoring BZ	
☒ OVM				☐	And screening soil	
☐				☐		
☐ FID				☐		
☐				☐		
☐				☐		
☒ RAM, Mini-RAM	4			☐		
☐				☐		
☐ Monitox				☐		
☐				☐		
☒ Personnel Sampling	4			☐	VOCs	
☐				☐		
☐ Bio-Aerosol Monitor				☐		
☒ Pump - MSA, Dräeger, Sensidyne	1			☐	Will be used if action Level is approached	
☐ Benzene				☐		
☐ Chlorinated Solvents				☐		
☐				☐		

*Refer to Attachment C for applicable Field Operational Procedures.

SITE AIR MONITORING PROGRAM

ACTION LEVELS

These Action Levels, if not defined by regulation, are some percent (usually 50%) of the applicable PEL/TLV/REL. That number must also be adjusted to account for instrument response factors.

	Tasks	Action Level		Action
☒ **Explosive atmosphere**	4	Ambient Air Concentration	Confined Space Concentration	
		<10% LEL	0 to 1% LEL	Work may continue. Consider toxicity potential.
		10 to 25% LEL	1 to 10% LEL	Work may continue. Increase monitoring frequency.
		>25% LEL	>10% LEL	Work must stop. Ventilate area before returning.
☐ **Oxygen**		Ambient Air Concentration	Confined Space Concentration	
		<19.5% O_2	<19.5% O_2	Leave area. Re-enter only with self-contained breathing apparatus.
		19.5% to 25% O_2	19.5% to 23.5% O_2	Work may continue. Investigate changes from 21%.
		>25% O_2	>23.5% O_2	Work must stop. Ventilate area before returning.
☐ **Radiation**		< 3 times background		Continue work.
		3 times background to < 1 mR/hour		Radiation above background levels (normally 0.01-0.02 mR/hr) signifies possible radiation source(s) present. Continue investigation with caution. Perform thorough monitoring. Consult with a Health Physicist.
		> 1 mrem/hour		Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of Health Physicist.
☒ **Organic gases and vapors**	1,2,4,5	0.5 UNITS SUSTAINED		Increase monitoring frequency.
		1.0 UNITS SUSTAINED		Stop work, apply engineering controls, upgrade PPE if necessary.
☒ **Inorganic gases, vapors, and particulates**	4,5	PM_{10} reading greater than 100 micrograms per cubic meter ($\mu g/m^3$) based on a 24-hour average		Increase monitoring frequency. Stop work, apply engineering controls, upgrade PPE if necessary.

ATTACHMENT A

SAFETY FORMS, PLANS AND CHECKLISTS

Included in this Attachment:

- Daily Site Safety Briefing Form
- EHS Analysis Checklist
- Excavation/Trenching Audit Checklist
- Excavation Inspection Permit Checklist
- Traffic Control Plan Checklist
- Equipment/Trucking Inspection Checklist
- Monitoring Equipment Calibration Sheets
- Air Sample Data Sheets
- Audit Forms
- Notification of Incident

DAILY SITE SAFETY BRIEFING FORM

DAILY SAFETY BRIEFING

OAKDALE DISPOSAL SITE **PROJECT NO. 02181.202.011**

DAY: M T W H F S S **DATE:_**

BRIEFING TOPICS:

1____

2____

3____

4____

5____

FIELD VIOLATIONS: ( ) NONE

1____

2____

ACTIONS TAKEN:

1____

2____

ATTENDED BY:

PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
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PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**
PRINT NAME / SIGNATURE	**PRINT NAME / SIGNATURE**

EHS ANALYSIS CHECKLIST

ACTIVITY HAZARD ANALYSIS AND ENVIRONMENTAL COMPLIANCE TOOL

DATE: _____/_____/2009

HAZARD CHECKLIST Site Manager/EHS Officer: Date: Location: Address:	Task Team (name or reference via daily sign-in sheet)

HAZARDS IDENTIFIED (check those applicable)

	Chemical		Biological		Physical		Aerial lifts		Remote Areas
☐	Flammable/combustible	☐	Insects	☐	Noise	☐	Man. Material Handling	☐	Materials handling
☐	Corrosive	☐	Animals	☐	Heat	☐	Demolition	☐	High Pressure Washers
☐	Oxidizer	☐	Plants	☐	Cold	☐	Excavation	☐	Hand and Power Tools
☐	Reactive	☐	Mold/Fungus	☐	Inclement Weather	☐	Pile Driving	☐	Low Illumination
☐	Toxic	☐	Viral/Bacterial	☐	Hot Work	☐	Welding/Cutting/Burn	☐	Drilling & Boring
☐	Inhalation	☐	Density Gauges	☐	Confined Spaces	☐	Hot Surfaces	☐	Striking against/Struck-by
☐	Eyes/Skin	☐	Radiological	☐	Stored hazardous Energy	☐	Hot Materials	☐	Caught-in/Caught between
☐	Pesticides	☐	Ultra-Violet	☐	Elevation	☐	Rough Terrain	☐	Pushing/pulling
☐	Carcinogen	☐	Sunlight	☐	Utilities	☐	Compressed Gases	☐	Falls at same level
☐	Asbestos	☐	Infrared	☐	Machinery	☐	Hazardous Mat. Storage	☐	Falls from elevation
☐	Lead	☐	Lasers	☐	Mobile equipment	☐	Diving	☐	Repetitive motion
☐	UXO/OE/ CWM	☐	XRF	☐	Cranes	☐	Operation of Boats	☐	High (>110v) Electricity
☐	Process Safety	☐	Isotopes	☐	Manual Material Handling	☐	Working Over Water	☐	Slippery surface Ice/Snow
☐	Applying Paint/Coatings	☐		☐	Ladders	☐	Traffic	☐	
☐		☐		☐	Scaffolding	☐	Site Security	☐	

REQUIRED PROTECTION (check those applicable)

	Engineering Controls		Administrative Control		PPE				Contingency
☐	Guard Rails	☐	Qualified for task	☐	Air Supplying Respirator	☐	Tyvek coveralls	☐	Emergency Signal Known
☐	Machine Guards	☐	Trained/Certified	☐	Air Purifying Respirator	☐	Coated Coveralls	☐	Eye wash/shower Location
☐	Sound Barriers	☐	Hot Work Permit	☐	SCBA	☐	Welding leathers	☐	First Aid Kit Location
☐	Enclosure	☐	CSE Permit	☐	Hard Hat	☐	CWM	☐	Fire Extinguisher Location
☐	Elevation	☐	Lockout/Tag Out	☐	Ear Plugs	☐	Safety Shoes/Boots	☐	Spill Kit Location
☐	Isolation	☐	Work Permit	☐	Ear Muffs	☐	Rubber Boots	☐	Severe weather shelter
☐	GFCI	☐	Dig Safe Permit	☐	Safety Glasses	☐	Gloves	☐	Evacuation Routes
☐	Assured Ground Program	☐	Contingency Plan	☐	Goggles	☐	Cooling Suits		
☐	Apply Anti-slip/skid Mat	☐	Critical Lift Plans	☐	Chemical Goggles	☐	Ice Vests		
		☐	Equip. Inspection Sheets	☐	Face Shield	☐	Radiant heat Suits		
				☐	Thermal Shield	☐	Fall Arrest		
				☐	Welding Mask	☐	PFD		
				☐	Cutting Glasses	☐	Electrical insulation		

Any Modification to Tasks (list)	Other tasks or activities that may affect my activity	Reasons for any changes indicated above

ACTIVITY HAZARD ANALYSIS AND ENVIRONMENTAL COMPLIANCE TOOL

DATE: _____/_____/2009

Environmental Compliance Considerations:

☒	Generation of Hazardous Waste*	☒	→Waste Identification & Manifesting - Marking, Placarding, Labeling
☒	Generation of Investigation Derived Waste*	☐	→Training & Licensing for Use of Radioactive Materials/Sources
☒	Treatment, Storage, or Disposal of Hazardous Waste*	☒	→ Containers: dated, labeled, closed, full, stored less than 90 days
☒	Contingency to prevent or contain hazardous materials or oil spills or discharges to drains, body of water, soil*	☐	→ Risk of explosion or catastrophic release due to chemical storage or processing involving reactivity, flammables, solvents or explosives
☒	Disturbing of Asbestos Containing Materials (ACM)*	☒	→Training & Licensing for Asbestos Remediation Activities
☐	Application of Pesticides or Herbicides*	☐	
☐	Work on Above or Under-ground Storage Tanks*	☐	
☐	Transportation, Storage or Disposal of Radioactive Material*	☐	
☒	Activities producing or generating Air Emissions (or fugitive "fence-line" emissions) requiring either monitoring and/or permit*	☐	
☒	Excavations, Drilling, Probing or other activities that could impact underground utilities, pipelines, sewer or treatment systems.	☐	
☐	Shipment of Hazardous Waste off-site* Shipment of Samples in accordance with DOT/IATA	☐	

* Indicates need for an environmental compliance plan.

Special Requirements or Concerns:

EXCAVATION / TRENCHING AUDIT CHECKLIST

WESTON EXCAVATING/TRENCHING AUDIT CHECKLIST

Project: ________________________________ Date: ________________________ Time: __________

Inspector: ________________________________ Excavation Location: ______________________________

Excavation Depth: ________________________ Anticipated Maximum Depth: _______________________

	Y	N	Comment
All excavations inspected?			If no, why not? ______________________________
Soil type verified for each excavation?			Indicate Type: ______________________________
Competent person identified?			Name: ______________________________________
PE involved?			Name: ______________________________________

NOTE: For California operations, a trenching permit issued by the Division of Occupational Safety and Health (DOSH) is required prior to beginning work on any excavation or trench 5 ft deep or deeper in which employees will be required to work.

This inspection list is designed to assist in verifying inspection requirements established in 29 CFR Part 1926.560-562 Subpart P and Cal/OSHA 8 CCR 341, 1540 and 1541.

A. TRAINING

	Y	N	Comments
1. Have employees been trained in hazard recognition and safe work practices associated with excavation work?			
2. Have employees been trained in excavation emergency procedures?			

B. SURFACE ENCUMBRANCES (Trees, Boulders, Telephone Poles, Heavy Equipment)

	Y	N	Comments
1. Are all surface encumbrances posing a threat to employees identified, removed, or supported?			

C. UNDERGROUND UTILITIES/INSTALLATIONS (Electric, Gas, Fuel, Product, Water, Telecommunication, Sewer, Lines, etc.)

	Y	N	Comments
1. Are utility searches completed and documented?			
2. Have the appropriate agencies/client representatives been contacted?			
3. Are local permits obtained and on file?			
4. If excavation will impinge on underground utilities: Are procedures in place to detect/protect as utilities are neared? Are procedures in place to guard/support exposed utility lines?			

D. ACCESS AND EGRESS

	Y	N	Comments
1. Are ladders, stairways, or ramps provided every 25 ft of linear travel in excavations 4 ft deep or deeper?			
2. Are ladders appropriately secured and extend at least 3 ft above the top landing area?			
3. Are personnel and equipment access and egress ramps designed by a competent person?			
4. Are ramps/runways of two or more structural members joined so as to prevent displacement?			
5. Are structural members of ramps/runways of two or more members of uniform thickness?			
6. Are the cleats or other appropriate means used to connect runway structural members attached to the bottom of the runway or in a manner to prevent tripping?			
7. Are all structural members slip-resistant?			

E. EXPOSURE TO VEHICULAR TRAFFIC

	Y	N	Comments
1. Are appropriate warning signs or barriers used to protect employees who are exposed to vehicular traffic?			
2. Are employees exposed to vehicular traffic provided with and wearing warning vests or other suitable garments marked with or made of reflective or high-visibility material?			

F. EXPOSURE TO FALLING LOADS

	Y	N	Comments
1. Are employees permitted underneath loads handled by lifting or digging equipment?			
2. Are employees required to stand away from any vehicle being loaded or unloaded to avoid being stuck by any spillage or falling materials?			
3. Operators should remain in the cabs of vehicles being loaded or unloaded only if the vehicles are equipped, according to 29 CFR Part 1926.601(b)(6), to provide adequate protection for the operator during loading/unloading operations. Are said vehicles so equipped?			

G. WARNING SYSTEM FOR MOBILE EQUIPMENT

	Y	N	Comments
1. Does the operator of mobile equipment operated adjacent to an excavation have a clear and direct view of the edge of the excavation?			
2. Is the grade away from the excavation?			
3. If not, and if this such equipment is required to approach the edge of an excavation, is a warning system used (barricades, hand or mechanical signals, or stop logs)?			

H. HAZARDOUS ATMOSPHERES

	Y	N	Comments
1. Is there potential for hazardous atmosphere in excavations?			
2. If yes, has the atmosphere in the excavations been tested before employees enter?			
3. Is atmosphere monitored at established frequency and documented in Section U, Atmospheric Monitoring Record?			
4. Are adequate precautions taken to prevent employee exposure to atmospheres containing less than 19.5% oxygen and other hazardous atmospheres?			
5. Are adequate precautions are taken to ensure employee exposure is less than 20% lower exposure limit (LEL)?			
6. Is testing conducted as often as necessary to ensure that the atmosphere remains safe?			

I. EMERGENCY RESCUE EQUIPMENT

	Y	N	Comments
1. Is emergency rescue equipment (breathing apparatus, safety harness and line, basket stretcher, etc.) readily available where hazardous atmospheric conditions exist or may the equipment reasonably be expected to be available during work in an excavation? Is equipment attended when in use?			
2. Do employees entering bell-bottom pier holes or other similar deep and confined footing excavations wear a harness with a lifeline securely attached? Is the lifeline separate from any line used to handle materials, and is it attended at all times while the employee wearing the lifeline is in the excavation?			

J. PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

	Y	N	Comments
1. Do employees work in excavations in which there is accumulated water, or in excavations in which water is accumulating? Have adequate precautions been taken to protect employees against the hazards posed by water accumulation?			
2. If water is controlled or prevented from accumulating by the use of water removal equipment, is the water removal equipment and operation monitored by a competent person to ensure proper operation?			
3. If excavation work interrupts the natural drainage of surface water (such as streams), are diversion ditches, dikes, or other suitable means used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation?			
4. Are excavations subject to runoff from heavy rains inspected by a competent person and are they in compliance with paragraphs 29 CFR 1926.651(h)(1) and (h)(2)?			

K. STABILITY OF ADJACENT STRUCTURES

	Y	N	Comments
1. Are support systems (shoring, bracing, or underpinning) provided to ensure the stability of such structures where the stability of adjoining buildings, walls, or other structures is endangered by excavation operation?			
2. Excavation below the level of the base or footing of any foundation or retaining wall is not permitted unless:			
- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure.			
- The excavation is in stable rock.			
- A PE has determined that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity.			
- A PE has determined that such excavation work will not pose a hazard to employees.			
3. Are sidewalks, pavements, and appurtenant structures stable? If they are undermined, is a support system or another method of protection provided to protect employees from the possible collapse of such structures?			

L. PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

	Y	N	Comments
1. Are employees protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations?			
2. Is adequate protection (such as scaling to remove loose material or installation of protective barricades) provided to protect employees from loose rock or soil falling or rolling from an excavation face?			

M. INSPECTIONS

	Y	N	Comments
1. Are inspections conducted prior to the start of work and as needed throughout the shift by a competent person?			
2. Are daily inspections of excavations, the adjacent areas, and protective systems made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions?			
3. Are inspections made after every rainstorm or other hazard-increasing occurrence (freezing, thawing, increased vibration, or new traffic pattern)?			
4. Are inspections documented?			

N. FALL PROTECTION

	Y	N	Comments
1. Are walkways or bridges with standard guardrails provided where employees or equipment are required or permitted to cross over excavations?			
2. Are adequate barrier physical protection (sufficient to provide protection for vehicles or pedestrians as appropriate) and lighting provided at all remotely located excavations?			
3. Are all wells, pits, shafts, etc., barricaded or covered?			

O. PROTECTION OF EMPLOYEES IN EXCAVATIONS

	Y	N	Comments
1. Each employee in an excavation is protected from cave-ins by an adequate protective system designed in accordance with paragraphs (b) or (c) of 29 CFR Part 1926.652 unless:			
- Excavations are made entirely in stable rock.			
- Excavations are less than 5 ft (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.			
2. Are employees permitted to work on the faces of sloped/benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment?			
3. Do the protective systems have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system?			

P. DESIGN OF SLOPING AND BENCHING SYSTEMS.

	Y	N	Comments
1. Are slopes and configurations of sloping and benching systems selected and constructed in accordance with the requirements of 29 CFR Part 1926.652:			
- Paragraph (b)(1) (slope angles no greater than 1 1/2:1 [75%] or conforms to slopes and configurations required in Appendix B for type C soils)?			
- Paragraph (b)(2) (slopes and configurations are according to Appendices A and B)?			
- Paragraph (b)(3) (slopes and configurations are according to other published tables that are available onsite)?			
- Paragraph (b)(4) (slopes and configurations are designed by a PE and a copy of the design is onsite)?			

Q. DESIGN OF SUPPORT SYSTEMS, SHIELD SYSTEMS, AND OTHER PROTECTIVE SYSTEMS.

	Y	N	Comments
1. Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or a designee and shall be in accordance with the requirements of 29 CFR Part 1926.652:			
- Paragraph (c)(1) (designs are based on Appendices A, C, and D)?			
- Paragraph (c)(2) (design is in accordance with manufacturer's tabulated data, specifications, or instructions and a copy of the data is onsite.)?			
- Paragraph (c)(3) (designs use other tabulated data and a copy of the data is onsite)?			
- Paragraph (c)(4) (designed by a PE and a copy of the design is onsite)?			

R. INSTALLATION AND REMOVAL OF SUPPORT

	Y	N	Comments
1. Are members of support systems securely connected together to prevent sliding, falling, kickouts, or other predictable failure?			
2. Is installation of a support system closely coordinated with the excavation of trenches?			
3. Are support systems installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system?			
4. Are individual members of support systems subjected to loads exceeding those they were designed to withstand?			
5. Before temporary removal of individual members begins, are additional precautions taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system?			
6. Removal begins at, and progresses from, the bottom of the excavation. Are members released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation?			
7. Does backfilling progress together with the removal of support systems from excavations?			
8. Excavation of material to a level no greater than 2 ft (.61 m) below the bottom of the members of a support system is permitted only if: - The system is designed to resist the forces calculated for the full depth of the trench. - There are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.			

S. SHIELD SYSTEMS

	Y	N	Comments
1. Are shield systems subjected to loads exceeding those the system was designed to withstand?			
2. Are shields installed in a manner to restrict lateral or other hazardous movement of the shield in the event of application of sudden lateral loads?			
3. Are employees protected from the hazard of cave-ins when entering or exiting the areas protected by shields?			
4. Are employees allowed in areas when shields are being installed, removed, or moved vertically?			
5. Excavation of earth material to a level not greater than 2 ft (.61 m) below the bottom of a shield is permitted only if the shield is designed to resist the forces calculated for the full depth of the trench, and if there are no indications, while the trench is open, of a possible loss of soil from behind or below the bottom of the shield.			

T. ADDITIONAL COMMENTS

____

____

____

____

____

____

U. ATMOSPHERIC MONITORING RECORD

Testing	**PEL/Action Level**	**Conc./Time**	**Conc./Time**	**Conc./Time**
Percent Oxygen	19.5-23.5% (D)			
Percent LEL	> 20% (withdraw)			
Toxic-	Refer to HASP			

EXCAVATION INSPECTION PERMIT CHECKLIST

WESTON EXCAVATION INSPECTION-PERMIT CHECKLIST

DATE: ___________ TIME: ___________ LOCATION: ________________________________

DESCRIPTION OF EXCAVATION: ____

PERSON IN CHARGE OF WORK: (SAFETY WATCH, If applicable) ___________________________

Item	**Y**	**N**	**Comment**
Is there a competent person on site?			
Have utilities been located?			
Will excavation be less than 5 ft in depth? If yes, has competent person determined appropriate worker protection?			
Will excavation be greater than 5 ft in depth? If yes, complete remainder.			
Will workers in or near top or face of excavation be adequately protected?			
What is expected soil type? ____________ Is protection (sloping, benching, shoring, sheeting, or shielding) according to 29 CFR Part 1926.652?			
If sloping/benching used: Angle no greater than 1½ horizontal to 1 vertical (34º)? Conforms to Appendix B, 29 CFR Part 1926.652 for type C soils? Conforms to Appendix A or B? Conforms to other published tables that are onsite? Is designed by competent PE?			
If shoring, sheeting, or shielding is used: Designs based on Appendices A, C, D, or G of 29 CFR Part 1926.652? Designed and used according to manufacturer's specifications and instructions? Design is according to published tables that are onsite? Design is by a competent PE?			
If Appendix A of 29 CFR Part 1926.652 is used, indicate soil classification _________. Is classification based on at least one manual and one visual test?			
Is plan for installation and removal of support systems appropriate?			
Is planned protection for surface encumbrances appropriate?			
Are there adequate provisions for access and egress?			
Is plan for protection from vehicular traffic adequate?			
Are barriers and lighting provided for pedestrian and vehicle protection?			
Is plan adequate for protection from exposure to falling loads?			
Is there an adequate proximity warning system for mobile equipment?			
Does plan adequately address hazards of/protection from accumulating water?			
Does plan adequately take into account stability and potential impact of adjacent structures?			
Is plan for protection from loose soil or rock adequate?			

Item	Y	N	Comment
Inspections will be conducted of excavation and adjacent areas: Prior to start of work? Daily? After rain storms or other hazard increasing occurrences? Are inspections documented?			
Is fall protection adequate?			
Is there a potentially hazardous environment? If yes, complete the following table.			
Is appropriate emergency/rescue equipment available?			

Testing	PEL/Action Level	Concentration/Time			
Percent Oxygen	19.5-23.5%				
Percent LEL	> 20%				
*Carbon monoxide	35 ppm				
*Hydrogen sulfide	10 ppm				

*If applicable

ADDITIONAL REQUIREMENTS

Item	Y	N	Comment
Hot work permit required?			
Confined entry procedures and permits required?			
Have all employees reviewed and signed HASP?			

EMERGENCY PLAN EMERGENCY TELEPHONE NUMBERS:

Fire Department: ______________ Police Department: ______________
Ambulance: ______________ Medical: ______________

EMERGENCY EQUIPMENT

Fire Extinguisher - Type: ________________________ Location: ____________________________________	First Aid Kit - Locations: ________________________ ____
Rescue Breathing Apparatus - Location: ____	Non-powered digging tools - Location: ____
Life Line Systems - Location: ___________________ ____	

Field Safety Officer: ___________________________ Competent Person: ___________________________

Registered Professional Engineer: ____

EMPLOYEES:

Name (Please Print)	Signature	Duties

TRAFFIC CONTROL PLAN CHECKLIST

APPENDIX B TRAFFIC CONTROL PLAN CHECKLIST

State, Local Government and Municipal Traffic Control Requirements

Yes	No	
		Will the project result in an increase of traffic volume or the type of vehicles that will be regulated by a government entity?
		Are there requirements for specific travel routes within the boundaries of any government jurisdiction?
		If so, are maps and descriptions provided to drivers along with clear communication of consequences of failing to follow these routes?
		Is there a system in place for communicating routes to vendors beside the vehicle operators involved in day to day material transport?
		Are there restrictions on when traffic is permitted?
		If so, is there clear communication of these requirements to all drivers and of consequences of failing to follow these routes?
		Is there a system in place for communicating these requirements to vendors beside the vehicle operators involved in day to day material transport?
		Are there prohibitions on types of brakes?
		Will signs be required?
		Is color, wording, size and spacing of signs specified?
		Are “flaggers” required?
		Must “flaggers” be certified or trained?
		Will barriers or other protection be required to protect workers along roadways?
		Are permits required for encroaching on, access to or providing new access to a highway?
		Have over-the-road drivers been informed that they are expected to obey all traffic laws while traveling to and from the WESTON site on WESTON business and that if WESTON learns of a traffic violation being issued or an accident occurs that that can result in prohibition of the driver being used for WESTON related work?

Personally Owned Vehicle (POV) Parking

Yes	No	
		Is there ample space for POV parking with safe access and exit to streets or highways?
		Are there separate areas provided for POV parking, equipment/materials lay-down and construction equipment parking?
		Are POV parking areas, equipment/material lay-down areas and construction equipment areas part of regular EHS inspections and checklists?

On site Traffic Control

Yes	No	
		Are routes established with all traffic traveling in one direction?
		If backing is necessary, is the distance minimized?
		Are aprons for turn around or dumping of sufficient size to allow maneuvering?
		Are dumping areas of sufficient soundness to support the largest anticipated loaded dump vehicles?
		Are spotters or flaggers used to control backing?
		Are spotters trained?
		Is a set of standard hand signals established that all spotters use?
		Are spotters prohibited from directing more than one vehicle at a time?
		Are spotters highly visible and positioned so that in the event of an overturn, they are sufficiently far from the vehicle so that they will not to be struck?
		Do spotters understand their responsibility to look out for overhead obstacles, unbalanced loads, unstable terrain, load hang-ups, and to prohibit dump trucks from driving more that the distance required to dump a load with the bed raised?
		Are roadways maintained to provide solid surfaces without ruts for travel by the largest anticipated vehicles?
		Is the project regulated by USACE EM 385-1-1?
		If so, do haul ways meet the requirements of EM 385-1-1, Section 8.D?
		Have reinforced dump beds been specified for semi-type dump truck beds?
		Is dumping curtailed in high wind conditions?
		Has the use of board roads been considered?
		Are speed limits posted on site roads?
		Are the limits enforced?
		Is driving across slope or turning on grade minimized?
		Is use of seat belts and wearing of hard hats by operators of on-site haul vehicles strictly enforced?

EQUIPMENT / TRUCKING INSPECTION CHECKLIST

3.10 EQUIPMENT/TRUCKING INSPECTION CHECKLIST

This inspection form is to be filled out at the start of the work shift by the Equipment/Truck Operator to insure that the equipment/truck is safe to operate and is free from apparent damage which could cause failure while in use. Once completed, this form is to be given to the Site Manager to be kept on file on-site. In all cases, consult the manufacturer's data to ensure compliance with all safety inspection criteria which may not be indicated below.

MAKE/DESCRIPTION____
MODEL/SERIAL____

	OK	**Not OK**	**Comment And Actions Taken**
Brakes			
Brake Lights			
Reverse Signal Alarm			
Horn			
Tires			
Steering			
Seat Belts			
Operating Controls			
Fire Extinguisher			
Lights			
Defroster			
Mirrors			
Instruments			
Coupling Devices			
Windshield/Window Glass			
Windshield Wiper			
Mud Flaps/Rock Guards			
Exhaust System			
Hitches & Safety Cables			
Hydraulic Lines/Air Hoses			
Engine Oil Level			
Roll-Over Protection/ Emergency Equipment			

Odometer: ______________________ Hour Meter: _____________________
Fuel Level: ______________________

Inspector Name/Signature: ____

Date: ____________________ Time: ____

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MONITORING EQUIPMENT CALIBRATION SHEETS

CALIBRATION - CGI

Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

CALIBRATION - PID

Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

CALIBRATION – PARTICULATE MONITORING EQUIPMENT

Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

CALIBRATION -

Air Monitoring Instruments Calibration Record

Instrument, Mfg., Model, Equip. ID No.	Date	Time	Calib. Material	Calib. Method Mfg.'s	Other	Initial Setting and Reading	Final Setting and Reading	Calibrator's Initials

AIR SAMPLE DATA SHEETS

SITE AIR MONITORING PROGRAM

Field Data Sheets

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

Location:

% LEL	% O_2	PID (units)	FID (units)	Aerosol Monitor (mg/m^3)	GM: Shield Probe/ Thin Window		NaI (uR/hr)	ZnS (cpm)
					mR/hr	cpm		
Monitox (ppm)				Detector Tube(s)				
Sound Levels (dBA)		Illumination	pH	Other	Other	Other	Other	Other

AIR MONITORING/SAMPLING DATA LOG

Client:

W.O. No.:

Sample No.:

Address:

Sampled By:

Date:

Employee and Location Information

Employee Name:

Employee No.:

Job Title:

Respirator ☐ APR ☐ ½ Mask ☐ Full Face
☐ PAPR ☐ ½ Mask ☐ Full Face ☐ Hood
☐ SAR ☐ ½ Mask ☐ Full Face ☐ Hood
☐ SCBA

Manufacturer:

Cartridge Type:

PPE: ☐ Hard Hat ☐ HPD ☐ Gloves ☐ Safety Shoes ☐ Coveralls ☐ Other:

Sampling Data

Sampling Type: ☐ Personal
☐ TWA ☐ STEL ☐ Area ☐ Source
☐ Full Shift ☐ Partial Shift ☐ Grab

Media:

Pump Type/Serial No.:
/

Calibrator/Serial No.:
/

Pre-Calibration:
1.
2.
3.
avg-pre:

Post-Calibration:
1.
2.
3.
avg-post:

Start Time:	**Restart Time:**	**Restart Time:**	**Avg. Flowrate:**	**% Change:**
1st Stop Time:	**2nd Stop Time:**	**3rd Stop Time:**	**Total Time:**	**Volume:**

Multiple Samples for this TWA:
☐ Yes ☐ No

Multiple Chemical Exposures:
☐ Yes ☐ No

Exposure Time:
☐ Normal ☐ Worst Case

Sampling Conditions

Weather Conditions:
Temp: R.H: B.P.: Other:

Engineering Controls:

Substances Evaluated

Substance	Result	Substance	Result	Substance	Result

Observations and Comments

QA by:

Date:

AUDIT FORMS

MANAGER'S FIELD SITE HEATLH AND SAFETY AUDIT FORM

PM name: _____________________________ Date: _________________________

Client name: ___________________________ W.O. No.: _____________________

Site location: ____________________________ Site phone no._________________

Inspection conducted by:

__ PM in person __ PM via phone (Contact Name: ________________________)

__ PM's designee (Designee's Name: ______________________)

1. Is the SSHASP available at the site? __yes __no Signed by all personnel? __yes __no
   (Have the cover page and site worker sign-off page faxed and attached to this form.)

2. What tasks are active? ____.

3. What special H&S considerations are necessary? (e.g., confined spaces, fall protection, construction safety, excavation evaluations, radiation, etc.)

   ____

   ____.

4A. List the name of the SHSC/FSO on Line (a) and any other employees working at the site on lines (b) through (i). Verify and check (✓) if field certifications are current:

Name	WESTON or Sub?	Training	Medical	Fit Test
a.				
(For above, circle: SHSC or FSO)				
b.				
c.				
d.				
e.				
f.				
g.				
h.				

4B.For large projects, is documentation on-site for employee certifications? __yes __no __NA

5. Is emergency contact information available on-site? __yes __no
   (Have a copy faxed from the site and attached to this report.)

6. Describe the ambient temperatures during recent work shifts:
____.

7. Was the level of PPE used for each task today as required by the SSHASP? __yes __no

8A. What contaminant monitoring is conducted?
____.

8B. How are results documented? ___Logbook ___Forms ___other (describe): __________.
(Have the most recent results and calibration information faxed and attached to this form.)

9. What other monitoring is done? (e.g., heat stress, cold, noise, etc.)
____________________.

10. How are work zones marked and/or designated?
____________________________________.

11. Are personnel and equipment decon performed as required by the SSHASP? __yes __no

12. Are first aid and CPR services provided as required by the SSHASP? __yes __no

13. When were first aid kits, BBP kits, and fire extinguishers last inspected? _______________.
(Have documentation faxed and attached to this form.)

14. Was site-specific hazard communication completed and properly documented?__yes ___no
(Have checklist in SSHASP Attachment D faxed and attached to this form.)

15. When was the last safety briefing conducted? __________________. List topic(s) discussed:
____.
(Have minutes/sign-up sheet faxed and attached to this form.)

16. Explain any negative findings below:
____
____
____
____
____
____
____
____
____
____
____
____
____
____

PM Signature/Date: ____

Revised 05/1998

HEALTH AND SAFETY FIELD AUDIT

Legend X = Yes, O = No

SITE NAME:____

WO #:____

LOCATION:____

INSPECTOR:____

DATE:____

CERTIFICATION OF PERSONNEL:

1._____All WESTON personnel on site are currently active on certification list?
2._____Site Safety Officer and Site Supervisor are qualified?

MEDICAL AND FIRST AID:

1._____First Aid Kits accessible and identified?
2._____Emergency eye/safety washes available?
3._____Daily First Aid logs up to date?
4._____First Aid Kits inspected weekly?
5._____At least two First Aid trained persons on site at all times when working?

SITE SAFETY/EMERGENCY PLANS:

1._____Safety plan posted on site and given to each person?
2._____Initial site safety plan meeting held and documented before work begins?
3._____Hazardous materials information available for all hazards?
4._____Designated, qualified site health and safety coordinator on site?
5._____Employees trained in toxicology/exposure risks?
6._____Emergency telephone numbers posted?
7._____Emergency routes designated?
8._____Emergency plan and signal reviewed with all persons?

TRAINING:

1._____Daily safety meetings documented?
2._____Question and answer time available to all site personnel?
3._____All employees instructed in hazardous materials handling practices?
4._____ New personnel to site receive: copy of safety plan_____, site orientation_____, Review of: LOP_____, DECON____, ZONES_____, Site specific safety and health hazards?____

HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

PERSONAL PROTECTION:

1._____All equipment meets ANSI/OSHA/EPA criteria?
2._____Levels of protection (LOP) established?
3._____Site control zones (Exclusion, CRZ, Support) clearly designated?
4._____All employees know their LOP scheme?
5._____OSHA respirator program in place?
6._____Employees fit tested for respirators?
    _____ On site?
    _____ Fit tests current?
7._____Defective equipment tagged out?
8._____Breathing air grade "D" certified?
9._____Sufficient quantities of equipment?
10.____Safety instrumentation maintained and calibrated?
    _____ Maint. & Cal. logs up to date?

DECONTAMINATION:

1._____Decon system set up on site?
    _____ Used?
    _____ According to safety plan?
2._____Contamination reduction corridor clearly delineated within the CRZ?
3._____Appropriate waste receptacles available for all waste?
4._____Receptacles properly closed at end of day?
5._____All Decon liquids properly contained and disposed of?
6._____All wastes disposed of according to approved plan?
7._____All personnel received Decon training?
8._____All reusable personal protective gear deconned and disinfected at least daily?

FIRE PREVENTION/PROTECTION:

1._____Hot work permits required?
2._____Smoking restricted to designated area?
3._____Fire lanes established, clearly designated & maintained?
4._____Flammable/combustible liquid dispensing transfer systems grounded & bonded?
5._____Proper flammable materials storage?
6._____Fire alarm established, workers aware?
7._____Location and use of fire extinguisher known by all personnel?
8._____Fire extinguishers checked before each shift?
    _____ Inspected monthly?
9._____Fire extinguisher appropriate for fire hazard potential?
10.____Combustible materials segregated from ignition sources?

HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

WALKING AND WORKING SURFACES:

1._____Accessways, stairs, ramps and ladders free of ice, mud, snow or debris?
2._____Ladders exceed max length?
3._____Ladders used in passageways, doors or driveways?
4._____Broken or damaged ladders tagged out?
5._____Metal ladders prohibited in electrical service?
6._____Safety feet on straight and extension ladders?
7._____Stairways, floor and wall openings guarded?
8._____Elevated work areas guardrailed or safety chained?
9._____Flotation devices worn when working on or over water?
10.____Toe boards on overhead work surfaces?
11.____Mobile offices/labs have fixed stairs and handrails?
12.____Work areas kept free of debris and equipment?

EXCAVATIONS, CONFINED SPACES, TUNNELS:

1._____Excavations sloped, shored or benched to prevent cave-ins?
2._____Shoring approved by engineer?
3._____Guardrails or fences placed around excavations near walkways or roads?
4._____Excavation locations lighted/or otherwise made visible at night?
5._____Utility check performed and documented before excavation or drilling?
6._____Ladders available in trenches more than 4 feet deep and at a minimum, 25' intervals along a fence?
7._____All excavated material, personnel, heavy equipment is at least 24" from the edge of all trenches?
8._____Confined space entry permit procedure in place and communicated to all?
9._____Employee training includes CSE hazards?
10.____Tunnels are adequately ventilated?
11.____There is proper lighting?
12.____Tunnel tested for: % O_2?
_____LEL, flammable gases, vapors?
_____TOX?
13.____Communication available inside to out?
14.____No flammables or combustibles in tunnel?
15.____CSE procedures used for Tunnels?
16.____CSE procedure checklist:
_____ Safety watch?
_____ Safety watch protected same as enterers?
_____ Safety line?
_____ Appropriate harness?
_____ Continuous monitoring for % O2, % LEL & TOX?

Legend X = Yes, O = No

EXCAVATIONS, CONFINED SPACES, TUNNELS (continued):

_____ Level B or constant ventilation and monitoring?
_____ Instruments calibrated?
_____ Maintain and inspect log for all equipment?

17.____Confined space isolated from electrical/mechanical activation by following lock out/tag out proceedings?
_____ Confined space isolated from any raw materials/chemical lines by disconnecting or blanking these lines?

MOTOR VEHICLES/HEAVY EQUIPMENT:

1._____Inspected before each use?
2._____Operators licensed for equipment used?
3._____Unsafe equipment tagged out and reported?
4._____All safety appliances/guards in place?
5._____Shut down for fueling?
6._____Equipped with back-up alarms or spotter used if 360° visibility restricted?
7._____Loads are secure before transport?
8._____Roads and structures inspected for load capacity per vehicle weights?
9._____Riders prohibited on heavy equipment?

SLINGS AND CHAINS:

1._____Slings, chains and rigging rated for intended use and inspected per OSHA. Documentation of inspection in daily log?
2._____Damaged slings, chains or rigging tagged out and reported?
3._____Employees are instructed and keep clear of suspended loads?

ELECTRICAL:

1._____Warning signs indicate the presence and location of high voltage equipment, 250 V or greater present and location?
2._____Electrical equipment and wiring properly guarded?
3._____Electrical lines, extension cords and cables guarded and properly maintained?
4._____Extension cords kept dry out of puddles and rain?
5._____Damaged equipment tagged out?
6._____Underground electrical lines located and indicated?
7._____Overhead electrical lines de-energized or elevated work platforms, work areas, booms or ladders erected so no contact can occur with electrical lines?
8._____A positive electrical lock-out system is used whenever work is done on or in electric equipment or electrically activated equipment

HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

HAND AND POWER TOOLS:

1._____Guards and safety devices in place and used?
2._____Inspected before each use?
3._____Tagged out if defective?
4._____Eye protection areas identified and protection worn?
5._____Non sparking tools available?

WELDING AND CUTTING:

1._____Fire extinguishers present at all welding and cutting operations?
2._____Confined spaces, tanks, pipelines tested before welding or cutting?
3._____Hot work permitting system in use?
4._____Proper helmets and shields (including proper tint for UV protection) used?
5._____Properly grounded?
6._____Fuel gas and O_2 gas cylinders stored at least 20' apart?
_____ Stored upright and secured?
7._____Only trained welders permitted?

COMPRESSED GAS CYLINDERS/PRESSURIZED LINES:

1._____Breathing air cylinders charged only to prescribed pressure?
2._____No other gas system can be mistaken for breathing air?
_____ Fittings prohibit cross connection?
3._____Cylinders segregated appropriately in controlled, protected but well ventilated areas?
4._____Smoking prohibited in storage areas?
5._____Cylinders stored upright and secured?
6._____Cylinder caps in place when stored (not in use) or when cylinders moved?
7._____Fuel gas and O_2 minimum 20' apart when stored?
8._____Pressurized air or waterlines are securely connected?
9._____All site personnel know never to step across a pressurized line?
10.____Gas or other hazardous lines are labeled appropriately?

MISCELLANEOUS:

1._____Tools and other equipment (portable) are stored away from walkways, roads or driveways where they cannot fall on or be fallen over by site personnel?
2._____Overhead hazards are noted, communicated to all and labeled as needed?
3._____Hard hat, eye hearing and protection areas are defined and signs in place?
4._____Hard hats, eye and head protection used where appropriate?
5._____Signs or labels are in place or appropriate training received?

HEALTH AND SAFETY FIELD AUDIT - Continued

Legend X = Yes, O = No

6._____Copies of contracts with client and sub-contractors are on-site, WESTON's role regarding site health and safety responsibilities clear in these and in the minds of the site manager(s)?

7._____Sub-contractors have received approved copies of their safety plan or have signified their intent to conform with WESTON's safety plan?

8._____Site managers understand their responsibilities for sub-contractors' conformance with all OSHA and other health and safety requirements?

9._____Site managers know what to do in the event of an OSHA inspection?

COMMENTS:

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NOTIFICATION OF INCIDENT

NOTIFICATION OF INCIDENT—INITIAL REPORT

The NOI form should be utilized to report ALL incidents. Incidents include: employee accidents, injuries, auto accidents, property damage/loss, information /data breaches, security concerns, contractor injuries/accidents/events, *OR other liability situations or circumstances that could give rise to a claim*. The NOI form is intended to be a preliminary summary (**due within 24 hours/one business day**) reporting what is immediately known of an event or situation. After a NOI report is released, and the appropriate resources within the organization are notified, an investigation should be initiated**.**

For SECURITY INCIDENTS. Initial notice and distribution via email limited to William Irwin, Corporate Security Manager, and Susan Hipp-Ludwick, Corporate Risk Manager. If incident is related to information /computer data concerns also include Joe Paquet, IS Technical Director in initial distribution.

SECTION 1: SECURITY INCIDENT SUMMARY (PROCEED TO ITEM #1 BELOW)

☐ THEFT ☐ VANDALISM ☐ THREAT / ASSAULT ☐ COMPUTERS ☐ OTHER

For **SAFETY-RELATED INCIDENTS/ACCIDENTS** involving an employee(s) or contractor. Submit written report via email to **Susan Hipp-Ludwick and Matthew Dillon in Risk Management, and Owen Douglass of Corporate EH&S, the Direct Supervisor of the involved employee(s), the Safety Officer, the Client Service Manager (CSM), and the Division EH&S Manager. Distribution of safety related incidents should also include**: **Pat McCann, President; Alan Solow, COO; Ray Griffin, Senior VP of HR; the appropriate Division Manager(s), and involved employee if such person is not the person completing the NOI**. Others may be added to the distribution as designated by a division, business team, profit center or project management.

OTHER INCIDENTS, including environmental and/or incidents that may give rise to a claim are to be reported in writing, and sent by email to **Susan Hipp-Ludwick and Matt Dillon** in the Risk Management, and appropriate project team members, profit center, and division/business line management **within 24 hours**. Include Owen Douglass in distribution of environmental incidents.

SECTION I: INCIDENT SUMMARY

☐ INJURY / ILLNESS ☐ AUTO ☐ CONTRACTOR ☐ ENVIRONMENTAL ☐ OTHER (e.g. property loss; or circumstance that could give rise to a claim)

---

1. DATE / TIME /LOCATION OF INCIDENT (Project, Office, or Other location. Include WO#):

2. EMPLOYEE(S) / INDIVIDUAL(S) INVOLVED or WITNESS TO INCIDENT / EVENT:

JOB TITLE / ROLE: DIV./ PROFIT CENTER / ORG. UNIT

3. DIRECT SUPERVISOR / AND OFFICE MANAGER OR PROJECT MANAGER (Whomever is Appropriate):

4. DIVISION / LOCAL SAFETY OFFICER (if applicable):

5. DESCRIPTION OF INCIDENT / POTENTIAL LIABILITY EXPOSURE/EVENT AND RESULTING INJURY / DAMAGES:

6. WERE AUTHORITIES CONTACTED (police, government)? IF YES, IDENTIFY (i.e., agency name, case number, etc).

SECTION II: INJURY/IES

7. TREATING PHYSICIAN NAME, HOSPITAL, if Applicable:

8. CAN PERSONNEL RETURN TO WORK? RESTRICTIONS, IF KNOWN :

SECTION III: IF VEHICLE OR EQUIPMENT INVOLVED

9. EQUIPMENT / VEHICLE INFORMATION (Year / Make / Model): VIN:

OWNED ☐ RENTED ☐ ALLOWANCE ☐ PERSONALLY OWNED VEHICLE ☐

FOR ADDITIONAL INFORMATION, CONTACT (Name and Phone Number):

This is preliminary information, subject to change, and may contain errors. Any errors in this report will be corrected as follow-up investigation is conducted.

Investigative reports and/or other documentation will often be necessary supplemental information supporting initial NOI report.

Questions can be directed to Susan Hipp-Ludwick at 610.701.3046

ATTACHMENT B

MATERIAL SAFETY DATA SHEETS
(MSDSs)

To be provided prior to field work.

ATTACHMENT C

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM

SITE-SPECIFIC HAZARD COMMUNICATION PROGRAM

Location-Specific Hazard Communication Program/Checklist

To ensure an understanding of and compliance with the Hazard Communication Standard, WESTON will use this checklist/document (or similar document) in conjunction with the WESTON Written Hazard Communication Program as a means of meeting site- or location-specific requirements.

While responsibility for activities within this document reference the WESTON Health and Safety Officer, it is the responsibility of all personnel to effect compliance. Responsibilities under various conditions can be found within the WESTON Written Hazard Communication Program.

To ensure that information about the dangers of all hazardous chemicals used by WESTON are known by all affected employees, the following Hazard Communication Program has been established. All affected personnel will participate in the Hazard Communication Program. This written program, as well as WESTON's Corporate Hazard Communication Program, will be available for review by any employee, employee representative, representative of OSHA, NIOSH, or any affected employer/employee on a multi-employer site.

☐ Site or other location name/address: OAKDALE RESPONSE ACTION, OAKDALE, MN

☐ Site/Project/Location Manager: ROB JUNNIER/GARY WITMER/JOHN HUNTER/DAVE CAIRNS

☐ Site/Location Health and Safety Officer: JOHN HUNTER/GARY WITMER/TIM FRINAK/DAVE CAIRNS

☐ List of chemicals compiled, format: ☒ HASP ☐ Other: ____________

☐ Location of MSDS files: HASP

☐ Training conducted by: Name: WESTON Health and Safety Officer Date: ____________

☐ Indicate format of training documentation: ☒ Field Log: ☒ Other: SSHASP

☐ Client briefing conducted regarding hazard communication: ____________

☐ If multi-employer site (client, contractor, agency, etc.), indicate name of affected companies:

____

____

____

☐ Other employer(s) notified of chemicals, labeling, and MSDS information: ____________

☐ Has WESTON been notified of other employer's or client's hazard communication program(s), as necessary? ☐ Yes ☐ No

List of Hazardous Chemicals

A list of known hazardous chemicals used by WESTON personnel must be prepared and attached to this document or placed in a centrally identified location with the MSDSs. Further information on each chemical may be obtained by reviewing the appropriate MSDS. The list will be arranged to enable cross-reference with the MSDS file and the label on the container. The Health and Safety Officer or Site Manager is responsible for ensuring the chemical listing remains up-to-date.

Container Labeling

The WESTON Health and Safety Officer will verify that all containers received from the chemical manufacturer, importer, or distributor for use on-site are clearly labeled.

The Health and Safety Officer is responsible for ensuring that labels are placed where required and for comparing MSDSs and other information with label information to ensure correctness.

Material Safety Data Sheets (MSDSs)

The Health and Safety Officer is responsible for establishing and monitoring WESTON's MSDS program for the location. The Health and Safety Officer will ensure that procedures are developed to obtain the necessary MSDSs and will review incoming MSDSs for new or significant health and safety information. He/she will see that any new information is passed on to the affected employees. If an MSDS is not received at the time of initial shipment, the Health and Safety Officer will call the manufacturer and have an MSDS delivered for that product in accordance with the requirements of WESTON's Written Hazard Communication Program.

A log for, and copies of, MSDSs for all hazardous chemicals in use will be kept in the MSDS folder at a location known to all site workers. MSDSs will be readily available to all employees during each work shift. If an MSDS is not available, immediately contact the WESTON Health and Safety Officer or the designated alternate. When a revised MSDS is received, the Health and Safety Officer will immediately replace the old MSDS.

Employee Training and Information

The Health and Safety Officer is responsible for the WESTON site-specific personnel training program. The Health and Safety Officer will ensure that all program elements specified below are supplied to all affected employees.

At the time of initial assignment for employees to the work site, or whenever a new hazard is introduced into the work area, employees will attend a health and safety meeting or briefing that includes the information indicated below.

- Hazardous chemicals present at the work site.
- Physical and health risks of the hazardous chemicals.
- The signs and symptoms of overexposure.
- Procedures to follow if employees are overexposed to hazardous chemicals.
- Location of the MSDS file and Written Hazard Communication Program.
- How to determine the presence or release of hazardous chemicals in the employee's work area.
- How to read labels and review MSDSs to obtain hazard information.
- Steps WESTON has taken to reduce or prevent exposure to hazardous chemicals.
- How to reduce or prevent exposure to hazardous chemicals through the use of controls procedures, work practices, and personal protective equipment.
- Hazardous, nonroutine tasks to be performed (if any).
- Chemicals within unlabeled piping (if any).

Hazardous Non-routine Tasks

When employees are required to perform hazardous non-routine tasks, the affected employee(s) will be given information by the Health and Safety Officer about the hazardous chemicals he or she may use during such activity. This information will include specific chemical hazards, protective and safety measures the employee can use, and steps WESTON is using to reduce the hazards. These steps include, but are not limited to, ventilation, respirators, presence of another employee, and emergency procedures.

Multi-Employer Work Sites

It is the responsibility of the Health and Safety Officer to provide other employers with information about hazardous chemicals imported by WESTON to which their employees may be exposed, along with suggested safety precautions. It is also the responsibility of the Health and Safety Officer and the Site Manager to obtain information about hazardous chemicals used by other employers to which WESTON employees may be exposed. WESTON's chemical listing will be made available to other employers, as requested. MSDSs will be available for viewing, as necessary.

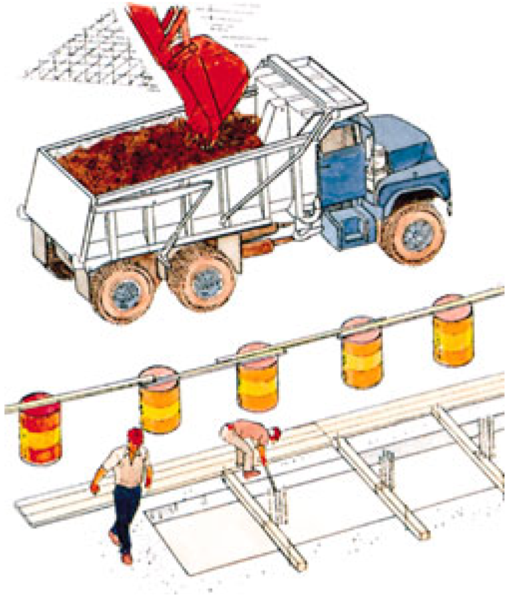
The location, format, and/or procedures for accessing MSDS information must be relayed to affected employees.

ATTACHMENT D

TRAFFIC CONTROL PLAN

Traffic Control

Construction Site Vehicle incidents include: Collisions, vehicle striking low or poorly visible stationary items (gates, railings, light posts/tower, parked vehicles, etc.) roll-over of dump beds, roll over of dump bodies, and contact with overhead utilities. Injury to personnel occurs form pedestrian/equipment interface and dump truck drivers, climbing on vehicles to check loads.



TRAFFIC CONTROL ON SITE

The main problem with moving construction equipment and vehicles is the driver's lack of visibility, especially when moving in reverse. Dump trucks and heavy equipment such as loaders, dozers, graders, and backhoes have blind spots that leave the operator no view or only a limited view of the intended path of travel (see illustrations on next page).

Workers within these blind spots are at risk, especially if kneeling or bending over. As a result, it is imperative that drivers use their mirrors and rely on signalers whenever their view is obstructed or personnel are in danger of being struck.

Preventing injuries and deaths caused by construction equipment moving on-site can be achieved through

- site planning
- use of signalers

Training Site Planning

- Eliminating or reducing the need for a vehicle to back up is the first objective when planning site layout. Drive-through operations can increase efficiency while reducing visibility problems.
- Workers on foot should be kept out of areas where heavy equipment frequently moves and operates. Plan to have workers in the area *before* activities requiring heavy equipment start or *after* they have ended.

- When workers on foot and equipment must both share the same area, each should work in their designated space with some form of barrier erected to create a physical separation (see illustration above).

- Where workers on foot share the site with moving equipment, especially reversing equipment, everyone should be aware of the need for a signaler whenever the view of the intended path of travel is obstructed or workers are in danger. Signs should be posted on-site to remind equipment operators and workers that a signaler must be used when travelling in reverse or any other direction affording the operator only limited visibility.

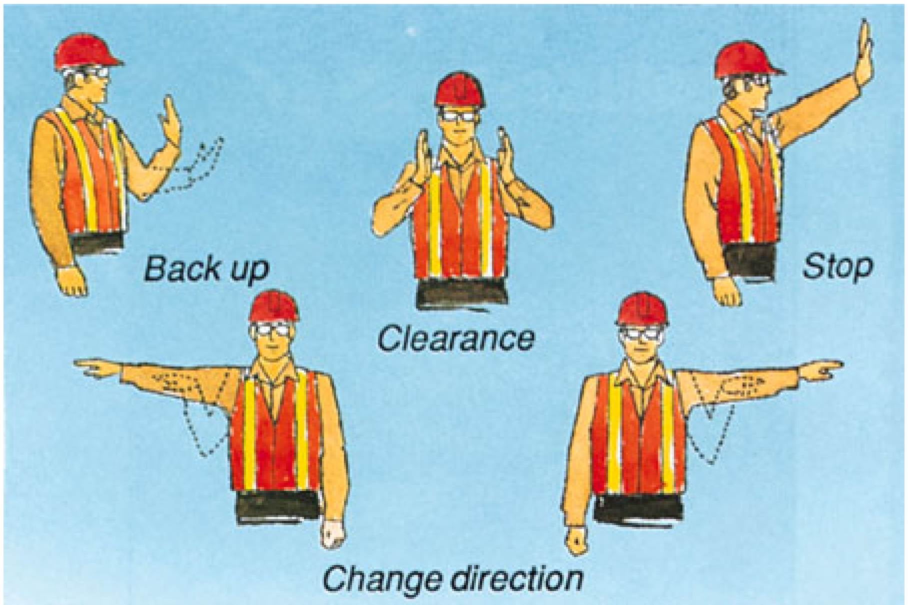
Use the standard signals

Signaler

Where there is a danger to workers from moving vehicles, particularly vehicles operating in reverse, a signaler must be used to safely direct traffic. The signaler must be trained in the on-site signals to be used, positioning, visibility, communication, and other points outlined in the following sections.

A signaler must wear personal protective equipment such as approved boots, hard hat, and reflective fluorescent blaze orange vest.

Part-time Signaler Where a full-time signaler is not required because vehicle movement is limited, a worker must be designated as part-time signaler and accordingly notify all vehicles entering the work zone. Operators must understand that, where visibility is obstructed, no equipment will move without the signaler's assistance. The part-time signaler does regular work until a vehicle enters the work zone and requires assistance. Then the worker stops work to direct equipment. While signaling, the worker should not be doing any other work. Equipment operators must stop their vehicle at once if the signaler is not paying attention to the task at hand. Once signaling is finished, the worker should continue regular work until required to signal again.



Signalers must stand outside the equipment's path of travel in case they trip and fall. When directing on-site traffic, the signaler must have a clear view of the intended path and must be fully visible to drivers to ensure that signals are being received. The signaler should stand squarely in the operator's mirror view, thereby ensuring maximum visibility.

For radio communication, equipment must be in good operating condition and batteries fully charged. When visual signals are used, they must be clear. Use the entire arm to indicate directional changes, not just fingers.

Workers should be instructed in the proper methods

Training

Site personnel should be trained to recognize blind spots the areas around every vehicle that are partly or completely invisible to the operator or driver, even with the help of mirrors. Specific training can then focus on the following points:

Workers on Foot

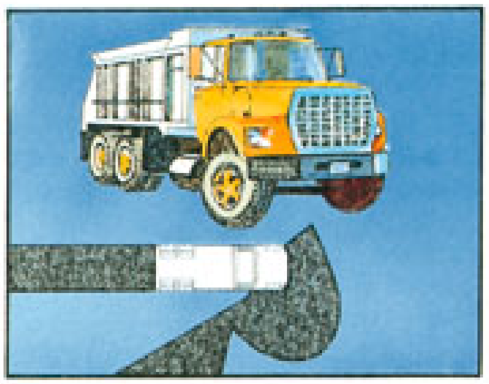
- Know how to work safely around trucks and operating equipment.
- Understand the effect of blind spots around vehicles and equipment.
- Avoid entering or standing in blind spots.
- Make eye contact with the driver or operator before approaching equipment.
- Signal intentions to the driver or operator.
- Where available, use separate access rather than vehicle ramps to enter and exit the site.
- Avoid standing and talking near vehicle paths, grading operations, and other activities where heavy equipment is moving back and forth.
- Advise fellow workers whenever they may be in a hazardous location.

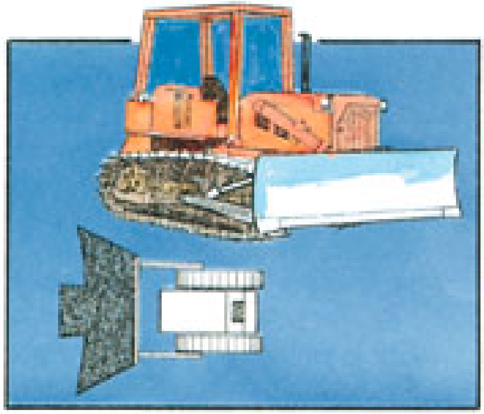
Drivers and Operators

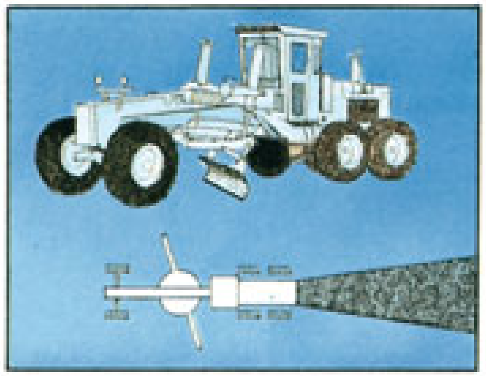
- Always obey the signaler or spotter. If more than one person is signaling, stop your vehicle and determine which one to obey.
- Remain in the cab if possible in areas where other equipment is likely to be backing up or may not see you because of blind spots.
- Make sure all mirrors are intact, functional, and properly adjusted for the best view.
- If you must leave your vehicle, you must have on safety shoes, hard hat and safety glasses.
- Climbing on truck bodies to check loads must be via well constructed ladders.
- Prior to climbing loading or unloading must stop and driver must verify equipment operators understand the driver intends to climb on the body.
- After leaving your equipment for any period of time, do a circle check when you return. Walk around the equipment to ensure the area is clear before you get into the cab and start moving.
- Stop the vehicle at once when a spotter, worker, or anyone else disappears from view.

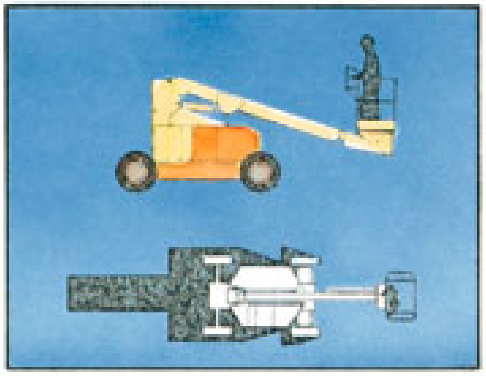
Signalers

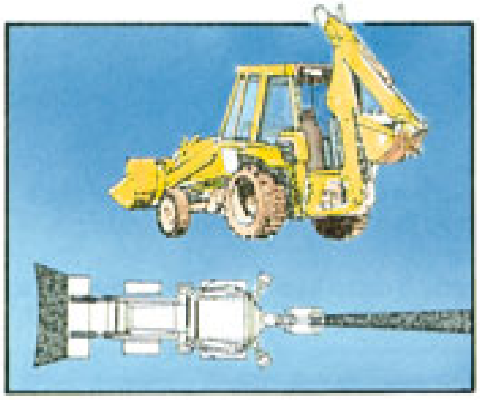
- Stay alert to recognize and deal with dangerous situations.
- Know and use the standard signals for on-site traffic.
- Wear reflective fluorescent vest and bright hard hat for high visibility.
- Understand the maneuvering limitations of vehicles and equipment.
- Know driver and operator blind spots.
- Stand where you can see and be seen by the driver or operator.
- Make eye contact with driver or operator before signaling or changing location.
- Never do other work when directing equipment.
- Notify drivers or operators that you are the designated signaler and that they must not maneuver without your guidance where their view is obstructed.

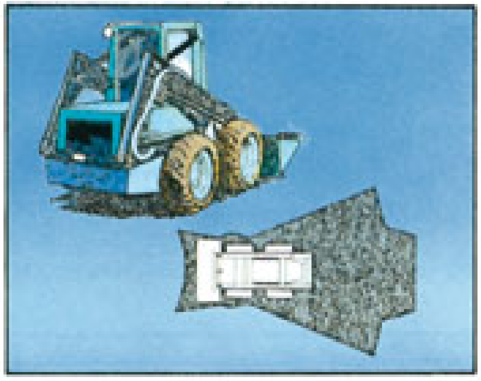


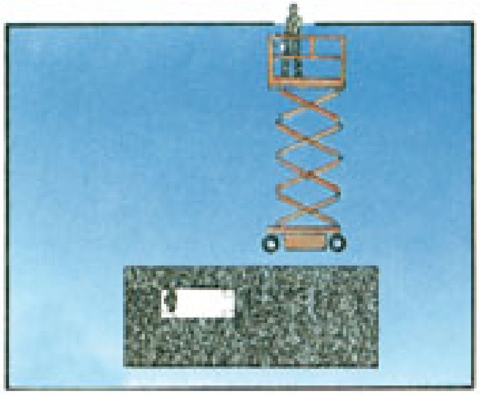


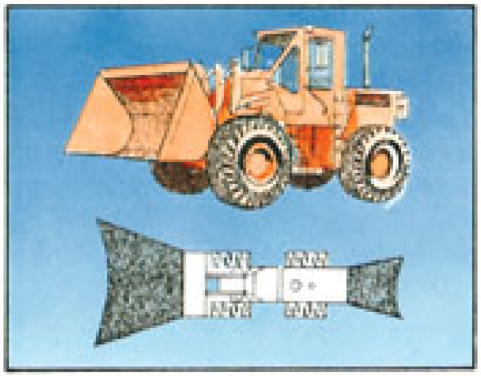












ATTACHMENT E

CHEMICAL CONTAMINANTS

Included in this Attachment:

- ***Copies of Laboratory Analytical Data for Soil Samples***
- ***Digital Copy of the NIOSH Pocket Guide***

To be provided prior to field work.

ATTACHMENT 6

DECONTAMINATION PLAN

DECONTAMINATION PLAN

OAKDALE SITE
OAKDALE, MN

February 2009

Prepared for

3M Company
St. Paul, Minnesota 55144

Prepared by

Weston Solutions, Inc.
West Chester, Pennsylvania 19380

W.O. No. 02181.202.011

TABLE OF CONTENTS

Section **Page**

LIST OF ACRONYMS

3M	3M Company
CRZ	Contamination Reduction Zone
EZ	Exclusion Zone
MCES	Metropolitan Council of Environmental Services
MPCA	Minnesota Pollution Control Agency
O&M	operation and maintenance
PFC	perfluorochemical
PPE	personal protective equipment
RA	Response Action
RD/RA	Remedial Design/Response Action
SSHASP	Site-Specific Security, Health and Safety Plan

1. INTRODUCTION

1.1 OVERVIEW

This Decontamination Plan is a supporting document to the Remedial Design/Response Action (RD/RA) Plan that has been prepared by the 3M Company (3M) for the Oakdale Site in Oakdale, Minnesota, to address the presence of perfluorochemicals (PFCs) in soil and groundwater. The primary focus of the Decontamination Plan is the soil excavation area north of Highway 5, since the work south of Highway 5 involves only minor handling of PFC-containing material during construction. However, elements of this plan may be applicable to the construction and the operation and maintenance (O&M) activities for the groundwater treatment system.

This plan presents the overall procedures and steps that will be taken to prevent cross-contamination or the spread of contamination at the Site. Minor modifications and additions may be made to this plan before and during implementation that will not involve regulatory review and approval.

1.2 DECONTAMINATION PLAN OBJECTIVES

This Decontamination Plan (Plan) outlines the measures that will be utilized at the Site to prevent cross-contamination of materials and the conveyance of contaminated materials outside the exclusion zones to public roadways through the use of operational controls. This Plan may be modified and/or supplemented by the Environmental Protection Plan provided by the successful excavation contractor, which will address decontamination procedures.

2. DECONTAMINATION PLAN COMPONENTS

This plan supplements the Site-Specific Security, Health and Safety Plan (SSHASP) for Response Action (RA) activities at the Oakdale Site. The entire Site within the fenceline will be identified as a restricted area. Access to the restricted area will be controlled by use of the perimeter fencing, access/entrance gates, and signage, as discussed in the RD/RA Plan. Any personnel, vehicles, and equipment entering this restricted area will be subject to a visual inspection and possibly decontamination procedures prior to exiting the restricted area, as discussed below.

2.1 DEFINITION OF ZONES

The following are definitions of the three zones that will be identified/established within the restricted area to ensure proper personal protective equipment (PPE) and decontamination procedures are followed. These areas will be identified in the contractor's Environmental Protection Plan:

- Exclusion Zone (EZ): An active work area on-site where PFC-containing materials are being disturbed or handled. These areas may include the staging area for stockpiles of PFC-containing soils and areas on-site where intrusive work is being performed (i.e., within the excavation footprint).

  The EZ area will be clearly identified in the contractor's Environmental Protection Plan and SSHASP. Temporary barriers may be placed if work activities are to occur in a more localized area for longer than one (1) day. These barriers will be placed to alert workers that they are about to enter an EZ and need to adhere to proper health and safety and decontamination practices. Barriers will be established using methods such as posts or cones and brightly colored rope or safety fencing, depending on the duration of the job and size of the area. Heavy equipment working in the area may be used to block the entrance to an area at the end of the day. If that piece of equipment is to be used elsewhere on-site, and no activities are to occur in the area, the barrier would be extended to close off the entrance.

  The EZ boundary may be modified during site activities based on the procedures for excavation as outlined in the contractor's Site Operations and Excavation Plan. For example, after an area is excavated and backfilled with clean fill, the EZ boundary may shift so that the clean, backfilled area is no longer inside the EZ. The contractor will be required to notify the WESTON

Site Superintendent in advance of moving the EZ boundary for approval. Decontamination procedures may also need to be reviewed.

Areas of concern, which could be designated as EZ, may include the following:

- Excavation.
- Soil stockpile/staging areas.
- Active construction areas with a working face that may not be stable.

- Contamination Reduction Zone (CRZ): An area on-site outside the EZ where decontamination occurs. These areas include the site decontamination pad and satellite areas for activities such as gross decontamination, PPE removal and disposal, and boot rinsing/brushing.
- Support Zone: An area where non-intrusive, non-PFC activities are occurring. These areas include the access road, haul roads, site trailers and storage/staging areas for non-impacted, non-PFC materials. Construction water storage tanks are also located in the support zone. A traffic control station will be set up on the access road through the Site. Vehicles will be inspected at the traffic control station prior to leaving the Site. Based on the results of the inspection, decontamination may be required as discussed in Section 2.4.

2.2 CONTROL MEASURES

Various measures will be employed at the site to ensure that all equipment and personnel entering the restricted area and/or coming into contact with PFC-containing materials are properly decontaminated to prevent possible cross contamination and conveyance of PFC-containing material outside an EZ.

- In an effort to reduce decontamination requirements to the extent possible, traffic from off-site (such as delivery vehicles, dump/haul trucks, disposal transporters, and courier services) will remain outside the EZ, will have controlled access to areas of the Site that are not impacted, or will run on clean, placed materials while on the Site. In the event that a vehicle does have to enter an EZ, this vehicle will be decontaminated (see procedures outlined in Section 2.4 of this Plan) prior to leaving the EZ.
- All hand tools and heavy equipment used within the EZ(s) will typically stay in the EZ area. When moved outside the EZ, these tools and/or equipment will undergo a gross decontamination in a satellite CRZ (see Section 2.3) or a

full decontamination at the CRZ decontamination pad (procedures outlined in Section 2.4 of this Plan).

- Failure of the contractor to maintain the EZ, which causes PFC-containing material to be carried outside the EZ, will require decontamination/ reconstruction of the roadway or decontamination of all vehicles leaving the Site as discussed in Section 2.4.

- The haul truck beds are to be lined with plastic sheeting. If the plastic sheeting is torn, such that the PFC-containing soils come into contact with the truck bed, then the truck bed will need to be decontaminated as discussed in Section 2.4.

- Materials to perform a gross decontamination, as discussed in Subsection 2.3 of this Plan, will be available for use in satellite CRZs when moving equipment and tools between work areas.

- Proper PPE, as identified in the SSHASP, such as coveralls and/or Tyvek (or the equivalent) will be worn by all personnel performing work on the site that would cause them to come into contact with PFC-containing materials (i.e., performing decontamination or sampling stockpiles). Personnel will remove these items, along with gloves, prior to leaving the work areas.

- Drums for disposable PPE/dry decontamination materials and rinse water will be located at the exit of intrusive work areas or at the decontamination pad.

- Sampling equipment, as discussed in the Construction Sampling Plan for this site, will primarily consist of disposable items (such as sterile plastic scoops, aluminum pans, and nitrile gloves), which would require no decontamination. Any hand tools (such as hand shovels) used to assist with the collection of samples would undergo the applicable wet decontamination activities, as discussed below, between individual sample locations.

- The excavator or bucket will be decontaminated at a satellite CRZ and/or the decontamination pad following the removal of PFC-containing soils.

- Boot rinse/dry brushing stations will be located at the exit of the intrusive work areas or at the decontamination pad.

2.3 GROSS DECONTAMINATION PROCEDURES – SATELLITE CRZs

The use of satellite CRZs for gross decontamination will be employed at site EZs where daily activities would require this form of decontamination and use of the main CRZ is not practicable. Areas that may incorporate the use of satellite CRZs may include any

PFC-containing soil excavation areas; these may be relocated throughout the job. Decontamination procedures will vary based upon activities, but will typically include the following procedures as appropriate:

- Dry decontamination:
    - Plastic sheeting will be set up with long-handled scrub brushes or other devices to remove large pieces of PFC-containing soil or solid materials prior to a water rinse, if applicable, or to ensure dry materials are removed from boots, coveralls, and Tyvek.
    - These solids will be placed within the EZ or in a drum to be combined with the materials to be removed from the Site.
- Wet decontamination:
    - A rinsing station will be set up for boots and small tools, consisting of one plastic tub for washing using potable water and a long handled scrub brush and one plastic tub for a potable rinse.
    - These rinsates will be placed in a drum to be combined with the construction water to be treated with any other construction water generated on-site.
- PPE decontamination:
    - An area for removal of disposable and non-disposable PPE will be identified.
    - Disposable PPE will be placed in a drum provided in the area. When full, drums provided for disposable PPE will be transported to the SKB Landfill as industrial waste.
    - Non-disposable PPE will be removed on plastic sheeting and shaken out/brushed to further remove any materials as appropriate. The non-disposable PPE will be placed in bags (such as plastic lawn trash bags) and temporarily stored in the on-site trailer.
    - If respirators are required to be used, they will be removed and bagged for cleaning as stipulated in the SSHASP.

Gross decontamination of heavy equipment prior to moving outside the EZ will be performed within the EZ, with rinsate collection. The rinsate will be handled as described in the wet decontamination procedures. All solids will be left in place, unless the area is no longer considered impacted. In this case, the solids would be collected in drums and handled as stated in the dry decontamination procedures.

2.4 DECONTAMINATION PROCEDURES – DECON PAD (MAIN CRZ)

If it is anticipated that heavy equipment will be frequently moving outside the EZ, then a decontamination pad (main CRZ) will be required. The main CRZ area will be located inside the restricted area. A 25-foot by 25-foot (approximate) asphalt pad will be constructed and graded to drain to a sump area, where the water will be collected and pumped out for treatment as construction water. Any solids or sediments collecting in the sump or on the pad will be shoveled out and either included with the materials to be removed from the Site, or drummed and characterized for off-site disposal. The sides of the pad will have a rolled asphalt curb to keep the rinsate from running off the pad. The procedures are as follows:

- Vehicles and or equipment will pull up/be placed on the pad.
- If necessary, large pieces of soil will be knocked off using shovels or other means prior to the use of water to reduce the amount of rinsate generated. These solids will be placed in a drum to be combined with the materials to be hauled off-site.
- A potable water rinse will be performed with a pressure washer.
- A final spray using a steam cleaner may be performed, as necessary.
- Any vehicles or equipment longer than 20 feet will be decontaminated in sections, with the vehicle/equipment moving forward only the portions that have been fully decontaminated.

If the contractor’s intent is to keep heavy equipment within the EZ during site activities, then a temporary decontamination pad may be constructed within the restricted area for one-time or infrequent use.

2.5 OTHER DECONTAMINATION ACTIVITIES AT COMPLETION

It is assumed that the construction water stored in the tanks will be discharged to the Metropolitan Council of Environmental Services (MCES) sewer in accordance with

MCES approval; however, this water may be shipped off-site for disposal. The water storage tanks will be decontaminated prior to being shipped back to the owner. Pumps, hosing, and piping will be disposed or decontaminated before shipping off-site or reuse. Finally, the haul roads will be scraped by the contractor to remove the surface layer of stone for appropriate off-site disposal.