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Field Sampling Plan – Surface and Shallow Soils, Off-Site Areas

Former Houston Wood Preserving Works Site (HWPW Site)

Prepared for

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Project Number TR1075A

March 2024 (Updated June 2024)

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ACRONYMS AND ABBREVIATIONS

ASAOC	Administrative Settlement Agreement and Order on Consent
BRA	Background Reference Areas
CBUD	Call Before You Dig
DMP	Data Management Plan
DOT	Department of Transportation
EPA	Environmental Protection Agency
ft bgs	feet below ground surface
FSP	Field Sampling Plan
Geosyntec	Geosyntec Consultants, Inc.
HASP	Health and Safety Plan
HWPW	Houston Wood Preserving Works
ID	Identification
IDW	Investigation derived waste
in bgs	inches below ground surface
mL	milliliter
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QC	Quality control
RSE	Removal Site Evaluation
SOW	Statement of Work
SVOC	Semi-Volatile Organic Compounds
TCEQ	Texas Commission on Environmental Quality
UPRR	Union Pacific Railroad Company
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compounds

1. INTRODUCTION

1.1 Terms of Reference and Field Sampling Plan Purpose

This document was prepared in accordance with Sections 3.2, 4.3 and 4.4 of the February 17, 2023, Statement of Work (SOW) included as Appendix C of the Administrative Settlement Agreement and Order on Consent (ASAOC) for Removal Site Evaluation (RSE), between the U.S. Environmental Protection Agency (EPA) and Union Pacific Railroad Company (UPRR), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Docket No. 06-02-03. The SOW calls for UPRR to prepare and submit a Field Sampling Plan (FSP) to EPA for the Houston Wood Preserving Works Site (HWPW, "Site") located at 4910 Liberty Road, Houston, Texas, (**Figure 1**), which is owned by UPRR.

This FSP was prepared by Geosyntec Consultants, Inc. (Geosyntec) with support from RSJ Consulting, LLC, ToxStrategies LLC, and WSP Golder Associates at the request of UPRR. This FSP documents the field sampling procedures being used in support of the RSE for the HWPW Site and surrounding properties and presents the approach and methodology for the collection of surface and shallow soil samples at off-Site areas as described in the *Removal Site Evaluation Work Plan – Surface and Shallow Soil Assessment, Former Houston Wood Preserving Works Site* (Geosyntec, 2024) and subsequent discussions with the EPA. This FSP will be valid for the duration of the RSE[1]. The FSP will be updated through revision or addendum as needed, or when additional work plans are developed. The soil quality assurance project plan (QAPP) has been approved by the EPA. The Site-Specific Health and Safety Plan (HASP) and Data Management Plan (DMP) have been prepared as separate documents and have also been approved by the EPA.

1.2 Document Organization

This FSP is organized into the following sections:

- Section 2 - Scope of Work. This section describes the proposed investigation scope for data collection.
- Section 3 – Investigation Methods and Procedures. This section describes the proposed investigation methods, and procedures for data collection.
- Section 4 – Investigation Support Activity Procedures. This section describes general procedures associated with equipment cleaning, handling, and disposal of investigation derived waste (IDW), quality control (QC) procedures, instrument calibration, personal protective equipment (PPE), field documentation, sample labels and identification (ID), chain-of-custody, and shipping.
- Section 5 – References. This section lists the documents referenced in this document.

[1] Separate but related FSPs have been prepared and submitted to EPA with respect to the vapor intrusion activities required under the SOW and RSE Work Plans.

2. SCOPE OF WORK

2.1 Off-Site Area Surface and Shallow Soil Sampling

The off-site surface and shallow soil investigation is intended to characterize the nature and extent of the presence of dioxin, furan, semi-volatile organic compounds (SVOC) and volatile organic compounds (VOC) analytes targeted by the analytical methods described in the QAPP in surface and shallow soils in the community (i.e., neighborhoods, schools, parks, child day care locations and recreation center) around the HWPW Site to support a human health risk assessment.

The Initial Focus Area for the Investigation is identified on **Figure 1** and is based on discussions with the EPA and Texas Commission on Environmental Quality (TCEQ) during scoping discussions subsequent to the issuance of the SOW. Initial sample locations and sequencing (Zones 1a and Zones 1 through 4) were selected based on relative perceived risk and historic site data, with the sampling approach prioritizing the properties closest to the site. The zones were sized based on operational and logistical considerations, particularly available laboratory capacity and estimated turnaround times for analytical results. Zone 1a parcels are located at a greater distance from the HWPW Site and were identified as a priority by the EPA during project scoping. Zone 1a will be sampled in the first phase of the field program along with Zone 1. Zone 1a includes Dogan Elementary School, Atherton Elementary School, the Julia C. Hester House, Catherine Adams Park, Boyce-Dorian Park, and Barbara Jordan Family Park.

Zone 1a and Zone 1 sampling activities will be completed first and then UPRR will move to Zone 2, then Zone 3, then Zone 4.

The off-site soil investigation is summarized in **Table 1**.

2.1.1.1 Dioxin, Furan, and SVOC Surface and Shallow Soil Sampling

Zone 1a Parcels

Composite soil samples will be obtained from 0-2 and 2-6 inches below ground surface (in bgs) at the Zone 1a parcels (**Figure 2**) for laboratory analysis of dioxins, furans, and SVOCs listed in the analytical methods specified in the QAPP. Composite samples will include soil sample increments from child play areas and community gardens. At 25% of the parcels, an additional composite soil sample will be collected at a depth of 6-12 in bgs. These sample locations will be randomly selected. In addition, at one of the five-point composite soil sample increment locations that is randomly selected, one discrete sample will be collected at the same depth intervals as the composite sample (i.e., 0-2, 2-6 and 6-12 in bgs) to support the off-site soil forensic attribution analysis by UPRR. The number of samples to be collected are identified on **Table 2**.

Zones 1, 2, 3, and 4 Parcels

Composite soil samples will be obtained from 0-2 and 2-6 inches below ground surface (in bgs) at the off-site parcels adjacent to the HWPW Site perimeter for laboratory analysis of dioxins and furans (**Figure 2**) and SVOCs (**Figure 3**) listed in the analytical methods specified in the QAPP. At 25% of the parcels, an additional composite soil sample will be collected at a depth of 6-12 in bgs. These sample locations will be randomly selected except at locations adjacent to HHD soil sample exceedances of dioxins and furans (HHD-21, HHD-34, and HHD-35). The samples will be collected at parcels that contain less than or equal to a 1/8th acre (≤ 0.125 acres) area not covered by a hard surface following the approach as shown in **Figure 4**. The samples will be collected at parcels that contain greater than a 1/8th acre (> 0.125 acres) area not covered by a hard surface following the approach as shown in **Figure 5**. In addition, at one of the five-point composite soil sample increment locations that is randomly selected, one discrete sample will be collected at the same depth intervals as the composite sample (i.e., 0-2, 2-6 and 6-12 in bgs) to support the off-site soil forensic attribution analysis by UPRR.

2.1.1.2 VOC Shallow Soil Sampling

Zone 1a Parcels

Discrete shallow soil samples will be collected at 2-6 and 6-12 in bgs at the Zone 1a parcels (**Figure 5**) for laboratory analysis of VOCs listed in the analytical methods specified in the QAPP. Discrete samples will include samples from child play areas. At 25% of the parcels, an additional discrete soil sample will be collected at a depth of 6-12 in bgs. These sample locations will be randomly selected. The number of samples to be collected are identified on **Table 2**.

Zones 1, 2, 3, and 4 Parcels

Discrete shallow soil samples will be collected at 2-6 and 6-12 in bgs at the off-site parcels immediately adjacent to the HWPW Site perimeter (**Figure 3**) for laboratory analysis of VOCs listed in the analytical methods specified in the QAPP. At 25% of the parcels, an additional discrete soil sample will be collected at a depth of 6-12 in bgs. These sample locations will be randomly selected. The samples will be collected at parcels that contain less than or equal to a 1/8th acre (≤ 0.125 acres) of area not covered by a hard surface following the approach shown in **Figure 6**. The samples will be collected at parcels that contain greater than a 1/8th acre (> 0.125 acres) area not covered by a hard surface following the approach shown in **Figure 7**.

2.1.1.3 Surface and Shallow Soil Sampling Results Evaluation

The 2022 HHD soil report asserts "the distribution of elevated dioxins/furans concentrations in soil samples were often greater nearer the UPRR Site and decreased at locations further away" (Epperson, 2022), which was reiterated in section 9.1(h) of the EPA's ASAOC. The sampling approach described herein would provide ample information to assess the accuracy of this assertion. Each soil sample location will represent a random approximation of that parcel.

Upon receiving the soil analytical results for a zone, the analyte data for each set of parcel soil samples will be evaluated according to their respective screening levels. If no exceedances of the analyte screening levels are reported for a parcel, then it will be concluded that the soil analytical data do not represent unacceptable hazards or risks for the parcel and no further action will be required. For parcels with soil screening level exceedances, those analytes in exceedance will be carried forward to a site-specific human health risk assessment to determine if unacceptable hazards/risks related to the soil analyte data are apparent.

Special case soil sampling investigations (e.g., property with a vegetable garden or small livestock) as required under SOW Section 4.4 and community impact mitigation activities as required under the ASAOC Section 17 will be included as an addendum to this Field Sampling Plan, if required.

3. INVESTIGATION METHODS AND PROCEDURES

3.1 Field Preparation Activities

Prior to initiating field activities, field team members will review project plans and become familiar with the history of the Site, health and safety requirements, field procedures, and QC requirements. Personnel will attend safety tailgate meetings prior to commencement of daily field activities.

3.2 Utility Clearance Activities

Texas811 will be notified in advance of any surface and subsurface sampling in areas identified in **Figures 2 and 5**. In addition, utility locates may be completed by an underground utility location contractor to identify the depth of subsurface features and potential locations of subsurface utilities and objects (e.g., previous pipe connections[s], electrical conduits), if warranted.

3.3 Permitting and Access

UPRR eRailSafe certification and UPRR contractor awareness is not required for EPA personnel or contractors who are observing work within UPRR property boundaries or off-Site areas. For safety reasons, UPRR will require EPA and its contractors to attend daily safety meetings and be escorted while on any UPRR property by an eRailSafe trained individual at all times.

3.4 Soil Sampling

Collection of discrete and composite surface and shallow soil samples will be completed in general accordance with Sections 2, 3 and 4 of USEPA *LSASDPROC-300-R5 Soil Sampling* (see **Appendix A**) using steel hand augers, shovels, or spoons. A general soil description will be documented for each soil sample (e.g., fill, topsoil, sand, gravel, etc.).

3.4.1 Discrete Sampling Procedures for VOC, Dioxin, Furan and SVOC Analysis

Boreholes to the desired depth will be completed using hand augers, shovels, or spoons.

The discrete samples collected for dioxins, furans, and SVOCs will be collected to support the off-site soil forensic attribution analysis by UPRR. At each discrete soil sample location for dioxins, furans and SVOCs, soil will be collected in 1-inch lifts using dedicated steel spoons to expose a fresh surface for sampling and placed in the dedicated stainless steel mixing vessel or large plastic bag (i.e., ziplock). Soil will be mixed and then transferred from the mixing vessel into the laboratory provided glass jars and capped. The total volume of soil collected from each sample depth interval (for the discrete sample) will be the same as the laboratory container.

Discrete soil samples for VOCs will be collected from the mid-point of the desired sample interval using a Terra Core® sampler. Following collection, the sample will be transferred into a 40 milliliter (mL) volatile organic analysis vial pre-charged with methanol preservative and capped. Additional details are provided in the QAPP.

A typical soil sampling field form is included in **Appendix B**.

3.4.2 Composite Soil Sampling Procedures for Dioxin, Furan, and SVOC Analysis

Composite soil sampling will consist of soil sample increments composited together. The soil sample increments composited will be spread out to provide coverage of the area being sampled (e.g., 500 square meter or 5,400 square feet).

Composite soil sampling will be completed in the field using hand augers, shovels, or spoons to advance boreholes to the desired sample intervals. Dedicated steel spoons will be used to expose a fresh surface of the desired sample interval and collect soil into a dedicated stainless steel mixing vessel or large plastic bag (i.e., ziplock). At each of the soil sample increment locations that make up the composite sample, soil will be collected in 1-inch lifts and placed in the mixing vessel. The volume of soil from each sample increment and depth interval will be of the same volume. The total volume of soil collected from each sample depth interval (for the composite sample) will be the same as the lab container (e.g., if 8 ounces jars are used, then the 0-2 in bgs sample interval from the five discrete soil samples will be a total of 8 ounces). The soil sample increments will be mixed and then transferred from the mixing vessel into the laboratory provided glass jars and capped.

A typical soil sampling field form is included in **Appendix B**.

4. INVESTIGATION SUPPORT ACTIVITY PROCEDURES

This section describes general procedures associated with equipment cleaning, handling, and disposal of IDW, QC procedures, PPE, field documentation, sample labels and ID, chain--of--custody, and shipping.

4.1 General Procedures

The following factors will be followed during the RSE investigation activities:

- Sampling Equipment Construction Material – The material from which sampling equipment is constructed can affect sample analytical results. Materials must not contaminate the sample being collected, and reusable equipment must be able to be readily cleaned so that samples are not cross-contaminated.
- Sample Containers and Volumes – The sample volume obtained will be sufficient to perform required analyses with an additional amount collected sufficient to provide for quality control needs or repeat examinations. Container types and required sample volumes are specified in the QAPP.
- Sample Preservation – Samples will be preserved to maintain their integrity as specified in the QAPP.
- Sample Hold Times – The elapsed time between sample collection and initiation of laboratory analyses is specified in the QAPP.
- Sample Chain-of-Custody – Chain-of-Custody procedures will be maintained from the point of sampling to final laboratory analysis.

4.2 Cleaning and Decontamination Procedures

During field activities, decontamination stations will be established in appropriate areas convenient to field-sampling locations. Procedures for decontamination of reusable sampling equipment will be consistent with USEPA *LSASDPROC-205-R4 Field Equipment Cleaning and Decontamination* (see **Appendix A**). Decontamination of reusable sampling equipment will be accomplished by using the following procedure:

- Wash with phosphate-free detergent, such as Alconox, and tap water using a brush to remove any particulate matter or surface film.
- Rinse the equipment thoroughly with tap water or bottled water.
- Rinse the equipment thoroughly with distilled water.
- Maintain the equipment in a clean manner until reuse.

Reusable sampling and testing equipment such as split spoon samplers, hand augers, and shovels will be decontaminated before the start of each sampling day and between each discrete and composite soil sample location to prevent potential cross-contamination. Disposable and/or dedicated equipment will not be decontaminated.

4.3 Quality Control Sampling Procedures

QC samples will be collected as described in the QAPP to allow evaluation of data quality.

4.4 Personal Protective Equipment

To protect the health and welfare of each field staff, appropriate PPE is required. Specific PPE requirements are included in the HASP.

4.5 Investigation Derived Waste

IDW will include common trash, PPE, and decontamination fluids. No soil cuttings will be generated during the collection of soil samples. Decontamination fluids will be placed into 55-gallon Department of Transportation (DOT)-rated drums for temporary storage on Site. The containers shall be in good working order and condition. Each drum shall include a cover/top which will allow the drum to be closed and sealed, except when fluids are being added to or removed from the drum. Drums will be labeled and stored within the container storage area within former HWPW Site pending classification and disposal. Liquid waste characterization samples will be collected for laboratory analysis of VOCs, SVOCs, Resource Conservation and Recovery Act metals, total petroleum hydrocarbons, reactivity, corrosivity, and ignitibility. Specific details of the laboratory analysis, sample containers, etc., are provided in the QAPP.

Containerized decontamination fluids will be characterized, classified, and profiled for disposal at a UPRR approved, TCEQ-permitted facility based on the comparison of the analytical data to Chapter 30 Texas Administrative Code 335 Subchapter R and the TCEQ Guidance for the Classification and Coding of Industrial and Hazardous Wastes (RG-022, 02/05). Pending waste classification, Texas Waste Codes listed on the current Notice of Registration (Solid Waste Registration Number 31547) for the former HWPW Site will be used for the wastes generated from the investigation activities.

4.6 Documentation and Sample Handling

4.6.1 Field Documentation

Field work and sample collection programs will be documented using a combination of field logbooks and/or specific field log forms. Examples of field forms are included in **Appendix B.** To the extent practical, field forms and information will be documented electronically and stored in the environmental database. Additional information is provided in the QAPP and DMP.

4.6.2 Field Activity Logs

A field logbook, field forms, or similar documentation will be maintained to record the details of field investigation activities and field data. Field activity logging procedures are defined in the QAPP and DMP.

4.6.3 Sample Documentation

The sample ID number will be logged in the field form along with the following information:

- Sampling personnel
- Date and time of collection
- Field sample location and depth (if appropriate)
- Observations of ambient conditions
- Type of sampling (composite or grab)
- Method of sampling
- Sampling matrix or source
- Results of field screening, as applicable
- The laboratory (organization and location) selected for analysis.

4.6.4 Photographic Documentation

Photographs will be taken that are representative of field sampling activities and locations. Photographs of samples will include a label indicating date, sample ID, and sample location and/or depth, as appropriate based on the sample type. Digital images will be retained in the environmental database.

4.6.5 Sample Labels, Identification, and Numbering

Each sample container will be labeled with the following information: date and time of sample collection; sample ID; project name; and sampler's initials. Indelible ink will be used to record information on the sample label.

Samples that are collected in the field will be identified with a unique alpha-numeric ID called a sample ID. The ID will follow the following format:

ZZZZ-AA-BB-C-MD-YYYYMMDD-SV

where:

- ZZZZ is an alphanumeric code describing the specific sample location (e.g., B1, S1, SS1) or type of QC sample (e.g., DUP [for a field replicate sample], TB [for a trip blank sample], EB [for an equipment blank sample], MS [for a matrix spike sample], MSD [for a matrix spike replicate sample]). One or more characters, including hyphens, will be used for sample locations.

- AA is a sequential number used only if the sample is a QC sample. For example, if two replicate samples are collected on the same day, 01 would indicate the first replicate and 02 would indicate the second replicate.
- BB is a numeric description of the sample depth, when appropriate. For example, 0-2 would indicate a sample collected 0–2 in bgs.
- C is an alphanumeric code describing the sampling method (e.g., C-composite, D-discrete).
- MD is an alphanumeric code describing the media being sampled (e.g., SS-Surface Soil, SH-shallow soil, etc.).
- YYYYMMDD is a number representing the date the sample was collected. For example, a sample collected on June 10, 2023, would be 20230610.
- SV is alphanumeric code indicating if the sample will be sieved by the laboratory. This is only applicable for samples being analyzed for dioxins and furans.

Field documentation will include the spatial location of the sample via mobile device with global positioning system capability and measurement of the vertical position below ground surface and the relation of QC samples to parent samples.

4.6.6 Chain-of-Custody Forms

The field chain-of-custody record will be used to record the custody of samples or other physical evidence collected and maintained. The chain-of-custody record also serves as a sample logging mechanism for the analytical laboratories' sample custodian. Details on Chain of Custody procedures have been defined in the QAPP and DMP.

4.6.7 Sample Packaging, Custody Seals, and Shipping

Details on sample packaging custody seals, and shipping are provided in the QAPP.

4.6.8 Electronic Data

Field data, to the extent practical, will be documented electronically and stored in the environmental database. Logbooks and forms used will be scanned and their images saved in the project folder on Geosyntec servers. Additional information is provided in the DMP.

5. REFERENCES

Geosyntec, 2024. Draft Removal Site Evaluation Work Plan – Surface and Shallow Soil Assessment, Former Houston Wood Preserving Works Site (HWPW Site), March 21, 2024 (Updated June 2024).

Tables

Table 1
Off-Site Surface and Shallow Soil Sampling Scope of Work
Union Pacific Railroad
Houston Wood Preserving Works

Sample Type	Area of Investigation		Number of Soil Sample Locations[1]	Soil Sample Depth (inches below ground surface)[2]	Soil Sample Type (Discrete/Composite)	Soil Laboratory Analysis		
						Dioxins and Furans	VOCs[3]	SVOCs
						Number of Investigative Samples for Each Analysis		
Surface and Shallow Soils	Off-Site	Zone 1a	6	0 - 2	Composite	<u>27</u>	0	<u>27</u>
					Discrete	27	0	27
				2 - 6	Composite	<u>27</u>	0	<u>27</u>
					Discrete	27	<u>27</u>	27
				6 - 12	Composite	<u>6</u>	0	6
					Discrete	6	<u>6</u>	6
		Zone 1	57	0 - 2	Composite	<u>57</u>	0	<u>23</u>
					Discrete	57	0	23
				2 - 6	Composite	<u>57</u>	0	<u>23</u>
					Discrete	57	<u>23</u>	23
				6 - 12	Composite	<u>15</u>	0	<u>6</u>
					Discrete	15	<u>6</u>	6
		Zone 2	83	0 - 2	Composite	<u>83</u>	0	<u>22</u>
					Discrete	83	0	22
				2 - 6	Composite	<u>83</u>	0	<u>22</u>
					Discrete	83	<u>22</u>	22
				6 - 12	Composite	<u>21</u>	0	<u>6</u>
					Discrete	21	<u>6</u>	6
		Zone 3	123	0 - 2	Composite	<u>123</u>	0	<u>53</u>
					Discrete	123	0	53
				2 - 6	Composite	<u>123</u>	0	<u>53</u>
					Discrete	123	<u>53</u>	53
				6 - 12	Composite	<u>31</u>	0	<u>14</u>
					Discrete	31	<u>14</u>	14
		Zone 4	73	0 - 2	Composite	<u>73</u>	0	<u>18</u>
					Discrete	73	0	18
				2 - 6	Composite	<u>73</u>	0	<u>18</u>
					Discrete	73	<u>18</u>	18
				6 - 12	Composite	<u>19</u>	0	<u>5</u>
					Discrete	19	<u>5</u>	5

Notes:

VOCs - volatile organic compounds

SVOCs - semi-volatile organic compounds

<u>Underline</u> indicates an EPA required soil sample. Samples not underlined are for UPRR forensic source attribution purposes.

[1] Sample locations for VOC and SVOC sampling will be parcels within Zone 1a through Zone 4 which are closest to HWPW property

[2] Samples at different depths to be collected at the same location or co-located for sample volume

[3] VOC soil samples will be collected as discrete samples and will only be collected from the 2-6 and 6-12 inch below ground surface soil intervals.

Table 2
Zone 1A Surface and Shallow Soil Sampling Scope of Work
Union Pacific Railroad
Houston Wood Preserving Works

Property	Area (acres)	Surface Area Available for Sampling (Acres)	Number of Locations for Dioxins, Furans & SVOC Analysis		Number of Discrete Sample Locations for VOC Analysis
			5-Point Composite Sample Locations	Discrete Sample Locations	
Boyce-Dorian Park	9.6	8.1	7	7	7
Julia Hester House	4.7	2.0	5	5	5
Atherton Elementary School	5.1	2.1	5	5	5
Dogan Elementary School	7.4	3.3	5	5	5
Catherine Adams Park	0.4	0.3	3	3	3
Barbara Jordan Park	0.4	0.3	2	2	2

Notes:

VOCs - volatile organic compounds

SVOCs - semi-volatile organic compounds

Figures

Legend

Approximate UPRR Property Boundary as defined in Appendix B of ASAOC For Removal Action Site Evaluation

Notes:
ASAOC - Administrative Settlement Agreement and Order on Consent
UPRR - Union Pacific Railroad

1. Aerial Imagery provided by ESRI Basemaps 2022.

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This document is not to be shared outside of the legal party intended. The information provided on this map does not, and is not intended to, constitute legal advice; instead, all information, content, and materials available on this site are for general informational purposes only. Information on this website may not constitute the most up-to-date legal or other information.

500 250 0 500 Feet

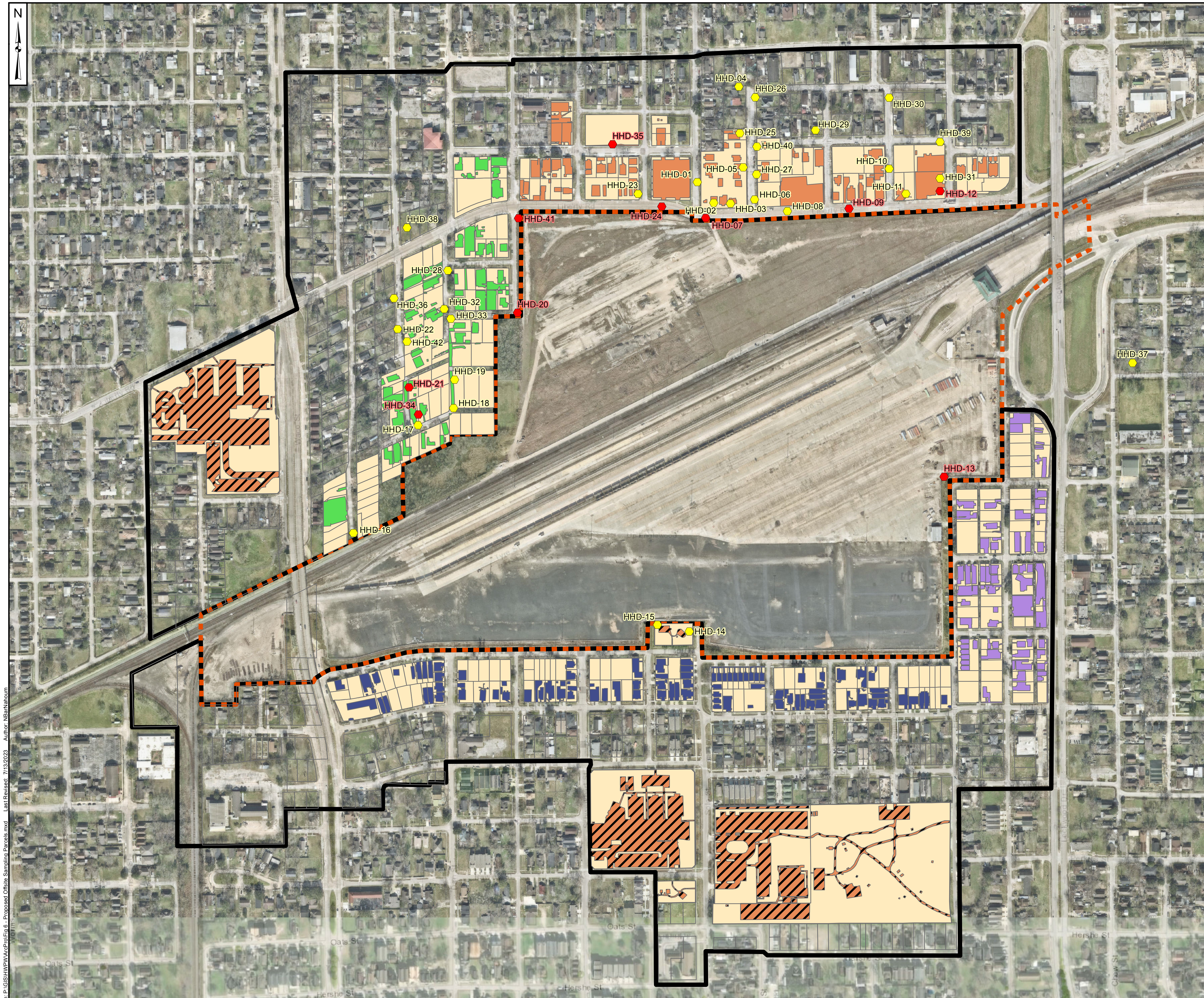
Site Location
Union Pacific Railroad
Houston Wood Preserving Works

Geosyntec consultants

Guelph | March 2024

Figure 1

Projection: GCS WGS 1984; Units in Degree



Legend

Proposed Off-Site Soil Sampling Parcels by

- Zone 1a (6 parcels with 5 samples per parcel = 30 samples)
- Zone 1 (57 parcels with 1 sample per parcel = 57 samples)
- Zone 2 (83 parcels with 1 sample per parcel = 83 samples)
- Zone 3 (123 parcels with 1 sample per parcel = 123 samples)
- Zone 4 (73 parcels with 1 sample per parcel = 73 samples)
- Zones 1 - 4 (Without Hard Surfaces)
- EPA Proposed Off-Site Area
- Approximate UPRR Property Boundary as defined in Appendix B of ASAOC For Removal Action Site Evaluation

Houston Health Department (HHD) Off-site Sample Locations

- Samples Result >RSL
- Samples Result <RSL

Prevailing Wind*

Notes:
*TCEQ Houston Kirkpatrick monitor annual average 2020-2021
ASAOC - Administrative Settlement Agreement and Order on Consent
UPRR - Union Pacific Railroad

1. Basemap Aerial Imagery: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community.

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400 200 0 400 Feet

Proposed Off-Site Soil Sampling Parcels - Dioxan/ Furans

Union Pacific Railroad
Houston Wood Preserving Works

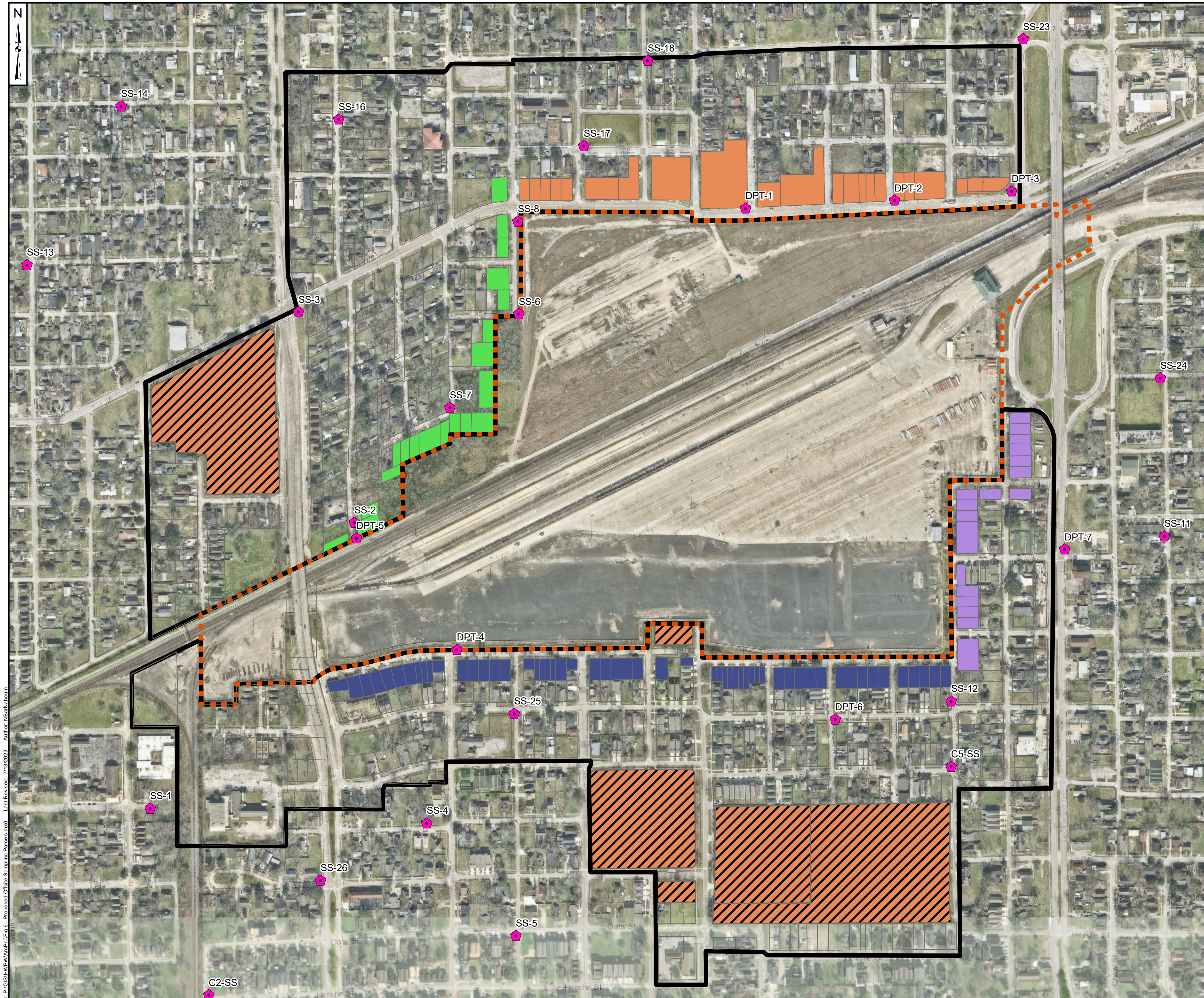
Geosyntec consultants

Figure 2

Guelph | March 2024

Path: P:\GIS\HWPW\ArcPro\Fig 6 - Proposed Offsite Sampling Parcels.mxd Last Revised: 7/13/2023 Author: NBarNahum

Projection: WGS 1984 Web Mercator Auxiliary Sphere; Units in Meter



Legend

Proposed Off-Site Sampling Parcels by Zone

- Zone 1a (6 parcels with 5 samples per parcel = 30 samples)
- Zone 1 (23 parcels with 1 sample per parcel = 23 samples)
- Zone 2 (22 parcels with 1 sample per parcel = 22 samples)
- Zone 3 (53 parcels with 1 sample per parcel = 53 samples)
- Zone 4 (18 parcels with 1 sample per parcel = 18 samples)
- EPA Proposed Off-Site Area
- Approximate UPRR Property Boundary as defined in Appendix B of ASAOC For Removal Action Site Evaluation

County Soil Sampling Locations

- Historical samples with VOC/SVOC concentrations below TRRP Tier 1 Residential Protective Concentration Levels

Prevailing Wind*

Notes:

*TCEQ Houston Kirkpatrick CAMS 0404 monitor annual average 2020-2021, arrow displays prevailing wind direction.
VOC - volatile organic compounds
SVOC - semi-volatile organic compounds

1. Basemap Aerial Imagery: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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400 200 0 400 Feet

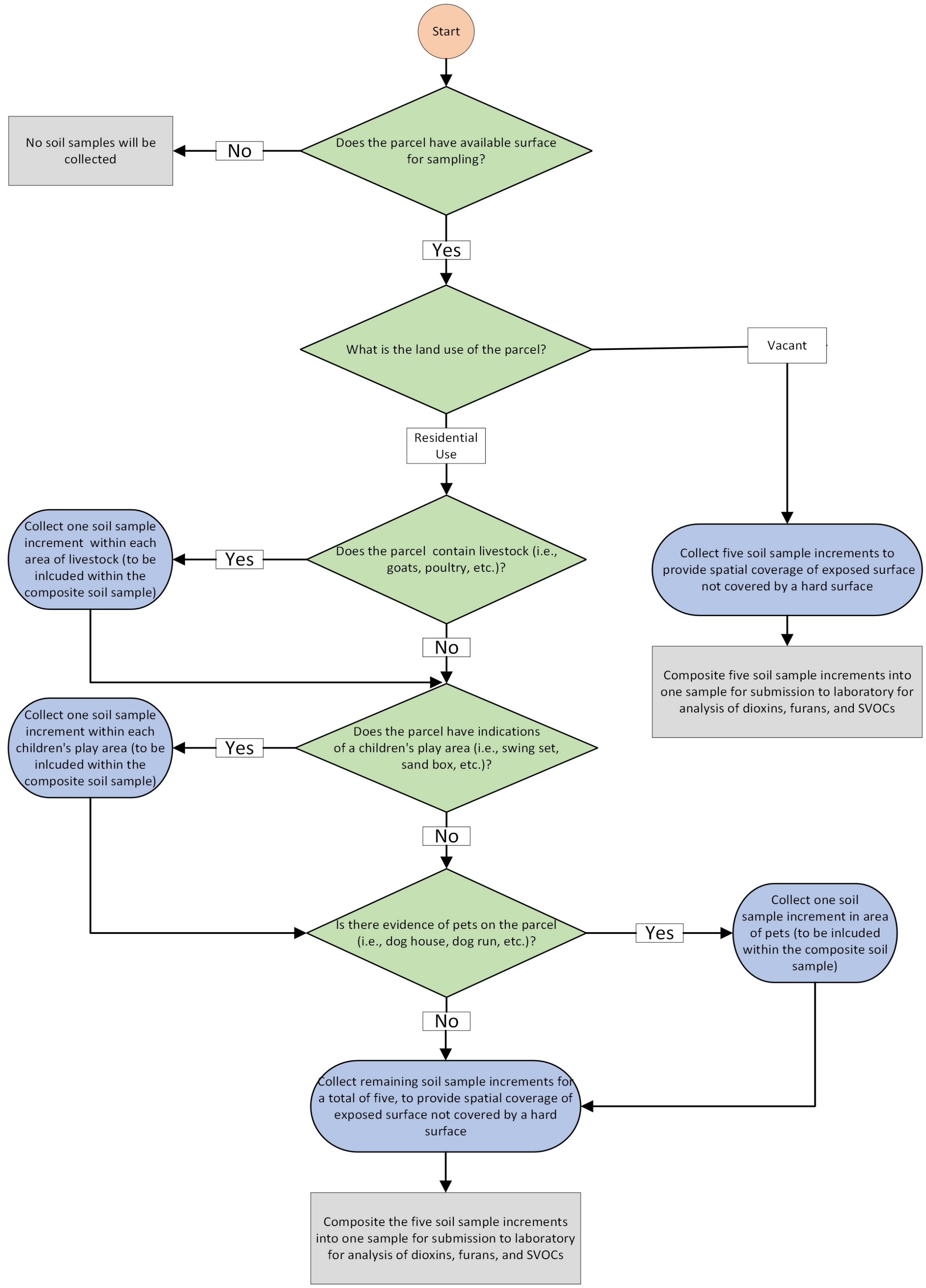
Proposed Off-Site Sampling Parcels - VOC/SVOC

Union Pacific Railroad
Houston Wood Preserving Works

Geosyntec consultants

Guelph | March 2024

Figure 3



Decision Points: Dioxins, Furans and SVOCs
Soil Sample Selection (Parcels ≤ 1/8 acre)[1]

Union Pacific Railroad
Houston Wood Preserving Works

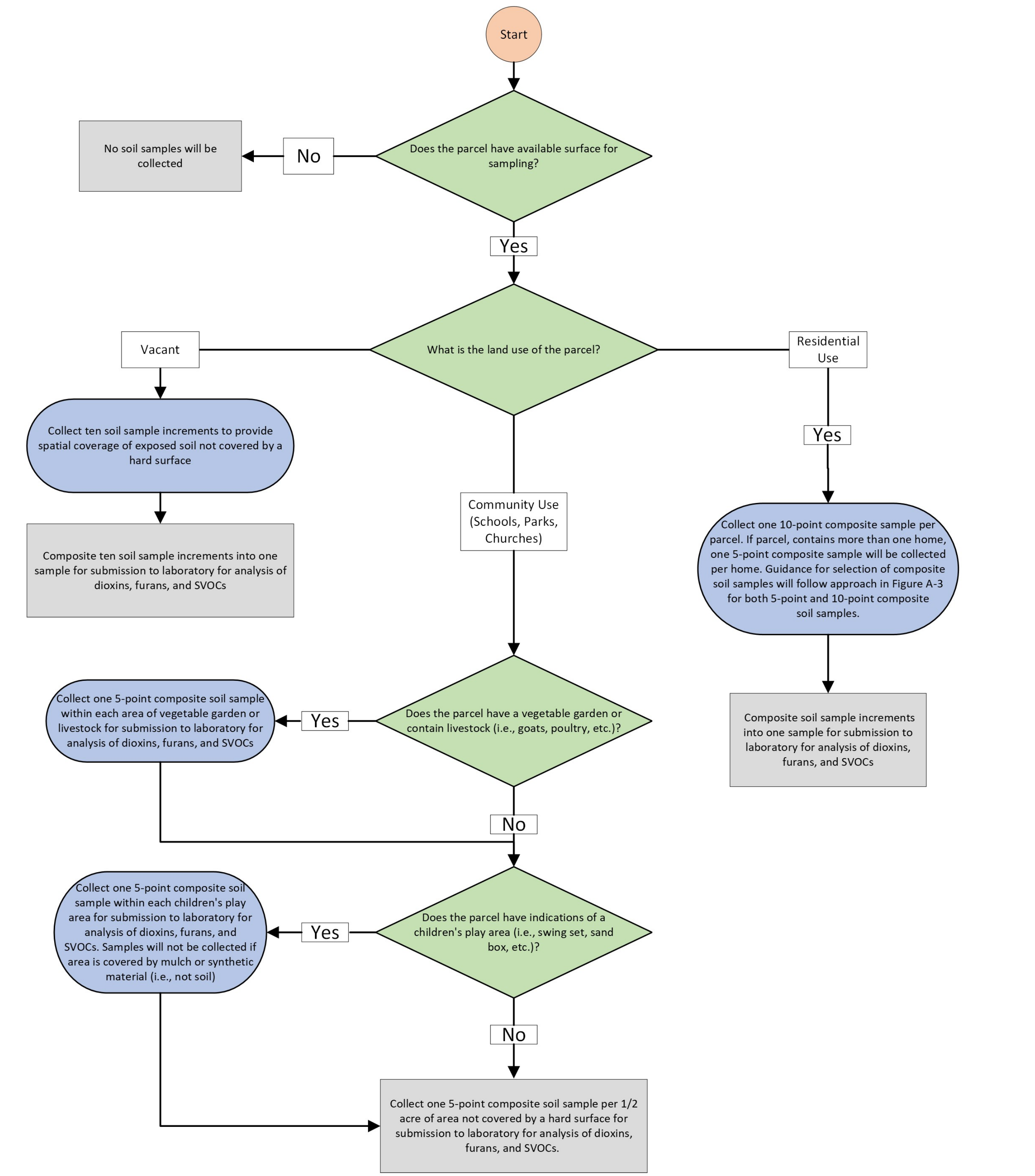
Geosyntec consultants

Figure 4

Guelph	March 2024

Notes:
[1] Parcels that contain less than or equal to 1/8 acre of area not covered by a hard surface
SVOCs - Semi-Volatile Organic Compounds

internal info: path, date revised, author.xls



Notes:
[1] Parcels that contain greater than 1/8 acre of area not covered by a hard surface
SVOCs - Semi-Volatile Organic Compounds

Decision Points: Dioxins, Furans and SVOCs Soil Sample Selection (Parcels > 1/8 acre)[1]

Union Pacific Railroad
Houston Wood Preserving Works

Geosyntec consultants

Figure 5

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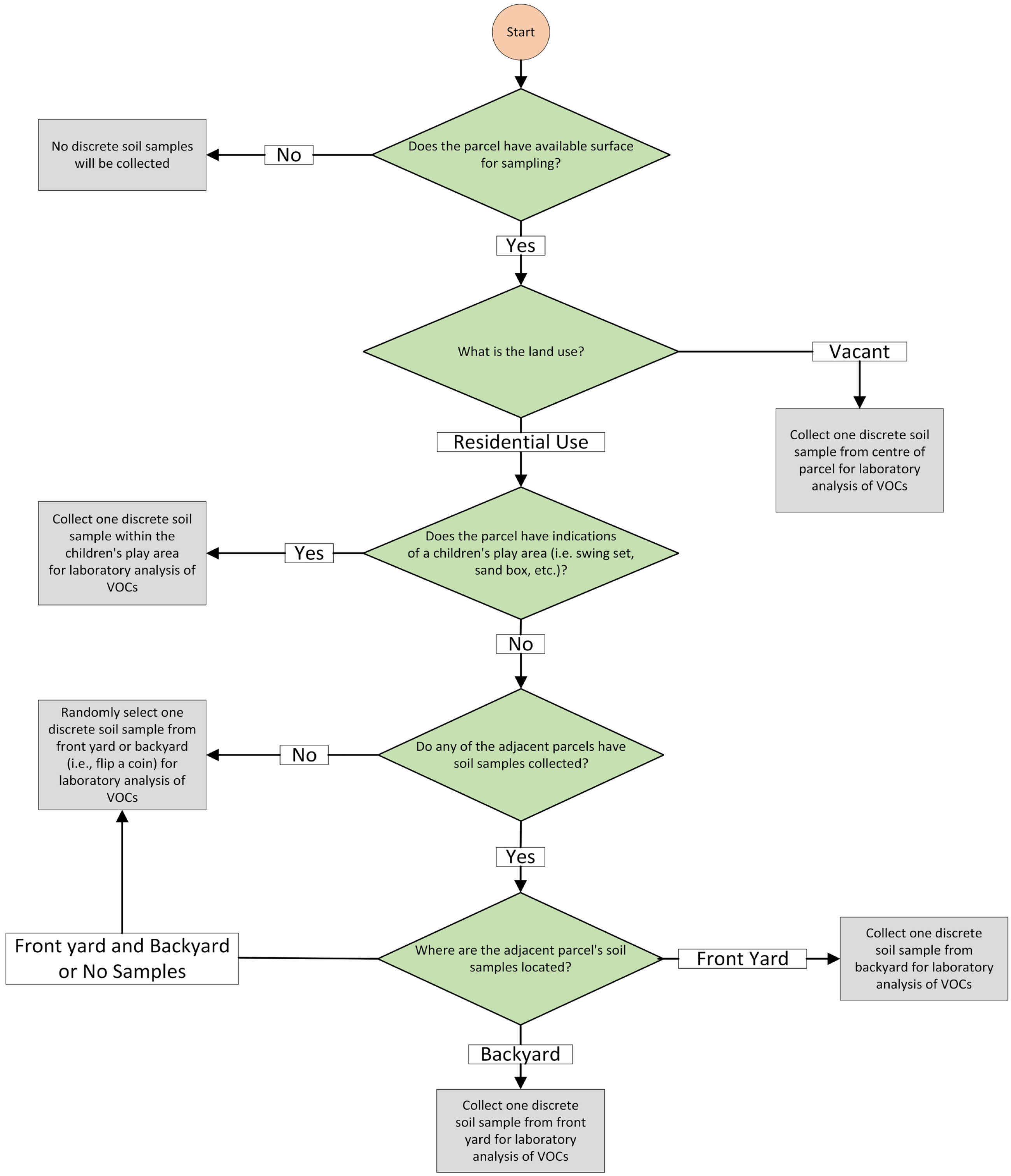

Decision Points: VOCs
Soil Sample Selection (Parcels ≤ 1/8 acre)[1]

Union Pacific Railroad
Houston Wood Preserving Works

Geosyntec consultants

Figure 6

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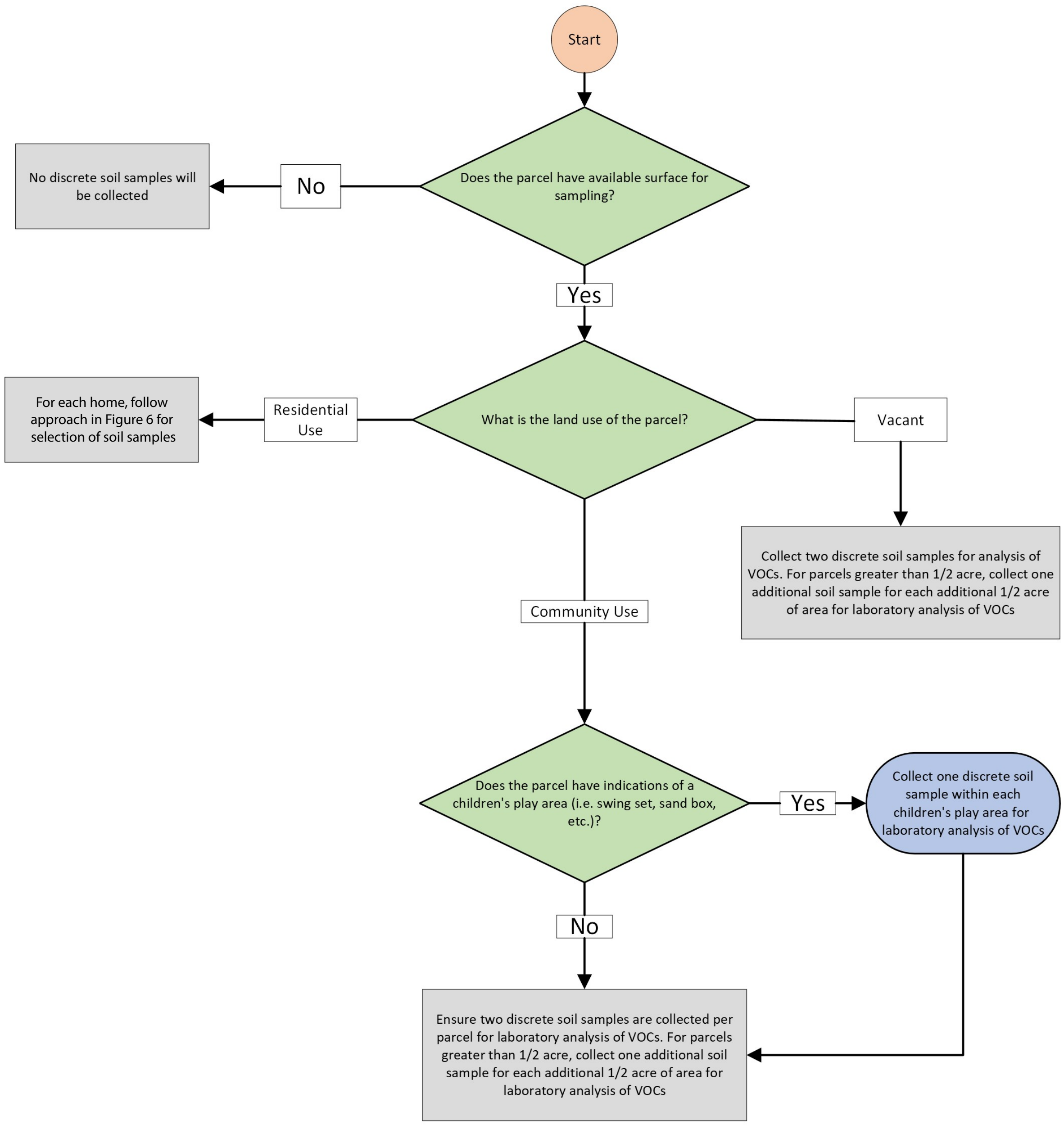
Notes:
[1] Parcels that contain less than or equal to 1/8 acre of area not covered by a hard surface
VOCs - Volatile Organic Compounds

internal info: path, date revised, author.xls



Decision Points: VOCs
Soil Sample Selection (Parcels > 1/8 acre)[1]

Union Pacific Railroad
Houston Wood Preserving Works

Geosyntec consultants

Figure 7

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Notes:
[1] Parcels that contain greater than 1/8 acre of area not covered by a hard surface
VOCs - Volatile Organic Compounds

internal info: path, date revised, author.xls

Appendix A
Field SOPs and Alternate Standardized Methods

APPENDIX B
SUMMARY OF FIELD PROCEDURES AND METHODS
Former Houston Wood Preserving Works, Houston, Texas

SOP or Alternate Standardized Method	Effective/Issue Date
USEPA LSASDPROC-300-R5 Soil Sampling	April 22, 2023
Recommended Use of the Terra Core®	N/A
USEPA LSASDPROC-205-R4 Field Equipment Cleaning and Decontamination	June 22, 2020

Region 4 **U.S. Environmental Protection Agency** **Laboratory Services & Applied Science Division** **Athens, Georgia**	
Operating Procedure	
Title: Soil Sampling	ID: LSASDPROC-300-R5
Issuing Authority: Field Services Branch Supervisor	
Effective Date: April 22, 2023	Review Due Date: June 10, 2024
Method Reference: N/A	SOP Author: Kevin Simmons

Purpose

This document describes general and specific procedures, methods and considerations to be used and observed when collecting soil samples for field screening or laboratory analysis.

Scope/Application

The procedures contained in this document are to be used by field personnel when collecting and handling soil samples in the field. On the occasion that LSASD field personnel determine that any of the procedures described in this section are inappropriate, inadequate or impractical and that another procedure must be used to obtain a soil sample, the variant procedure will be documented in the field logbook and subsequent investigation report, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

Table of Contents

1 General Information

1.1 Documentation/Verification

This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD local area network (LAN). The QAC is responsible for ensuring the most recent version of the procedure is placed on the LAN, and for maintaining records of review conducted prior to its issuance.

1.2 General Precautions

1.2.1 Safety

Proper safety precautions must be observed when collecting soil samples. Refer to the LSASD Safety and Occupational Health Manual and any pertinent site-specific Health and Safety Plans (HASP) and Job Hazard Assessments for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. The reader should address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

1.2.2 Procedural Precautions

The following precautions should be considered when collecting soil samples:

- Special care must be taken not to contaminate samples. This includes storing samples in a secure location to preclude conditions which could alter the properties of the sample. Samples shall be custody sealed during long-term storage or shipment.
- Collected samples are in the custody of the sampler or sample custodian until the samples are relinquished to another party.
- If samples are transported by the sampler, they will remain under his/her custody or be secured until they are relinquished.
- Shipped samples shall conform to all U.S. Department of Transportation (DOT) rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179), and/or International Air Transportation Association (IATA) hazardous materials shipping requirements found in the current edition of IATA's Dangerous Goods Regulations.
- Documentation of field sampling is done in a bound logbook.

- Chain-of-custody documents shall be filled out and remain with the samples until custody is relinquished.
- All shipping documents, such as air bills, bills of lading, etc., shall be retained by the project leader in the project files. (Air bills are generated online via UPS Campusship program and package tracking is done online). Receipts are not always received at time of shipping.
- Sampling in landscaped areas: Cuttings should be placed on plastic sheeting and returned to the borehole upon completion of the sample collection. Any 'turf plug' generated during the sampling process should be returned to the borehole.
- Sampling in non-landscaped areas: Return any unused sample material back to the auger, drill or push hole from which the sample was collected.

2 Special Sampling Considerations

2.1 Special Precautions for Trace Contaminant Soil Sampling

- A clean pair of new, non-powdered, disposable gloves will be worn each time a different sample is collected and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.
- Sample containers with samples suspected of containing high concentrations of contaminants shall be handled and stored separately.
- All background samples shall be segregated from obvious high-concentration or waste samples. Sample collection activities shall proceed progressively from the least suspected contaminated area to the most suspected contaminated area. Samples of waste or highly-contaminated media must not be placed in the same ice chest as environmental (i.e., containing low contaminant levels) or background samples.
- If possible, one member of the field sampling team should take all the notes and photographs, fill out tags, etc., while the other member(s) collect the samples.
- Samplers must use new, verified/certified-clean disposable or non-disposable equipment cleaned according to procedures contained in the LSASD Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205), for collection of samples for trace metals or organic compound analyses.

2.2 Sample Homogenization

1. If sub-sampling of the primary sample is to be performed in the laboratory, transfer the entire primary sample directly into an appropriate, labeled sample container(s). Proceed to step 4.

2. If sub-sampling the primary sample in the field or compositing multiple primary samples in the field, place the sample into a glass or stainless steel homogenization container and mix thoroughly. Each aliquot of a composite sample should be of the same approximate volume.

3. All soil samples must be thoroughly mixed to ensure that the sample is as representative as possible of the sample media. ***Samples for VOC analysis are not homogenized.*** The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

    - The material in the sample pan should be divided into quarters and each quarter should be mixed individually.
    - Two quarters should then be mixed to form halves.
    - The two halves should be mixed to form a homogenous matrix.

    This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

4. Place the sample into an appropriate, labeled container(s) by using the alternate shoveling method and secure the cap(s) tightly. The alternate shoveling method involves placing a spoonful of soil in each container in sequence and repeating until the containers are full or the sample volume has been exhausted. Threads on the container and lid should be cleaned to ensure a tight seal when closed.

2.3 Dressing Soil Surfaces

Any time a vertical or near vertical surface is sampled, such as achieved when shovels or similar devices are used for subsurface sampling, the surface should be dressed (scraped) to remove smeared soil. This is necessary to minimize the effects of contaminant migration interferences due to smearing of material from other levels.

2.4 Quality Control

If possible, a control sample should be collected from an area not affected by the possible contaminants of concern and submitted with the other samples. This control sample should be collected as close to the sampled area as possible and from the same soil type. Equipment blanks should be collected if equipment is field cleaned and re-used on-site or if necessary to document that low-level contaminants were not introduced by sampling tools. LSASD Operating Procedure for Field Sampling Quality Control (SESDPROC-011) contains other procedures that may be applicable to soil sampling investigations.

2.5 Records

Field notes, recorded in a bound field logbook, as well as chain-of-custody documentation will be generated as described in the LSASD Operating Procedure for Logbooks (SESDPROC-010) and the LSASD Operating Procedure for Sample and Evidence Management (SESDPROC-005).

3 Samples Collected for Volatile Organic Compounds (VOC) or for Per- and Polyfluoroalkyl Substances (PFAS) Analyses

3.1 Soil Samples Collected for Volatile Organic Compounds (VOC) Analysis

The procedures outlined here are summarized from *Test Methods for Evaluating SolidWaste, Physical/Chemical Methods SW-846, Method 5035.*If samples are to be analyzed for VOCs, they should be collected in a manner that minimizes disturbance of the sample. For example, when sampling with an auger bucket, the sample for VOC analysis should be collected directly from the auger bucket (preferred) or from minimally disturbed material immediately after an auger bucket is emptied into the pan. The sample shall be containerized by filling an En Core® Sampler or other Method 5035 compatible container. ***Samples for VOC analysis are not homogenized.*** Preservatives may be required for some samples with certain variations of Method 5035. Consult the method or the principal analytical chemist to determine if preservatives are necessary.

3.2 Soil Sampling for VOCs (Method 5035)

The following sampling protocol is recommended for site investigators assessing the extent of VOCs in soils at a project site. Because of the large number of options available, careful coordination between field and laboratory personnel is needed. The specific sampling containers and sampling tools required will depend upon the detection levels and intended data use. Once this information has been established, selection of the appropriate sampling procedure and preservation method best applicable to the investigation can be made.

3.2.1 Equipment

Soil for VOC analyses may be retrieved using any of the LSASD soil sampling methods described in Sections 4 through 8 of this procedure. Once the soil has been obtained, the En Core® Sampler, syringes, stainless steel spatula, standard 2- oz. soil VOC container, or pre-prepared 40 mL vials may be used/required for sub-sampling. The specific sample containers and the sampling tools required will depend upon the data quality objectives established for the site or sampling investigation. The various sub-sampling methods are described below.

3.2.2 Sampling Methodology - Low Concentrations (<200 µg/kg)

When the total VOC concentration in the soil is expected to be less than 200 µg/kg, the samples may be collected directly with the En Core® Sampler or syringe. If using the syringes, the sample must be placed in the sample container (40 mL pre-prepared vial) immediately to reduce volatilization losses. The 40 mL vials should contain 10 mL of organic-free water for an un-preserved sample or approximately 10 mL of organic-free water and a preservative. It is recommended that the 40 mL vials be prepared and weighed by the laboratory (commercial sources are available which supply preserved and tared vials). When sampling directly with the En Core® Sampler, the vial must be immediately capped and locked.

A soil sample for VOC analysis may also be collected with conventional sampling equipment. A sample collected in this fashion must either be placed in the final sample container (En Core® Sampler or 40 mL pre-prepared vial) immediately or the sample may be immediately placed into an intermediate sample container with no head space. If an intermediate container (usually 2-oz. soil jar) is used, the sample must be transferred to the final sample container (En Core® Sampler or 40 mL pre-prepared vial) as soon as possible, not to exceed 30 minutes.

NOTE:After collection of the sample into either the En Core® Sampler or other container, the sample must immediately be stored in an ice chest and cooled.

Soil samples may be prepared for shipping and analysis as follows:

En Core® Sampler - the sample shall be capped, locked, and secured in the original foil bag. All foil bags containing En Core® samplers are then placed in a plastic bag and sealed with custody tape, if required.

Syringe - Add about 3.7 cc (approximately 5 grams) of sample material to 40-mL pre-prepared containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag. Note: When using the syringes, it is important that no air is allowed to become trapped behind the sample prior to extrusion, as this will adversely affect the sample.

Stainless Steel Laboratory Spatulas - Add between 4.5 and 5.5 grams (approximate) of sample material to 40 mL containers. Secure the containers in a plastic bag. Do not use a custody seal on the container; place the custody seal on the plastic bag.

3.2.3 Sampling Methodology - High Concentrations (>200 µg/kg)

Based upon the data quality objectives and the detection level requirements, this high-level method may also be used. Specifically, the sample may be packed into a single 2-oz. glass container with a screw cap and septum seal. The sample container must be filled quickly and completely to eliminate head space. Soils\sediments containing high total VOC concentrations may also be collected as described in Section 3.2.2, Sampling Methodology - Low Concentrations, and preserved using 10 mL methanol.

3.2.4 Special Techniques and Considerations for Method 5035

<u>Effervescence</u>

If low concentration samples effervesce (rapidly form bubbles) from contact with the acid preservative, then either a test for effervescence must be performed prior to sampling, or the investigators must be prepared to collect each sample both preserved or un-preserved, as needed, or all samples must be collected unpreserved.

To check for effervescence, collect a test sample and add to a pre-preserved vial. If preservation (acidification) of the sample results in effervescence then preservation by acidification is not acceptable, and the sample must be collected un-preserved.

If effervescence occurs and only pre-preserved sample vials are available, the preservative solution may be placed into an appropriate hazardous waste container and the vials triple rinsed with organic free water. An appropriate amount of organic free water, equal to the amount of preservative solution, should be placed into the vial. The sample may then be collected as an un-preserved sample. Note: the amount of organic free water placed into the vials will have to be accurately measured.

Sample Size

While this method is an improvement over earlier ones, field investigators must be aware of an inherent limitation. Because of the extremely small sample size and the lack of sample mixing, sample representativeness for VOCs may be reduced compared to samples with larger volumes collected for other constituents. The sampling design and objectives of the investigation should take this into consideration.

Holding Times

Sample holding times are specified in the Laboratory Services Branch *Laboratory Operations and Quality Assurance Manual* (ASBLOQAM), Most Recent Version. Field investigators should note that the holding time for an un-preserved VOC soil/sediment sample on ice is 48 hours. Arrangements should be made to ship the soil/sediment VOC samples to the laboratory by overnight delivery the day they are collected so the laboratory may preserve and/or analyze the sample within 48 hours of collection.

Percent Solids

Samplers must ensure that the laboratory has sufficient material to determine percent solids in the VOC soil/sediment sample to correct the analytical results to dry weight. If other analyses requiring percent solids determination are being performed upon the sample, these results may be used. If not, a separate sample (minimum of 2 oz.) for percent solids determination will be required. The sample collected for percent solids may also be used by the laboratory to check for preservative compatibility.

Safety

Methanol is a toxic and flammable liquid. Therefore, methanol must be handled with all required safety precautions related to toxic and flammable liquids. Inhalation of methanol vapors must be avoided. Vials should be opened and closed quickly during the sample preservation procedure. Methanol must be handled in a ventilated area. Use protective gloves when handling the methanol vials. Store methanol away from sources of ignition such as extreme heat or open flames. The vials of methanol should be stored in a cooler with ice at all times.

Shipping

Methanol and sodium bisulfate are considered dangerous goods, therefore shipment of samples preserved with these materials by common carrier is regulated by the U.S. Department of Transportation and the International Air Transport Association (IATA). The rules of shipment found in Title 49 of the Code of Federal Regulations (49 CFR parts 171 to 179) and the current edition of the IATA Dangerous Goods Regulations must be followed when shipping methanol and sodium bisulfate. Consult the above documents or the carrier for additional information. Shipment of the quantities of methanol and sodium bisulfate used for sample preservation falls under the exemption for small quantities.

The summary table on the following page lists the options available for compliance with SW846 Method 5035. The advantages and disadvantages are noted for each option. LASSD's goal is to minimize the use of hazardous material (methanol and sodium bisulfate) and minimize the generation of hazardous waste during sample collection.

Table 1: Method 5035 Summary

OPTION	PROCEDURE	ADVANTAGES	DISADVANTAGES
1	Collect two 40 mL vials with ≈ 5 grams of sample, and one 2 oz. glass jar w/septum lid for screening, % moisture and preservative compatibility.	Screening conducted by lab.	Presently a 48-hour holding time for unpreserved samples. Sample containers must be tared.
2	Collect three En Core® samplers, and one 2 oz. glass jar w/septum lid for screening, % solids.	Lab conducts all preservation/preparation procedures.	Presently a 48- hour holding time for preparation of samples.
3	Collect two 40 mL vials with 5 grams of sample and preserve w/methanol or sodium bisulfate, and one 2-oz. glass jar w/septum lid for screening, % solids .	High level VOC samples may be composited. Longer holding time.	Hazardous materials used in the field. Sample containers must be tared.
4	Collect one 2-oz. glass jar w/septum lid for analysis, % solids (high level VOC only).	Lab conducts all preservation/preparation procedures.	May have significant VOC loss.

3.3 Soil Samples for Per- and Polyfluoroalkyl Substances (PFAS) Analysis

Sources of PFAS contamination in soils can include direct discharges, direct applications of some PFAS products such as aqueous film-forming foams (AFFF), air deposition from manufacturing stack emissions, landfill leachate, and land applications of biosolids or effluents. The distribution of PFAS in soils is multifaceted and will be dependent on site-specific conditions and soils as well as the individual properties of the PFAS such as chain length and functional group. Heavy PFAS contamination of subsurface soils can serve as long-term sources for both groundwater and surface water contamination. For more information about conducting site investigations for PFAS, please see the Interstate Technology and Regulatory Council's (ITRC's) April 2020 Fact Sheets: *Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*, and *Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances*.

3.3.1 Sampling Equipment

Guidance documents recommend sampling equipment be made of stainless-steel, high-density polyethylene (HDPE), polypropylene, and/or silicone. Standard soil sampling equipment such as stainless-steel spoons, hand augers, and direct push samplers with liners that are PFAS-free can be used to collect samples for PFAS analyses. Direct contact sampling equipment that will be used to collect samples for PFAS analyses should be decontaminated following the procedures in the *Field Equipment Cleaning and Decontamination at the FEC*, LSASDPROC-206.

3.3.2 PFAS Soil Sample Mixing and Homogenization Considerations

Because studies have shown the loss of PFAS due to adsorption to surfaces, samples should be minimally handled and directly placed into the sample container when possible. Sample preparation procedures should be specified in the Sampling and Analysis Plan (SAP). If compositing, mixing or homogenization of the sample is desired, it should preferably be done at the laboratory so that a representative subsample will be analyzed. In cases where the homogenization is conducted in the field, extra grab samples should accompany the mixed or composited samples to determine the variability and impacts on PFAS concentrations of the mixed samples.

3.3.3 Trace Level Sampling Technique for PFAS

To prevent PFAS contamination, **extreme care** is required when handling containers, samples and equipment that will be used to collect samples for PFAS analyses. **New gloves** need to be worn when decontaminating and handling sample containers and equipment. When worn gloves become compromised by potential PFAS containing materials, they need to be changed for new gloves. Nitrile gloves are recommended for PFAS sampling investigations. Also, sample containers should be kept covered in original packaging or in Whirl-Paks® until ready for use due to potential PFAS contamination from air deposition of vapors, aerosols, and particulates.

This trace level sampling technique is used to minimize PFAS contamination of the samples. This process will require two field personnel for PFAS sample collection. When the field investigators are prepared to fill the sample container(s), a designated sampler will don new gloves while a second designee, also with new gloves, will assist by opening sample container packaging/Whirl-Pak®. The designated sampler removes the sample container(s) from the packaging but keeps them closed. Only after the second designee is ready to fill the sample container does the designated sampler remove the cap and hold it in their hand until the appropriate sample volume is obtained. After capping the sample container(s), return them to their Whirl-Pak®. The designated sampler who holds the sample container(s) should not touch anything else during the sample collection process. This is important because of the wide use of PFAS in commercial products such as clothing, field gear, personnel protective equipment, sunscreen, insect repellants, and personal hygiene products. Additionally, the designated sampler should avoid touching the sample media and the inside of the sample container. The second designee will operate sampling equipment and assist with sample container packaging and labeling. Sampling equipment known or suspected to contain PFAS should be avoided during sampling activities.

3.3.4 Quality Control Samples and Standard Operating Procedures

For soil samples undergoing PFAS analyses, it extremely important that quality control samples be collected as part of the investigation to account for the PFAS contribution of the sample containers, decontamination solutions, gloves, decontaminated equipment and plastic used to store equipment. Equipment rinse and material blanks are needed for PFAS sampling investigations to assess the direct contact sampling equipment impact on the sampling results. It is also helpful to take field quality control samples such as field blanks, duplicates, and trip blanks to evaluate the soil sampling and sample handling activities of the investigation. Laboratory sources of water used for equipment decontamination and blank sample collection should be produced as PFAS-free or assessed for background concentrations of PFAS.

Along with a good quality assurance program, standard operating procedures (SOPs) and detailed SAPs are required for PFAS investigations to provide consistency between samplers and investigations.

4 Manual Soil Sampling Methods

4.1 General

These methods are used primarily to collect surface and shallow subsurface soil samples. Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface. The most common interval is 0 to 6 inches; however, the data quality objectives of the investigation may dictate another interval, such as 0 to 3 inches for risk assessment purposes. The shallow subsurface interval may be considered to extend from approximately 12 inches below ground surface to a site-specific depth at which sample collection using manual collection methods becomes impractical.

If a thick, matted root zone, gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

When compositing, make sure that each composite location (aliquot) consist of equal volumes, i.e., same number of equal spoonfuls.

4.2 Spoons

Stainless steel spoons may be used for surface soil sampling to depths of approximately 6 inches below ground surface where conditions are generally soft and non-indurated, and there is no problematic vegetative layer to penetrate.

4.2.1 Special Considerations When Using Spoons

When using stainless steel spoons, consideration must be given to the procedure used to collect the volatile organic compound sample. If the soil being sampled is cohesive and holds its in situ texture in the spoon, the En Core® Sampler or syringe used to collect the sub-sample for Method 5035 should be plugged directly from the spoon. If, however, the soil is not cohesive and crumbles when removed from the ground surface for sampling, consideration should be given to plugging the sample for Method 5035 directly from the ground surface at a depth appropriate for the investigation Data Quality Objectives.

4.3 Hand Augers

Hand augers may be used to advance boreholes and collect soil samples in the surface and shallow subsurface intervals. Typically, 3-inch stainless steel auger buckets with cutting heads are used. The bucket is advanced by simultaneously pushing and turning using an attached handle with extensions (if needed).

4.3.1 Surface Soil Sampling

When conducting surface soil sampling with hand augers, the auger buckets may be used with a handle alone or with a handle and extensions. The bucket is advanced to the appropriate depth and the contents are transferred to the homogenization container for processing. Observe precautions for volatile organic compound and PFAS sample collection found in Section 3.

4.3.2 Subsurface Soil Sampling

Hand augers are the most common equipment used to collect shallow subsurface soil samples. Auger holes are advanced one bucket at a time until the sample depth is achieved. When the sample depth is reached, the bucket used to advance the hole is removed and a clean bucket is attached. The clean auger bucket is then placed in the hole and filled with soil to make up the sample and removed.

The practical depth of investigation using a hand auger depends upon the soil properties and depth of investigation. In sand, augering is usually easily performed, but the depth of collection is limited to the depth at which the sand begins to flow or collapse. Hand augers may also be of limited use in tight clays or cemented sands. In these soil types, the greater the depth attempted, the more difficult it is to recover a sample due to increased friction and torqueing of the hand auger extensions. At some point these problems become so severe that power equipment must be used.

4.3.3 Special Considerations for Soil Sampling with the Hand Auger

- Because of the tendency for the auger bucket to scrape material from the sides of the auger hole while being extracted, the top several inches of soil in the auger bucket should be discarded prior to placing the bucket contents in the homogenization container for processing.
- Observe precautions for volatile organic compound (VOC) and PFAS sample collection found in Section 3. Collect the VOC sample directly from the auger bucket, if possible.
- Power augers, such as the Little Beaver® and drill rigs may be used to advance boreholes to depths for subsurface soil sampling with the hand auger. They may not be used for sample collection. When power augers are used to advance a borehole to depth for sampling, care must be taken that exhaust fumes, gasoline and/or oil do not contaminate the borehole or area in the immediate vicinity of sampling.
- When moving to a new sampling location, the entire hand auger assembly must be replaced with a properly decontaminated hand auger assembly.

5 Direct Push Soil Sampling Methods

5.1 General

These methods are used primarily to collect shallow and deep subsurface soil samples. Three samplers are available for use within the Division's direct push tooling inventory. All of the sampling tools involve the collection and retrieval of the soil sample within a thin-walled liner. The following sections describe each of the specific sampling methods that can be accomplished using direct push techniques, along with details specific to each method. While LSASD currently uses the sample tooling described, tooling of similar design and materials is acceptable.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

5.2 Large Bore® Soil Sampler

The Large Bore® (LB) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of depth-discrete subsurface soil samples. The sample barrel is approximately 30-inches (762 mm) long and has a 1.5-inch (38 mm) outside diameter. The LB® sampler is capable of recovering a discrete sample core 22 inches x 1.0 inch (559 mm x 25 mm) contained inside a removable liner. The resultant sample volume is a maximum of 283 mL.

After the LB® sample barrel is equipped with the cutting shoe and liner, the piston-rod point assembly is inserted, along with the drive head and piston stop assembly. The assembled sampler is driven to the desired sampling depth, at which time the piston stop pin is removed, freeing the push point. The LB® sampler is then pushed into the soil a distance equal to the length of the LB® sample barrel. The probe rod string, with the LB® sampler attached, is then removed from the subsurface. After retrieval, the LB® sampler is then removed from the probe rod string. The drive head is then removed to allow removal of the liner and soil sample.

5.3 Macro-Core® Soil Sampler

The Macro-Core® (MC) sampler is a solid barrel direct push sampler equipped with a piston-rod point assembly used primarily for collection of either continuous or depth-discrete subsurface soil samples. Although other lengths are available, the standard MC® sampler has an assembled length of approximately 52 inches (1321 mm) with an outside diameter of 2.2 inches (56 mm). The MC® sampler is capable of recovering a discrete sample core 45 inches x 1.5 inches (1143 mm x 38 mm) contained inside a removable liner. The resultant sample volume is a maximum of 1300 mL. The MC® sampler may be used in either an open-tube or closed-point configuration. Although the MC® sampler can be used as an open-barrel sampler, in LSASD usage, the piston point is always used to prevent the collection of slough from the borehole sides.

5.4 Dual Tube Soil Sampling System

The Dual Tube 21 soil sampling system is a direct push system for collecting continuous core samples of unconsolidated materials from within a sealed outer casing of 2.125-inch (54 mm) OD probe rod. The samples are collected within a liner that is threaded onto the leading end of a string of 1.0-inch diameter probe rod. Collected samples have a volume of up to 800 mL in the form of a 1.125-inch x 48-inch (29 mm x 1219 mm) core. Use of this method allows for collection of continuous core inside a cased hole, minimizing or preventing cross-contamination between different intervals during sample collection. The outer casing is advanced, one core length at a time, with only the inner probe rod and core being removed and replaced between samples. If the sampling zone of interest begins at some depth below ground surface, a solid drive tip must be used to drive the dual tube assembly and core to its initial sample depth.

5.5 Special Considerations When Using Direct Push Sampling Methods

- *Liner Use and Material Selection* – Direct Push Soil Samples are collected within a liner to facilitate removal of sample material from the sample barrel. The liners may only be available in a limited number of materials for a given sample tool, although overall, liners are available in brass, stainless steel, cellulose acetate butyrate (CAB), polyethylene terepthalate glycol (PETG), polyvinyl chloride (PVC) and Teflon®. For most LSASD investigations, the standard polymer liner material for a sampling tool will be acceptable. When the study objectives require very low reporting levels or unusual contaminants of concern, the use of more inert liner materials such as Teflon® or stainless steel may be necessary.

- *Sample Orientation* – When the liners and associated sample are removed from the sample tubes, it is important to maintain the proper orientation of the sample. This is particularly important when multiple sample depths are collected from the same push. It is also important to maintain proper orientation to define precisely the depth at which an aliquot was collected. Maintaining proper orientation is typically accomplished using vinyl end caps. Convention is to place red caps on the top of the liner and black caps on the bottom to maintain proper sample orientation. Orientation can also be indicated by marking on the exterior of the liner with a permanent marker.

- *Core Catchers* – Occasionally the material being sampled lacks cohesiveness and is subject to crumbling and falling out of the sample liner. In cases such as these, the use of core catchers on the leading end of the sampler may help retain the sample until it is retrieved to the surface. Core catchers may only be available in specific materials and should be evaluated for suitability. However, given the limited sample contact that core-catchers have with the sample material, most standard core-catchers available for a tool system will be acceptable.

- *Decontamination* – The cutting shoe and piston rod point are to be decontaminated between each sample, using the procedures specified for the collection of trace organic and inorganic compounds found in Field Equipment and Decontamination – SESDPROC-205, most recent version. Within a borehole, the sample barrel, rods, and drive head may be subjected to an abbreviated cleaning to remove obvious and loose material, but must be cleaned between boreholes using the procedures specified for downhole drilling equipment in Field Equipment and Decontamination – SESDPROC-205, most recent version.

- *Decommissioning* – Boreholes must be decommissioned after the completion of sampling. Boreholes less than 10 feet deep that remain open and do not approach the water table may be decommissioned by pouring 30% solids bentonite grout from the surface or pouring bentonite pellets from the surface, hydrating the pellets in lifts. Boreholes deeper than 10 feet, or any borehole that intercepts groundwater, must be decommissioned by pressure grouting with 30% solids bentonite grout, either through a re-entry tool string or through tremie pipe introduced to within several feet of the borehole bottom.

- *VOC and PFAS Sample Collection* – Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3 of this procedure.

6 Split Spoon/Drill Rig Methods

6.1 General

Split spoon sampling methods are used primarily to collect shallow and deep subsurface soil samples. All split spoon samplers, regardless of size, are basically split cylindrical barrels that are threaded on each end. The leading end is held together with a beveled threaded collar that functions as a cutting shoe. The other end is held together with a threaded collar that serves as the sub used to attach the spoon to the string of drill rod. Two basic methods are available for use, including the smaller diameter standard split spoon, driven with the drill rig safety hammer, and the larger diameter continuous split spoon, advanced inside and slightly ahead of the lead auger during hollow stem auger drilling. The following sections describe each of the specific sampling methods, along with details specific to each method.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with these devices.

6.2 Standard Split Spoon

A drill rig is used to advance a borehole to the target depth. The drill string is then removed and a standard split spoon is attached to a string of drill rod. Split spoons used for soil sampling must be constructed of stainless steel and are typically 2.0-inches OD (1.5-inches ID) and 18-inches to 24-inches in length. Other diameters and lengths are common and may be used if constructed of the proper material. After the spoon is attached to the string of drill rod, it is lowered into the borehole. The safety hammer is then used to drive the split spoon into the soil at the bottom of the borehole. After the split spoon has been driven into the soil, filling the spoon, it is retrieved to the surface, where it is removed from the drill rod string and opened for sample acquisition.

6.3 Continuous Split Spoon

The continuous split spoon is a large diameter split spoon that is advanced into the soil column inside a hollow stem auger. Continuous split spoons are typically 3 to 5 inches in diameter and either 5 feet or 10 feet in length, although the 5-foot long samplers are most common. After the auger string has been advanced into the soil column a distance equal to the length of the sampler being used it is returned to the surface. The sampler is removed from inside the hollow stem auger and the threaded collars are removed. The split spoon is then opened for sampling.

6.4 Special Considerations When Using Split Spoon Sampling Methods

- Always discard the top several inches of material in the spoon before removing any portion for sampling. This material normally consists of borehole wall material that has sloughed off of the borehole wall after removal of the drill string prior to and during inserting the split spoon.
- Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3.

7 Shelby Tube/Thin-Walled Sampling Methods

7.1 General

Shelby tubes, also referred to generically as thin-walled push tubes or Acker thin-walled samplers, are used to collect subsurface soil samples in cohesive soils and clays during drilling activities. In addition to samples for chemical analyses, Shelby tubes are also used to collect relatively undisturbed soil samples for geotechnical analyses, such as hydraulic conductivity and permeability, to support hydrogeologic characterizations at hazardous waste and other sites.

If gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials. Turf grass is not typically removed prior to sampling with this device.

7.2 Shelby Tube Sampling Method

A typical Shelby tube is 30 inches in length and has a 3.0-inch OD (2.875-inch ID) and may be constructed of steel, stainless steel, galvanized steel, or brass. They also typically are attached to push heads that are constructed with a ball-check to aid in holding the contained sample during retrieval. If used for collecting samples for chemical analyses, it must be constructed of stainless steel. If used for collecting samples for standard geotechnical parameters, any material is acceptable.

To collect a sample, the tube is attached to a string of drill rod and is lowered into the borehole, where the sampler is then pressed into the undisturbed material by hydraulic force. After retrieval to the surface, the tube containing the sample is then removed from the sampler head. If samples for chemical analyses are needed, the soil contained inside the tube is then removed for sample acquisition. If the sample is collected for geotechnical parameters, the tube is typically capped, maintaining the sample in its relatively undisturbed state, and shipped to the appropriate geotechnical laboratory.

7.3 Special Considerations When Using Split Spoon Sampling Methods

Observe precautions for volatile organic compounds and Per- and Polyfluoroalkyl Substances sample collection found in Section 3.

8 Backhoe Sampling Method

8.1 General

Backhoes may be used in the collection of surface and shallow subsurface soil samples. The trenches created by excavation with a backhoe offer the capability of collecting samples from very specific intervals and allow visual correlation with vertically and horizontally adjacent material. If possible, the sample should be collected without entering the trench. Samples may be obtained from the trench wall or they may be obtained directly from the bucket at the surface. The following sections describe various techniques for safely collecting representative soil samples with the aid of a backhoe.

The depth measurement for the sample begins at the top of the soil horizon.

8.2 Scoop-and-Bracket Method

If a sample interval is targeted from the surface, it can be sampled using a stainless steel scoop and bracket. First a scoop and bracket are affixed to a length of conduit and is lowered into the backhoe pit. The first step is to take the scoop and scrape away the soil comprising the surface of the excavated wall. This material likely represents soil that has been smeared by the backhoe bucket from adjacent material. After the smeared material has been scraped off, the original stainless steel scoop is removed and a clean stainless steel scoop is placed on the bracket. The clean scoop can then be used to remove sufficient volume of soil from the excavation wall to make up the required sample volume.

8.3 Direct-from-Bucket Method

It is also possible to collect soil samples directly from the backhoe bucket at the surface. Some precision with respect to actual depth or location may be lost with this method but if the soil to be sampled is uniquely distinguishable from the adjacent or nearby soils, it may be possible to characterize the material as to location and depth. In order to ensure representativeness, it is also advisable to dress the surface to be sampled by scraping off any smeared material that may cross-contaminate the sample.

8.4 Special Considerations When Sampling with a Backhoe

- Do not physically enter backhoe excavations to collect a sample. Use either procedure 8.2, Scoop-and-Bracket Method, or procedure 8.3, Direct-from-Bucket Method to obtain soil for sampling.

- Smearing is an important issue when sampling with a backhoe. Measures must be taken, such as dressing the surfaces to be sampled (see Section 2.3), to mitigate problems with smearing.
- Paint, grease and rust must be removed and the bucket decontaminated prior to sample collection.
- Observe precautions for volatile organic compound and PFAS sample collection found in Section 3.

9 Incremental Sampling Method

9.1 General

ISM is a structured composite sampling and processing protocol that reduces data variability and provides an unbiased estimate of mean contaminant concentrations in the area targeted for sampling. ISM provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil (typically 30–100) that are combined, processed, and subsampled according to specific protocols. Triplicate samples are collected to measure and evaluate the reproducibility of the sample data.

Like all sampling approaches, ISM should be applied within a systematic planning framework. The size, orientation, and location of a DU is site-specific and represents the smallest volume of soil about which a decision is to be made (USEPA 1999, Ramsey and Hewitt 2005, HDOH 2008a, ADEC 2009). DUs are based on project-specific needs and site-specific DQOs. More detailed information on conducting sampling using ISM can be found in the Interstate Technology and Regulatory Council's *Incremental Sampling Methodology* (ISM-1).

9.2 Field Implementation, Sample Collection, and Processing

9.2.1 Introduction

The goal of most sampling efforts is to collect a sample that is representative of the target area (or DU). ISM is designed to collect representative and reproducible soil data. To help ensure data quality, all field sampling and field processing activities should be performed and supervised by personnel trained in ISM implementation

9.2.2 Sampling Tools

The selection of the appropriate sampling tool for collecting an ISM sample depends on the cohesiveness and composition of the soil substrate. The sampling tool should obtain cylindrical or core-shaped increments of a constant depth from the presented surface so that each increment collected is the same approximate volume and mass.

See Figures 1 and 2 for examples of sampling tools for nonvolatile ISM sample collection. Various other hand augers, core sampling tools, step probes, etc., are available from environmental or agricultural suppliers and are applicable to ISM if the specifications meet project DQOs. It is highly recommended that the proposed sampling tool is tested at the sample location prior to full mobilization to ensure that the sampling tool is appropriate for site conditions. If a pilot sampling effort is not possible, a variety of tools to address different soil types or site conditions should be taken into the field.

Note: Volatile ISM sample collection should follow Method 5035 recommendations. See Section 3 of this SOP.

9.2.3 Field Collection

Incremental soil samples are prepared by collecting multiple increments of soil (typically 30 or more) from a specified DU and physically combining these increments into a single sample, referred to as the "incremental sample." Samples are collected in triplicate from different locations within the same DU. Sample increments locations can be selected by a random number generator or evenly spaced across the DU to ensure that the incremental sample is representative of the DU. Survey flags or other markers can be helpful in identifying increment collection locations prior to beginning sample location.

The number of increments to be collected from each DU of a site investigation should be evaluated during systematic planning as part of the DQO process and documented in the sampling and analysis plan (SAP).See section 5.3.2 of ISM-1 for subsurface ISM sample collection.

9.2.4 Field Handling of ISM Samples

ISM samples collect a larger volume of soil than discrete samples and will require a larger collection container than may be specified by the laboratory or that is typically used. For example, a gallon-sized sealable plastic bag or a liter glass jar may be used depending upon the suspect analytes. When building the incremental sample by collecting increments, it may be more practical to collect the sample in an aluminum pan, plastic bucket, stainless-steel bowl, or other easily transported container until the entire sample has been collected. The final sample can then be processed in the field or transferred to a container for shipment to a laboratory for sample processing and analysis.

Processing of ISM samples is ideally performed in a laboratory. However, subsampling, disaggregation, drying, and sieving are some processing steps that may be required to be performed in the field. Field processing may be necessary if field analysis will be performed on the samples of if the laboratory is unable to perform the sample processing steps required. Any field processing steps should be rigorously performed to ensure that the sample representativeness is maintained through analysis. To ensure proper sample size reduction and representative subsampling, they should be performed using a 2-D Japanese slab cake and specialized subsampling tool, a riffle splitter, rotary cone sample splitter, or similar. Sample volume reduction of ISM samples should not be conducted with a stainless-steel spoon and a stainless-steel bowl. All sample processing equipment should be appropriately decontaminated between sample stations.

9.3 Special Considerations When Using Incremental Sampling Methods

- Selection of an appropriately sized and positioned Decision Unit is important to ensuring quality data and useful results
- Steps should be taken throughout the sampling effort to ensure that the representativeness of the sample is maintained from collection through analysis
- Advance coordination with the laboratory is necessary to ensure that the laboratory has the capability and capacity to conduct any sample processing that may be necessary. If the lab cannot complete the required processing steps, the sampling team may need to perform the sample processing steps in the field.

Figure 1

Figure 2

10 References

International Air Transport Authority (IATA). Dangerous Goods Regulations, Most Recent Version

LSASD Operating Procedure for Field Equipment Cleaning and Decontamination, SESDPROC-205, Most Recent Version

LSASD Operating Procedure for Field Equipment Cleaning and Decontamination at the FEC, SESDPROC-206, Most Recent Version

LSASD Operating Procedure for Field Sampling Quality Control, SESDPROC-011, Most Recent Version

LSASD Operating Procedure for Field X-Ray Fluorescence (XRF) Measurement, SESDPROC-107, Most Recent Version

LSASD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

LSASD Operating Procedure for Sample and Evidence Management, SESDPROC-005, Most Recent Version

Title 49 Code of Federal Regulations, Pts. 171 to 179, Most Recent Version

US EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods SW-846, Most Recent Version (Method 5035)

US EPA Region 4 Safety and Occupational Health Manual. Region 4 LSASD, Athens, GA, Most Recent Version

ITRC (Interstate Technology & Regulatory Council). 2012. Incremental Sampling Methodology. ISM-1. Washington, D.C.: Interstate Technology & Regulatory Council, Incremental Sampling Methodology Team. www.itrcweb.org.

ITRC (Interstate Technology and Regulatory Council) April 2020 Fact Sheets: *Site Characterization Considerations, Sampling Precautions,* and *Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)*, and *Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances*

11 Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the LSASD Quality Assurance Coordinator (QAC) on the LSASD local area network (LAN).

History	Effective Date
Replaced Chief with Supervisor; General formatting changes.	April 22, 2023
LSASDPROC-300-R4, *Soil Sampling,* replaces SESDPROC-300-R3Added Section 3.3. Soil Samples Collected for PFAS Analysis. Added Section 9, Incremental Sampling Method including Figures 1 and 2. **General:** Throughout the document, mention of SESD was replaced with LSASD as appropriate. Mention of Document Control Coordinator changed to Quality Assurance Coordinator. **Cover Page:** Changed Kevin Simmons, Environmental Scientist to Life Scientist. Changed Acting Supervisor, John Deatrick of the Enforcement and Investigations Branch to Supervisor, Applied Science Branch. Changed Acting Supervisor, Laura Ackerman, Ecological Assessment Branch to Supervisor, Hunter Johnson, Superfund Section. Changed Bobby Lewis, Field Quality Manager, Science and Ecosystem Support Division to Stacie Masters, Quality Assurance Coordinator, Laboratory Services and Applied Science Division.	June 11, 2020
SESDPROC-300-R3, *Soil Sampling*, replaces SESDPROC-300-R2. **General:** Corrected any typographical, grammatical and/or editorial errors. **Title Page:** Updated the author from Fred Sloan to Kevin Simmons. Updated the Enforcement and Investigations Branch Supervisor from Archie Lee to Acting Supervisor, John Deatrick. Section 1.5.1: Added "The reader should" to last sentence of the paragraph. Section 1.5.2: Omitted "When sampling in landscaped areas," from first sentence of eighth bullet. Section 3.2.4: In the first paragraph, first sentence, added "(rapidly form bubbles)." Omitted "(rapidly form bubbles)" from second paragraph, second sentence. Any reference to "Percent Moisture and Preservation Compatibility (MOICA)" or "Percent Moisture" was changed to "Percent Solids", both in the text and in Table 1.	August 21, 2014

SESDPROC-300-R2, *Soil Sampling*, replaces SESDPROC-300-R1.	December 20, 2011

SESDPROC-300-R1, *Soil Sampling*, replaces SESDPROC-300-R0.	November 1, 2007
SESDPROC-300-R0, Soil Sampling, Original Issue	February 05, 2007

Recommended Use Of The Terra Core®

NOTE: The Terra Core® Sampler is a single use device. It cannot be cleaned and/or reused.

Step 1

Have ready a 40ml glass VOA vial containing the appropriate preservative. With the plunger seated in the handle, push the Terra Core® into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 or 10 grams of soil.

Step 2

Wipe all soil or debris from the outside of the Terra Core® sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Step 3

Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40ml VOA vial containing the appropriate preservative and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40ml VOA vial. **Note:** When capping the 40ml VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

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Region 4 U.S. Environmental Protection Agency Laboratory Services and Applied Science Division Athens, Georgia	
Operating Procedure	
Title: Field Equipment Cleaning and Decontamination	ID: LSASDPROC-205-R4
Issuing Authority: LSASD Field Branch Chief	
Effective Date: June 22, 2020	Review Due Date: June 22, 2023

Purpose

This procedure is to be used by Region 4 Laboratory Services and Applied Science Division staff . This document describes general and specific procedures, methods and considerations to be used and observed when cleaning and decontaminating sampling equipment during the course of field investigations. This procedure is to be used by all Region 4 Laboratory Services and Applied Science Division (LSASD) staff.

Scope/Application

The procedures contained in this document are to be followed when field cleaning sampling equipment, for both re-use in the field, as well as used equipment being returned to the Field Equipment Center (FEC). On the occasion that LSASD field investigators determine that any of the procedures described in this section are either inappropriate, inadequate or impractical and that other procedures must be used to clean or decontaminate sampling equipment at a particular site, the variant procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products in this operating procedure does not constitute endorsement or recommendation for use.

TABLE OF CONTENTS

1 General Information

1.1 Documentation/Verification

This procedure was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and have been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the LSASD Local Area Network (LAN). The Document Control Coordinator (DCC) is responsible for ensuring the most recent version of the procedure is placed on LAN and for maintaining records of review conducted prior to its issuance.

1.2 Definitions

- Decontamination: The process of cleaning dirty sampling equipment to the degree to which it can be re-used, with appropriate QA/QC, in the field.

- Deionized water: Tap water that has been treated by passing through a standard deionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard inductively coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. Deionized water obtained by other methods is acceptable, as long as it meets the above analytical criteria. Organic-free water may be substituted for deionized water.

- Detergent shall be a standard brand of phosphate-free laboratory detergent such as Liquinox® or Luminox®. Liquinox® is a traditional anionic laboratory detergent and is used for general cleaning and where there is concern for the stability of the cleaned items in harsher cleaners. Luminox® is a specialized detergent with the capability of removing oils and organic contamination. It is used in lieu of a solvent rinse step in cleaning of equipment for trace contaminant sampling. Where not specified in these procedures, either detergent is acceptable.

- Drilling Equipment: All power equipment used to collect surface and sub-surface soil samples or install wells. For purposes of this procedure, direct push is also included in this definition.

- Field Cleaning: The process of cleaning dirty sampling equipment such that it can be returned to the FEC in a condition that will minimize the risk of transfer of contaminants from a site.

- Organic-free water: Tap water that has been treated with activated carbon and deionizing units. At a minimum, the finished water must meet the analytical criteria of deionized water and it should contain no detectable pesticides, herbicides, or extractable organic compounds, and no volatile organic compounds above minimum detectable levels as determined by the Region 4 laboratory for a given set of analyses. Organic-free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

- Tap water: Water from any potable water supply. Deionized water or organic-free water may be substituted for tap water.

1.3 General Precautions

1.3.1 Safety

Proper safety precautions must be observed when field cleaning or decontaminating dirty sampling equipment. Refer to the LSASD Safety, Health and Environmental Management Program (SHEMP) Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate. At a minimum, the following precautions should be taken in the field during these cleaning operations:

- When conducting field cleaning or decontamination using laboratory detergent, safety glasses with splash shields or goggles, and latex gloves will be worn.
- No eating, smoking, drinking, chewing, or any hand to mouth contact should be permitted during cleaning operations.

1.3.2 Procedural Precaution

Prior to mobilization to a site, the expected types of contamination should be evaluated to determine if the field cleaning and decontamination activities will generate rinses and other waste waters that might be considered RCRA hazardous waste or may require special handling.

2 Introduction to Field Equipment Cleaning and Decontamination

2.1 General

The procedures outlined in this document are intended for use by field investigators for cleaning and decontaminating sampling and other equipment in the field. These procedures should be followed in order that equipment is returned to the FEC in a condition that will minimize the risk of transfer of contaminants from a site.

Sampling and field equipment cleaned in accordance with these procedures must meet the minimum requirements for the Data Quality Objectives (DQOs) of the study or investigation. If deviations from these procedures need to be made during the course of the field investigation, they will be documented in the field logbook along with a description of the circumstances requiring the use of the variant procedure.

Cleaning procedures for use at the Field Equipment Center (FEC) are found in LSASD Operating Procedure for Equipment Cleaning and Decontamination at the FEC (LSASDPROC-206).

2.2 Handling Practices and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated. Storage and application containers must be constructed of the proper materials to ensure their integrity. Following are acceptable materials used for containing the specified cleaning solutions:

- Detergent must be kept in clean plastic, metal, or glass containers until used. It should be poured directly from the container during use.

- Tap water may be kept in tanks, hand pressure sprayers, squeeze bottles, or applied directly from a hose.

- Deionized water must be stored in clean, glass or plastic containers that can be closed for transport. It can be applied from plastic squeeze bottles.

- Organic-free water must be stored in clean glass or Teflon® containers prior to use. It may be applied using Teflon® squeeze bottles, or with the portable system.

2.3 Disposal of Cleaning Solutions

Procedures for the safe handling and disposition of investigation derived waste (IDW); including used wash water and rinse water are in LSASD Operating Procedure for Management of Investigation Derived Waste (LSASDPROC-202).

2.4 Sample Collection Equipment Contaminated with Concentrated Materials

Equipment used to collect samples of concentrated materials from investigation sites must be field cleaned before returning from the study. At a minimum, this should consist of washing with detergent and rinsing with tap water. When the above procedure cannot be followed, the following options are acceptable:

- Leave with facility for proper disposal;

- If possible, containerize, seal, and secure the equipment and leave on-site for later disposal;

- Containerize, bag, or seal the equipment so that no odor is detected and return to the Field Equipment Center.

It is the project leader's responsibility to evaluate the nature of the sampled material and determine the most appropriate cleaning procedures for the equipment used to sample that material.

2.5 Sample Collection Equipment Contaminated with Environmental Media

Equipment used to collect samples of environmental media from investigation sites should be field cleaned before returning from the study. Based on the condition of the sampling equipment, one or more of the following options must be used for field cleaning:

- Wipe the equipment clean;

- Water-rinse the equipment;

- Wash the equipment in detergent and water followed by a tap water rinse.

- For grossly contaminated equipment, the procedures set forth in Section 2.4 must be followed.

Under extenuating circumstances such as facility limitations, regulatory limitations, or during residential sampling investigations where field cleaning operations are not feasible, equipment can be containerized, bagged or sealed so that no odor is detected and returned to the FEC without being field cleaned. If possible, FEC personnel should be notified that equipment will be returned without being field cleaned. It is the project leader's responsibility to evaluate the nature of the sampled material and determine the most appropriate cleaning procedures for the equipment used to sample that material.

2.6 Handling of Decontaminated Equipment

After decontamination, equipment should be handled only by personnel wearing clean gloves to prevent re-contamination. In addition, the equipment should be moved away (preferably upwind) from the decontamination area to prevent re-contamination. If the equipment is not to be immediately re-used, it should be covered with plastic sheeting or wrapped in aluminum foil to prevent re-contamination. The area where the equipment is kept prior to re-use must be free of contaminants.

3 Field Equipment Decontamination Procedures

3.1 General

Sufficient equipment should be transported to the field so that an entire study can be conducted without the need for decontamination. When equipment must be decontaminated in the field, the following procedures are to be utilized.

Note: Equipment utilized for PFAS sampling will not cleaned in the field.

3.2 Specifications for Decontamination Pads

Decontamination pads constructed for field cleaning of sampling and drilling equipment should meet the following minimum specifications:

- The pad should be constructed in an area known or believed to be free of surface contamination.
- The pad should not leak.
- If possible, the pad should be constructed on a level, paved surface and should facilitate the removal of wastewater. This may be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit should also be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above ground to prevent equipment from being splashed.
- Water should be removed from the decontamination pad frequently.
- A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced (disposable) or repairable.

At the completion of site activities, the decontamination pad should be deactivated. The pit or sump should be backfilled with the appropriate material designated by the site project leader, but only after all waste/rinse water has been pumped into containers for disposal. See LSASD Operating Procedure for Management of Investigation Derived Waste (LSASDPROC-202) for proper handling and disposal of these materials. If the decontamination pad has leaked excessively, soil sampling may be required.

3.3 "Classical Parameter" Sampling Equipment

"Classical Parameters" are analyses such as oxygen demand, nutrients, certain inorganic compounds, sulfide, flow measurements, etc. For routine operations involving classical parameter analyses, water quality sampling equipment such as Kemmerers, buckets, dissolved oxygen dunkers, dredges, etc., may be cleaned with the sample water or tap water between sampling locations as appropriate.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gauging equipment may be cleaned with tap water between measuring locations, if necessary.

Note: The procedures described in Section 3.3 are not to be used for cleaning field equipment to be used for the collection of samples undergoing trace organic or inorganic constituent analyses.

3.4 Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds

For samples undergoing trace organic or inorganic constituent analyses, the following procedures are to be used for all sampling equipment or components of equipment that come in contact with the sample:

3.4.1 Standard LSASD Method

- An optional Liquinox® detergent wash step may be useful to remove gross dirt and soil.
- Clean with tap water and Luminox® detergent using a brush, if necessary, to remove particulate matter and surface films.
- Rinse thoroughly with tap water.
- Rinse thoroughly with organic-free water and place on a clean foil-wrapped surface to **a**ir-dry.
- Wrap the dry equipment with aluminum foil or bag in clean plastic. If the equipment is to be stored overnight before it is wrapped in foil, it should be covered and secured with clean, unused plastic sheeting.

3.4.2 Alternative Solvent Rinse Method

The historical solvent rinse method of cleaning equipment for trace contaminant sampling remains an acceptable method.

- Clean with tap water and Liquinox® detergent using a brush, if necessary, to remove particulate matter and surface films. Equipment may be steam cleaned (Liquinox® detergent and high-pressure hot water) as an alternative to brushing. Sampling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. PVC or plastic items should not be steam cleaned.

- Rinse thoroughly with tap water.

- Rinse thoroughly with deionized water.
- Rinse with an appropriate solvent (generally isopropanol).
- Rinse with organic-free water and place on a clean foil-wrapped surface to **a**ir-dry.
- Wrap the dry equipment with aluminum foil or plastic. If the equipment is to be stored overnight before it is wrapped, it should be covered and secured with clean, unused plastic sheeting.

3.5 Well Sounders or Tapes

The following procedures are recommended for decontaminating well sounders (water level indicators) and tapes. Unless conditions warrant, it is only necessary to decontaminate the wetted portion of the sounder or tape.

- Wash with Liquinox® detergent and tap water.
- Rinse with tap water.
- Rinse with deionized water.

3.6 Redi-Flo2® Pump

CAUTION – Do not wet the controller. Always disconnect power from the pump when handling the pump body.

The Redi-Flo2® pump and any associated connected hardware (e.g., check valve) should be decontaminated between each monitoring well. The following procedures are required, depending on whether the pump is used solely for purging or used for purging and sampling.

3.6.1 Purge Only (Pump and Wetted Portion of Tubing or Hose)

- Disconnect power and wash exterior of pump and wetted portion of the power lead and tubing or hose with Liquinox® detergent and water solution.
- Rinse with tap water.
- Final rinse with deionized water.
- Place pump and reel in a clean plastic bag and keep tubing or hose contained in clean plastic or galvanized tub between uses.

3.6.2 Purge And Sample

Grundfos Redi-Flo2® pumps are extensively decontaminated and tested at the FEC to prevent contamination from being transmitted between sites. The relevant sections of LSASDPROC-206, *Field Equipment Cleaning and Decontamination at the FEC,* should be implemented in the field where a high risk of cross-contamination exists, such as where NAPL or high-concentration contaminants occur. In most cases, the abbreviated cleaning procedure described below will suffice, provided that sampling proceeds from least to most contaminated areas.

- Disconnect and discard the previously used sample tubing from the pump. Remove the check valve and tubing adapters and clean separately (See Section 3.6.3 for check valve). Wash the pump exterior with detergent and water.

- Prepare and fill three containers with decontamination solutions, consisting of <u>Container #1</u>, a tap water/detergent washing solution. Luminox® is commonly used. An additional pre-wash container of Liquinox® may be used; <u>Container #2</u>, a tap water rinsing solution; and <u>Container #3</u>, a deionized or organic-free water final rinsing solution. Choice of detergent and final rinsing solution for all steps in this procedure is dependent upon project objectives (analytes and compounds of interest). The containers should be large enough to hold the pump and one to two liters of solution. An array of 2' long 2" PVC pipes with bottom caps is a common arrangement. The solutions should be changed at least daily.

- Place the pump in Container #1. Turn the pump on and circulate the detergent and water solution through the pump and then turn the pump off.

- Place the pump in Container #2. Turn the pump on and circulate the tap water through the pump and then turn the pump off.

- Place the pump in Container #3. Turn the pump on and circulate deionized or organic-free water through the pump and then turn the pump off.

- Disconnect power and remove pump from Container #3. Rinse exterior and interior of pump with fresh deionized or organic-free water.

- Decontaminate the power lead by washing with detergent and water, followed by tap water and deionized water rinses. This step may be performed before washing the pump if desired.

- Reassemble check valve and tubing adapters to pump. ALWAYS use Teflon® tape to prevent galling of threads. Firm hand-tightening of fittings or light wrench torque is generally adequate.

- Place the pump and reel in a clean plastic bag.

3.6.3 Redi-Flo2® Ball Check Valve

- Remove the ball check valve from the pump head. Check for wear and/or corrosion, and replace as needed. During decontamination check for free-flow in forward direction and blocking of flow in reverse direction.

- Using a brush, scrub all components with detergent and tap water.

- Rinse with deionized water.

- Rethread the ball check valve to the Redi-Flo2® pump head.

3.7 Mega-Monsoon® and GeoSub® Electric Submersible Pump

As these pumps have lower velocities in the turbine section and are easier to disassemble in the field than Grundfos pumps, the outer pump housing should be removed to expose the impeller for cleaning prior to use and between each use when used as a sampling pump for trace contaminant sampling.

- Remove check valves and adapter fittings and clean separately.
- Remove the outer motor housing by holding the top of the pump head and unscrewing the outer housing from its O-ring sealed seat.
- Clean all pump components per the provisions of section 3.4. Use a small bottle brush for the pump head passages
- Wet the O-ring(s) on the pump head with organic-free water. Reassemble the outer pump housing to the pump head.
- Clean cable and reel per Section 3.4.
- Conduct final rinse of pump with organic-free water over pump and through pump turbine.

3.8 Bladder Pumps

Bladder pumps are presumed to be intended for use as low flow purge-and-sample pumps. The Geotech® bladder pump and Geoprobe Systems® mechanical bladder pump can be cleaned similarly.

- Discard any tubing returned with the pump.

- Completely disassemble the pump, being careful to note the initial position of and retain any springs and loose ball checks.

- Discard pump bladder.

- Clean all parts as per the standard cleaning procedure in Section 3.4.

- Install a new Teflon® bladder and reassemble pump.

3.9 Downhole Drilling Equipment

While LSASD does not currently operate drilling equipment, LSASD personnel do oversee and specify drilling operations. The following procedures are to be used for drilling activities involving the collection of soil samples for trace organic and inorganic constituent analyses and for the construction of monitoring wells to be used for the collection of groundwater samples for trace organic and inorganic constituent analyses.

3.9.1 Introduction

Cleaning and decontamination of all equipment should occur at a designated area (decontamination pad) on the site. The decontamination pad should meet the specifications of Section 3.2 of this procedure.

Tap water brought on the site for drilling and cleaning purposes should be contained in a pre-cleaned tank.

A steam cleaner and/or high pressure hot water washer capable of generating a pressure of at least 2500 PSI and producing hot water and/or steam, with a detergent compartment, should be obtained.

3.9.2 Preliminary Cleaning and Inspection

Drilling equipment should be clean of any contaminants that may have been transported from off-site to minimize the potential for cross-contamination. The drilling equipment should not serve as a source of contaminants. Associated drilling and decontamination equipment, well construction materials, and equipment handling procedures should meet these minimum specified criteria:

- All downhole augering, drilling, and sampling equipment should be sandblasted before use if painted, and/or there is a buildup of rust, hard or caked matter, etc., that cannot be removed by steam cleaning (detergent and high pressure hot water), or wire brushing. Sandblasting should be performed <u>prior to arrival</u> on site, or well away from the decontamination pad and areas to be sampled.

- Any portion of the drilling equipment that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (detergent and high pressure hot water) and wire brushed (as needed) to remove all rust, soil, and other material which may have come from other sites before being brought on site.

- Printing and/or writing on well casing, tremie tubing, etc., should be removed before use. Emery cloth or sand paper can be used to remove the printing and/or writing. Most well material suppliers can provide materials without the printing and/or writing if specified when ordered. Items that cannot be cleaned are not acceptable and should be discarded.

- Equipment associated with the drilling and sampling activities should be inspected to insure that all oils, greases, hydraulic fluids, etc., have been removed, and all seals and gaskets are intact with no fluid leaks.

3.9.3 Drill Rig Field Cleaning Procedure

Any portion of the drill rig, backhoe, etc., that is over the borehole (kelly bar or mast, backhoe buckets, drilling platform, hoist or chain pulldowns, spindles, cathead, etc.) should be steam cleaned (detergent and high pressure hot water) between boreholes.

3.9.4 Field Decontamination Procedure for Drilling Equipment

The following is the standard procedure for field cleaning augers, drill stems, rods, tools, and associated equipment. This procedure does not apply to well casings, well screens, or split-spoon samplers used to obtain samples for chemical analyses, which should be decontaminated as outlined in Section 3.4 of this procedure.

- Wash with tap water and detergent, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with detergent) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses at least two feet above the floor of the decontamination pad. Hollow-stem augers, drill rods, etc., that are hollow or have holes that transmit water or drilling fluids, should be cleaned on the inside with vigorous brushing.

- Rinse thoroughly with tap water.

- Remove from the decontamination pad and cover with clean, unused plastic if not used immediately. If stored overnight, the plastic should be secured to ensure that it stays in place.

3.9.5 Field Decontamination Procedure for Direct Push Technology (DPT) Equipment

- Certain specific procedures for the decontamination of DPT tools are described in the various sampling procedures, but the following general guidelines apply:

- Prior to return to the Field Equipment Center, all threaded tool joints should be broken apart and the equipment cleaned per the provisions of *Section 2.5, Sample Collection Equipment Contaminated with Environmental Media* of this procedure.

- Equipment that contacts the sample media and is cleaned in the field for reuse should be cleaned per the provisions of *Section 3.4, Sampling Equipment used for the Collection of Trace Organic and Inorganic Compounds* of this procedure. This would include piston sampler points and shoes, screen point sampler screens and sheaths, and the drive rods when used for groundwater sampling.

- Equipment that does not directly contact the sample media and is cleaned in the field for reuse can generally be cleaned per the provisions of Section *3.7.4, Field Decontamination Procedure for Drilling Equipment* of this procedure.

- Stainless steel SP15/16 well screens require special care as the narrow slots are difficult to clean under even controlled circumstances and galvanic corrosion can release chrome from the screen surface. As soon as possible after retrieval, the screen slots should be sprayed from the outside to break loose as much material as possible before it can dry in place. To prevent galvanic corrosion, the screens must be segregated from the sampler sheaths, drive rods, and other carbon steel during return transport from the field.

3.10 Rental Pumps

Completing a groundwater sampling project may require the use of rental pumps. Rental pumps are acceptable where they are of suitable stainless steel and Teflon® construction. These pumps should be cleaned prior to use using the procedures specified herein and a rinse-blank collected prior to use.

4 References

LSASD Operating Procedure for Management of Investigation Derived Waste, LSASDPROC-202, Most Recent Version

LSASD Operating Procedure for Equipment Cleaning and Decontamination at the FEC, LSASDPROC-206, Most Recent Version

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 LSASD, Athens, GA, Most Recent Version

Revision History

The top row of this table shows the most recent changes to this controlled document. For previous revision history information, archived versions of this document are maintained by the LSASD Document Control Coordinator on the LSASD local area network (LAN).

History	Effective Date
LSASDPROC-205-R4, *Field Equipment Cleaning and Decontamination,* replaces SESDPROC-205-R3 **General:** Updated format, Division and Branch names and naming conventions post agency re-alignment. Section 3.1: Added note that PFAS sampling equipment will not be cleaned in the field. Clarified in Section 3.9 that LSASD does not performing drilling activities.	June 22, 2020
SESDPROC-205-R3, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R2. **Cover Page:** The author was changed to Brian Striggow. LSASD's reorganization was reflected in the authorization section by making John Deatrick the Chief of the Field Services Branch. The FQM was changed from Bobby Lewis to Hunter Johnson. **Revision History:** Changes were made to reflect the current practice of only including the most recent changes in the revision history. **General:** Corrected any typographical, grammatical and/or editorial errors. **Section 1.4:** Differentiate between Liquinox® and Luminox® detergents. **Section 3.4:** Restore solvent rinse as alternative cleaning method. **Section 3.7:** Added section on cleaning of 12 Volt electric submersible pumps. **Section 3.8:** Added section on cleaning of bladder pumps. **Section 3.9:** Added language on cleaning and transport of SP15/16 screens **Section 3.10:** Added section on cleaning of rental pumps	December 18, 2015
SESDPROC-205-R2, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R1.	December 20, 2011
SESDPROC-205-R1, *Field Equipment Cleaning and Decontamination*, replaces SESDPROC-205-R0.	November 1, 2007

SESDPROC-205-R0, *Field Equipment Cleaning and Decontamination*, Original Issue	February 05, 2007

Appendix B
Example Field Forms

DAILY FIELD REPORT

Geosyntec consultants

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Project Name: ____________________ **Date:** ____________________ **Page** ___ **of** ___

Project Number: ____________________ **Primary Activities:** ____________________

Field Personnel: ____________________

Recorded By: ____________________

Weather: ____________________

Time	Description of activities - location of work, work performed, equipment & personnel used, incidental information

Geosyntec consultants

SOIL SAMPLING LOG

Project Name: ______________________ Date: ______________________
Project Number: ______________________ Weather: ______________________
Site: ______________________ Sample Collected by: ______________________

Date	Time	Sample Location	Sample ID	Sample Interval (ft bgs)		Sample Type ☑		Analysis Requested ☑			Soil Description (e.g. fill, topsoil, sand, gravel, etc.)
				Starting Depth	Ending Depth	Composite	Discrete	Dioxins and Furans	VOCs	SVOCs	

Comments: ______________________