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BARR

November 2, 2016

Ms. Beth Grosen
City of Minneapolis
Community Planning and Economic Development
105 Fifth Avenue South, Suite 200
Minneapolis, MN 55401-2534

Re: Proposed Phase II Investigation Activities, 2nd Avenue North and Girard Avenue North

Dear Ms. Grosen:

This letter presents our recommended approach for a Phase II Investigation at City of Minneapolis Community Planning and Economic Development (CPED)-owned parcels near 2nd Avenue North and Girard Avenue North in Minneapolis, Minnesota. The Site is composed of Parcels A and B as shown on Figure 1. We understand the City recently purchased the property at 1215 2nd Avenue North and plans to abate and demolish three buildings to prepare the parcels for sale to a developer. No investigations have been conducted at 1215 2nd Avenue North, a portion of Parcel B. The other portions of the Site have been owned by the City for several years, buildings have been removed and Phase II investigations have been conducted, but additional information is needed in these areas prior to redevelopment. These portions of the Site were enrolled in the voluntary site investigation (VIC) program (VP19780) in 2004 as part of the Van White Memorial Boulevard construction project. The proposed investigation will address environmental data gaps identified after review of existing information and will obtain information regarding hydrogeologic conditions at the Site.

Previous Investigations and Source Areas

Several investigations have been conducted in portions of the Site and at surrounding properties. The investigations are summarized on the Hennepin County Environmental Data Access Tool (https://hennepinedat.barr.com/). In addition, a Phase I assessment was conducted in January 2016 at 1215 2nd Avenue North. A review of the previous assessments indicates that multiple potential and known sources of contamination to soil, groundwater and soil vapors at the Site have been identified. The general source areas are shown on Figure 1, and include, but are not limited to the following:

- **Precision Plating Chlorinated Solvent Impacts.** The Precision Plating site is located immediately to the north, estimated to be upgradient of the Site, and is currently being investigated as part of the MCPA State Superfund program. Chlorinated volatile organic compound (CVOC) contamination is present in the groundwater and soil vapors at the site, and the extent of impacts to the south and southeast has not been fully delineated. Additional investigation of the Precision Plating site is planned by the MPCA this fall; we have worked to coordinate our scope on CPED-owned properties with the MPCA's planned investigation.
- **CVOCs in Groundwater on Girard Avenue North.** Elevated CVOC concentrations were documented in groundwater at a location on Girard Avenue North, near the sanitary sewer line and between Parcels A and B; the source has not been identified.

- **Scrap Metal Processors.** Polycyclic aromatic hydrocarbons (PAH) and metals contamination has been identified in surficial and subsurface soil and groundwater on the properties formerly occupied by Scrap Metal Processors, s, which comprise Parcel A, and the western-most portion of Parcel B. This includes surficial soil contamination on Parcel A, and elevated PAH concentrations observed in an area corresponding to shallow sub-surface fill with slag and cinders on the western portion of Parcel B; the extent of this fill has not been delineated.
- **1215 2nd Avenue North.** This portion of the Site has not been investigated, but its historical uses may have resulted in impacts to the soil or groundwater. Previous occupants included a bulk petroleum company with several ASTs, a warehouse, a slate manufacturer, a shooting equipment manufacturer, a X-ray equipment and supply company, and an auto parts recycling company (Import Engine Parts), who was noted to use petroleum and solvents that were discharged to floor drains and a flammable waste trap (Phase I ESA, 2016).
- **Former UST at 1207 2nd Avenue North.** Previous investigations and soil remediation was conducted on this parcel as part of the Van White Memorial Boulevard construction project. Metals and CVOC impacts are present in soils, including CVOC impacts in soils in a former UST basin. The extent of soil, groundwater and soil vapor CVOC impacts have not been delineated.

Investigation Objectives

The overall objectives of the investigation include the following:

- Fill in soil, groundwater, and soil vapor data gaps germane to facilitating Site redevelopment, assisting in obtaining future liability assurances, and identifying whether institutional controls or response actions are needed during future redevelopment.
- Delineate or further define the extent of soil, groundwater, and soil vapor impacts in identified source areas within the Site boundaries.
- Better define the hydrogeologic conditions at the Site and in surrounding areas to provide greater certainty and more comprehensive information regarding groundwater flow direction.

Scope of Work

The scope of this investigation includes the completion of up to 27 soil borings for soil and groundwater sampling, and installation of up to 9 soil vapor sampling points. Soil, vapor and groundwater sampling is planned within the footprint of the to-be-demolished buildings at 1215 2nd Avenue North, and to fill in data gaps in existing information based on previous Phase I and Phase II assessments at the other properties. Proposed sampling locations are shown on Figure 2. A detailed scope and sampling rationale is presented for soil and groundwater/soil vapor samples on Tables 1 and 2, respectively. Field activities will be conducted in accordance with the attached Standard Operating Procedures (SOPs). The scope of work is summarized below.

- **Field inspection and soil sampling at 1215 2nd Avenue North** is proposed to characterize subsurface features uncovered at the time of building demolition, such as the area of the former hydraulic lift/waste trap, drains pits or other subsurface structures. Field screening and sample collection with hand auger or other hand collection tools will be conducted, if warranted. Samples will be analyzed for parameters based on field screening, which is anticipated to include VOCs and DRO/GRO, if warranted. GPS locations of subsurface features will be obtained.

- **Direct-push soil borings will be completed** at up to 27 locations to fill data gaps and further defined identified source areas across the Site. Soil borings will be advanced to the water table or native material using direct-push technologies, estimated to range from 8-12 feet below ground surface (bgs), and will be continuously logged and inspected for visual evidence of contamination (i.e. incidental odor, discoloration, and sheen), and headspace volatile organic vapor screening.

- **Up to 30 soil samples will be collected** and analyzed for PAHs and RCRA metals, with select samples additionally analyzed for priority pollutant (PP) metals, volatile organic compounds (VOCs) and diesel and gasoline range organics (DRO/GRO).

- **Soil vapor samples will be collected** at up to nine locations to fill in data gaps across the parcels and identify risk of vapor intrusion relating to redevelopment of the parcels. Soil vapor samples will be collected 2-3 feet above the water table to identify the "worst-case" concentrations and analyzed for VOCs.

- **Groundwater samples will be collected** from up to 9 temporary wells installed across the investigation parcels and from 3 permanent wells within the area (MW-1, MW-2, and MW-3) to fill in data gaps across the parcels. Groundwater samples will be collected in accordance with Barr's SOPs and analyzed for VOCs, with select samples additionally analyzed for PAHs, cyanide, PP metals and RCRA metals. Additionally, MW-1 requires redevelopment as determined based on well reconnaissance. MW-1 will be redeveloped by a Minnesota Department of Health licensed well contractor prior to sample collection.

- **Groundwater elevations will be measured** at all temporary monitoring wells, sampled monitoring wells MW-1, MW-2, and MW-3, and four monitoring wells located on the Precision Plating site (MW-1 through MW-4), if accessible, to better define the groundwater gradients and confirm the hydrogeologic conceptual model for the parcels. Collection of water elevations would be completed in one day, prior to well purging and sampling.

- **Surveying will be completed** at wells and boring locations. All boring locations will be established using GPS, and the existing monitoring wells and representative boring locations will be surveyed to establish elevations so that water level measurements can be converted to groundwater elevations. If available, elevations for the Precision Plating wells may be obtained from the MPCA or their consultant.

- **Laboratory analysis** will be conducted by Legend Technical Services in St. Paul, Minnesota. One field blank and one field duplicate sample will be collected for each media.

- **Investigation-derived waste** will be containerized in drums. Soil will be sampled and analyzed for parameters required by the landfill for disposal. Purge water produced during purging of temporary wells and CPED wells MW-2 and MW-3 will be containerized and discharged to the sanitary sewer under a temporary MCES discharge permit. Water produced during redevelopment and sampling of MW-1 will be discharged to the ground surface. Previous data from this well indicates chemical concentrations are below Minnesota Health Risk Limits (https://hennepinedat.barr.com/).

Actual sampling locations may vary from the proposed locations depending on field conditions, access, field screening observations, utility locations and subsurface structures identified during demolition or investigation activities. While the total number of samples and boring locations will remain within the number outlined above, locations, depths, parameters, and media sampled for analysis may be modified due to these unexpected factors.

Reporting

A Phase II Investigation report will be prepared that includes table(s) comparing analytical data to applicable soil, groundwater, or vapor intrusion screening levels, a figure showing sample locations, boring logs, and a summary and interpretation of the investigation results. The interpretation will utilize results from previous investigations to provide an overall picture of Site conditions. Recommendations will be provided regarding approaches to Site redevelopment and whether any additional Site characterization or interim response actions are warranted.

Schedule and Access

Enrollment of the Site in the MPCA voluntary remediation program is recommended prior to conducting the demolition and investigation at the Site. The overall Phase II investigation schedule will be coordinated with the City and depends on the schedule for demolition of the structures at 1215 2nd Avenue North. Inspection and potentially sampling in the areas of any subsurface structures discovered beneath the 1215 2nd Avenue North buildings should be conducted during demolition, if possible. The remaining investigation activities will be conducted following demolition, and are estimated to take about one week for subcontracting and preparation and one week for field work, depending on access to Precision Plating wells and drilling contractor availability.

Assuming the Site is enrolled in the VIC program next week, and if so, that the Agency approves this work plan and demolition of the buildings occurs by December 9, we anticipate completing the field work described above in December and providing the draft report to CPED by mid-February. The attached schedule shows the Phase II investigation and reporting tasks, as well as response action planning activities anticipated in 2017.

We assume that CPED will coordinate authorizing access to Parcels A and B. Access to Precision Plating wells for water level measurements will be coordinated by Barr with the MCPA or their consultant, and may require CPED's assistance.

Please contact Jenni Brekken (952-832-2700) or me (952-832-2722) with any questions. We look forward to being of continued service to the City.

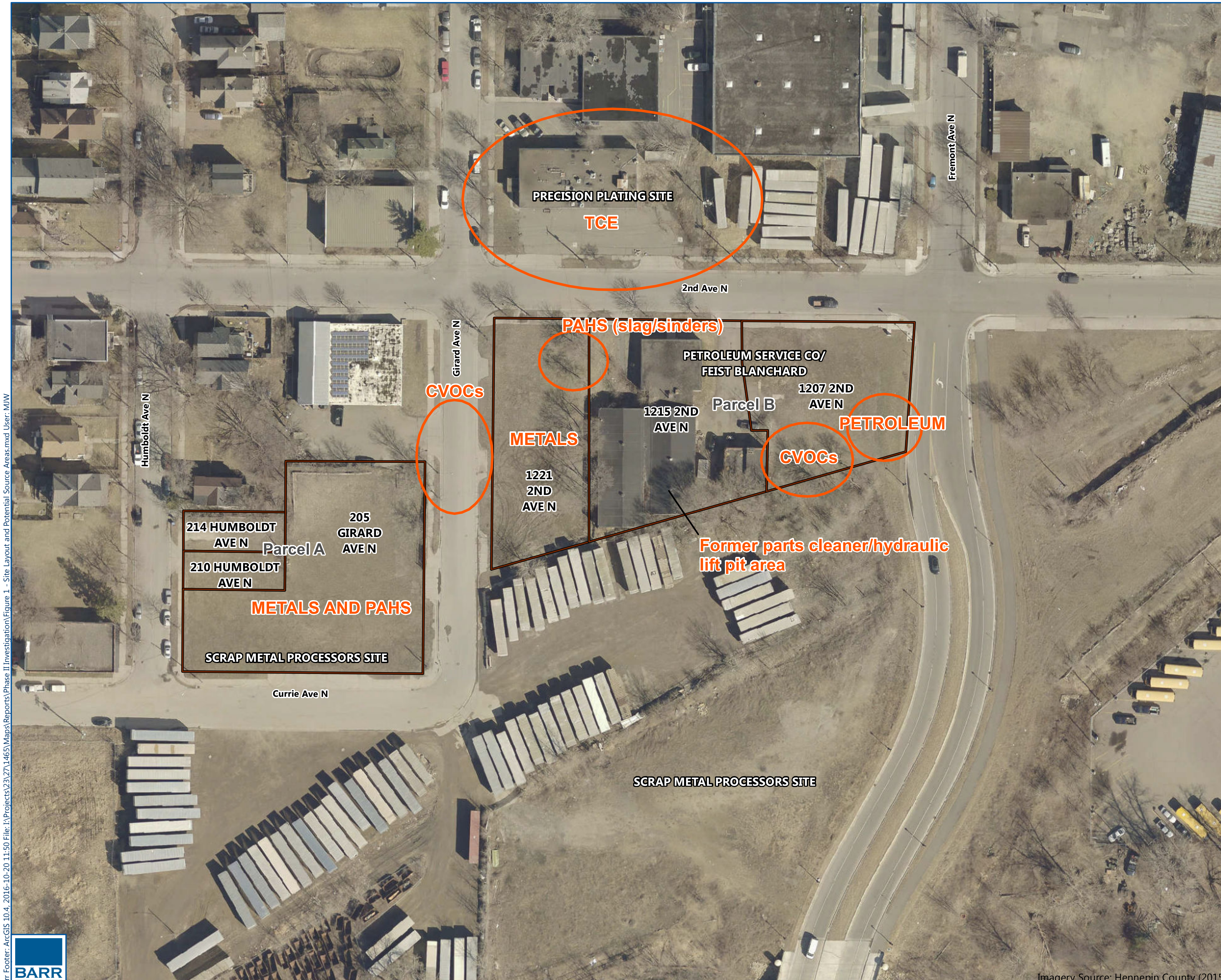
Sincerely

Jennifer Brekken
Senior Environmental Engineer

Cc: Mary Finch, Hennepin County

Attachments:

Figure 1 – Site Layout and Potential Source Areas
Figure 2 – Proposed Investigation Locations
Table 1 – Proposed Soil Investigation Summary and Rationale
Table 2 – Proposed Groundwater and Soil Vapor Investigation Summary and Rationale
Phase II Investigation Schedule
Barr Standard Operating Procedures
Compendium of Field Documentation



Potential Source Areas

Site Boundary

N

0 80 160

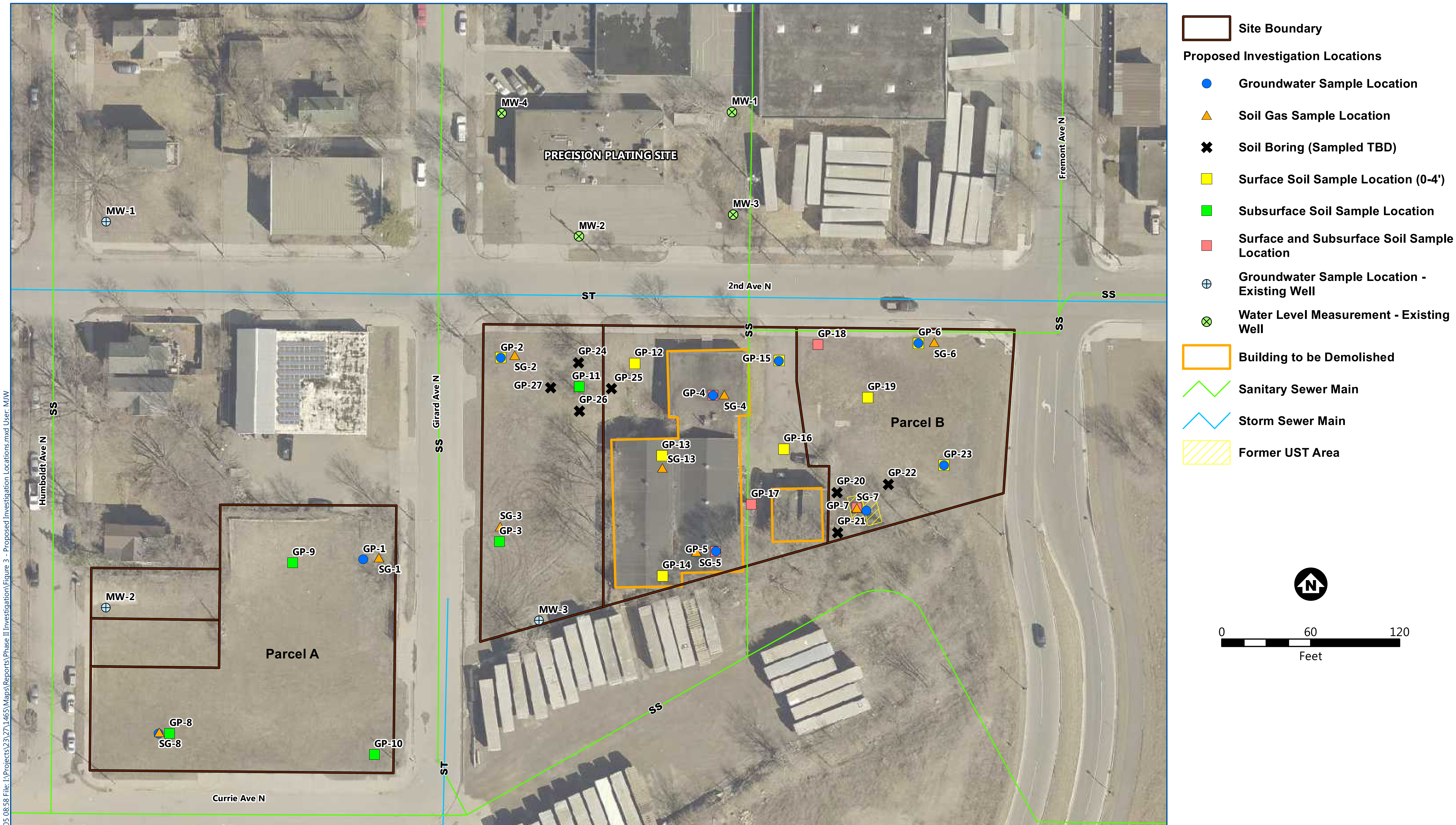
Feet

SITE LAYOUT AND POTENTIAL SOURCE AREAS
Second Avenue and Girard, Minneapolis

FIGURE 1

BARR

Barr Footer: ArcGIS 10.4, 2016-10-20 11:50 File: I:\Projects\23\27\1465\Maps\Reports\Phase II Investigation\Figure 1 - Site Layout and Potential Source Areas.mxd User: MJW



PROPOSED INVESTIGATION LOCATIONS
Second Avenue and Girard, Minneapolis

FIGURE 2

Table 1
Proposed Soil Investigation Summary and Rationale
2nd and Girard Avenue North Properties
Minneapolis, Minnesota

Parcel Address	Location	Sample Type	Sample Depth (1) (feet bgs)	Boring Depth (feet bgs)	Analysis (4,5)						Sampling Rationale
					VOCs (2)	GRO (2)	DRO (Silica Gel)	PAHs	RCRA Metals (3)	PP + RCRA Metals (3)	
Push Probe Samples											
205 Girard Ave N	GP-8	Subsurface Soil	Below 4'	Native Horizon				X		X	Assess soil concentrations in native soils.
	GP-9	Subsurface Soil	Below 4'	Native Horizon				X		X	
	GP-10	Subsurface Soil	Below 4'	Native Horizon				X		X	
1221 2nd Ave N	GP-2	Surface Soil	0-4	Water Table				X		X	Assess soil concentrations south of Precision Plating site.
	GP-3	Subsurface Soil	Below 4'	Water Table				X		X	
	GP-11	Subsurface Soil	Below 4'	Water Table				X	X		
	GP-24	Subsurface Soil	Below 4'	Water Table				X	X		Delineate the extent of slag/cinder concentration observed in previous investigations.
	GP-25	Subsurface Soil	Below 4'	Water Table				X	X		
	GP-26	Subsurface Soil	Below 4'	Water Table				X	X		
	GP-27	Subsurface Soil	Below 4'	Water Table				X	X		
1215 2nd Ave N	GP-4	Surface Soil	0-4	Water Table	X	X	X	X	X		Assess soil concentrations at location of former building floor drain.
		Subsurface Soil	Below 4'	Water Table	X	X	X	X	X		
	GP-5	Surface Soil	0-4	Water Table	X	X	X	X	X		Assess soil concentrations at location of former parts cleaner.
		Subsurface Soil	Below 4'	Water Table	X	X	X	X	X		
	GP-12	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations onsite.
	GP-13	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations near location of former hazardous materials storage.
	GP-14	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations near location of former paint booth.
	GP-15	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations onsite.
	GP-16	Surface Soil	0-4	Water Table				X	X		
	GP-17	Surface Soil	0-4	Water Table	X	X	X	X	X		Assess soil concentrations in location of former petroleum ASTs.
		Subsurface Soil	Below 4'	Water Table	X	X	X	X	X		
1207 2nd Ave N	GP-6	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations onsite.
	GP-7	Surface Soil	0-4	Water Table	X	X	X	X	X		Assess soil concentrations and delineate extent of CVOC impacts near former UST basin. Historical data from 2006 indicates elevated chlorinated VOC concentrations in groundwater.
		Subsurface Soil	Below 4'	Water Table	X	X	X	X	X		
	GP-20	Subsurface Soil	Below 4'	Water Table	X						
	GP-21	Subsurface Soil	Below 4'	Water Table	X						
	GP-22	Subsurface Soil	Below 4'	Water Table	X						
	GP-18	Surface Soil	0-4	Water Table				X	X		Assess soil concentrations onsite.
		Subsurface Soil	Below 4'	Water Table				X	X		
	GP-19	Surface Soil	0-4	Water Table				X	X		
	GP-23	Surface Soil	0-4	Water Table	X	X	X	X	X		Assess soil concentrations near former petroleum ASTs.

(1) Soil probes will extend to the water table, estimated to be at about 9-10 feet bgs. Soil samples will be a composite sample from 0-4' below ground surface (bgs); Soil VOC and GRO samples will be discrete. Additional soil samples may be collected from deeper soils if field screening indicates impacts.

(2) VOC and GRO soil sample collected only if field screening indicates potential VOC/GRO impacts. "X" indicates VOC contamination anticipated based on potential and known sources. Samples for VOC/GRO analysis may be collected at additional locations if field screening indicates VOC/GRO impacts.

(3) Metals Lists:
RCRA Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
Priority Pollutant Metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc
RCRA + Priority Pollutant Metals = Priority Pollutant Metals + Barium

(4) TCLP analysis will be performed on soil samples for metals or VOCs for parameters with analytical results indicating potentially hazardous levels.

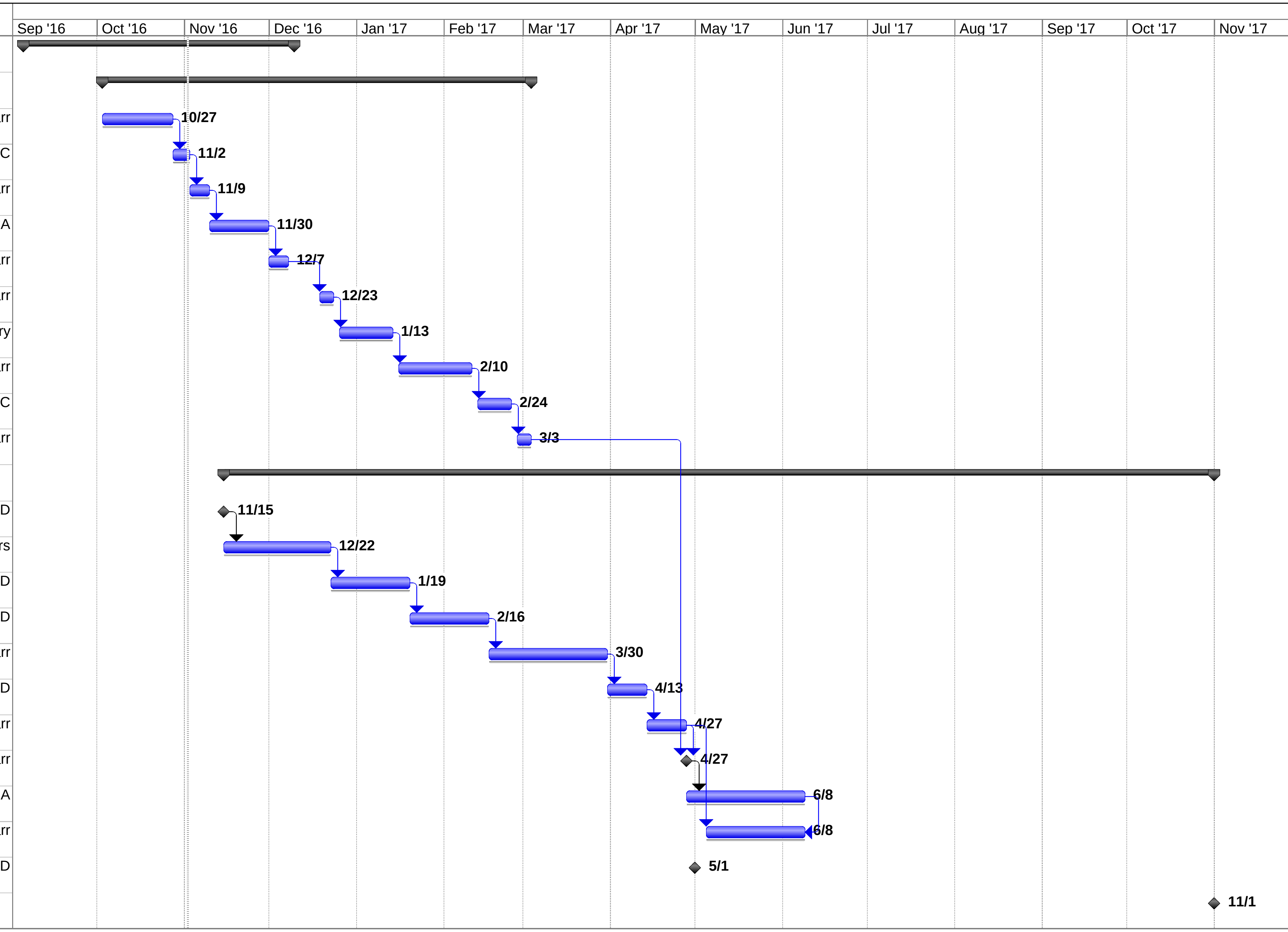
(5) Asbestos analysis will be performed if potential asbestos containing material encountered in debris.

Table 2
Proposed Groundwater and Soil Vapor Investigation Summary and Rationale
2nd and Girard Avenue North Properties
Minneapolis, Minnesota

Parcel Address	Location	Sample Type	Sample Depth (1) (feet bgs)	Analysis: VOCs	PAHs	Cyanide	RCRA Metals (2)	PP + RCRA Metals (2)	Sampling Rationale
Push Probe Samples									
205 Girard Ave N	GP-1	Groundwater	Water Table	X				X	Assess groundwater and soil gas concentrations west of ST-01-04 on Girard Ave N, where elevated CVOCs were detected in groundwater.
	SG-1	Soil Gas	about 7.5 - 8	X					
	GP-8	Groundwater	Water Table	X				X	Assess groundwater and soil gas concentrations (data gap) across Parcel A.
	SG-8	Soil Gas	about 7.5 - 8	X					
1221 2nd Ave N	GP-2	Groundwater	Water Table	X	X	X		X	Assess groundwater and soil gas east of ST-01-04 on Girard Ave N, where elevated CVOCs were detected in groundwater, and south of Precision Plating Site.
	SG-2	Soil Gas	about 7.5 - 8	X					
	SG-3	Soil Gas	about 7.5 - 8	X					
1215 2nd Ave N	GP-4	Groundwater	Water Table	X	X	X		X	Assess groundwater and soil gas concentrations at location of former building floor drain and south of Precision Plating Site. .
	SG-4	Soil Gas	about 7.5 - 8	X					
	GP-5	Groundwater	Water Table	X	X			X	Assess groundwater and soil gas concentrations at location of former parts cleaner and south of Precision Plating Site.
	SG-5	Soil Gas	about 7.5 - 8	X					
	SG-13	Soil Gas	about 7.5 - 8	X					Assess soil gas concentrations below building (data gap).
	GP-15	Groundwater	Water Table	X	X	X		X	Assess groundwater concentrations southeast of Precision Plating Site.
1207 2nd Ave N	GP-6	Groundwater	Water Table	X					Assess groundwater and soil gas concentrations southeast of Precision Plating Site, and near petroleum impacted excavation.
	SG-6	Soil Gas	about 7.5 - 8	X					
	GP-7	Groundwater	Water Table	X					Assess groundwater and soil gas concentrations former UST basin. Historical data from 2006 indicates elevated chlorinated VOC concentrations in groundwater.
	SG-7	Soil Gas	about 7.5 - 8	X					
	GP-23	Groundwater	Water Table	X	X			X	Assess groundwater concentrations near former petroleum ASTs.
Existing Monitoring Wells									
232 Humboldt Ave N	MW-1	Groundwater	12.7-27.7	X				X	Redevelop MW-1. Assess current groundwater concentrations and flow direction.
214 Humboldt Ave N	MW-2	Groundwater	4.7-14.7	X				X	
1221 2nd Ave N	MW-3	Groundwater	5.2-15.2	X	X			X	
Precision Plating Site, 230 Girard Ave N	*MW-1*	*Water Level*							Collect water level measurements to assess groundwater flow direction.
	MW-2	*Water Level*							
	MW-3	*Water Level*							
	MW-4	*Water Level*							

(1) Soil probes will extend to the water table, estimated to be at about 9-10 feet bgs. Soil gas samples will be collected approximately 2' above the water table. Groundwater samples will be collected at the water table.
(2) Metals Lists:
RCRA Metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
Priority Pollutant Metals: antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc
RCRA + Priority Pollutant Metals = Priority Pollutant Metals + Barium
Groundwater samples for metals analysis will be filtered in the field.

ID	Task Name	Duration	Start	Finish	Resource Names
1	**Building Abatement and Demolition**	**70 days**	**Mon 9/5/16**	**Fri 12/9/16**	
10	**Phase II Investigation**	**110 days**	**Mon 10/3/16**	**Fri 3/3/17**	
11	Prepare Phase II Work Plan	19 days	Mon 10/3/16	Thu 10/27/16	Barr
12	City/county review of work plan	4 days	Fri 10/28/16	Wed 11/2/16	CPED/HC
13	Enroll in VIC program, Submit Phase I, WP	5 days	Thu 11/3/16	Wed 11/9/16	CPED/Barr
14	MPCA Process VIC Application	15 days	Thu 11/10/16	Wed 11/30/16	MPCA
15	Phase II preparation/contracting	5 days	Thu 12/1/16	Wed 12/7/16	Barr
16	Phase II Investigation Field Work	5 days	Mon 12/19/16	Fri 12/23/16	Barr
17	Lab analysis	15 days	Mon 12/26/16	Fri 1/13/17	laboratory
18	Prepare report	20 days	Mon 1/16/17	Fri 2/10/17	Barr
19	City/county review report	10 days	Mon 2/13/17	Fri 2/24/17	CPED/HC
20	Finalize Phase II report	5 days	Mon 2/27/17	Fri 3/3/17	Barr
21	**Redevelopment Planning**	**251 days**	**Tue 11/15/16**	**Wed 11/1/17**	
22	Issue RFP for Redevelopment Plan	0 days	Tue 11/15/16	Tue 11/15/16	CPED
23	Proposals	28 days	Tue 11/15/16	Thu 12/22/16	Developers
24	Review Redevelopment Proposals	20 days	Fri 12/23/16	Thu 1/19/17	CPED
25	Select developer(s), contracting	20 days	Fri 1/20/17	Thu 2/16/17	CPED
26	Prepare Response Action Plan	30 days	Fri 2/17/17	Thu 3/30/17	Barr
27	City/Developer review RAP	10 days	Fri 3/31/17	Thu 4/13/17	CPED
28	Finalize RAP	10 days	Fri 4/14/17	Thu 4/27/17	Barr
29	Submit Phase II Report and RAP to MPCA	0 days	Thu 4/27/17	Thu 4/27/17	Barr
30	MPCA review/approval of RAP	30 days	Fri 4/28/17	Thu 6/8/17	MCPA
31	Prepare Grant Application(s)	25 days	Fri 5/5/17	Thu 6/8/17	CPED/Barr
32	Spring Grant Application Deadline	0 days	Mon 5/1/17	Mon 5/1/17	CPED
33	Fall Grant Application Deadline	0 days	Wed 11/1/17	Wed 11/1/17	



Project: 2nd and Van White Phase II
City of Minneapolis CPED
Date: Wed 11/2/16

Task		Progress		Summary		External Tasks		Deadline	
Split		Milestone		Project Summary		External Milestone			

Standard Operating Procedure

Collection of Groundwater Samples from a Temporary or Permanent Monitoring Well (Includes Well Purging and Stabilization)

Revision 1

April 5, 2016

Approved By:

Print	Technical Reviewer	Signature	Date
Kim Johannessen		[signature]	04/05/16

Print	QA Manager	Signature	Date
Terri Olson		[signature]	04/05/16

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:	______________	Date:	______________
Initials:	______________	Date:	______________
Initials:	______________	Date:	______________
Initials:	______________	Date:	______________

Collection of Groundwater Samples from a Monitoring Well (Includes Well Purging and Stabilization)

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the methods used for monitoring well purging, stabilization, and sampling (excluding residential/water supply systems). The SOP also provides details regarding the calculation of purge volumes and measurement of groundwater stabilization criteria and identifies the common container, preservative, and holding times for typical groundwater sample analyses.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Sample collection methods can vary by project. If not specified in the project scope of work and/or documentation (e.g., Work Plan, Sampling Analysis Plan (SAP), or Quality Assurance Project Plan (QAPP)), consult with the appropriate regulatory agency for guidance.
- Collection of groundwater samples from residential/water supply systems are not discussed within this SOP.
- Dedicated sampling equipment and/or decontamination of sampling equipment is required to prevent cross-contamination.
- Low-flow sampling methods are not discussed within this SOP.
- Sample collection using 'clean hands/dirty hands' methods is not discussed within this SOP.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technician(s) are responsible for the measurement of well pumping rates, calculation of well purge volume, field screening procedures, field equipment and calibration, proper sample identification, collection of samples, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling waters contaminated with corrosive materials, emergency eye flushing facilities should be available.

5.0 Equipment, Reagents, and Supplies

- Water quality meter (e.g., YSI, or equivalent)
- Polyethylene bailer and rope
- Sample tubing and fittings
- Turbidimeter (optional)
- Coolers
- Ice
- Chemical resistant gloves (e.g., nitrile)
- Custody seal, if applicable
- Calculator
- Locks/keys
- Pump (peristaltic or submersible), power source, and appropriate drive tubing
- Cord reel (optional)
- Graduated measuring container
- Plastic bags
- Waterproof ink pen or pencil
- Clock or stopwatch
- Sample containers (method specific)
- Sample labels
- Chain-of-custody (COC)

6.0 Procedure

This section describes the procedure(s) for calibrating field equipment, measuring pumping rates, calculating purge volumes, well purging, measuring well stabilization, and the sampling, handling, and delivery of groundwater samples. Best practices include setting up the purging, stabilization, and sampling equipment in an upwind direction from any potential source of contamination.

This SOP describes the groundwater collection from a bore hole, temporary well, or permanent monitoring well. Typically, a direct-push (Geoprobe® or equivalent) will be used to create the bore hole or temporary well by advancing the direct-push sampler to the desired sampling interval (sampling depth). When the sampling depth is reached, small diameter extension rods are inserted through the steel probe rods to hold the groundwater sampler screen in place while the rods and screen sheath are retracted, exposing the screen. The groundwater sampler screen can typically be exposed up to 41 inches, but can be exposed a shorter length depending on project requirements. Alternately, a small diameter PVC well screen and riser pipe may be installed in the bore hole for use as a temporary well. Polyethylene (or project specified) tubing is placed into the bore hole or temporary well, and a peristaltic pump (or equivalent) or project specified pump is used to draw water samples to the surface for collection. Well stabilization is not always necessary for temporary well s but if required by the project, see Section 6.2.6 of this SOP.

After each borehole or temporary well is constructed, the probe rods are decontaminated by the drilling contractor in accordance with project requirements. The polyethylene (or project specified) tubing is discarded after each sample is collected and new tubing is used for the collection of the next sample. The borehole and temporary well locations will be permanently sealed following applicable state and local regulations.

6.1 Calibration

The water quality meter and turbidimeter will be calibrated as per the applicable Barr SOP. The meters will undergo calibration checks, at a minimum, before and after sampling. The calibration check will be documented on a calibration form (as appropriate) and/or in the field notebook. Any significant issues found during the calibration check will be noted in the field notebook and the Equipment Technicians will be notified.

6.2 Purging/Well Stabilization/Sampling

Prior to sampling, purging of the monitoring well is performed to remove stagnant water from within the well and to stabilize the well to allow for representative groundwater sample collection. The term 'purge volume' refers to the amount of water removed from a well before groundwater sample collection occurs.

Purging well volumes and stabilizing to remove stagnant water from a temporary well may not be necessary due to the short time frame between well installation and sampling. Purging and well stabilization procedure for temporary wells may vary by project or by well. Recommended practice is to purge a temporary well until the water clears, if possible, prior to sampling; however, purging prior to sampling may not be possible at all if water is limited (as it might be in a perched water zone), or water recharge is slow (as it would be in a clayey or silty water bearing zone).

6.2.1 Purge Volume

The volume of standing water in the well is calculated to determine the purge volume that needs to be removed from the well. The water level must be measured in order to determine the volume (see applicable Barr SOP). Calculation of the purge volume is addressed in Section 6.3, Data Reduction/Calculation of this SOP and Table 1. If a well is pumped dry, this constitutes an adequate purge and the well can be sampled following recovery. Refer to project documentation for volumes required to be purged.

6.2.2 Bailer Purging

A bailer can be used for slowly recovering wells with minimal water volume and a depth to groundwater greater than 25 feet. A new disposable polyethylene bailer with a check valve can be attached to a cord reel or a downrigger and support assembly. Polyethylene bailers can be hauled using stainless steel wire or new nylon line (rope).

- Put on gloves for skin protection and to prevent sample contamination.
- Secure the bailer and lower slowly into the water column until the bailer is submerged. Avoid rapid movements of the bailer to minimize turbidity. A cord reel can be used to aid in the lowering of the bailer.
- Raise the bailer and empty the water collected from the bailer into a graduated measuring container.
- Sampling may begin once desired volume is purged and the well has stabilized (see Section 6.2.6, Well Stabilization of this SOP).

6.2.3 Peristaltic Pump Purging

A peristaltic pump is used when the water level is within suction lift (e.g., within about 25 feet of the ground surface but may be less at higher altitudes). It usually is a low-volume suction pump with low pumping rates suitable for sampling shallow, small-diameter wells.

- Put on gloves for skin protection and to prevent sample contamination.
- Lower tubing into the well water (1 to 2 feet below surface) and cut to the desired length.
- Connect the well tubing to the drive tubing entering the pump.
- Connect the drive tubing exiting the pump to the short section of tubing entering the flow-through cell or graduated measuring container.
- Turn on pump and set the speed at the desired rate of flow.
- Sampling may begin once desired volume is purged and the well has stabilized (see Section 6.2.6, Well Stabilization of this SOP).

6.2.4 Submersible Pump Purging

A submersible pump is used when the water level is greater than the suction lift associated with a peristaltic pump. It is commonly used in conjunction with a control box to achieve the desired pumping rate (low to high). Variable rate submersible pumps are available to fit inside 2 inch or larger wells.

6.2.4.1 1.5-inch Submersible Pump

This is a type of submersible pump that can be used in 2-inch or larger diameter wells. It can purge water from depths down to 200 feet or greater, depending on pump model and manufacturer.

- Put on gloves for skin protection and to prevent sample contamination.
- Attach appropriate diameter tubing to pump intake, lower pump, and secure at desired depth.
- Cut off tubing, allowing additional tubing length for discharge.
- Plug the pump into the controller. Pump will begin pumping using the variable speed controller. There are a variety of speed controllers available, typically designed for a specific pump.
- Attach the controller to the power supply.
- Turn on the controller and dial the speed control to the desired flow rate. The controller can slow the purge rate down to the optimum rate.

  Note: If the submersible pump is not running, turn off the pump and then disconnect from the power supply. Check connections and try again.
- Attach the flow-through cell for the water quality meter.

  Note: If water is considerably turbid after initial pump start-up, the flow-through cell may be connected after purge water has cleared visually.
- Sampling may begin once desired volume is purged and the well has stabilized (see Section 6.2.6, Well Stabilization of this SOP).

6.2.4.2 3 or 4-inch Submersible Pump

This pump may be used to purge water samples from any depth.

- Put on gloves for skin protection and to prevent sample contamination.

- Attach purging hose to the pipe connected on the top of the submersible pump.
- Lower the submersible pump slowly into the well until it is completely submersed into the water and secure at desired depth.
- Connect the pump to the generator with an extension cord.
- Turn switch to start the generator, put choke on, pull recoil rope, and let generator idle until it is running smoothly
- Turn on power (which is located on the front of the generator).

  Note: Submersible pump should be running; if not, turn off the generator and check connections.
- Adjust flow rate to desired rate with the valve and measure the flow rate with the graduated measuring container.
- Attach the flow-through cell for the water quality meter.

  Note: If water is considerably turbid after initial pump start-up, the flow-through cell may be connected after purge water has cleared visually.
- Sampling may begin once desired volume is purged and the well has stabilized (see Section 6.2.6, Well Stabilization of this SOP).

6.2.5 Well Purging with In-place Plumbing

In-place plumbing consists of dedicated, submersible pumps that are permanently installed in a well.

- Put on gloves for skin protection and to prevent sample contamination.
- Turn switch to start the generator, put choke on, pull recoil rope, and let generator idle until it is running smooth.
- Connect the pump to the generator with an extension cord.
- Connect the pipe, elbow, and valve to the discharge pipe of the submersible pump (located at the top of the well) and turn on the generator.

  Note: If the pump does not start, check the connection from the generator to the pump.
- When water flows from discharge of the pump, adjust the flow according to desired flow rate and measure the flow rate with the graduated measuring container.
- Attach the flow-through cell for the water quality meter.

  Note: If water is considerably turbid after initial pump start-up, the flow-through cell may be connected after purge water has cleared visually.
- Sampling may begin once desired volume is purged and the well has stabilized (see Section 6.2.6, Well Stabilization of this SOP).

  Note: Each dedicated pump has its own pipe, elbow, and valve. These pieces are left at each well.

6.2.6 Well Stabilization

Well stabilization is typically conducted to help verify that the groundwater sample is representative of aquifer conditions. A well is considered 'stabilized' after the well purge volume has been met and the groundwater (or well) stabilization parameter measurements are within acceptable limits for three consecutive readings. Well stabilization parameters may vary by project or regulatory agency but at a minimum typically include pH, temperature, and specific conductance (temperature corrected electrical conductivity). Dissolved oxygen (DO) and oxidation-reduction potential (ORP) may also be used as stabilization parameters.

The procedure to stabilize a well includes recording well stabilization parameter measurements collected with the water quality meter at the beginning of the well purging process and after subsequently purged well volumes. A well volume is measured as the volume of water present inside a well screen and/or casing (i.e., from the base of the well to the water level measurement) and is defined in the footnotes of Table 1. Groundwater aliquots used for stabilization parameter measurements are typically collected by either directing the purge water discharge line through a flow-through cell or by pouring groundwater from a bailer into a container holding the water quality meter probe (depending on the purging method used).

Documentation of the well stabilization process typically includes recording pertinent information such as the pump type, pumping rate, volume pumped, and well stabilization measurements on the field log data sheets or field notebook. If only the minimum parameters are used for stabilization, the DO and ORP should still be measured and recorded as they may be needed to interpret other chemical parameter results. Turbidity is measured with a standalone turbidimeter but is typically not used as a stabilization parameter. A qualitative determination of turbidity may also be noted (e.g. clear, cloudy, very cloudy, etc.).

The well may be sampled after three consecutive measurements (typically one well volume per measurement), collected at the intervals described above, are within specific project criteria or the criteria presented in Section 7.2, Measurement Criteria of this SOP.

If field parameters do not stabilize after five well volumes have been purged, then the field technician will verify that the probes and related equipment are functioning properly and that operator error is not an issue. They will also re-evaluate whether or not water is being withdrawn from the appropriate depth to effectively evacuate the well. If all the checks produce no new insight, a decision will need to be made by the project team on whether to collect samples for laboratory analysis. When samples are collected, it will be clearly documented that stabilization was not achieved; at a minimum, this fact will be reported on the field log data sheets and in the Field Sampling Report.

If the well was purged dry, it shall be allowed to recharge and the samples should then be collected. If there is insufficient sample volume for the analyses being sampled, the project team will need to decide if sampling should be carried out or if a reduced prioritized list of analyses should be collected.

6.2.7 Sampling

The project team will determine the order for sampling the wells but general guidelines are below:

- Where water quality data are available, the least contaminated wells would be sampled first, proceeding to increasingly contaminated wells.
- Where the distribution of contaminants is not known, wells considered to be up gradient from likely sources of contamination would be sampled first and downgradient wells closest to the suspected contamination would be last.
- Make certain to keep records of the order in which wells were sampled.

Similar to purging, sampling requires the use of pumps or bailers. It may be appropriate to use a different device to sample than that which was used to purge. The most common example of this is the use of a pump to purge and a bailer to sample. There are several factors to take into consideration when choosing a sampling device. The experience of the project team will be used to determine which is appropriate and care should be taken when reviewing the advantages or disadvantages of any one device.

To prevent the possible loss of some volatile organic compounds (VOCs), samples for volatile parameters should be collected first with as little agitation and disturbance as possible, then proceed in order towards the least volatile parameter as listed in Barr's 'Water Sampling Guidelines' form. The 40 mL vials used to collect the VOC samples should be checked for air bubbles. Air bubbles may be caused by insufficient meniscus when sealing the vial, degassing after sample collection or during sample shipment, or reaction between the sample and preservative (HCl). If air bubbles > 6 mm (pea-sized) are observed during sampling, discard the vial and recollect the sample using a new vial. If air bubbles are believed to be due to the sample reacting with the preservative, the sample should be collected in an unpreserved vial if possible.

Put on new sampling gloves at each sampling site to reduce the risk of sample cross-contamination and exposure to skin. Never reuse old gloves.

Prepare sampling containers by filling out the label, using an indelible permanent pen, with the following information at a minimum:

- Sample ID
- Date and time of sample collection
- Preservative
- Sample analysis (if required by the lab)

When filling the containers, do not insert the tubing into the containers and do not overfill preserved containers. When all samples are containerized, place the filled sample containers in a sampling cooler with ice, turn off any equipment, disassemble the sampling apparatus, dispose of all one-time use (disposable) equipment, and decontaminate reusable equipment per Barr's SOP 'Decontamination of Sampling Equipment'.

6.2.7.1 Bailer Sampling

After the well has been purged and stabilized, secure the bailer and slowly lower into the top of the water column making certain not to stir up the water with the bailer, which could result in volatizing the samples. Keep the bailer in the top portion of the water column when collecting the sample.

When the bailer is filled, slowly raise the bailer out of the well. A clean tarp may be used to cover the ground to minimize the contact of the rope with the ground. Fill containers in the order listed in Barr's 'Water Sampling Guidelines' form.

6.2.7.2 Peristaltic / Submersible Pump Sampling

After the well has been purged and stabilized, disconnect the tubing exiting the pump from the flow-through cell, if used and fill containers as listed in Barr's 'Water Sampling Guidelines' form.

6.2.7.3 Check Valve Sampling

Sampling temporary wells through tubing with a check valve may be conducted following a drilling subcontractor's procedure.

6.2.8 Preservation

Container volume, type, and preservative are important considerations in sample collection. Container volume must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful. Barr's 'Water Sampling Guidelines' form lists the parameter, container type, container volume, and preservative for many of the most common parameters collected.

6.2.9 Handling

The samples will be bubble wrapped or bagged after collection, stored in a sample cooler, and packed on double bagged wet ice. Samples will be kept cold (≤ 6 °C, but not frozen), until receipt at the laboratory (where applicable).

Note: Samples may need to be stored indoors in winter to prevent freezing.

6.2.10 Shipment/Delivery

Once the cooler is packed to prevent breaking of bottles, the proper chain-of-custody (COC) documentation is signed and placed inside a plastic bag then added to the cooler.

All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier, if possible, in accordance with all Federal, State and Local transportation regulations and Barr's SOP 'Domestic Transport of Samples to the Laboratory'.

6.3 Data Reduction/Calculations

Table 1 provides the volume of water (per foot or meter of depth) based on the diameter of the casing or hole. The following are two examples of calculations used in Table 1:

Volume of Standing Water (V), cubic feet

$$V = (\pi)(r^2)(h)$$

Where: π = 3.1416

r = Well radius (ft)

h = Total well depth (ft) – depth to static water (ft) = Water column height (ft)

Note: For the table calculations, 'h' is equal to one foot.

Well Volume (WV), gallons

$$WV = (V)(7.48)$$

Where: V = Volume of standing water, cubic feet

7.48 = Cubic foot to US Gallons conversion factor

Calculate the volume of water to be purged using the equation below:

$$VP = (WV)(NWV)$$

Where: VP = Volume of water to be purged

WV = Well volume in gallons

NMV = Number of well volumes to be purged per project requirements

6.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and Barr's SOP 'Investigative Derived Waste'. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. The sampling frequency should be performed at the frequency noted in the project scope of work and/or documentation (e.g., Work Plan, SAP, or QAPP).

7.2 Well Stabilization Criteria

Well stabilization criteria to be used if there are no project specific criteria:

- pH ± 0.1 standard units
- Temperature ± 0.5 °C
- Specific conductance ± 5%
- Optional Criteria:
  - ORP ± 10 mV
  - Dissolved oxygen ± 10% (> 0.5 mg/L)

    Note: Three consecutive readings ≤ 0.5 mg/L can be considered stabilized.
  - Turbidity ± 10% (> 5 Nephelometric Turbidity Units (NTU))

    Note: Three consecutive readings ≤ 5 NTU can be considered stabilized.

8.0 Records

The field technician will document the pumping flow rate, well volume, time purged, volume purged, water level, total well depth and stabilization test measurements on the field log data sheet and/or field notebook. They will also document the type and number of bottles on the chain-of-custody record, as appropriate. The analysis for each container and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Chain-of-custody (COC)

- Sample label
- Custody seal (if applicable)
- Water Level Data Sheet
- Field Log Data Sheet
- Field Log Cover Sheet
- Field Sampling Report
- Water Sampling Guidelines (includes sampling order, container, preservation, and holding time)

The field documents and COCs are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual".

Other Barr SOP subjects referenced within this SOP: water level measurement, water quality meter, turbidimeter, collection of QC samples, decontamination of sampling equipment, and documentation on a COC.

9.0 References

Environmental Protection Agency. *Title 40 of the Code of Federal Regulations, Part 136.3*.

Environmental Protection Agency, EPA/540/P-91/007. 1999. *Compendium of ERT Groundwater Sampling Procedures*.

Minnesota Pollution Control Agency, Water Quality Division. 2006. *Sampling Procedures for Groundwater Monitoring Wells*.

Table 1

Volume of Water in Casing or Hole

Diameter of Casing or Hole (In)	Gallons per Foot of Depth (WV)	Cubic Feet per Foot of Depth (V)	Liters per Meter of Depth	Cubic Meters per Meter of Depth
1	0.041	0.0055	0.509	0.509×10^{-3}
1½	0.092	0.0123	1.142	1.142×10^{-3}
2	0.163	0.0218	2.024	2.024×10^{-3}
2½	0.255	0.0341	3.167	3.167×10^{-3}
3	0.367	0.0491	4.558	4.558×10^{-3}
3½	0.500	0.0668	6.209	6.209×10^{-3}
4	0.653	0.0873	8.110	8.110×10^{-3}
4½	0.826	0.1104	10.26	10.26×10^{-3}
5	1.020	0.1364	12.67	12.67×10^{-3}
5½	1.234	0.1650	15.33	15.33×10^{-3}
6	1.469	0.1963	18.24	18.24×10^{-3}
7	2.000	0.2673	24.84	24.84×10^{-3}
8	2.611	0.3491	32.43	32.43×10^{-3}
9	3.305	0.4418	41.04	42.04×10^{-3}
10	4.080	0.5454	50.67	50.67×10^{-3}
11	4.937	0.6600	61.31	61.31×10^{-3}
12	5.875	0.7854	72.96	72.96×10^{-3}
14	8.000	1.069	99.35	99.35×10^{-3}
16	10.44	1.396	129.65	129.65×10^{-3}
18	13.22	1.767	164.18	164.18×10^{-3}
20	16.32	2.182	202.68	202.68×10^{-3}
22	19.75	2.640	245.28	245.28×10^{-3}
24	23.50	3.142	291.85	291.85×10^{-3}
26	27.58	3.687	342.52	342.52×10^{-3}
28	32.00	4.276	397.41	397.41×10^{-3}
30	36.72	4.909	456.02	456.02×10^{-3}
32	41.78	5.585	518.87	518.87×10^{-3}
34	47.16	6.305	585.68	585.68×10^{-3}
36	52.88	7.069	656.72	656.72×10^{-3}

1 gallon = 3.7854 liters
1 liter = 0.26417 gallons
1 meter = 3.281 feet
1 gallon water weighs 8.33 lbs. = 3.785 kilograms
1 liter water weighs 1 kilogram = 2.205 lbs.
1 gallon per foot of depth = 12.419 liters per foot of depth
1 gallon per meter of depth = 12.419×10^{-3} cubic meters per meter of depth

Standard Operating Procedure
Collection of Quality Control Samples

Revision 6

October 22, 2015

Approved By:

Terri Olson		[signature]	10/22/15
Print	QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
Initials:		Date:	
Initials:		Date:	
Initials:		Date:	

Collection of Quality Control Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures used in the collection and handling of field quality control (QC) samples: field blanks, equipment blanks, trip blanks, field (masked) duplicate samples, matrix spikes and matrix spike duplicate samples.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Laboratory specific QC samples (e.g., method blanks, laboratory control samples) are not discussed within this SOP.

3.0 Responsibilities

Experienced Field Technicians are responsible for the accurate collection of QC samples and the laboratory is responsible for the accurate set-up and analysis of QC samples. Project staff are responsible for ordering sample containers prior to the sampling event.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, Sampling Analysis Plan (SAP), etc.).

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Laboratory-certified containers appropriate for the required analysis
- Chemical resistant gloves (e.g., nitrile)
- Sample labels
- Matrix specific sampling devices and equipment
- Sample containers/media
- Analyte-free water

6.0 Procedure

This section provides the definitions and sampling procedure(s) for QC samples.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Sampling

General considerations to be taken into account when planning and conducting sampling operations are the required sample amount, sample holding times, sample handling, and special precautions for trace contaminant sampling. Matrix specific sampling SOPs should be followed for the collection and preservation of samples. The QC samples will be handled in the same manner as the sample group for which they are intended (i.e. stored and transported with the sample group).

6.2.1 Field Blank

Field blank samples are prepared on-site and are a sample of analyte-free water exposed to environmental conditions at the sampling site by transfer from one vessel to another. It measures field and laboratory sources of contamination. Generally, blanks are collected for each parameter of interest.

6.2.2 Equipment Blank (Rinsate Blank)

Equipment blank (or rinsate blank) samples are prepared on-site by pouring analyte-free water through decontaminated sample collection equipment (e.g., bailer or pump, hand-trowel, etc.) and collecting the "rinsate" in the appropriate sample container. If collecting a blank for dissolved metals or dissolved organic carbon, the rinsate will be filtered before adding to the sample container. In addition to the field sources of contamination that may be introduced in the transferring of samples to one vessel to another, an equipment blank also tests the potential cross contamination from incomplete decontamination. Generally, blanks are collected for each parameter of interest.

6.2.3 Trip Blank

Trip blank samples are used when sampling volatile organic compounds (VOC) only. Analyte-free water is used for water samples and methanol (or other applicable sample preservative) is used for soil samples. They are prepared or provided by the laboratory along with the VOC sampling containers prior to a sampling event. Trip blank sample containers are not to be opened in the field and accompany the VOC samples during collection, storage, and transport to the analytical laboratory. There must be one set of trip blank samples per sample cooler containing VOC samples from the Site. The trip blanks should be listed on the chain-of-custody (COC) along with the samples and the analysis required. The purpose of the trip blank sample is to determine the extent of potential contamination introduced during sample transport and handling.

6.2.4 Field (Masked) Duplicate

Field (masked) duplicate samples are two aliquots of a sample collected at the same time using the same procedures, equipment, and types of containers as the required samples. The samples are collected by rotating sampling containers from the original/source sample to the field duplicate sample (using the same exact methods for both). The field duplicate sample is identified with an alias (e.g., M-1 or FD) on the sample container label and on the COC to avoid alerting laboratories to the source of the sample duplicated. The time collected should be omitted on this sample also. Analyses of field duplicate samples are the same as the required samples and give a measure of the precision associated with sample collection, preservation, and storage, as well as laboratory procedures. Field duplicate samples are submitted to the laboratory for the same analyses as the original/source sample.

6.2.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) samples are two aliquots of a sample to which known quantities of analytes are added (spiked) in the laboratory. The MS and MSD are prepared and analyzed exactly like their native/source sample aliquot. For some analyses, it is required that three separate sample aliquots are collected in the field for each analysis. One aliquot is analyzed to determine the concentrations in the native/source sample, a second sample aliquot serves as the MS and the third sample aliquot serves as the MSD. The purpose of the MS and MSD is to quantify the bias and precision caused by the sample matrix.

6.3 Data Reduction/Calculations

6.3.1 Field Duplicate

Field duplicate sample results are evaluated by calculating the Relative Percent Difference (RPD) value. The RPD formula is as follows:

$$RPD = \frac{|S - D|}{(S + D)/2} \, x \, 100$$

Where: RPD = relative percent difference
S = native sample result
D = duplicate sample result

Note: The RPD equation may also be used to calculate the precision between the MS and MSD

6.3.2 MS/MSD

MS/MSD recoveries are calculated using the following equation:

$$\%R = \frac{SSR - SR}{SA} \, x \, 100$$

Where: %R = % recovery
SSR = spiked sample result
SR = native/source sample result
SA = spike added to native/source sample

6.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and Barr's 'Investigative Derived Waste' SOP. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

The frequency of QC samples is generally one field blank/equipment blank/field duplicate/MS/MSD per twenty samples; however, specific project requirements may require alternative sampling frequencies.

7.2 Measurement Criteria

Criteria are defined in project specific documentation or in Barr's data evaluation SOPs.

8.0 Records

The field technician will document the type and number of QC samples collected during each sampling event on a COC and in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- COC
- Sample label
- Custody seal (if applicable)

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual".

Other Barr SOP subjects referenced within this SOP: sample collection, investigative derived waste, decontamination of sampling equipment, and documentation on a COC.

9.0 References

EPA QA/G-5. 2002. Guidance for Quality Assurance Project Plans.

Standard Operating Procedure

Collection of Soil Samples

Revision 8

February 23, 2016

Approved By:

Kevin McGilp		[signature]	02/23/16
Print	Technical Reviewer	Signature	Date
Terri Olson		[signature]	02/23/16
Print	QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Initials: ____________ Date: ____________

Collection of Soil Samples

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the collection of a representative soil sample using a variety of methods (including compositing of discrete samples) and equipment depending on the depth and type of sample required. This procedure applies to the collection of soil samples for volatiles (VOC), semivolatiles (SVOC), metals, and inorganics analyses. It also identifies the container, preservative, and weight required for each analysis type.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Sample collection methods can vary by project. If not specified in the project scope of work and/or documentation (e.g., Work Plan, Sampling Analysis Plan (SAP), or Quality Assurance Project Plan (QAPP)), consult with the appropriate regulatory agency for guidance.
- Inadequate homogenization of the samples, where applicable, can result in non-representative samples and results.
- Decontamination of sampling equipment is required to prevent cross-contamination.
- Contact the local utilities hotline prior to digging to have utilities identified at sampling locations.

3.0 Responsibilities

Equipment Technicians are responsible to maintain equipment in working order and aid in troubleshooting equipment issues.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, SAP, etc.).

Experienced Field Technicians are responsible for the proper sample identification, collection of samples, field screening procedures, field equipment and calibration, quality control procedures, and documentation.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Sampling devices/tools
- Stainless steel mixing bowl and spoon
- Sample containers (method specific)
- Balance
- Coolers
- Plastic bags
- Non-phosphorus containing detergent (e.g., Liquinox™)
- Chemical resistant gloves (e.g., nitrile)
- Paper towels/laboratory tissues
- Chain-of-custody (COC)
- Sample label
- Custody seal, if applicable
- Waterproof ink pen or pencil
- Ice

6.0 Procedure

This section describes the procedure(s) for the sampling, handling, and delivery of soil samples.

6.1 Calibration

No specific calibration procedures are required for the actual sampling equipment; however, the calibration of the balance should be verified prior to use. Refer to the applicable Barr SOP.

6.2 Sampling

General considerations to be taken into account when planning and conducting sampling operations are the required sample weight, sample holding times, sample handling, and special precautions for trace contaminant sampling.

To prevent sample cross-contamination, the soil sampling equipment is carefully cleaned before initially sampling and after working at each sampling point per Barr's SOP 'Decontamination of Sampling Equipment'. A new, clean outer pair of disposable gloves will be worn for each sample location and sample containers are placed in separate plastic bags after collecting, preserving and tagging. Sample collection activities will proceed progressively from the least contaminated area to the most contaminated area (when known).

Depending on the project work to be done, soil samples will be collected for analysis by either a drilling apparatus (equipped with a split spoon or core barrel sampler), hand excavation (hand auger, trowel, or shovel), or direct-push (Geoprobe®) technology

- If a drilling apparatus was used, retrieve the split spoon or core barrel sampler from the desired sampling interval and open. If a liner (sleeve) is present and will not be sampled in the field, wrap the ends of the liner with heavy-duty aluminum foil, taking care to not pierce the foil. Tape the foil to the brass liner with duct tape to seal. Cover the ends of the liner with plastic caps or duct tape to fully protect the foil and package for shipment to the laboratory. If a liner is being sampled in the field, open the liner to sample the soil.

- If hand excavating, dig with a trowel or shovel to the desired sampling interval and expose a fresh soil surface to sample. Collect a large sample on a shovel and bring it to the surface or collect the sample directly from the fresh soil surface. The hand excavation technique may be done from the bucket of a backhoe also.
- If direct-push (Geoprobe®) technology is used, soils are typically sampled following the subcontractor's soil sampling procedures. This method generally utilizes a direct-push soil boring rig, steel drive rods and a 2-inch outside diameter (O.D.) soil core sampler with a dedicated 1.75-inch inside diameter (I.D) removable acetate plastic sampler liner. The probe rods and sampling unit are driven to the desired sampling depth by the static weight of the carrier vehicle and hydraulic hammer percussion. Two, four, or five-foot sample cores are typically collected. The assembly is brought to the surface and the soil sample is exposed by cutting open the sampler liner.

In most investigations, the soil samples are field screened for moisture, odor, oil sheen, discoloration and the presence of organic soil vapors and classified in accordance with ASTM D-2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Refer to Barr's SOP 'Screening Soil Samples'.

The form 'Soil Sampling Guidelines' lists the analyses (in order of collection) and describes the weight of sample, preservation, container, and holding time for the most common sampling media (information can vary depending on the laboratory used). The container size, type, preservative, and holding time are important considerations in sample collection. Sample and container size must be adequate to meet laboratory requirements for quality control, split samples, or repeat analyses. The container type varies with the analysis required. Typically, the analytical laboratory will preserve the container before shipment, where applicable. Preservation and shelf life vary; contact the laboratory to determine if an on-hand container is still useful.

Both discrete and composite samples can be used for environmental investigations. A discrete sample is a sample that originated from a specific area at a specific time. The sample may be transferred directly from the sampler or sampling location to the sample container.

A composite sample is a collection of multiple temporary or discrete samples of the same medium that are combined, thoroughly homogenized, and treated as a single sample. Composite samples are valuable in characterizing a large area or volume of soil.

NOTE: Samples collected for analysis of volatile organic compounds (VOC) should not be homogenized or composited, due to aeration of the sample during mixing which may result in loss of VOC.

6.2.1 Volatile Organic Compounds (VOC)

If VOC or similar analyses (e.g., GRO, TPH as Gasoline) are being analyzed, these samples should be collected as soon as possible after the soil is removed from the ground from a representative area of the most undisturbed soil possible. Please refer to Barr's SOP 'Screening Soil Samples'. It is important to note that there are different containers and sampling media available for collecting a soil sample for VOC. Typically, the VOC sample is collected at a 1:1 weight ratio with a preservative. A coring device, such as a Terra Core® or En Core® sampler, is the first choice for sampling. After VOC samples are collected, mix the remaining soil from the sampling locations/intervals prior to filling the rest of the sample containers.

Note: Analytical samples should not be collected from polyethylene bags sometimes used for field screening purposes.

6.2.1.1 Terra Core® Sampler

The Terra Core® Sampler is a single use device that is typically supplied with a 40 mL VOA vial containing preservative (e.g., methanol) and an unpreserved container for % moisture/% solids determination. To use the Terra Core®, make certain the plunger is aligned with, and seated in, the handle. Push the Terra Core® into freshly exposed soil until the sample chamber is filled. Depending on the Terra Core® sampler size, a filled chamber will deliver approximately 5 or 10 g of soil. If a 1:1 ratio of soil to preservative is needed, verify the correct size sampler is being used.

Wipe the outside of the sampler, check that the soil plug is flush with the mouth of the sampler, and remove any excess soil. Rotate the plunger 90° until it is aligned with the slots in the body. Extrude the sample into the appropriate container by pushing the plunger down. To provide a good sealing surface, wipe the container lip and screw threads to remove soil and immediately screw on the lid. If preservative is present in the container, swirl to immerse the sample. Record the sample ID on the container and package for shipment to the laboratory.

6.2.1.2 En Core® Sampler

The disposable En Core® sampler is a single use device that is pushed into the soil using a reusable En Core® T-handle. Two, 5 g samplers are typically supplied with an unpreserved container for % moisture/% solids determination. Hold the En Core® coring body and push plunger down until the small O-ring rests against the tabs so the plunger moves freely.

Depress the locking lever on the T-handle. Place coring body plunger end first into the open end of the T-Handle, aligning the slots on the coring body with the locking pins in the T-Handle. Twist coring body clockwise to lock pins in slots. Make certain that the sampler is locked in place.

Turn T-handle with T-up and coring body down. This will position the plunger bottom flush with bottom of coring body. Using T-handle, push sampler into soil until coring body is completely full. When full the small O-ring will be centered in the T-handle viewing hole. Remove excess soil from the coring body exterior.

Cap the coring body while it is still on the T-handle by pushing and twisting the cap over the bottom until grooves on locking arms seat over ridge on coring body. Remove the coring body from the T-handle and lock plunger by rotating extended plunger rod fully counterclockwise until wings rest firmly against tabs.

Attach the accompanying label and package for shipment to the laboratory.

6.2.1.3 Other

If no coring device is available, an estimate of the amount of soil needed to provide the desired weight can be determined. Place an extra laboratory container, disposable weigh boat, paper towel, or laboratory tissue on a balance pan. Using a stainless steel spoon, add the desired weight (10 g or 25 g) of a representative soil sample on the balance. Once the amount has been established, discard the soil used in the estimation and collect the sample as per form 'Soil Sampling Guidelines'.

If allowed by applicable regulations for VOC sample collection, the VOC aliquot may be weighed directly into the sample container by placing the pre-weighed sample container on the balance, taring the balance, then adding the appropriate amount of soil to the container to reach the desired aliquot weight. This should be done quickly to reduce the possible loss of VOCs.

6.2.2 Compositing Discrete Samples

Discrete samples, to be used for compositing, are stored at ≤ 6 °C until each individual sample is obtained. A minimum volume of soil obtained during discrete sampling will be dependent on the final analytical requirements for the composite sample; however, a minimum weight of eight ounces should be sufficient for analysis of semivolatiles (SVOC), PCBs, pesticides, and metals.

After discrete samples have been obtained, record the locations to be included in a final composited sample in the field documentation. Appropriate laboratory containers should be labeled with this final sample identifier and the date of collection.

Retrieve the samples selected for compositing from storage. One container from each discrete sample location should remain in storage in case individual sample confirmations are necessary. Empty the entire contents of each container into a stainless steel mixing bowl, removing any large debris or rocks, and mix thoroughly.

6.2.3 Diesel Range Organics (DRO) / SVOC / General Chemistry / Metals

Using either a composited sample or a homogenized, discrete sample, fill the remaining containers in the order listed on form 'Soil Sampling Guidelines'. Unless aliquot weights are listed, pack the soil into the sample jars leaving no headspace. If allowed by applicable regulations, the WIDRO sample may be weighed directly into the sample container by placing the pre-weighed sample container on the field balance, taring the field balance, then adding the appropriate amount of soil to the container to reach the desired sample weight (~25 g).

Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

6.2.4 Handling

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. Immediately after samples are collected, they are bubble wrap or bagged and placed in a cooler containing bagged ice. Samples will be kept cold (≤ 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area.

Keep samples secure to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

6.2.5 Shipment/Delivery

Once the cooler is packed to prevent breaking of containers, the proper COC documentation is relinquished by the sampler, placed into a plastic bag, and included in the cooler. Custody seals may be used, and the coolers should be taped shut if not hand delivered.

The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations and Barr's SOP 'Domestic Transport of Samples to the Laboratory'.

Note: Samples may have to be stored indoors in winter to prevent freezing.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and Barr's SOP 'Investigative Derived Waste'. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. The sampling frequency should be performed as written in the project scope of work and/or documentation (e.g., Work Plan, SAP, or QAPP).

7.2 Measurement Criteria

No specific criteria apply to the implementation of this SOP.

8.0 Records

The field technician will document the soil sampling event in a project dedicated field logbook or on field log data sheets. The analysis for each container, the number of bottles, and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Data Sheet
- COC
- Sample label
- Custody seal (if applicable)
- Soil Sampling Guidelines (includes sampling order, container, preservation, and holding time)

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual."

Other Barr SOP subjects referenced within this SOP: screening soil samples, balance calibration, collection of QC samples, decontamination of sampling equipment, investigative derived waste, domestic transport of samples, and documentation on a COC.

9.0 References

USEPA Environmental Response Team. 2000. *SOP for Soil Sampling*.

BARR

Standard Operating Procedure

Decontamination of Sampling Equipment

Revision 0

October 28, 2015

Approved By:

John Juntilla	[signature]	10/28/15
Print Technical Reviewer	Signature	Date
Terri Olson	[signature]	10/28/15
Print QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials: ______	Date: ______
Initials: ______	Date: ______
Initials: ______	Date: ______
Initials: ______	Date: ______

Decontamination of Sampling Equipment

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to define the process used for decontaminating environmental sampling-related equipment including pumps, meters, and materials coming into contact with actual sampling equipment or with sampling personnel. This procedure is applicable to all personnel who are collecting samples and/or decontaminating sampling and field equipment.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Equipment used once and discarded such as bailers, protective gear, and filtration devices are not part of this SOP.

3.0 Responsibilities

The equipment technician is responsible for ensuring field equipment has been thoroughly decontaminated and prepared for use out in the field. The field technician(s) are responsible for decontamination in the field at each individual sampling point and for ensuring adherence to any investigative derived waste (IDW) project-specific requirements set forth in a QAPP or SAP (if applicable).

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

4.0 Safety

Barr staff is responsible for implementing all aspects of the job safely. Where available, refer to the appropriate Project Health and Safety Plan (PHASP) to determine the proper personal protection equipment (PPE) required when using this SOP. Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling soils contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Non-phosphorus detergent (e.g., Liquinox™)
- Scrub brush made of inert materials
- Oven
- Bucket
- Tap water
- Analyte-free water (e.g., distilled or deionized (DI) water, or equivalent)
- Kimwipes®, or equivalent
- Chemical resistant gloves (e.g., nitrile)
- Spray bottle
- Organic solvent (e.g. methanol)

6.0 Procedure

This section describes the procedure(s) for the decontamination of equipment used to sample water, soil, or air.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Operation

Decontamination of sampling equipment will be performed before sampling and after working at each sampling point, if applicable.

6.2.1 Water Sampling Equipment

Equipment that does not contact sample water or the inside of the well should be rinsed with analyte-free water and inspected for remaining particles or surface film. If these are noted, repeat cleaning and rinse procedures.

Equipment that contacts sample water or the inside of the well should be cleaned (inside and outside where possible) with a non-phosphorus detergent solution applied with a spray bottle and/or scrub brush (if needed). Rinse with analyte-free water and containerize with other IDW if required by the SAP or QAPP and inspect for remaining particles or surface film. If these are noted, repeat cleaning and rinse procedures. Shake off remaining water and allow to air dry.

The internal surfaces of pumps and tubing that cannot be adequately cleaned by the above methods alone will also be cleaned by first circulating a non-phosphorus detergent solution through them followed by circulating analyte-free water. Special care will be exercised to ensure that the "rinse" fluids will be circulated in sufficient quantities to completely flush out contaminants and detergents.

When transporting or storing equipment after cleaning, the equipment will be stored in a manner that minimizes the potential for contamination.

6.2.2 Soil/Sediment Sampling Equipment

A variety of samplers (split-barrel, split-barrel with brass liners, piston sampler, backhoe, hand-auger, or shovel) may be used to retrieve soil from sampling locations. The soil sample will either be sealed within the sampler (e.g., collecting volatile samples) or the soil sample will be transferred to laboratory-supplied containers depending on the analysis to be conducted on the soil sample. The equipment required to transfer the soil from the sampler to the laboratory-supplied sample containers includes: stainless-steel spoons or scoops and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the PHASP.

All soil sampling equipment, including split-barrels, stainless-steel spoons and scoops, will be carefully cleaned before and during sampling with a tap water and non-phosphorus detergent solution, using a brush if necessary to remove particulate matter and films. The equipment is then rinsed three times with tap water and/or three times with analyte-free water. Inspect equipment and repeat procedure if any residual soil or visible contaminants are present. Dry sampler with a Kimwipes®. Organic solvents (e.g., methanol) may be used to aid with desorbing organic material but should be kept to a minimum and must be collected and containerized if used.

At the completion of the work day, the samplers should be decontaminated following the procedure above and stored in a manner that minimizes the potential for contamination.

6.2.3 Air Sampling Equipment

For non-laboratory manifold equipment, methanol soak manifold components for a minimum of two hours. Remove from the methanol bath and place in an oven pre-heated to 90 °C and continue to heat manifold components for at least 3 hours or until interior and exterior surface inspections of the manifold components indicate that they are free of liquid methanol.

6.2.4 Handling

All equipment will be handled in a manner that minimizes cross-contamination between points. After cleaning, the equipment will be visibly inspected to detect any residues or other substances that may exist after normal cleaning. If inspection reveals that decontamination was insufficient, the decontamination procedures will be repeated.

6.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

6.4 Disposal

IDW generated by this process will be disposed of in accordance with Federal, State and Local regulations and/or as required by project-specific SAP or Work Plan. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

Decontamination procedures may be monitored through the use of an equipment blank which consists of analyte-free water processed through non-disposable or non-dedicated aqueous or solid sampling equipment after equipment decontamination and before field sample collection. The equipment blank is analyzed for the same parameters as the samples at a project specific frequency (e.g., one per twenty samples).

7.2 Measurement Criteria

Equipment blank results should be below the laboratory's method detection limit or reporting limit (depending on the data quality objectives).

8.0 Records

The field technician(s) will document the field equipment decontamination procedures in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Cover Sheet
- Field Log Data Sheet
- COC

Field documentation and COC are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual."

Other Barr SOP subjects referenced within this SOP: investigative derived waste and sample collection.

9.0 References

ASTM. 2015. Standard Practice for Decontamination of Field Equipment Used at Waste Sites.

Standard Operating Procedure

Documentation on a Chain-of-Custody Form

Revision 4

September 11, 2015

Approved By:

Andrea Nord		09/11/15
Print	Technical Reviewer Signature	Date
Terri Olson		09/11/15
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
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Documentation on a Chain-of-Custody Form

1.0 Scope and Applicability

The purpose of this procedure is to describe how to properly document information on a Chain-of-Custody (COC) form. A COC is a legally binding document that identifies sample identification, analyses required, and shows traceable possession of samples from the time they are obtained until they are introduced as evidence in legal proceedings. A Field Technician completes the information on the COC at the time he/she collects samples and the COC accompanies the samples during transport to a storage facility or to the laboratory for analysis.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- The SOP does not apply to sample aliquots that are only collected for field screening purposes.
- The SOP does not apply to samples remaining on-site.

3.0 Responsibilities

Experienced Field Technicians are responsible for the proper sample identification and for accurate and complete documentation on the COC.

4.0 Procedure

The COC is the most important sampling document; it must be filled out accurately and completely every time a sample is collected. The instructions below are specific to Barr's COC for air canisters and Barr's COC typically used for solid and liquid samples. The COC for air canisters is typically used when collecting soil gas, soil vapor, or air samples in an evacuated canister. The COC for soil and water samples is typically used when collecting matrices such as groundwater, surface water, drinking water, waste water, storm water, sediment, oil, paint chips, bulk materials, etc. Information common to the COCs and specific to each COC are detailed below. Some of the information on a COC may be filled out ahead of time (e.g., report and invoice recipient details, project number, project name, project manager, purchase order number, etc.) while other information should be completed when sampling. Complete one COC or more as needed for each set of project samples. The COC should be completed prior to leaving the sampling location.

Laboratory supplied COCs may be used but may differ in the information to record. The use of a Barr COC is recommended as it allows for more efficient data processing within Barr's systems. If there are any questions, please contact a member of Barr's Data Quality team.

The laboratory receiving the samples will sign and record when received, the lab work order number, and whether any custody seals were used and if intact.

4.1 Common Chain-of-Custody Information

- Barr office location managing the work.
- Two digit identification for the state or province the samples originated from/sampled in.
- COC numbered pages (e.g., 1 of 1).
- Report and invoice recipient information.
- Purchase order number (if applicable).
- Barr project name and number.
- Sample location.
- Sample collection date and time
- Sample matrix abbreviation (see "Matrix Code" on COC).
- Analysis requested.
- Field Technician (sampler) name.
- Barr Project Manager and project Data Quality (DQ) Manager names.
- Laboratory name and location.
- Requested due date.
- Signature of Field Technician (i.e. sampler) under the first 'relinquished by'.
- Signature of sample transferee.
- Date and time of sample transfers.
- Method of transport (UPS, FedEx, local courier, sampler, etc.).
- Air Bill number (if applicable).

4.2 Completing a Chain-of-Custody for Air Canisters

- Lab deliverable contents (based on project needs).
- Canister serial # and size.
- Flow controller serial #.
- Initial and final vacuum (record unit).
- Record both the start and stop time and calculate the total time.
- PID reading (indicate if ppm or ppb).
- Sample comments (if any).

4.3 Completing a Chain-of Custody for Solid and Liquid Samples

- Sample start and stop depth (if applicable) and unit of measurement (meter, feet, inches, etc.).
- Information regarding whether to perform sample Matrix Spike (MS) and MS duplicate (MSD).
- Container preservative type (see "Preservative Code" on COC).
- Information regarding whether the sample was field filtered.
- Number of each container type and the total number of containers for the sample.
- Presence or absence of ice.

4.4 Distribution of the COC Pages

Page one (white copy) accompanies the sample shipment to the laboratory; page two (yellow copy) is the Field Technician's copy; and page three (pink copy) is submitted to a Barr Data Management Administrator for filing.

5.0 Quality Control and Quality Assurance (QA/QC)

The Field Technician should review the COC for accurate and complete documentation.

6.0 Records

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Chain-of-Custody for Air Canisters Form
- Chain-of-Custody Form

A copy of the COC is provided to a Barr Data Management Administrator for storage on the internal Barr network files.

Additional records information can be found in Barr's "Records Management System Manual".

7.0 References

United States Environmental Protection Agency. 2002. *Guidance for Quality Assurance Project Plans*. EPA QA/G-5.

BARR

Standard Operating Procedure

Domestic Transport of Samples to Laboratories within the United States of America – States and Territories

Revision No. 2

April 11, 2016

Approved By:

Andrea Nord		[signature]	4/11/2016
Print	QA Manager	Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:	____________	Date:	____________
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Initials:	____________	Date:	____________

Standard Operating Procedures for the Domestic Transport of Samples to the Laboratories within the United States of America – States and Territories

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures necessary for personal delivery or shipment of samples from locations within the United States of America and its territories to analytical laboratories located within the United States of America and its territories. This procedure applies to the transportation of ground and surface water, soil, wipe, sediment, paint chip, debris, and air samples to the appropriate laboratory.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- Maintaining proper sample temperatures (<6°C or ambient air temperature in accordance with the analytical method requirements) and delivering samples to the laboratory within 24 to 48 hours from collection are primary concerns.
- This procedure does not apply to the transportation of ground and surface water, soil, wipe, sediment, paint chip, debris, and air samples to laboratories outside of the United States of America – States and Territories.

3.0 Responsibilities

The field technician(s) shall ensure the security, temperature, and packaging of environmental samples during transport and shipment.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When samples may be contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Rigid Cooler
- Ziploc® baggies
- Absorbent Padding
- Ice
- Chain-of-custody Record
- Dangerous Goods in Excepted Quantities Label with the number "8" added indicating the hazard class. This label must be used for all coolers containing unused sample containers with corrosive preservative.
- Directional arrow labels may be used to ensure samples remain upright.
- Environmental Samples
- Bubble-wrap/bubble bags (inner packing material
- Heavy bag for containing ice and preventing leakage of melted water
- Packing Tape
- Shipping Papers – if shipping via delivery service
- Dangerous Goods in Excepted Quantities Label with the number "3" added indicating the hazard class. This label must be used for all coolers containing methanol preservative

6.0 Procedure

6.1 Packaging of water, soil and sediment samples (requiring chilled preservation per the analytical method of analysis)

6.1.1 Packaging Samples

Place samples in a rigid cooler, pack glass containers in bubble wrap or other cushioning material to avoid breakage. (Note: Bubble-wrap is the preferred packing material.) Methanol sample containers must be placed in a Ziploc® Baggie to meet shipping requirements for preventing leaks.

Place samples and cushioning material in strong plastic bag with enough absorption padding to absorb all of the liquid in the packaging. Be sure to zip tie this bag shut.

Add enough ice to maintain a constant temperature at < 6 °C, (but not frozen) until the samples arrive at the laboratory. Package ice in double-lined bags to ensure sample labels will not be compromised, and the cooler(s) will not leak melt water.

Before sealing cooler, fill out the chain-of-custody form completely and include required copies with the samples (see Standard Operating Procedure for Documentation on a Chain-of-Custody).

Adhere two to three strips of packaging tape on the cooler from top to bottom, and adhere an additional strip of tape covering the gap between the lid and sides of cooler to seal the cooler to avoid leakage. Custody Seals must be adhered on the cooler if project quality assurance plan or sampling and analysis plan require them. The custody seal must be adhered to the crack of the lid and the side of the cooler to ensure the cooler lid has not been tampered with in transit. Be sure to attach the courier shipping label to the top of the cooler.

6.1.2 Labeling

A secondary label with the same information should also be attached with packaging tape to the cooler in event that the original label is damaged or destroyed during sample shipment.

When shipping samples preserved with methanol, the cooler must have a Dangerous Goods in Excepted Quantities label (see attachment 4) placed on the outside of the cooler. Be sure to add the number "3" to each label in permanent marker to indicate the hazard class being shipped.

Each cooler shall not exceed 500 mL of Methanol (16 vials, 30 mL of methanol per vial) and each vial shall not have more than 30 mL of methanol to meet the requirements of a dangerous good in excepted quantities. Acid/base preserved samples vials are often 40 mL or larger and do not qualify for excepted quantities.

When shipping UNUSED sample containers preserved with acids or bases, the cooler must have a Dangerous Goods in Excepted Quantities label (see attachment 4) placed on the outside of the cooler. Be sure to add the number "8" to each label in permanent marker to indicate the hazard class being shipped.

Directional arrow labels should also be attached to the cooler to insure the cooler remains upright during shipping. Directional arrow labels should be attached to the outside of the cooler to keep the cooler in an upright position during sample shipment.

6.2 Packaging of wipe, paint chip, debris, and air samples (requiring ambient air temperature per the analytical method of analysis)

6.2.1 Packaging Samples

Place the samples in a cooler or cardboard box in a manner that will avoid breakage.

Adhere two to three strips of packaging tape from top to bottom on the cooler or box. Fill out the chain-of-custody completely and include required copies with the samples (see Standard Operating Procedure for chain-of-custody record).

Custody Seals must be adhered over the lid if project quality assurance plan or sampling and analysis plan require them. The custody seal must be adhered to the crack of the lid and the side of the cooler or over the flaps of the box to ensure the container remained shut and has not been tampered with in transit.

6.3 Sample Storage

For samples requiring ice as a preservative, the samples will be bubble wrapped, bagged immediately after collection, stored in a sample cooler, packed on double bagged wet ice and accompanied with the proper chain-of-custody documentation. The samples will be kept cold (< 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area.

For samples that are stored at ambient air temperature, the samples (wipe, paint chip, debris, and air samples) will be placed in a baggie or shipping carton (i.e. cardboard box) and accompanied with the proper chain-of-custody documentation.

For all samples, custody seals may be present, but at minimum, the coolers must be taped shut with two to three straps of packing tape. All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured. The coolers must be delivered to the laboratory via hand or over-night delivery courier in accordance with all Federal, State and Local shipping regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

6.4 Shipping Considerations

6.4.1 Shipment/Delivery

Once the cooler is packed to prevent breaking of bottles, the proper chain-of-custody (COC) documentation is signed off, sealed in a plastic bag, and placed in the cooler.

All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations and Barr's SOP 'Domestic Transport of Samples to the Laboratory.

6.4.2 Transport/Delivery Options

Account for all samples before shipping and compare to the chain of custody (see Standard Operating Procedure for chain-of-custody record). Ship samples during times when the laboratory will be able to accept and quickly analyze them. Whenever possible, select mode of transport/delivery to ensure delivery to the laboratory will occur with ample EPA recommended holding time remaining for the specified analytical methods required for the samples. Avoid sending samples during holidays and weekends. All Federal, State and Local shipping regulations must be met.

Personal Delivery. The samples are delivered to the laboratory by the field technician(s). The chain-of-custody record is signed and dated by the laboratory representative.

Local Courier. The same procedures are followed as above; i.e., the chain-of-custody record is signed and dated and the top copy is sent with the samples. The cooler or box is then secured with packaging tape and a courier form is filled out for the designated laboratory. The cooler or box is then left in the services area for pickup.

Overnight Courier. Follow the procedures above, replacing the courier form with the overnight courier (examples Federal Express, United Parcel Service, Speedy Delivery) form. Date, project number, type of delivery desired, weight, and number of coolers or boxes should be included.

7.0 Quality Control and Quality Assurance (QA/QC)

Not Applicable

8.0 Records

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Chain-of-custody record

Chain-of-custody records are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual".

Other Barr SOP subjects referenced within this SOP: Standard Operating Procedure for chain-of-custody record

9.0 References

Barr Engineering Co. Most current version. *Quality Assurance Manual: Groundwater and Surface Water Sampling Procedures*

Minnesota Pollution Control Agency. January 1995. *Procedures for Ground Water Monitoring*

STANDARD OPERATING PROCEDURE

Field Screening Soil Samples

Revision 6

June 16, 2014

Approved By:	Dana Pasi	[signature]	6/16/14
	Print	QA Manager(s) Signature	Date
	KEVIN McGILP	[signature]	6/16/14
	Print	Field Technician(s) Signature	Date

Barr Engineering Company
4700 West 77th Street • Minneapolis, MN 55435-4803
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Review of the SOP has been performed
and the SOP still reflects current practice.

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Initials: ______________ Date: ______________

Standard Operating Procedure for
Field Screening Soil Samples

Purpose

To describe the procedure for properly screening soil or sediment samples in the field.

Applicability

This procedure applies to all field technicians responsible for field screening soil or sediment samples.

Definitions

PPE Personal protective equipment
PID Photoionization Detector
FID Flame Ionization Detector

Equipment

PPE (gloves, safety glasses)
Project Health and Safety Plan
Quart-sized-self-sealing Polyethylene bag
Photoionization detector (PID)
Flame ionization detector (FID)
Thermometer
Indelible ink pen or pencil
Stainless-steel spoon
Squirt bottle with tap water
Logbook
Alconox®
Brush

Responsibilities

The environmental technician(s) is responsible for the proper sample identification; field screening procedures; field equipment and calibration; quality control procedures and documentation.

Equipment Calibration

The PID or FID shall be calibrated or checked against a known concentration of a calibration gas standard prior to collection of field measurements. Calibration of the PID or FID shall follow the recommended procedures as described in the manufacturer's operation manual and as outlined below.

Regular calibration checks (bump tests) are expected to be performed by the field technician a minimum of once per day of use in the field. It is recommended that bump tests be conducted around mid-day and at the end of the day. More frequent bump testing may be completed if warranted by field conditions. The bump testing results should be recorded in the field log book or field log data sheets.

If problems occur during calibration, during bump tests, or if the unit will not stay calibrated, then the field technician should contact the equipment technician and project manager for assistance.

Procedure

The field screening techniques for soils are as follows: (1) visual examination; (2) odor; (3) headspace organic vapor screening; and (4) oil sheen. The results of these four screening procedures may be used to screen soil samples for possible contamination.

- **Visual Examination.** A visual examination of the soil sample will include noting any discoloration of the soil or visible oiliness or tar.

- **Odor.** The field technician will note odor only if noticed incidentally while handling the soil sample. Field technicians will not unduly expose themselves to sample odors. Odor will be described as trace, light, moderate, or strong, and appropriate description of the type of odor, if evident.

- **Headspace Organic Vapor Screening.** The polyethylene bag headspace method recommended by the Minnesota Pollution Control Agency will be used in the field to screen soils suspected to contain volatile organic compounds. The screening method is intended to be used in conjunction with other “real time” observations.

  The following equipment is required to conduct headspace organic vapor screening: photoionization or flame ionization detector (PID or FID), self-sealing quart-sized polyethylene bag, a log book or record sheet, and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the Project Health and Safety Plan (PHASP). The PID or FID shall be calibrated daily or more frequently if suspect data is obtained.

  The following procedure will be used for checking the calibration of the FID:

  FID calibration check is typically conducted using a two point calibration process with methane gas. Calibrate the instrument by analyzing the calibration gas at 100 ppm and 1,000 ppm. If instrument values exceed ± 5% from true value, then the FID needs to be recalibrated.

  Reference the Standard Operating procedure for the TVA1000B (FID) for further information.

  The following procedure will be used for checking the calibration of the PID:

  PID calibration check is conducted typically using isobutylene calibration gas at a concentration of 100 ppm. Analyze a sample of the calibration gas; evaluate result, if result exceeds ± 5% from true value, then the PID needs to be recalibrated.

Reference the Standard Operating procedure for the specific PID model for further information.

The following procedure will be used for conducting headspace organic vapor screening:

1. Soil samples collected from a split-barrel sampler or a direct-push (i.e., Geoprobe) sample liner will be collected immediately after opening the barrel or liner. If the sample is collected from an excavation wall, soil pile, or backhoe bucket, it will be collected from a freshly exposed surface.

2. Half-fill the bag with the sample to be analyzed using a stainless-steel spoon or a gloved hand and immediately seal it.

3. Agitate the bag for 15 seconds. Manually break up any soil clumps within the bag.

4. Allow headspace development for approximately 10 minutes. The sample should be kept in a shaded area out of direct sunlight. Ambient temperatures during headspace development should be recorded. When ambient temperatures are below 50°F, headspace development should be conducted inside a heated vehicle or building.

5. After completing the headspace development, agitate the bag for an additional 15 seconds.

6. Quickly puncture the bag with the sampling probe of the PID or FID at a point about one-half of the headspace depth. Exercise care to avoid uptake of water droplets or soil particles.

7. Record the highest PID or FID meter response as the headspace concentration. The maximum response will likely occur between 0 to 5 seconds.

8. When using a FID, it may be necessary to correct for methane. In this case, take a reading first with carbon filter, then without. This will require two duplicate bag samples. The second reading less the first is the headspace adjusted for methane. Adjusted readings less than zero are considered zero. Methane correction is not necessary if a PID is used.

- **Oil Sheen Test.** The oil sheen or hydrocarbon test is a method used to immediately determine the approximate magnitude of coal tar or petroleum contamination in soil by observation of the sample in the field. The test is useful in soils which do not have a high binding capacity with petroleum compounds or polyaromatic hydrocarbons (PAHs) (i.e., the petroleum compounds or PAHs are free on the surface of the soil particles and can be released by a stream of water).

  The equipment required to conduct the oil sheen test includes: a stainless-steel spoon, a squirt bottle filled with tap water, a log book or field log data sheet, and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the Project Health and Safety Plan. Decontamination of the spoon between test events will consist of scrubbing the surface of the spoon with a solution of Alconox™ in water using a brush and then rinsing the spoon with water.

The procedure for conducting the oil sheen test consists of obtaining approximately 50 grams (about 30 cc) of representative soil with the spoon and then directing a stream of water onto the soil in the spoon with the squirt bottle until the soil is saturated and water begins to collect around the soil. The amount of oil sheen present on the water is determined by observation and the results of the test are reported as a magnitude of oil sheen observed: none, trace, light, moderate, heavy or rainbow. The test results, sample location, and observations of the sample's appearance and odor are recorded in the log book or field log data sheet.

The specific soil types at the area of investigation should be accounted for when performing the oil sheen test. The best results are obtained in silts, sands, and/or gravels with low organic content. The results obtained from clay soils may appear deceptively low. Typical descriptions of each test result are given below.

Oil Sheen Test Result	Description
None	No sheen detected.
Trace	Possible or faint oil sheen observed (may not continue to generate sheen as additional water is added).
Light	Obvious sheen that may not cover entire water surface
Moderate	Definite oil sheen that covers entire surface, but "rainbow colors" not distinguishable.
Heavy	Definite oil film or product that does not display rainbow colors.
Rainbow	Definite oil sheen, film or product that displays rainbow colors.

Interferences

Interferences on the test can be caused by any contaminant that can cause an oil sheen on water. The samples will be carefully observed for characteristic appearance or odors which may indicate a possible contaminant other than coal tar or petroleum substances. Sunlight and low temperatures may interfere with headspace development. Water and soil particles may interfere with PID and FID measurements.

Documentation

The field technician(s) will document the soil sampling and field screening activities and measurement in a project dedicated field logbook or on field log data sheets.

Attachments

Attachment 1: Field Sampling Report
Attachment 2: Field Log Data Sheet

Attachment 1
Field Sampling Report

BARR

FIELD SAMPLING REPORT

Date:

Project:

Contact:

Barr Engineering Company
4700 W. 77th Street
Minneapolis, MN 55435-4803

Field Sampling

Field Report

Attachments:

-
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Laboratory Analysis Status

____
<Name inserts here>
Environmental Technician

Document1

Barr Engineering Company · 4700 W. 77th Street · Minneapolis, MN 55435-4803 · 952/832-2600

Attachment 2
Field Log Data Sheet

Barr Engineering Company
Field Log Data Sheet
Soil Samples

Client:
Location:
Project #:
Project Name:

Sample Identification	Collection		Matrix			Type			Number of Containers/ Analysis															
	Date	Time	Soil	Sludge		Grab	Comp.	QC	2 oz. Pres.	2 oz. Unpres.	4 oz. Unpres.	8 oz. Unpres.	Moisture-plastic vial etc.	Other:	SVOC	PAH	VOC	WIGRO	WIDRO	PCB	RCRA Metals	Moisture	Other:	Other:
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STANDARD OPERATING PROCEDURE

Maintenance and Operation of the YSI Model 556 MPS Water Quality Monitoring System

Revision 6

September 4, 2014

Approved By:

Print	QA Manager(s) Signature	Date
Dana Pasi		9/04/2014

Print	Field Technician(s) Signature	Date
Kevin McGilp		9/04/2014

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Review of the SOP has been performed
and the SOP still reflects current practice.

Initials: ______________	Date: ______________
Initials: ______________	Date: ______________
Initials: ______________	Date: ______________
Initials: ______________	Date: ______________
Initials: ______________	Date: ______________

Standard Operating Procedures for the Maintenance and Operation of the YSI Model 556 MPS Water Quality Monitoring System

Purpose

The purpose of this SOP is to clearly define the procedures required to accurately measure dissolved oxygen, conductivity, temperature, pH and oxidation reduction potential (ORP) in the field using the YSI Model 556 MPS water quality system.

Applicability

This procedure is applicable to field technician who will be using the YSI Model 556 MPS to measure dissolved oxygen, conductivity, temperature, pH and ORP in the field.

Definitions

ORP Oxidation Reduction Potential
MPS Multi-Probe System

Equipment

YSI Model 556 MPS
O-ring lubricant
Four alkaline "C" batteries
Mild soap
Water
ChemWipes
Screwdrivers
Conductivity standard
pH buffer solution (pH 7.00 and 10.00)
ORP solution (Zobell)
Zobell solution value chart
Moist sponge
Calibration cup
Field Log Data Sheet

References

YSI Model 556 MPS water quality system Operations Manual

Website: www.ysi.com/productsdetail.php?556MPS-21

Responsibilities

The field technician(s) is responsible for the proper sample identification; field screening procedures; field equipment and calibration; quality control procedures and documentation.

Equipment Calibration

The equipment YSI 556 MPS will undergo calibration checks, at a minimum, before and after sampling. In some instances, a mid-day calibration check may be warranted. The calibration check will be documented in a calibration form (as appropriate) and/or in the field notes. Any significant issues found during the calibration check will be noted in the field notes and the equipment technician(s) will be notified. If calibration check values fall outside of the calibration check accuracy acceptance limits in the following table, the YSI 556 MPS should be recalibrated as described in the Calibration section of this SOP.

Sensor	Calibration Solution Value	Calibration Check Acceptance Limits
Dissolved Oxygen (%)	Assumed 100% air saturation based on barometric pressure and/or stabilized reading at time of calibration	± 0.5 mg/L of saturated value
Dissolved Oxygen (mg/L)	Solution of known value (0-20 mg/L)	± 0.5 mg/L of saturated value
Conductivity (mS/cm)	1.409	± 10% of standard or 20 uS/cm, whichever is greater
pH (Standard Units)	4.00 (if used)	± 0.3 Standard Units
pH (Standard Units)	7.00	± 0.3 Standard Units
pH (Standard Units)	10.00 (if used)	± 0.3 Standard Units
ORP (mV)	Zobell Solution (231.0 mV @ 25^{o} C	± 10 mV for temperature based calculation

Instrument

The YSI 556 MPS (Multi-Probe System) is an easy-to-use hand-held unit. It includes a waterproof, impact-resistant case and it simultaneously measures dissolved oxygen, conductivity, temperature, pH and ORP.

Analysis	Conductivity	Salinity	Oxidation Reduction Potential	pH	Dissolved Oxygen
Analytical Method	Standard Method 2510	Standard Method 2520A	Standard Method 2580A	Standard Method 4500-H B	Standard Method 4500-O G

Maintenance/Installation

1. Instrument

The 556 requires occasional battery replacement and cleaning. Four alkaline “C” cells in the 556 provide approximately180 hours of operation. Battery life is displayed on the keypad and the batteries should be changed when it is low.

a. Loosen the four screws in the battery lid on the back of the instrument.
b. Insert four “C” batteries in the clips following the polarity labels on the bottom of the battery compartment.
c. Check the gasket for proper placement and place the lid.
d. Do not over tighten the screws.
e. Clean the display pad with a mild soap and water solution.
f. Wipe the solution on and off.
g. Follow with a clean water wipe.

2. The Probe Module

To prepare the probe module for calibration and operation, the sensors need to be installed into the connectors on the probe module bulkhead. Whenever you install, remove or replace a sensor, it is important that the probe module and all the sensors be dry. This will prevent water from entering the port.

a. Unscrew and remove the probe sensor guard.
b. Using the sensor installation tool, unscrew and remove the sensor port plugs.
c. Locate the port with the connector that corresponds to the sensor that is to be installed.
d. Apply a thin coat of o-ring lubricant to the o-rings on the connector-side of the sensor.
e. Be sure that the probe module sensor port is free of moisture and insert the sensor into the correct port.
f. Gently rotate the sensor until the two connectors align.
g. With connectors aligned, screw down the sensor nut using the installation tool.
h. Repeat these steps for all sensors.

3. Instrument/Cable Connection

a. Line up the pins and guides on the cable with the holes and indentations on the cable connector at the bottom of the 556 instrument.
b. Holding the cable firmly against the cable connector, turn the locking mechanism clockwise until it snaps into place.

Calibration

All of the sensors, except temperature, require daily calibration to assure high performance. The specific calibration procedures for all sensors that require calibration are noted below. Make sure that the sensors are completely submersed when calibration values are entered. For maximum accuracy, use a small amount of calibration solution to pre-rinse the probe module. Have room temperature water on hand to rinse the probes between calibration solutions. Make sure to dry the probe module between rinses and calibration solutions. Be sure that port plugs are installed in all ports where sensors are not installed.

To access the calibration screen:

a. Press the on/off key to display the run screen.
b. Press the escape key to display the main menu screen.
c. Use the arrow keys to highlight the calibrate selection.
d. Press the enter key and the calibration screen is displayed.

1. Conductivity Calibration

a. Go to the calibrate screen as described above.
b. Use the arrow key to highlight the conductivity selection.
c. Press enter. The conductivity calibration screen is displayed.
d. Select the specific conductance selection. Press enter.
e. Place the correct volume of conductivity standard into a clean calibration cup.

f. Carefully immerse the sensor end of the probe module into the solution. The sensor must be completely immersed past its vent hole.
g. Gently move the probe up and down to remove any bubbles from the cell.
h. Use the keypad to enter the calibration value of the standard you are using. Be sure to enter the value in ms/cm@25ºC.
i. Press enter; the conductivity calibration screen is displayed. Allow at least one minute for temperature equilibration before proceeding. The current values for all enabled sensors will appear on the screen.
j. Observe the reading under specific conductance. When the reading shows no significant change for 30 seconds, press enter. The screen will indicate that the calibration has been accepted and prompt you to press enter. This returns you to the conductivity calibrate selection screen.
k. Press escape to return to the calibrate menu.
l. Rinse the probe module and dry.

2. Dissolved Oxygen Calibration

[Note: The instrument must be on for at least 20 minutes to polarize the DO sensor before calibrating. Calibrating any one option (% or µg/L) automatically calibrates the other.]

a. Go to the calibrate screen.
b. Use the arrow keys to highlight the dissolved oxygen selection. Press enter. The dissolved oxygen calibration screen is displayed.
c. Use the arrow keys to highlight the DO% selection. Press enter. The DO barometric pressure entry screen is displayed.
d. Place ⅛ inch of water in the bottom of the calibration cup and screw it on the probe module (only engage one or two threads to ensure the DO sensor is vented to the atmosphere).
e. Use the keypad to enter the current local barometric pressure. (If the unit has the optional barometer, no entry is required.)
f. Press enter and the DO% saturation calibrating screen is displayed. Allow 10 minutes for the air in the calibration cup to become water-saturated and for the temperature to equilibrate before proceeding.
g. Observe the reading under DO%. When the reading shows no significant change for 30 seconds, press enter. The screen will indicate that the calibration has been accepted and prompt you to press enter again. This will return you to the DO calibration screen.
h. Press escape to return to the calibrate menu.
i. Rinse the probe and dry.

Note: A moist sponge should be kept with the probe sensor guard to prevent the dissolved oxygen membrane from drying out.

3. pH Calibration

a. Go to the calibrate screen and select the pH selection.
b. Press enter, and the pH calibration screen is displayed.
c. Select the two-point option. Press enter. The pH entry screen is displayed.
d. Place the correct amount of pH buffer into a clean calibration cup. (Note: for maximum accuracy, the pH buffers you choose should be within the same pH range as the water you are sampling.)

e. Carefully immerse the sensor end of the probe module into the solution.
f. Gently rotate the probe up and down to remove any air bubbles.
g. Use the keypad to enter the calibration value of the buffer you are using. Press enter. The pH calibration screen is displayed.
h. Allow one minute for temperature equilibrium before proceeding. The current values of all enabled sensors will appear on the screen.
i. Observe the reading under pH. When the reading shows no significant change for 30 seconds, press enter. The screen will indicate the calibration has been accepted and prompt you to press enter again to continue.
j. Press enter. This returns you to the specified pH calibration screen.
k. Rinse the probe modules, calibration cup and sensors, and dry.
l. Repeat the above steps using the second pH buffer.
m. Press enter. This returns you to the pH calibration screen.
n. Press escape to return to the calibrate screen.
o. Rinse the probe and dry.

4. ORP Calibration

a. Go to the calibrate screen and use the arrows to highlight the ORP selection.
b. Press enter. The calibration screen is displayed.
c. Place the correct amount of a known ORP solution (Zobell) into a clean calibration cup. (Note: before proceeding, make sure the sensor is dry and, ideally, rinse it with ORP solution.)
d. Carefully immerse the sensor end of the probe up and down to remove any air bubbles.
e. Use the keypad to enter the correct value of the calibration solution you are using at the current temperature. Refer to the Zobell solution value chart.
f. Press enter. The ORP calibration screen is displayed.
g. Allow at least one minute for temperature equilibration before proceeding.
h. Observe the reading under ORP.
i. When the reading shows no significant change for 30 seconds, press enter. The screen will indicate that the calibration has been accepted and prompt you to press enter again to continue.
j. Rinse the probe and dry. The meter is now calibrated and ready for use.

If any calibrations fail, contact the Equipment Technician or manufacturer immediately or obtain a replacement instrument.

Quality Control Samples

Replicate sample measurements should be taken at a minimum of one of twenty project samples per type of measurement.

Safety

Please refer to the proper MSDS sheets or the Project Health and Safety Plan to determine the proper PPE required for use with the calibration solutions and reagents listed in this SOP prior to working with these chemicals.

Interferences

Rinse the probe sensor between instrument readings with water and dab dry to ensure accurate results.

Disposal

All waste generated by this process will be disposed of in accordance with Federal, State and Local regulations. Staff is encouraged to minimize the amount of waste generated during sample collection.

Documentation

The field technician will document the YSI Model 556 MPS dissolved oxygen, conductivity, temperature, pH and ORP data on the Field Log Data Sheet.

Attachments

Attachment 1: Field Sampling Report
Attachment 2: Field Log Cover Sheet
Attachment 3: Field Log Data Sheet
Attachment 4: Meter Calibration Summary Form

Attachment 1
Field Sampling Report

BARR

FIELD SAMPLING REPORT

Date:

Project:

Contact:
Barr Engineering Company
4700 W. 77th Street
Minneapolis, MN 55435-4803

Field Sampling

Field Report

Attachments:

-
-
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Laboratory Analysis Status

____
<Name inserts here>
Environmental Technician

Document1

Barr Engineering Company · 4700 W. 77th Street · Minneapolis, MN 55435-4803 · 952/832-2600

Attachment 2
Field Log Cover Sheet

BARR

FIELD LOG COVER SHEET
WATER SAMPLING

Client: **Project No.:**

Technician: **Sampling Period:**

Date	Temperature	Wind Speed	Wind Direction	Cloud Cover

Summary of Field Activities

Document1

Barr Engineering Company ` 4700 W. 77th Street ` Minneapolis, MN 55435-4803 ` 952/832-2600

Attachment 3
Field Log Data Sheet

BARR

Barr Engineering Company
Field Log Data Sheet

Client:	**Monitoring Point:**
Location:	**Date:**
Project #:	**Sample Time:**

GENERAL DATA		**STABILIZATION TEST**						
Barr lock:		Time/ Volume	Temp. °C	Cond. @ 25	pH	Eh	D.O.	Turbidity Appearance
Casing diameter:								
Total well depth:*								
Static water level:*								
Water depth:*								
Well volume: (gal)								
Purge method:								
Sample method:								

Start time:		Odor:
Stop time:		Purge Appearance:
Duration: (minutes)		Sample Appearance:
Rate, gpm:		Comments:
Volume, purged:		
Duplicate collected?		
Sample collection by:		CO2- Mn2- Fe(T)- Fe2-

Others present:

WELL INSPECTION (answer for each category, state if lock replaced, detail any repairs needed on back of form)

CASING & CAP: COLLAR: LOCK: OTHER:

MW: groundwater monitoring well WS: water supply well SW: surface water SE: sediment other:

VOC- semi-volatile- general- nutrient- cyanide- DRO- Sulfide-

oil,grease- bacteria- total metal- filtered metal- methane- filter-

Others:

*Measurements are referenced from top of riser pipe, unless otherwise indicated.

S:\DM\Templates\FieldLogDataSheet.doc

Attachment 4
Meter Calibration Summary Form

MCS-1

BARR ENGINEERING COMPANY
METER CALIBRATION SUMMARY

PROJECT ____________________

TECHNICIAN ____________________

Meter type and number	Date	Time	Temperature C	Standard Used	Meter Reading	Slope	Conductivity Redline
Conductivity	Date	Solution Used	Cell Result				
Cell Check							
ORP Probe	Date	Temp.	ORP Reading	Calculation Result			
Check							
231+,- 10mV @ 25C							
231mV = Display Value + [(Display Temp. - 25 C) x (1.3 mV)]							

WEATHER CONDITIONS

Date	Wind Direction	Wind Speed	Temperature F	Cloud Cover	Comments

Comments: ____

BARR

Standard Operating Procedure

Sampling and Disposal of Investigative Derived Waste

Revision 5

November 30, 2015

Approved By:

Kevin McGilp	[signature]	11/30/15
Print	Technical Reviewer Signature	Date
Terri Olson	[signature]	11/30/15
Print	QA Manager Signature	Date

Review of the SOP has been performed and the SOP still reflects current practice.

Initials:		Date:	
Initials:		Date:	
Initials:		Date:	
Initials:		Date:	

Sampling and Disposal of Investigative Derived Waste

1.0 Scope and Applicability

The purpose of this Standard Operating Procedure (SOP) is to define the procedures for the sampling and disposal of investigative derived waste (IDW) generated during field investigation activities. This procedure is applicable to sampling IDW which are materials containing pollutants derived during investigation activities including drill cuttings, drilling fluids, cleaning liquids, waste water, DNAPL, soil and rock samples, protective clothing and equipment, or any other items or materials which are exposed to, or may contain pollutants that must be characterized for off-site disposal.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 Limitations

- IDW can be contaminated with various hazardous substances, characterization may be necessary.

3.0 Responsibilities

The Barr Project Manager is responsible for determining whether any solid or liquid-phase product needs to be containerized and characterized for off-site disposal.

Experienced Field Technicians are responsible for the proper sample identification, collection and management of samples, documentation and sample transport to the laboratory.

The role of the Project Health and Safety Team Leader is to oversee all aspects of on-site safety activities.

Project staff are responsible for ordering sample containers prior to the sampling event.

4.0 Safety

Barr staff is responsible for conducting all aspects of the job safely. When applicable, refer to the appropriate Project Health and Safety Plan (PHASP) to understand the hazards associated with suspected contamination, symptoms of exposure, methods to minimize exposure, personal protection equipment (PPE), and personal air monitoring required when using this SOP. Minimum protection of two pair of chemical resistant gloves (e.g., nitrile) and safety glasses with side shields should be worn to prevent sample contact with the skin and eyes. When sampling material contaminated with corrosive materials, emergency eye flushing facilities should be available.

Some of the sample containers may require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

5.0 Equipment, Reagents, and Supplies

- Applicable sampling equipment
- Weatherproof container labels
- Plastic garbage bags
- IDW containers
- Permanent markers
- Plastic covering

6.0 Procedure

The Barr Project Manager is responsible for determining if IDW can be left on-site or if it must be disposed of off-site. Two general objectives that will be considered when managing IDW are the minimization of IDW generation and managing the IDW consistent with the final remedy for the site. The extent to which the objectives can be met is dependent on the site-specific circumstances.

Any IDW that is required to be containerized will be containerized separately by media until laboratory data are received to determine the appropriate disposition of the materials. Containerization and disposal of personal protective equipment and/or other materials, if necessary, will be determined on a project by project basis and discussed in the project Sampling and Analysis Plan (SAP).

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Sampling

Representative samples will be collected, and/or composited, preserved, and handled following Barr's matrix specific sampling SOP. Sampling equipment will be cleaned following Barr's 'Decontamination of Sampling Equipment' SOP.

The samples must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations and Barr's 'Domestic Transport of Samples to the Laboratory' SOP.

6.3 Data Reduction/Calculations

Data reduction or calculations are not applicable to this SOP.

6.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

QA/QC samples are defined in Barr's SOP 'Collection of Quality Control Samples'. The sampling frequency should be performed as written in the project scope of work and/or documentation (e.g., Work Plan, SAP, or Quality Assurance Project Plan).

7.2 Measurement Criteria

Measurement criteria are not applicable to this SOP.

8.0 Records

The field technician will document the IDW sampling event on the field log data sheet and/or field notebook. They will also document the type and number of bottles on the chain-of-custody record, as appropriate. The analysis for each container and the laboratory used will be documented on the chain-of-custody record. Refer to Barr's SOP 'Documentation on a Chain-of-Custody (COC)' for further information.

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation is listed in the SOPs referenced in this procedure.

The field documents and COCs are provided to a Barr Data Management Administrator for storage on the internal Barr network.

Additional records information can be found in Barr's "Records Management System Manual".

Other Barr SOP subjects referenced within this SOP: collection of samples, collection of QC samples, decontamination of sampling equipment, domestic transport of samples, and documentation on a COC.

9.0 References

Environmental Protection Agency, 9345.3-03FS. January 1992. *Guide to Management of Investigation-Derived Wastes*

Compendium

Of

Field Documentation

Chain of Custody Form

Barr Engineering Co. Chain of Custody

☐ Ann Arbor ☐ Duluth ☐ Jefferson City
☐ Bismarck ☐ Hibbing ☐ Minneapolis

Sample Origination State:
☐ KS ☐ MO ☐ WI
☐ MI ☐ ND Other: ______
☐ MN ☐ SD

REPORT TO	INVOICE TO
Company:	Company:
Address:	Address:
Name:	Name:
email:	email:
Copy to: datamgt@barr.com	P.O.
Project Name:	Barr Project No:

COC Number:

COC ______ of ______

Location	Sample Depth Start	Sample Depth Stop	Sample Depth Unit (m./ft. or in.)	Collection Date (mm/dd/yyyy)	Collection Time (hh:mm)	Matrix Code	Perform MS/MSD Y / N	Total Number Of Containers	Analysis Requested: Water						Analysis Requested: Soil					% Solids	
																					Preservative Code
																					Field Filtered Y/N
1.																					
2.																					
3.																					
4.																					
5.																					
6.																					
7.																					
8.																					
9.																					
10.																					

Matrix Code:	Preservative Code:
GW = Groundwater	A = None
SW = Surface Water	B = HCl
WW = Waste Water	C = HNO_3
DW = Drinking Water	D = H_2SO_4
S = Soil/Solid	E = NaOH
SD = Sediment	F = MeOH
O = Other	G = $NaHSO_4$
	H = $Na_2S_2O_3$
	I = Ascorbic Acid
	J = NH_4Cl
	K = Zn Acetate
	O = Other

BARR USE ONLY								
Sampled by:	Relinquished by:	On Ice? Y N	Date	Time	Received by:		Date	Time
Barr Proj. Manager:	Relinquished by:	On Ice? Y N	Date	Time	Received by:		Date	Time
Barr DQ Manager:	Samples Shipped VIA: ☐ Courier ☐ Federal Express ☐ Sampler ☐ Other: ______				Air Bill Number:	Requested Due Date: ☐ Standard Turn Around Time ☐ Rush ______ (mm/dd/yyyy)		
Lab Name:								
Lab Location:	Lab WO:	Temperature on Receipt (°C):			Custody Seal Intact? ☐Y ☐N ☐None			

Distribution - White-Original: Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Pink Copy:** Send to Data Management Administrators.

HR\LGSTD FORMS\Chain Of Custody Form 2015 RLG Rev. 06/14/15

Chain of Custody Form – Air Canisters

Chain of Custody for Air Canisters

☐ Ann Arbor ☐ Bismarck ☐ Duluth ☐ Hibbing ☐ Jefferson City ☐ Minneapolis

Sample Origination State: ☐ KS ☐ MI ☐ MN ☐ MO ☐ ND ☐ SD ☐ WI Other: ______

Analysis Requested: ☐ TO-14 ☐ TO-15 ☐ TO-15SIM ☐ 3C ☐ Other

COC Number:

COC ______ of ______

REPORT TO	INVOICE TO
Company:	Company:
Address:	Address:
Name:	Name:
email:	email:
Copy to: datamgt@barr.com	P.O.
Project Name:	Barr Project No:

Lab Deliverable Contents:
(check all that apply)

☐ Sample Data with QC
☐ TIC Library Search
☐ Sample Chromatograms
☐ Individual Canister Certification Data

EDD:
☐ EQuIS ☐ EQuIS-LITE
☐ TIC results in EDD
Other: ______

Matrix Code:
AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other: ______

Location	Canister		Flow Controller Serial #	Vacuum		Collection Date (mm/dd/yyyy)	Collection Time		Total Time	Matrix Code	PID Reading (ppm/ppb)	Sample Comments
	Serial #	Size		Initial	Final		Start (hh:mm)	Stop (hh:mm)				
1.												
2.												
3.												
4.												
5.												
6.												
7.												
8.												
9.												
10.												

BARR USE ONLY						
Sampled by:	Relinquished by:	Date	Time	Received by:	Date	Time
Barr Proj. Manager:	Relinquished by:	Date	Time	Received by:	Date	Time
Barr DQ Manager:	Samples Shipped VIA: ☐ Courier ☐ Federal Express ☐ Sampler ☐ Other: ______			Air Bill Number:		
Lab Name:						
Lab Location:	Lab WO:	Custody Seal Intact ? ☐ Y ☐ N ☐ None				

Requested Due Date:
☐ Standard Turn Around Time
☐ Rush ______ (mm/dd/yyyy)

Distribution - White-Original: Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Pink Copy:** Send to Data Management Administrators.

H:\RLGSTD FORMS\Chain Of Custody for Air Canisters Form 2015 RLG Rev 04/06/15

Meter Calibration Summary Form

Barr Engineering Company
Meter Calibration Summary

Project ____

Technician ____

Meter type and number	Date	Time	Temperature C	Standard Used	Meter Reading	Slope	Conductivity Redline
Conductivity	**Date**	**Solution Used**	**Cell Result**				
Cell Check							
ORP Probe	**Date**	**Temp.**	**ORP Reading**	**Calculation Result**			
Check							
231+,-10mV @25C							
231mV = Display Value + [Display Temp.-25 C) x (1.3 mV)]							

Weather Conditions

Date	Wind Direction	Wind Speed	Temperature F	Cloud Cover	Comments

Comments: ____

____

____

____

W:\Business Units\AR\Subunit Admin\Practice Groups\Data Quality\Field Forms and Documents\Meter Calibration Summary

Troll Checklist / Data Sheet

BARR

Barr Engineering Company
Troll Checklist / Data Sheet

Client:	Monitoring Point:
Location:	Troll Serial Number:
Project #:	Date:

- **Memory Status (approximate):**
- **Battery Status (approximate):**
- **Test Running?:**
- **Time Downloaded:**

Water Level Measurements:			
Time	**Water Level Measured by Hand**	**Troll Water Level Reading**	**Difference in Measurements***

*consider restarting test with a new reference if difference between measurements is >0.15 feet

- **Troll Removed?** circle one: **Yes** **No**

  Complete the following if Troll was removed

  Time removed:

  Time reinstalled:

Post Reinstallation Water Level Measurements:			
Time	**Water Level Measured by Hand**	**Troll Water Level Reading**	**Difference in Measurements**

- **For Troll 9500 only**
  - **Calibrated?**

Water Level Data Sheet

WATER LEVEL DATA SHEET

Project: ____________________

Project Number: ____________________

Environmental Staff: ____________________ Date: ____________

Monitoring Location	Measuring Point Elevation	Water Level Depth	Total Well Depth	Static Water Elevation	Comments

BARR

Field Log Data Sheet

Client:	**Monitoring Point:**
Location:	**Date:**
Project #:	**Sample time:**

GENERAL DATA		**STABILIZATION TEST**						
Barr lock:		Time/ Volume	Temp. ºC	Cond. @ 25	PH	ORP mV	D.O.	Turbidity NTU (not appearance)
Casing diameter:								
Total well depth:*		NA						
Static well level:*								
Water depth:*								
Well volume: (gal)								
Purge method:								
Sample method:								
Start time:		Odor:						
Stop time:		Purge Appearance:						
Duration: (minutes)		Sample Appearance:						
Rate, gpm:		Comments:						
Volume purged:								
Duplicate collected:								
Sample collection by:								

Others present:	Well condition:

MW: groundwater monitoring well	WS: water supply well	SW: surface water	SE: sediment	Other: sump		
VOC	Semi-volatile	General	Nutrient	Cyanide	DRO	Sulfide
Oil, grease	Bacteria	Total Metal	Filtered Metal	Methane	Filter	
Others:						

* Measurements are referenced from the top of riser pipe, unless otherwise indicated.

BARR

Barr Engineering Company
Field Log Data Sheet
Soil Samples

Client:

Location:

Project #:

Project Name:

Sample Identification	Collection		Matrix			Type			Number of Containers/ Analysis															
	Date	Time	Soil	Sludge		Grab	Comp.	QC	2 oz. Pres.	2 oz. Unpres.	4 oz. Unpres.	8 oz. Unpres.	Moisture-plastic vial etc.	Other:	SVOC	PAH	VOC	WIGRO	WIDRO	PCB	RCRA Metals	Moisture	Other:	Other:
1.																								
2.																								
3.																								
4.																								
5.																								
6.																								
7.																								
8.																								
9.																								
10.																								
11.																								
12.																								
13.																								
14.																								
15.																								
16.																								
17.																								
18																								
19.																								
20.																								

Recovery Rate Test Form

Recovery Rate Test

Project:________________________________Sampled by: _________________________

Date: ____

Well Number: ____

Water Level Before Evacuation (0.01 Ft.): ____________________________________

____

Time Well Was Evacuated: ___________________ Sample Time: _____________

Time from Evacuation (min.)	Water Level (0.01 ft.)	Time from Evacuation	Water Level (0.01 ft.)
:00			
:30			
1:00			
1:30			
2:00			
2:30			
3:00			
3:30			
4:00			
4:30			
5:00			
6:00			
7:00			
8:00			
9:00			
10:00			
11:00			
12:00			
13:00			
14:00			
15:00			

Field Sampling Quality Control Check List
(Sub-slab Soil Vapor)

Project: ____

Sample Unique ID #: ____

☐ Sub-slab soil vapor monitoring point purging was completed. Volume purged:______________

☐ Vacuum based leak testing was performed. Vacuum:________ Duration:_________

☐ Water based leak testing was performed (if Vapor Pin™ was used).

☐ Initial summa canister vacuum was greater than 25 in. of Hg. Initial vacuum:_______

☐ PID screening was performed. Reading:___________ Background: ______________

☐ Sample information was added to the chain of custody form.

Chain of Custody Form #: ___________

☐ Sample collection information added to summa canister tag

☐ Photo of monitoring point location taken before and after installation

BARR

FIELD LOG COVER SHEET
WATER SAMPLING

Client: **Project No.:**

Technician: **Sampling Period:**

Date	Temperature	Wind Speed	Wind Direction	Cloud Cover

Summary of Field Activities

Document1

Field Sampling Report

BARR

FIELD SAMPLING REPORT

Date:

Project:

Contact:

Barr Engineering Company
4700 W. 77th Street
Minneapolis, MN 55435-4803

Field Sampling

Field Report

Attachments:

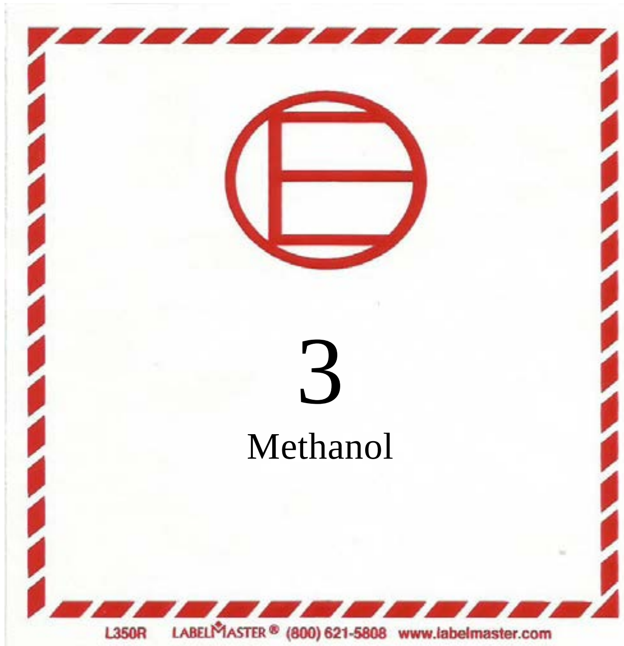
-
-
-
-
-
-
-

Laboratory Analysis Status

____
<Name inserts here>
Environmental Technician

Document1

Dangerous Goods in Excepted Quantities Label Examples



Courier Form Example

FedEx Express US Airbill

FedEx Tracking Number 8549 4339 7651

Form ID No. 0200 Sender's Copy

1 From *Please print and press hard.*

Date ______ Sender's FedEx Account Number ______

Sender's Name ______ Phone ( )

Company ______

Address ______ Dept./Floor/Suite/Room

City ______ State ______ ZIP ______

2 Your Internal Billing Reference OPTIONAL

First 24 characters will appear on invoice.

3 To

Recipient's Name ______ Phone ( )

Company ______

Recipient's Address ______

We cannot deliver to P.O. boxes or P.O. ZIP codes. Dept./Floor/Suite/Room

Address ______

To request a package be held at a specific FedEx location, print FedEx address here.

City ______ State ______ ZIP ______

Try online shipping at fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and in the current FedEx Service Guide, including terms that limit our liability.

Questions? Go to our Web site at fedex.com

or call 1.800.GoFedEx 1.800.463.3339.

4a Express Package Service To add SATURDAY Delivery, see Section 6. *Packages up to 150 lbs.* * To most locations.

- [ ] FedEx Priority Overnight — Next business morning.*
- [ ] FedEx Standard Overnight — Next business afternoon.*
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations.*
- [ ] FedEx 2Day — Second business day.*
- [ ] FedEx Express Saver — Third business day.*

FedEx Envelope rate not available. Minimum charge: One-pound rate.

4b Express Freight Service To add SATURDAY Delivery, see Section 6. *Packages over 150 lbs.* ** To most locations.

- [ ] FedEx 1Day Freight* — Next business day.**
- [ ] FedEx 2Day Freight — Second business day.**
- [ ] FedEx 3Day Freight — Third business day.**

* Call for Confirmation: ______

5 Packaging * Declared value limit $500.

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak.
- [ ] FedEx Box
- [ ] FedEx Tube
- [ ] Other

6 Special Handling Include FedEx address in Section 3.

- [ ] **SATURDAY Delivery Available ONLY for** FedEx Priority Overnight, FedEx 2Day, FedEx 1Day Freight, and FedEx 2Day Freight to select ZIP codes.
- [ ] **HOLD Weekday** at FedEx Location **NOT Available for** FedEx First Overnight.
- [ ] **HOLD Saturday** at FedEx Location **Available ONLY for** FedEx Priority Overnight and FedEx 2Day to select locations.

Does this shipment contain dangerous goods? One box must be checked.

- [ ] No
- [ ] Yes — As per attached Shipper's Declaration.
- [ ] Yes — Shipper's Declaration not required.
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ______ x ______ kg
- [ ] Cargo Aircraft Only

Dangerous goods (including dry ice) cannot be shipped in FedEx packaging.

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below.

- [ ] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. ______ Exp. Date ______

Total Packages	Total Weight	Total Declared Value†	
		$ .00	FedEx Use Only

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 *NEW* Residential Delivery Signature Options If you require a signature, check Direct or Indirect.

- [ ] No Signature Required — Package may be left without obtaining a signature for delivery.
- [ ] Direct Signature — Anyone at recipient's address may sign for delivery. *Fee applies.*
- [ ] Indirect Signature — If no one is available at recipient's address, anyone at a neighboring address may sign for delivery. *Fee applies.*

520

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RETAIN THIS COPY FOR YOUR RECORDS.

Sample Label Examples

ANALYSIS ______________________

SAMPLE I. D. ____________________

PRESERVATIVE DATE

Sample Site: ____

Station: ____

Depth: ____

Collection Date: ________________ Time: ____________________

Collected by: ___________

Project #: ____

BARR

Custody Seal Example

Soil Sampling Guidelines

Some of the analyses below require the use of preservatives. Consult the applicable Safety Data Sheet to review hazards and appropriate PPE to minimize exposure.

Sampling Order	Analysis	Container	Preservative / Amount	Weight of Sample (g)	Holding Time
1	VOC	Glass jar or vial w/PTFE-lined lid, pre-weighed by laboratory	Cool, ≤ 6 °C, 1:1 w/chemical preservation (e.g., methanol, sodium bisulfate)	5, 10, 25	14 days
		En Core®	Freeze or extrude into chemical preservative	Depends on sampler size	48 hours
2	TCLP VOC	4 oz. glass jar w/PTFE-lined lid	NA	Full, no headspace	14 days
3	WI GRO/PVOC	Glass jar or vial w/PTFE-lined lid,	Cool, ≤ 6 °C, 1:1 w/methanol	5, 10, 25	21 days
4	WI DRO	2 or 4 oz. jar w/PTFE-lined lid, pre-weighed by laboratory	Cool, ≤ 6 °C	25 – 35 g*	10 days
5	TPH as Jet Fuel, Fuel Oil, Motor Oil (etc.)	2 or 4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	14 days
6	SVOC/PAH, Pesticides, Herbicides	2 or 4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	14 days
7	TCLP SVOC, TCLP Pesticides. TCLP Herbicides	4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	14 days
8	PCB	2 or 4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	None
9	Metals / Mercury	2 or 4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	6 months (mercury 28 days)
10	TCLP Metals / TCLP Mercury	4 oz. jar w/PTFE-lined lid	Cool, ≤ 6 °C	Full, no headspace	6 months (mercury 28 days)
11	General Chemistry	2 or 4 oz. jar w/PTFE-lined lid	NA	Full, no headspace	Various depending on analysis

* = For best data quality results, do not use less than 25 grams/sample.

Note: Hold times are from initial sampling event to first analytical process. The times stated above do not reflect hold times extended due to extraction or other preparatory methods.

Note: Container types and sizes listed are for guidance only. Refer to your specific regulatory agency sampling protocols. Laboratories may use different containers or combine analyses into larger volume containers.

Water Sampling Guidelines

Safety Considerations: Acids and bases are used for some of the preservatives - use appropriate PPE when sampling, Minimum protection of gloves and safety glasses should be worn to prevent sample contact with the skin and eyes.

Sampling Order	Parameter Group	Container Type, Size, and Number	Preservation	Sampling Instructions	Holding Time
1	VOCs, WI GRO, TPH as Gasoline	3-40 mL VOA glass vials, Teflon septum cap	HCl, pH < 2, Zero Headspace; Cool, ≤ 6 °C	Allow slow stream of water to fill vial at an angle to minimize agitation. Near top, return vial to vertical and add water until meniscus forms, avoid overfilling. Cap tightly, invert and tap lightly; should be no headspace, if bubbles appear (> 6mm), recollect sample.	14 Days, 7 Days if pH > 2
2	SVOCs, Pesticides, Herbicides, Dioxin/Furans	1 L amber glass, Teflon septum cap	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation. Fill bottle with enough water to minimize headspace.	7 Days
3	WI DRO	1 L amber glass, Teflon septum cap	HCl, pH < 2; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation. Fill bottle with enough water to minimize headspace.	7 Days
4	TPH as Jet Fuel, Fuel Oil, Motor Oil (etc.)	1 L amber glass, Teflon septum cap	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation. Fill bottle with enough water to minimize headspace.	7 Days
5	PCBs	1 L amber glass, Teflon septum cap	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation. Fill bottle with enough water to minimize headspace.	None
6	Metals, Mercury	500 mL polyethylene; LL Hg – fluoropolymer or glass	HNO_3, pH < 2; Cool, ≤ 6 °C (not required, best practice)	Fill slowly to minimize sample agitation.	180 days; Hg 28 days; LL Hg preserve w/in 48 hrs. or if oxidized, 28 days
7	Dissolved Metals, Mercury	500 mL polyethylene ; LL Hg – fluoropolymer or glass	HNO_3, pH < 2; Cool, ≤ 6 °C (not required, best practice)	Filter sample through a 0.45 µm filter. Fill slowly to minimize sample agitation.	180 days; Hg 28 days; LL Hg lab filter w/in 24 hrs., if field filtered see above
8	Cyanide	1 L polyethylene	NaOH, pH > 12; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	14 days
9	Sulfide	500 mL polyethylene	NaOH, pH >9 and zinc acetate; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	7 days
10	General Chemistry	1 L	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	14-28 days (except below)
10	TDS, TSS	1 L polyethylene	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	7 days
10	BOD, CBOD	1 L polyethylene	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	**48 hrs.**
10	Nitrate <u>or</u> Nitrite Only	250 mL polyethylene	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	**48 hrs.**
10	Chromium VI	250 mL polyethylene	Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	**24 hrs.**
11	Phenolics, Ammonia, Nitrate+nitrite, TKN, COD	Varies by parameter	H_2SO_4, pH < 2; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	28 days
11	HEM (Oil and Grease)	1 L amber glass	HCl or H_2SO_4, pH < 2; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	28 days
12	Total / Fecal Coliforms	125 mL sterile	$Na_2S_2O_3$; Cool, ≤ 6 °C	Fill slowly to minimize sample agitation.	**≤ 30 / ≤24 hrs**

Note: Hold times are from initial sampling event to first analytical process. The times stated above do not reflect hold times extended due to extraction or other preparatory methods.

Note: Container types and sizes listed are for guidance only. Refer to your specific regulatory agency sampling protocols. Laboratories may use different containers or combine analyses into larger volume containers.