Site-Specific Quality Assurance Project Plan Addendum

Supplemental Phase II Environmental Site Assessment Work Plan

145, 249, 256, and 258 Bay Street
St. Johnsbury, Vermont 05819

U.S. EPA Cooperative Agreement No. BF-00A01669
U.S. EPA QA Tracking No. 24013 A 15

Prepared for: Northeastern Vermont Development Association

Prepared by: Onterris USA, Inc.

July 2026

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Issued: July 17, 2026

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This Site-Specific Quality Assurance Project Plan Addendum (SSQAPP-A) supplements NVDA's Master Quality Assurance Project Plan for Implementation of EPA Region 1 Brownfield Assessment, Multipurpose, and Revolving Loan Fund Grant Projects (QA#24013)

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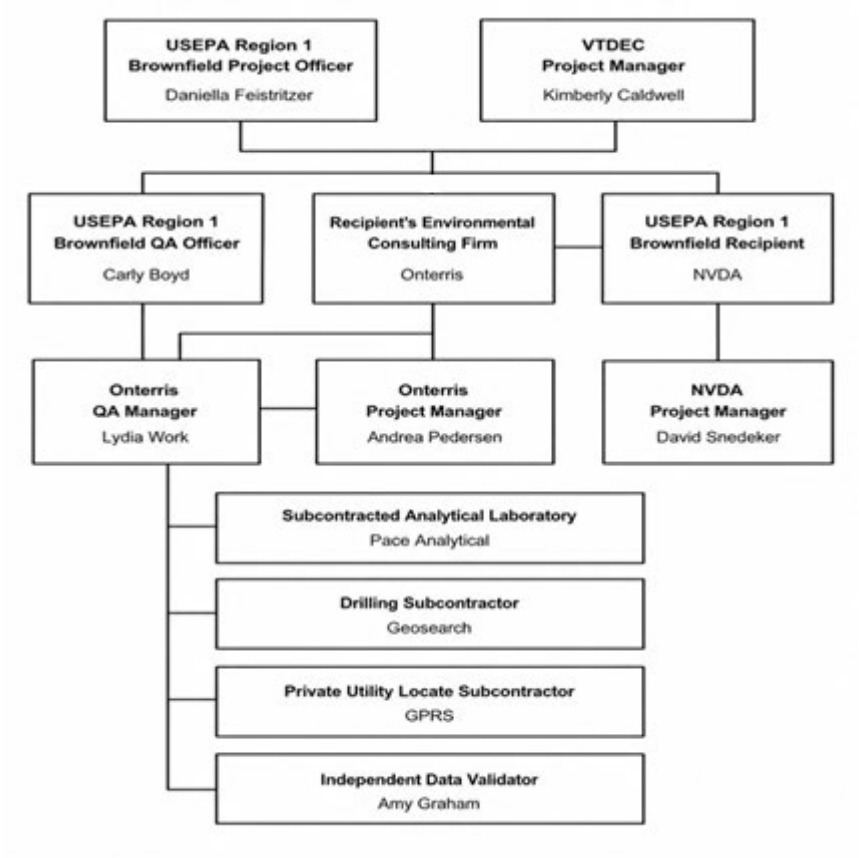
1 Introduction

Onterris USA, Inc. (“Onterris”) – formerly known as Montrose Environmental Solutions, Inc. (Montrose) – has prepared this Site-Specific Quality Assurance Project Plan Addendum (SSQAPP-A) on behalf of the Northeastern Vermont Development Association (NVDA or the Client) for submission to the United States Environmental Protection Agency (EPA) and Vermont Department of Environmental Conservation (VTDEC). This proposed scope of work consists of a Supplemental Phase II Environmental Site Assessment (ESA) to be completed at the former rkMILES property located at 145, 249, 256, and 258 Bay Street in the Town of St. Johnsbury, Vermont (the Site or Subject Property).

This SSQAPP-A was prepared for NVDA’s Brownfields Coalition Assessment Program (USEPA Cooperative Agreement No. BF-00A01669). Work will be completed in accordance with the Master Quality Assurance Project Plan, approved by USEPA and VTDEC on December 8, 2023 (QA#24013).

1.1 Project Organization

The project organization follows the VTDEC and USEPA-approved QAPP and is summarized on QAPP Worksheet #9 (**Appendix A**). An organization chart showing the relationships, lines of authority, and the lines of communication among project participants is included in the submitted QAPP (Worksheets #3-8) and summarized below:



Onterris has selected Pace Analytical (Pace) of East Longmeadow, Massachusetts to perform laboratory analytical services. Pace is a Vermont Department of Health (VTDOH)-certified analytical laboratory. A copy of this SSQAPP-A and the QAPP will be provided to the laboratory at least 10 days prior to sample receipt. Data packages will be requested in electronic format and will include internal laboratory and data handling records.

Field personnel will be current on 40-hour Occupational Safety and Health Administration (OSHA) training requirements and will have familiarity with applicable standard operating procedures (SOPs) and the submitted QAPP. Sample collection procedures and project data quality objectives will follow the QAPP unless otherwise specified herein. The QAPP includes project management roles and responsibilities, measurement and data acquisition guidelines, SOPs, assessment and oversight protocols, and data validation and usability guidelines. SOPs are identified in **Section 4.2** and included as **Appendix B**.

1.2 Objectives

The primary objectives of this SSQAPP-A are to:

- Describe the history of the Site based upon review of previous assessments and available regulatory records;
- Describe the Site assessment activities necessary to address recommendations presented in the Phase I ESA and to define the nature and extent of potential contaminants of concern (COCs);
- Evaluate potential exposure pathways; and
- Develop a conceptual site model (CSM).

2 Site Information

2.1 Property Description & History

The Site occupies four (4) non-contiguous parcels addressed 145, 249, 256, and 258 Bay Street in the Town of St. Johnsbury, Vermont (**Figure 1**). The Site totals approximately 1.82-acres of land and is within a long-developed commercial and industrial corridor.

Site location information and property details are summarized by the following tables:

145 Bay Street – VTDEC Site No. 20265565

Parcel No.	024-003-025-000
Area:	0.27-acres
Latitude/Longitude:	44.418744°, -72.013540°
Improvements:	2,560-sq. foot storage building, 2,372-sq. foot lumber storage canopy, 3,917-sq. foot lumber storage canopy
Surrounding Properties:	North: 119 Bay Street - VTDEC Site No. 20104049 South: 195 Bay Street - VTDEC Site No. 20124308 East: 299 Bay Street - VTDEC Site No. 921202, and the Passumpsic River West: Bay Street, 136 Bay Street - VTDEC Site No. 941711, and 202 Bay Street - VTDEC Site No. 20209466
Owner:	Town of St. Johnsbury

249 Bay Street – VTDEC Site No. 20265565

Parcel No.	024-003-031-000
Area:	1.32-acres
Latitude/Longitude:	44.417699°, -72.014235°
Improvements:	9,413-sq. foot office building, 3,251-sq. foot storage building, 4,595-sq. foot lumber storage canopy, 460-sq. foot shed
Surrounding Properties:	North: 195 Bay Street - VTDEC Site No. 20124308 South: 299 Bay Street - VTDEC Site No. 921202 East: 299 Bay Street - VTDEC Site No. 921202 West: 256 & 258 Bay Street - VTDEC Site No. 20265565
Owner:	Town of St. Johnsbury

256 Bay Street – VTDEC Site No. 20265565

Parcel No.	024-003-029-000
Area:	0.16-acres
Latitude/Longitude:	44.417880°, -72.014645°
Improvements:	8,980-sq. foot storage building
Surrounding Properties:	North: Depot Square and 202 Bay Street - VTDEC Site No. 20209466 South: 258 Bay Street - VTDEC Site No. 20265565 East: Bay Street and 249 Bay Street - VTDEC Site No. 20265565 West: Railroad corridor
Owner:	Town of St. Johnsbury

258 Bay Street – VTDEC Site No. 20265565

Parcel No.	558-176-10065
Area:	0.07-acres
Latitude/Longitude:	44.417543°, -72.014718°
Improvements:	Undeveloped
Surrounding Properties:	North: 256 Bay Street - VTDEC Site No. 20265565 South: Railroad corridor East: Bay Street and 249 Bay Street - VTDEC Site No. 20265565 West: Railroad corridor
Owner:	Town of St. Johnsbury

A layout of the Site and surrounding properties is depicted on **Figure 2**.

Although the Site consists of four (4) non-contiguous tax parcels, the parcels are collectively identified as one (1) Site because they were operated by rkMILES as components of a larger lumber, building-material, hardware, storage, and distribution operation. The parcels supported complementary functions, including office, warehouse, material storage, parking, and related activities. They were also evaluated collectively in the prior Phase I and Phase II ESAs and are being considered together by the Town of St. Johnsbury and NVDA for assessment and redevelopment planning.

The parcels share common operational and historical linkages and are located within the same long-developed commercial and industrial corridor. The prior Phase II ESA also identified environmental conditions on multiple parcels, including anthropogenic fill and polycyclic aromatic hydrocarbon (PAH) and lead-related soil impacts.

The four (4) parcels were previously submitted to EPA as the former rkMILES property and underwent a Brownfields eligibility determination before the current assessment activities were authorized. This SSQAPP-A does not expand the previously reviewed property boundary.

2.2 Site History

The Site has been developed for commercial and industrial use since at least 1884. Historical Sanborn® Fire Insurance Maps indicate that the 249, 256, and 258 Bay Street parcels were historically occupied by St. Johnsbury Granite Company operations, including machine shops, woodworking areas, polishing shops, marble and granite working areas, a brass foundry, paint and carriage shop, and associated storage buildings. The 145 Bay Street parcel was initially undeveloped or partially associated with the Passumpsic River corridor, but later included ice houses, storage buildings, lumber sheds, auto and machine storage, and printing-related operations.

By the early to mid-1900s, the Site continued to be used for industrial and storage purposes, including offices, storage rooms, print/oil/glazing storage, lumber storage, auto and machine storage, and warehouse uses. From approximately 1927 through 1964, the Subject Property and immediately surrounding area included a mix of lumber yard operations, auto and machine shops, storage warehouses, railroad-related uses, and other industrial or commercial activities.

Historical aerial photographs indicate that the Site was generally in its current configuration by at least 1979, with the existing buildings and surrounding developed commercial/industrial land uses visible in later aerial imagery.

The surrounding properties also have a long industrial history. Adjacent and nearby uses historically included rail lines, lumber yards, furniture manufacturing, maple products manufacturing, coal yards, auto shops, a gas and electric company, transformer yards, and other commercial and industrial operations.

While not currently in operation, the Site was most recently occupied by rk MILES, a building material, lumber, and hardware supplier. The Site was acquired by the Town of St. Johnsbury in March 2026.

2.3 Previous Environmental Assessments

2.3.1 Phase I Environmental Site Assessment – August 2025

Montrose (Onterris) completed a Phase I ESA for the Site in August 2025. The Phase I ESA was completed to evaluate recognized environmental conditions associated with the Site and to support due diligence efforts and redevelopment planning.

The Phase I ESA documented a long history of industrial and commercial use at the Site and surrounding properties. Three (3) recognized environmental conditions (RECs) were identified in connection with the Site. The first REC was associated with historical on-Site operations, including the former granite works, machine shops, polishing shops, and warehouse/manufacturing uses. The second REC was associated with adjacent manufacturing and industrial operations, including former utility, transformer yard, lumber yard, mill, furniture manufacturing, auto shop, dry cleaner, spill, tank, and Brownfields-related listings. The third REC was associated with the adjacent rail corridor west of the Site, due to the potential for PAHs, metals, pesticides, and herbicides to have affected the western portion of the Site.

The Phase I ESA also identified several business environmental risks (BERs) and related issues relevant to future investigation and redevelopment, including potential regulated building materials (RBMs) in existing Site structures, potential polychlorinated biphenyl (PCB) concerns associated with utility-owned transformers and historical transformer yards, and an aboveground storage tank (AST) observed during the August 2025 Site visit. The AST appeared empty and was reported to be in fair condition; however, documentation regarding its installation, contents, and removal was not identified. The AST was subsequently removed before the Phase II ESA field investigation. Its former location is shown on the attached Figures.

2.3.2 Phase I Environmental Site Assessment Update – February 2026

The findings of the February 2026 Phase I ESA Update were generally consistent with the August 2025 Phase I ESA. New information identified during the update included a VTDEC record documenting a Temporary EPA Identification Number request submitted by Vermont Railway for disposal of per- and polyfluoroalkyl substances (PFAS)/perfluorooctanoic acid (PFOA)-containing waste associated with 292 Bay Street, approximately 200-feet south of the Site.

The record indicates that approximately 5 to 7 pallets of 5-gallon pails containing PFAS/PFOA material were to be transported by ACV Environmental Services, Inc. to US Ecology Burlington for disposal. The temporary identification number was issued on December 11, 2025 and was valid for 90 days.

Although the record states the waste was not generated in response to a spill, it does not specify whether the material originated at 292 Bay Street or was collected from elsewhere along the generally upgradient Vermont Railway corridor prior to staging for disposal.

2.3.3 Phase II Environmental Site Assessment – January 2026

Montrose (Onterris) completed a Phase II ESA for the Site to investigate RECs identified in the August 2025 Phase I ESA. The investigation evaluated potential impacts associated with historical on-Site industrial operations, adjacent commercial and industrial properties, the adjoining rail corridor, and the former AST area. The AST observed during the August 2025 Phase I ESA Site visit had been removed before the Phase II ESA field investigation. No additional on-Site ASTs were identified. The scope included limited geophysical screening and utility clearance, advancement of 14 soil borings, collection of surface and subsurface soil samples, installation and sampling of seven (7) groundwater monitoring wells, and collection of three (3) sub-slab soil vapor samples.

Soil sampling identified anthropogenic fill across portions of the Site, including brick, presumed foundation debris, wood fragments, and coal fragments at depths ranging from ground surface to approximately 20-feet below ground surface (bgs). Analytical results identified exceedances of Vermont Soil Standards (VSSs) for PAHs and lead. Naphthalene exceeded the residential VSS in one (1) surface soil sample; benzo(a)pyrene and carcinogenic-PAH (cPAH) toxicity equivalent quotient (TEQ) exceeded applicable standards in multiple surface and subsurface soil samples; and lead exceeded the urban background VSS in three (3) surface soil samples and one (1) subsurface soil sample. These impacts were interpreted as generally consistent with historical fill, long-term industrial use, and potential rail-related or area-wide industrial source contributions.

The Phase II ESA concluded that the soil dataset did not sufficiently evaluate the lateral or vertical extent of impacts. Because shallow soil samples were collected from only a subset of boring locations, the available data were not sufficient to characterize near-surface lead and PAH impacts across the Site or whether shallow soil impacts were limited to rail-adjacent areas. The report therefore recommended additional soil investigation to evaluate the extent of lead and PAH impacts in shallow and subsurface soil.

Groundwater sampling identified two (2) confirmed exceedances of Vermont Groundwater Enforcement Standards (VGESs): naphthalene in MW-9 at 249 Bay Street and perfluorooctanesulfonic acid (PFOS) in MW-11 at 145 Bay Street. The report also noted that several non-detect groundwater results had reporting limits above applicable VGES criteria, including 1,2,3-trichloropropane, 1,2-dibromoethane, 1,4-dioxane, benzo(a)pyrene, naphthalene, and pentachlorophenol. These elevated reporting limits limited the ability to fully evaluate groundwater quality for certain constituents, particularly naphthalene.

The PFOS exceedance in MW-11 was not fully characterized. The available PFAS dataset was limited and did not provide a sufficient basis to determine whether the PFAS originated from on-Site sources, off-Site sources, area-wide conditions, or a combination of sources. Non-regulated PFAS results were identified as a potentially useful line of evidence for source evaluation, but were not considered sufficient to confirm a source. Additional PFAS sampling was therefore recommended to further evaluate PFAS distribution and potential on- and off-Site source contributions.

The naphthalene exceedance in MW-9 was also not fully characterized. MW-9 is located near the former AST area; however, the available data were not sufficient to determine whether the naphthalene detection was attributable to a former on-Site release, historic fill, generalized industrial conditions, off-Site source contributions, or a combination of factors. The Phase II ESA also noted that a well elevation survey was not completed, which limited the ability to reliably evaluate groundwater elevations, flow direction, and potential contaminant migration pathways.

Soil vapor sampling did not identify exceedances of applicable Vermont Vapor Intrusion Standards (VISs), and vapor intrusion was not identified as a primary driver for the Supplemental Phase II ESA scope.

Overall, the Phase II ESA recommended additional investigation to support redevelopment planning, including further evaluation of PAH- and lead-impacted soil, additional shallow soil evaluation, additional groundwater sampling to address data gaps and elevated reporting limits, further evaluation of PFOS and naphthalene in groundwater, and collection of hydrogeologic data including a well elevation survey, groundwater gauging, and interpretation of groundwater flow direction.

2.4 Future Site Use

The anticipated future use of the Site has not been finalized; however, for purposes of this SSQAPP-A, future use is assumed to be continued commercial and/or industrial operations. This assumption is consistent with the Site's current and historical use, surrounding land-use patterns, and the existing commercial/industrial character of the Bay Street corridor. The Site is currently improved with warehouse/storage buildings on the 145, 249, and 256 Bay Street parcels, while the 258 Bay Street parcel is used for storage and parking. Future redevelopment may include continued or modified commercial/industrial use, storage, warehouse, light industrial, municipal, or other non-residential uses.

Because the specific redevelopment plan has not yet been determined, this SSQAPP-A has been designed to generate data suitable for evaluating environmental conditions under reasonably anticipated commercial/industrial use while also supporting flexible redevelopment planning. This includes evaluating near-surface soil conditions that may affect future workers, construction workers, utility workers, and soil management during redevelopment; further assessing groundwater quality and potential contaminant migration pathways; and developing data that can support a future Soil Management Plan, corrective action planning, or institutional/engineering controls, if needed.

3 Conceptual Site Model

The conceptual site model (CSM) is a representation of the physical, chemical, and biological processes that control the transport, migration, and actual and potential impacts of contamination (in soil, air, soil vapor, groundwater, surface water, and/or sediments) to potential receptors. The following CSM is based on information provided in environmental investigation reports. The CSM will be updated with pertinent findings following Phase II ESA activities described herein.

3.1 Physical Setting

The Site is situated at an approximate elevation of 575-feet above mean sea level. Surface topography is generally flat but gently slopes to the east toward the Passumpsic River. The Passumpsic River is the nearest surface water body and is located approximately 30-feet east of the 145 Bay Street parcel and approximately 175-feet east of the 249 Bay Street parcel. Stormwater at the Site is expected to either infiltrate through pervious portions of the ground surface or flow overland to the east toward the Passumpsic River. Walkable exterior portions of the Site are largely covered by hardscape.

3.2 Geology & Hydrogeology

Subsurface conditions encountered during the prior Phase II ESA generally consisted of fine- to coarse-grained sand with lesser amounts of silt and clay. Anthropogenic fill was observed in multiple soil borings advanced across the Site and included layers of brick, presumed foundation debris, wood fragments, and coal fragments. Inferred fill material was observed at depths ranging from ground surface to approximately 20-feet below ground surface. Native soils, where encountered, generally consisted primarily of sand and were observed at depths ranging from approximately 0 to 15-feet bgs.

Bedrock was not encountered during the Phase II ESA, which included borings advanced to maximum depths of approximately 15 to 20-feet bgs. Based on prior reports, bedrock beneath the Site is expected to be associated with the Gile Mountain and Waits River Formations, consisting of carbonaceous phyllite and limestone, and thick-bedded micaceous feldspathic quartzite.

Seven (7) monitoring wells were installed during the prior Phase II ESA to assess groundwater quality and potential groundwater impacts. A well elevation survey was not completed as part of the prior Phase II ESA; therefore, Site-specific groundwater elevation contours and a definitive groundwater flow direction were not established. However, based on Site topography and the proximity of the Passumpsic River, groundwater is generally inferred to flow east toward the river.

3.3 Contaminants of Concern

The following contaminants of concern (COCs) have been identified:

Parcel	Affected Media	Contaminants of Concern		
		SVOCs	Metals	PFAS
145 Bay Street	Surface Soil	NA[1]	NA[1]	NA[1]
	Subsurface Soil	Benzo(a)pyrene cPAHs[2]	None Identified	NA[1]
	Groundwater	None Identified	NA[1]	PFOS
249 Bay Street	Surface Soil	None Identified	Lead	NA[1]
	Subsurface Soil	Benzo(a)pyrene cPAHs[2]	Lead	NA[1]
	Groundwater	Naphthalene[3]	None Identified	None Identified
256 Bay Street	Surface Soil	Benzo(a)pyrene cPAHs[2]	Lead	NA[1]
	Subsurface Soil	Benzo(a)pyrene cPAHs[2]	None Identified	NA[1]
	Groundwater	None Identified	None Identified	None Identified
258 Bay Street	Surface Soil	Naphthalene Benzo(a)pyrene cPAHs[2]	Lead	NA[1]
	Subsurface Soil	None Identified	None Identified	None Identified
	Groundwater	None Identified	None Identified	None Identified

1: Not analyzed for referenced parameter
2: Expressed as Total TEQ
3: Result reported as non-detect when analyzed for SVOCs via EPA Method 8270 SIM

3.4 Nature & Extent of Contamination

The January 2026 Phase II ESA identified impacts to surface soil, subsurface soil, and groundwater across multiple parcels, with the principal contaminants consisting of semivolatile organic compounds (SVOCs), specifically PAHs, cPAH TEQ, lead, PFOS, and naphthalene. Soil impacts were identified in both shallow and subsurface intervals.

Shallow soil impacts were most pronounced at 256 Bay Street and 258 Bay Street, where SVOCs/cPAH TEQ and lead exceeded applicable criteria, while 249 Bay Street exhibited more limited shallow soil impacts associated with lead. Subsurface soil impacts were identified at 145, 249, and 256 Bay Street and were characterized primarily by benzo(a)pyrene and cPAH TEQ exceedances, indicating PAH-related impacts in deeper soil and/or fill materials. No subsurface soil exceedances were identified at 258 Bay Street.

Confirmed groundwater exceedances consisted of PFOS in sample MW-11 at 145 Bay Street and naphthalene in sample MW-9 at 249 Bay Street. No other groundwater samples exhibited detected VOC or SVOC concentrations above applicable VGES criteria; however, several analytes in groundwater were reported as non-detect at reporting limits exceeding applicable VGES criteria, which limits the completeness of the groundwater evaluation for those constituents.

3.5 Existing Data Gaps

The scope of work presented in this SSQAPP-A has been designed to address RECs/data gaps identified through review of the 2026 Phase I ESA (see **Section 2.3**) and the preliminary CSM. The following matrix provides a summary of the identified data gaps as well as a generalized summary of the proposed investigation tasks:

Potential Source	Concern / Rationale	Potential COCs	Subject Media	Investigation Elements
Data Gap #1 – Presence of lead and PAH impacts to Site soils	The vertical and lateral extent of lead and PAH impacts has not been evaluated	SVOCs/PAHs Metals	Surface/shallow subsurface soil	Installation of soil borings and associated soil sampling at each parcel.
Data Gap #2 – Presence of PFAS impacts to Site groundwater	The extent of PFOS impacts to groundwater has not been evaluated	PFOS	Groundwater	Installation of monitoring wells and associated groundwater sampling
Data Gap #3 – Presence of naphthalene impacts to Site groundwater	The extent of naphthalene impacts to groundwater has not been evaluated	SVOCs/naphthalene	Groundwater	Groundwater sampling at 249 Bay Street
Data Gap #4 – Incomplete understanding of Site hydrogeology	Data sufficient to evaluate groundwater flow, and subsequently potential contaminant migration pathways, has not been collected.	N/A	Groundwater	Collect additional hydrogeologic information, including a well elevation survey, well gauging, evaluation of groundwater elevations, and interpretation of groundwater flow direction

4 Scope of Work

The scope of work has been designed to assess potential impacts to Site soils and groundwater based on the data gaps identified during review of available information and summarized in **Sections 3.5**. Data generated by this Supplemental Phase II ESA will be used to refine the CSM and identify any remaining data gaps which will be used as a basis for the development of appropriate future investigations or remedial actions, as warranted.

4.1 Health & Safety and Pre-Field Activities

Prior to commencement of field activities, Onterris will perform the following:

1. Prepare a Site-specific health and safety plan (HASP) in accordance with Title 29 of the U.S. Code of Federal Regulations (CFR) Part 1910.120, and Onterris protocols;
2. Provide notification to Dig Safe to mark underground utilities located on the public right-of-way adjacent to the Site;
3. Contract a private utility locate service provider to identify potential underground utilities/structures at the planned sampling locations;
4. Contract with Pace Analytical laboratory for soil and groundwater analytical testing services; and
5. Contract with a Vermont-licensed driller for the advancement of soil borings and installation of three (3) permanent groundwater monitoring wells.

A health and safety briefing will be presented by Onterris personnel to the field staff prior to initiating field activities.

4.2 Standard Operating Procedures

Sample rationale and locations (Worksheets #17 & 18), sample handling procedures (Worksheets #19 & 30), tracking and chain-of-custody (Worksheets #26 & 27), and laboratory analytical methods (Worksheets #24, 25 & 26) are designed to be consistent with those specified in the requirements of the QAPP. The QAPP includes sample chain-of-custody form, custody seal, and example sample labels.

The Field Activities SOPs (QAPP Worksheet #21) will be followed. The SOPs applicable to the activities outlined in this SSQAPP-A include:

- SOP 001 – Field Documentation Procedures
- SOP 002 – Field Screening Instrumentation and Procedures
- SOP 003 – Utility Clearance
- SOP 004 – Surface and Subsurface Soil Sampling
- SOP 013 – Low-Flow Groundwater Sampling
- SOP 015 – Field Quality Control Sampling Procedures

- SOP 016 – Sample Labeling, Packaging, and Shipping
- SOP 017 – Decontamination of Equipment
- SOP 018 – Management of Investigation-Derived Waste
- SOP 030 – Considerations when collecting Samples for Per- and Polyfluoroalkyl Substances Analysis

Pace's laboratory SOPs for tasks associated with analysis of samples are presented in the QAPP. The SOPs applicable to the activities outlined in this SSQAPP-A are listed below:

- ENV-SOP-ELON-0004 v02, SOP 454 PFAS Water Isotope Dilution, May 03, 2022
- ENV-SOP-ELON-0025 v03, USEPA 8260D, May 31, 2023
- ENV-SOP-ELON-0033 v01, SOP 466 PFAS Soils Isotope Dilution, May 03, 2022
- ENV-SOP-ELON-0077 v01, USEPA 8270E, December 20, 2022
- ENV-SOP-ELON-0080 v02, Mercury, August 14, 2023
- ENV-SOP-ELON-0082 v02, ICP 6010, August 14, 2023

4.3 Subsurface Evaluation

The subsurface assessment of the Property will include: the advancement of 16 direct-push Geoprobe® borings to facilitate soil sampling, and conversion of three (3) borings to permanent monitoring wells to facilitate groundwater sampling and collection of hydrogeologic information.

The sampling and analysis program for soil and groundwater is summarized in **Tables 1** (soil), and **Table 2** (groundwater). Proposed soil boring and monitoring well locations are shown on **Figure 3-1** and **3-2**.

4.3.1 Soil Sampling

Prior to drilling, GPRS will conduct a private subsurface utility survey. Drilling activities will be subcontracted to an appropriately licensed drilling subcontractor. After soft-digging or hand clearing the top 5-feet of each location, soil borings will be advanced using a direct-push Geoprobe® drill rig. Borings advanced for soil characterization will generally be completed to depths of approximately 10-feet bgs. Borings proposed for conversion to monitoring wells will be advanced to approximately 20-feet bgs, or approximately 5-feet below the top of the water table, whichever is shallower. Final boring depths may vary based on field conditions, including equipment refusal, subsurface obstructions, utility conflicts, or the depth at which groundwater is encountered.

Soil cores will be collected continuously and visually classified in the field by an Onterris geologist or environmental scientist. Field observations will include soil color, texture, moisture content, apparent fill materials, debris, staining, odors, and other evidence of potential impacts. Soil cores will also be screened for volatile organic vapors using a photoionization detector (PID) equipped with a 10.6 electron-volt lamp. Visual, olfactory, and PID screening observations will be recorded on soil boring logs.

Soil samples will be collected in accordance with the QAPP and applicable SOPs. A shallow soil sample will be collected at each proposed boring from the upper 1.5-feet of soil beneath the ground surface or existing surface cover, as applicable. Selected borings will also be sampled at one or more subsurface intervals below 1.5-feet bgs. Subsurface sampling intervals will be selected based on field screening results, including odors, discoloration, elevated PID readings, or other evidence of potential impacts. Where field screening does not identify evidence of contamination, the subsurface sample will generally be collected from immediately above the overburden-groundwater interface.

Soil samples will be submitted to Pace Analytical, a Vermont-certified laboratory for analysis of PAHs and metals. Additional analyses may be performed, if warranted, based on field observations, prior analytical results, or VTDEC requirements. Sample containers will be labeled, placed directly into iced coolers, and maintained at approximately 4° Celsius pending shipment or delivery to the laboratory. Samples will be managed under standard chain-of-custody procedures.

Quality assurance/quality control (QA/QC) samples will be collected in accordance with the QAPP and may include field duplicates, matrix spike/matrix spike duplicate samples, equipment blanks, and/or other applicable QC samples based on the final sampling design and analytical program. Macro-core tooling, cutting shoes, and other reusable downhole equipment will be decontaminated between boring locations in accordance with the procedures referenced in the QAPP. Dedicated or disposable sampling equipment will be used to the extent practicable. If non-dedicated sampling equipment is used for sample collection, equipment blank samples will be collected, as appropriate, by pouring laboratory-provided water over the decontaminated equipment and collecting the rinse water in laboratory-provided containers.

Following receipt of shallow soil analytical results, a Method 2 Cumulative Risk Assessment will be performed, as applicable, in accordance with §35-401(c)(2) of the IRule to evaluate whether an incremental lifetime cancer risk of 1×10^{-6} or a hazard index of 1.0 is exceeded based on direct contact with shallow soil. Soil analytical results will be compared to applicable Vermont Soil Standards, including residential, non-residential, and urban background standards, as appropriate. Results will be used to evaluate PAH and metals impacts in soil and to support redevelopment planning, soil management considerations, and preparation of a Soil Management Plan, if warranted.

4.3.2 Monitoring Well Installation

Three (3) permanent 1-inch inner diameter (ID) monitoring wells (145-MW01 to 145-MW03) will be installed to facilitate the evaluation of groundwater quality relative to the previously identified PFOS exceedance at 145 Bay Street (**Figure 3-2**).

Monitoring wells will be constructed using Schedule 40 PVC flush-threaded riser and with 10-feet of 0.010-inch slot well screen. Where practical, wells will be screened across the water table. Sand packs will consist of fine sand extending approximately 12-inches above the well screens, as feasible. The sand packs will be capped with an approximate 2-foot bentonite seal and completed with a steel flush-mounted curb box to protect the surface of the wells.

Following installation, monitoring wells will be developed by surging and pumping to remove fines potentially introduced during installation. An attempt will be made to evacuate three (3) well volumes of groundwater during a maximum well development period of 1-hour per well. The wells will be surveyed relative to an arbitrary Site benchmark to facilitate the future calculation of groundwater gradients and flow directions.

4.3.3 Groundwater Sampling

Groundwater sampling will include MW-11 and the newly installed wells (145-MW01 to 145-MW03) for evaluation of PFAS, and existing wells MW-4, MW-8, and MW-9 for evaluation of naphthalene. Prior to sample collection, depth to groundwater will be measured and recorded. Additionally, each well will be gauged for the presence of product (non-aqueous phase liquids). If encountered, product thickness will be measured and recorded in lieu of sampling.

Groundwater samples will be collected via low-flow sampling techniques. Following initial readings, purging will be initiated at an approximate rate of 100 to 300 milliliter (mL) per minute based on known well recharge characteristics and to maintain less than 0.3-feet of drawdown, when practical. The pump discharge will be connected directly to a flow-through cell for measuring specific conductance, pH, temperature, DO, ORP (redox), and turbidity. Purging of each well will continue until the field water-quality readings stabilize (± 3 percent for conductance and temperature, ±- 0.3 mg/L or 3% of readings for dissolved oxygen, ±10 millivolts for redox; ≤ 10 nephelometric turbidity units, and ±0.1 units for pH). Following the stabilization of field parameters, the flow-through cell will be disconnected prior to sampling and the sample will be drawn directly from the discharge line into appropriate sample containers.

One (1) groundwater sample will be collected from each monitoring well; as summarized in **Table 2**.

4.3.4 Investigation-Derived Waste

Investigation-derived waste (IDW) shall be managed during field operations in compliance with *'Management of Investigation-Derived Waste During Site Inspections'* (EPA/540/G-9/009). It is recognized and agreed that Onterris and any sub-consultant are not a co-generator of said waste, are not acting as bailees, and at no time assume title to said waste.

Impacted soil cuttings and purge water (determined by visual, olfactory, and field observations [i.e., PID screening]) generated as part of the planned activities will be containerized in labeled 55-gallon DOT-approved drums (open top for soil, closed top for water) and staged in an appropriate location on-Site. Following receipt of analytical data from the investigation arrangements will be to dispose of the IDW and/or collect additional samples as required by the proposed disposal facility.

4.4 Regulated Building Materials Survey

A dedicated RBM survey work plan has been prepared under separate cover.

4.5 Analytical Sensitivity & Project Criteria

Data collected during the field sampling activities will be screened and compared to the following regulatory benchmarks and action levels:

- Vermont Soil Standards – Investigation and Remediation of Contaminated Properties Rule (IRule), effective February 24, 2024 (§35-Appendix A1 - Soil Standards).
- Vermont Groundwater Enforcement Standards – Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule and Strategy, effective January 31, 2026.

The laboratory reporting limits and regulatory standards included in **Appendix C** and the QAPP have been reviewed and are current and accurate as of the date of the plan.

4.6 Quality Assurance / Quality Control

The laboratory will meet the minimum QA / QC requirements of the analytical methods provided in the QAPP. The control limit for field duplicate sample analyses, measured as precision, is 30% for aqueous sample and 50% for soil samples. Control limits for matrix spike/matrix spike duplicate (MS/MSD) sample analyses will be determined by the laboratory's internal QA plan. The completeness goal is 90%.

Field QC samples will be collected during the work to assess sampling precision as summarized in the QAPP. The minimum sample volume, container type, preservative, and technical holding time of each media (i.e. solid or aqueous) and analytical request are summarized by **Table 3**.

The QA/QC samples utilized to evaluate precision include MS/MSD and field duplicates. To maximize precision, consistent sampling and analytical procedures are to be followed. The data will undergo verification and validation as outlined in QAPP.

4.7 Documentation & Reporting

Field activities will be documented in accordance with the applicable QAPP requirements and field sampling SOPs. A Supplemental Phase II ESA Report will be prepared following completion of field activities and receipt of validated laboratory data.

The report will summarize field activities, analytical results, the updated CSM, deviations from the SSQAPP-A or QAPP, and recommendations for additional investigation or response actions, as warranted. Results, findings, conclusions, and recommendations will be presented by parcel, as appropriate, to preserve parcel-level resolution and support future redevelopment and soil-management planning.

5 Anticipated Schedule

Onterris will begin the work immediately following receipt of EPA/DEC approval of this Work Plan.

Milestone	Timeline
Conduct GPR Survey	To Be Determined (TBD)
Initiate Subsurface Investigation and RBM Survey	August 03, 2026 (approximate)
Sample Collection	3 days on-Site; return 10 days later for one (1) round groundwater sampling
Laboratory Analysis	Within 3 weeks of sampling completion
Data Verification and Validation	Within 4 weeks of laboratory data package receipt
Phase II ESA Report	Within 2 weeks of data verification and validation

If sampling is delayed, the following project participants will be notified via electronic mail:

- The property owner: Town of St. Johnsbury | jkasprzak@stjvt.com | (802)738-3926
- EPA Project Officer: Daniella Feistritzer | feistritzer.daniella@epa.gov | (617)918-1114
- VTDEC Project Manager: Kimberly Caldwell | Kimberly.caldwell@vermont.gov | (802)461-5857

References

Montrose. Master Quality Assurance Project Plan for Implementation of EPA Region 1 Brownfields Assessment & Revolving Loan Fund Grant Projects, Cooperative Agreement Nos. 4B-00A01260 & 4B00401268, Northeastern Vermont Development Association. December 05, 2023.

Montrose. Phase I Environmental Site Assessment, RK Miles, 145, 249, 256, and 258 Bay Street, St. Johnsbury, Vermont 05819. August 2025.

Montrose. Phase I Environmental Site Assessment Update, RK Miles, 145, 249, 256, and 258 Bay Street, St. Johnsbury, Vermont 05819. February 2026.

Montrose. Phase II Environmental Site Assessment Report, RK Miles, 145, 249, 256, and 258 Bay Street, St. Johnsbury, Vermont 05819. May 2026.

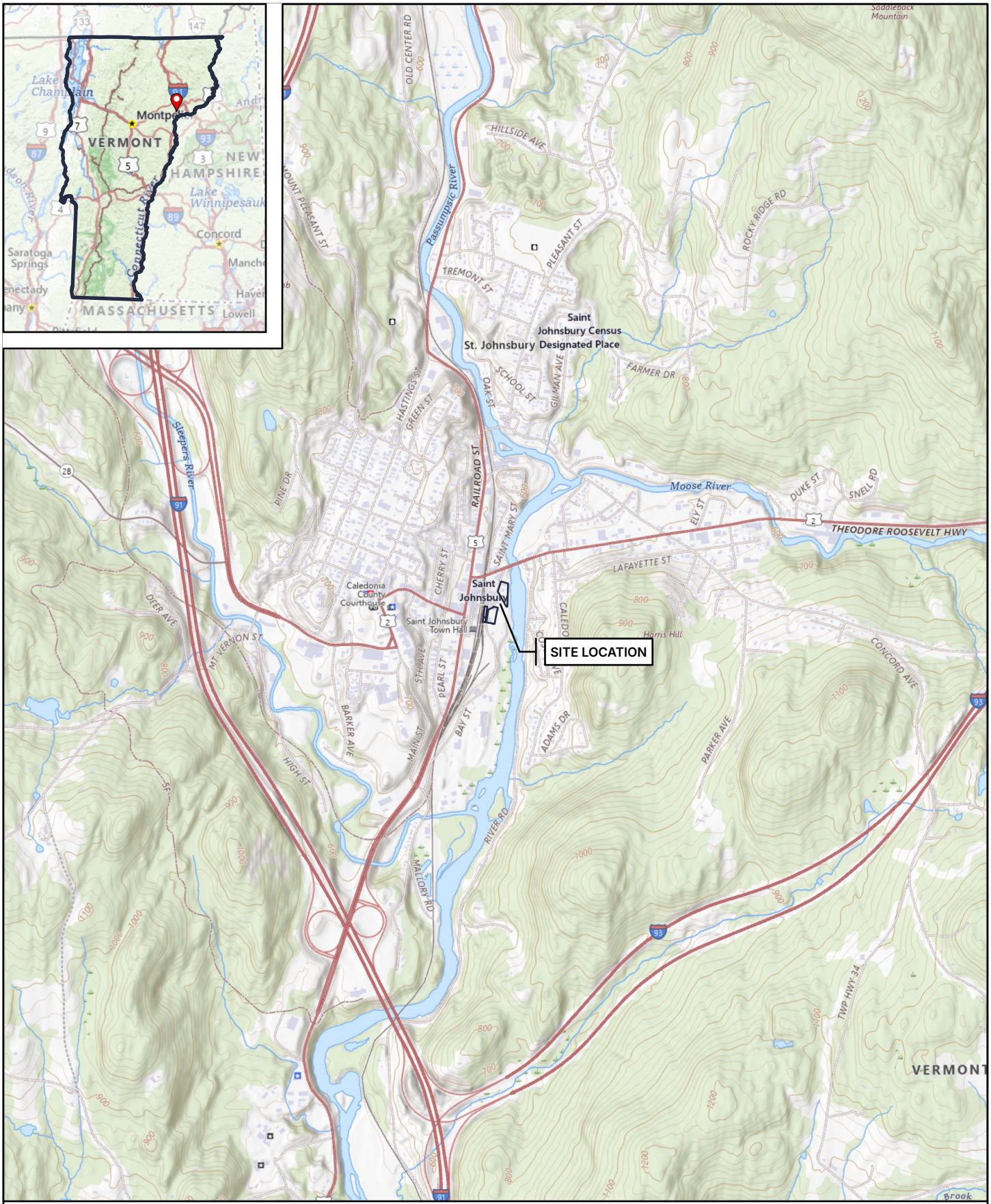
State of Vermont. Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule and Strategy. Agency of Natural Resources. Adopted July 6, 2019

State of Vermont. Chapter 35 of the Environmental Protection Rules: Investigation and Remediation of Contaminated Properties Rule. Agency of Natural Resources. Adopted February 24, 2024

State of Vermont. Vapor Intrusion Guidance. Agency of Natural Resources. Updated June 2022.

U.S. Environmental Protection Agency. Management of Investigation-Derived Waste During Site Inspections. Office of Emergency and Remedial Response. May 1991.

Figures



Note(s):
1. Coordinate System: NAD 1983 State Plan VT FIPS 4400 (US Feet)
2. Source: State of Vermont GIS / ESRI

2,000 1,000 0 2,000 Feet

Scale: 1:24,000

N

TITLE: SITE LOCATION MAP	DATE: July 17, 2026			Onterris
PROJECT: RK MILES 145, 249, 256, 258 BAY STREET ST. JOHNSBURY, VT	PROJECT NO. PROJ-058176			
	REV. NO. 00	DRN BY: BS	APR BY: BH	FIGURE 1

LEGEND

- SITE BOUNDARY
- STORM SEWER
- EXISTING MONITORING WELL
- APPROXIMATE LOCATION OF FORMER AST

0 35 70 140 Feet

1 inch = 70 feet

N

NOTES:
1) Contour lines present elevation in feet AMSL.

SOURCE:
- Vermont Open Geodata Portal
- ESRI ArcGIS Online Basemap
- NearMap Aerial Imagery

TITLE:

SITE LAYOUT

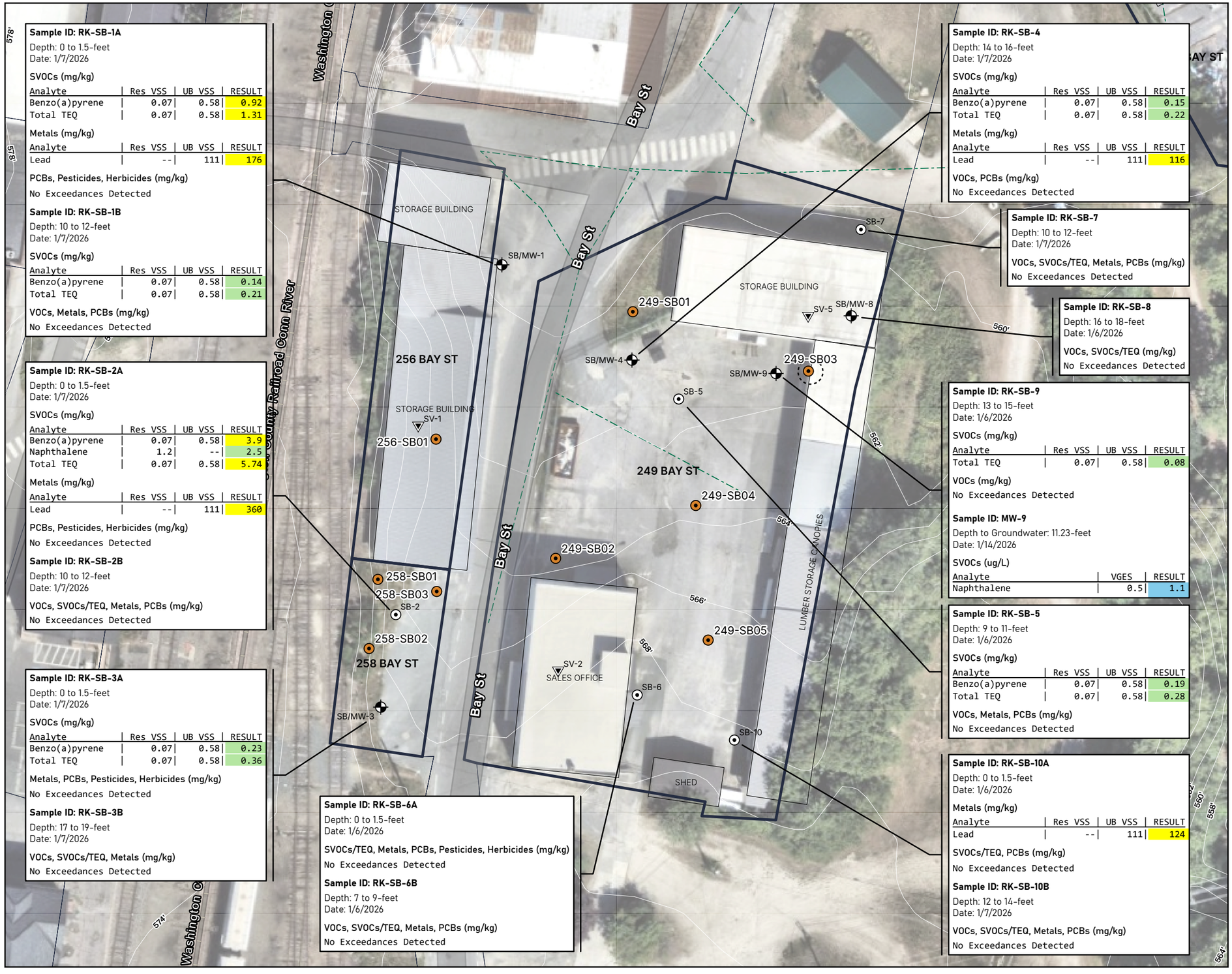
PROJECT:
RK MILES
SUPPLEMENTAL PHASE II ESA
ST. JOHNSBURY, VT

DATE:	PROJECT NO.	REVISION NO.	DRAWN BY:	APPROVED BY:
July 17, 2026	PROJ-058176	00	BS	BH

Onterris

FIGURE 2

Document Path: C:\Users\benjaminseifert\Work Drive\NVDA\RK Miles\GIS\Mapping\Supplemental Phase II ESA\Supplemental Phase II SOA.aprx



Sample ID: RK-SB-1A
Depth: 0 to 1.5-feet
Date: 1/7/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.92
Total TEQ	0.07	0.58	1.31

Metals (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Lead	--	111	176

PCBs, Pesticides, Herbicides (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-1B
Depth: 10 to 12-feet
Date: 1/7/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.14
Total TEQ	0.07	0.58	0.21

VOCs, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-2A
Depth: 0 to 1.5-feet
Date: 1/7/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	3.9
Naphthalene	1.2	--	2.5
Total TEQ	0.07	0.58	5.74

Metals (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Lead	--	111	360

PCBs, Pesticides, Herbicides (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-2B
Depth: 10 to 12-feet
Date: 1/7/2026

VOCs, SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-3A
Depth: 0 to 1.5-feet
Date: 1/7/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.23
Total TEQ	0.07	0.58	0.36

Metals, PCBs, Pesticides, Herbicides (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-3B
Depth: 17 to 19-feet
Date: 1/7/2026

VOCs, SVOCs/TEQ, Metals (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-6A
Depth: 0 to 1.5-feet
Date: 1/6/2026

SVOCs/TEQ, Metals, PCBs, Pesticides, Herbicides (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-6B
Depth: 7 to 9-feet
Date: 1/6/2026

VOCs, SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-4
Depth: 14 to 16-feet
Date: 1/7/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.15
Total TEQ	0.07	0.58	0.22

Metals (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Lead	--	111	116

VOCs, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-7
Depth: 10 to 12-feet
Date: 1/7/2026

VOCs, SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-8
Depth: 16 to 18-feet
Date: 1/6/2026

VOCs, SVOCs/TEQ (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-9
Depth: 13 to 15-feet
Date: 1/6/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Total TEQ	0.07	0.58	0.08

VOCs (mg/kg)
No Exceedances Detected

Sample ID: MW-9
Depth to Groundwater: 11.23-feet
Date: 1/14/2026

SVOCs (ug/L)

Analyte	VGES	RESULT
Naphthalene	0.5	1.1

Sample ID: RK-SB-5
Depth: 9 to 11-feet
Date: 1/6/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.19
Total TEQ	0.07	0.58	0.28

VOCs, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-10A
Depth: 0 to 1.5-feet
Date: 1/6/2026

Metals (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Lead	--	111	124

SVOCs/TEQ, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-10B
Depth: 12 to 14-feet
Date: 1/7/2026

VOCs, SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected

LEGEND

- SITE BOUNDARY
- STORM SEWER
- PROPOSED SOIL BORING
- PROPOSED MONITORING WELL
- PREVIOUS SOIL BORING
- EXISTING MONITORING WELL
- PREVIOUS SOIL VAPOR SAMPLE
- APPROXIMATE LOCATION OF FORMER AST

0 20 40 80 Feet
1 inch = 40 feet

N

NOTES:
1) Contour lines present elevation in feet AMSL.
2) Res VSS: Resident Vermont Soil Screening Standard
[RESULT] Exceeds Applicable Resident VSS Criteria
3) UB VSS: Urban Background Vermont Soil Screening Standard
[RESULT] Exceeds Applicable Urban Background VSS Criteria
4) VGES: Vermont Groundwater Enforcement Standard
[RESULT] Exceeds Applicable VGES Criteria

SOURCE:
- Vermont Open Geodata Portal
- ESRI ArcGIS Online Basemap
- NearMap Aerial Imagery

TITLE:
PROPOSED INVESTIGATION LOCATIONS AND PRIOR PHASE II ESA ANALYTICAL RESULTS

PROJECT:
RK MILES
SUPPLEMENTAL PHASE II ESA
ST. JOHNSBURY, VT

DATE:	PROJECT NO.	REVISION NO.	DRAWN BY:	APPROVED BY:
July 17, 2026	PROJ-058176	00	BS	BH

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FIGURE 3-1

Document Path: C:\Users\benjaminseifert\Work Drive\NV\DARK Miles\GIS\Mapping\Supplemental Phase II ESA\Supplemental Phase II SOA.aprx

Sample ID: RK-SB-11
Depth: 14 to 16-feet
Date: 1/6/2026

SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: MW-11
Depth to Groundwater: 10.62-feet
Date: 1/15/2026

PFAS (ng/L)

Analyte	VGES	RESULT
PFOS	4	16.2

Sample ID: RK-SB-12
Depth: 13 to 15-feet
Date: 1/5/2026

SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Benzo(a)pyrene	0.07	0.58	0.12
Total TEQ	0.07	0.58	0.18

VOCs, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-13
Depth: 14 to 14.9-feet
Date: 1/5/2026

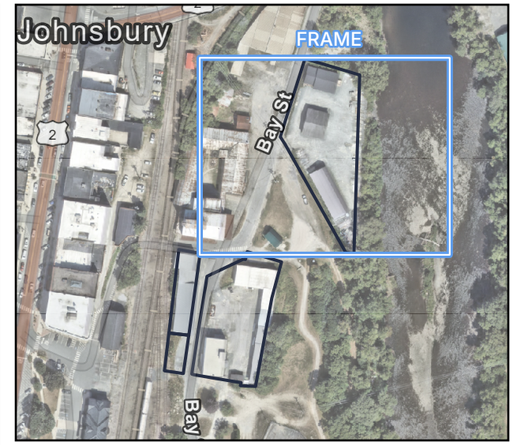
SVOCs (mg/kg)

Analyte	Res VSS	UB VSS	RESULT
Total TEQ	0.07	0.58	0.08

VOCs, Metals, PCBs (mg/kg)
No Exceedances Detected

Sample ID: RK-SB-14
Depth: 13 to 15-feet
Date: 1/5/2026

SVOCs/TEQ, Metals, PCBs (mg/kg)
No Exceedances Detected



LEGEND

- SITE BOUNDARY
- STORM SEWER
- PROPOSED SOIL BORING
- PROPOSED MONITORING WELL
- PREVIOUS SOIL BORING
- EXISTING MONITORING WELL
- PREVIOUS SOIL VAPOR SAMPLE
- APPROXIMATE LOCATION OF FORMER AST

0 20 40 80 Feet
1 inch = 40 feet

N

NOTES:
1) Contour lines present elevation in feet AMSL.
2) Res VSS: Resident Vermont Soil Screening Standard
[RESULT] Exceeds Applicable Resident VSS Criteria
3) UB VSS: Urban Background Vermont Soil Screening Standard
[RESULT] Exceeds Applicable Urban Background VSS Criteria
4) VGES: Vermont Groundwater Enforcement Standard
[RESULT] Exceeds Applicable VGES Criteria

SOURCE:
- Vermont Open Geodata Portal
- ESRI ArcGIS Online Basemap
- NearMap Aerial Imagery

TITLE:
PROPOSED INVESTIGATION LOCATIONS AND PRIOR PHASE II ESA ANALYTICAL RESULTS

PROJECT:
RK MILES
SUPPLEMENTAL PHASE II ESA
ST. JOHNSBURY, VT

DATE:	PROJECT NO.	REVISION NO.	DRAWN BY:	APPROVED BY:
July 17, 2026	PROJ-058176	00	BS	BH

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FIGURE 3-2

Document Path: C:\Users\benjaminseifert\Work Drive\NVDA\RK Miles\GIS\Mapping\Supplemental Phase II ESA\Supplemental Phase II SOA.aprx

Tables

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Table 1: Sample Design – Soil
Supplemental Phase II Environmental Site Assessment
145, 249, 256, and 258 Bay Street, St. Johnsbury, VT

Parcel	Boring ID	Estimated Maximum Exploration Depth	Sample ID	Sample Type	Media	Depth Interval	Laboratory Analysis (Method)	
							PAHs (8270SIM)	RCRA Metals & Mercury (6010/7470)
145 Bay Street	145-SB/MW01	20'	145-SB01-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			145-SB01-DEPTH	Grab	Soil / Fill	>1.5'	1	--
	145-SB/MW02	20'	145-SB02-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			145-SB02-DEPTH	Grab	Soil / Fill	>1.5'	1	--
	145-SB/MW03	20'	145-SB03-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
	145-SB04	10'	145-SB04-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
	145-SB05	10'	145-SB05-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			145-SB05-DEPTH	Grab	Soil / Fill	>1.5'	1	--
249 Bay Street	249-SB01	10'	249-SB01-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
	249-SB02	10'	249-SB02-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			249-SB02-DEPTH	Grab	Soil / Fill	>1.5'	1	1
	249-SB03	10'	249-SB03-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
	249-SB04	10'	249-SB04-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			249-SB04-DEPTH	Grab	Soil / Fill	>1.5'	1	1
	249-SB05	10'	249-SB05-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
256 Bay Street	256-SB01	10'	256-SB01-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			256-SB01-DEPTH	Grab	Soil / Fill	>1.5'	1	--
258 Bay Street	258-SB01	10'	258-SB01-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			258-SB01-DEPTH	Grab	Soil / Fill	>1.5'	1	--
	258-SB02	10'	258-SB02-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			258-SB02-DEPTH	Grab	Soil / Fill	>1.5'	1	--
	258-SB03	10'	258-SB03-DEPTH	Grab	Soil / Fill	0-1.5'	1	1
			258-SB03-DEPTH	Grab	Soil / Fill	>1.5'	1	--
						Subtotal:	23	16
Quality Control Samples	TBD	N/A	FD-1	Field Duplicate	Soil / Fill (Same as Parent Sample)	1 per 20	2	1
	TBD	N/A	XXX-XXXX-XX(MS/MSD)	Matrix Spike/Matrix Spike Duplicate	Soil / Fill (Same as Parent Sample)	1 per 20	2	1
	--	N/A	EB-1	Equipment Blank	Rinsate Water	1 per Day	1	1
						Subtotal:	5	3
						Total:	**28**	**19**

Notes:
PAHs - polycyclic aromatic hydrocarbons
RCRA - Resource Conservation & Recovery Act
SIM - selective ion monitoring

Table 2: Sample Design – Groundwater
Supplemental Phase II Environmental Site Assessment
145, 249, 256, and 258 Bay Street, St. Johnsbury, VT

						Laboratory Analysis (Method)	
Parcel	Location/Well	Sample ID	Sample Type	Media	Depth Interval	PFAS (1633)	SVOCs (8270SIM)
145 Bay Street	145-MW01		Low Flow	Groundwater	TBD	1	-
	145-MW02		Low Flow	Groundwater	TBD	1	-
	145-MW03		Low Flow	Groundwater	TBD	1	-
	MW-11		Low Flow	Groundwater	TBD	1	-
249 Bay Street	MW-4		Low Flow	Groundwater	TBD	-	1
	MW-8		Low Flow	Groundwater	TBD	-	1
	MW-9		Low Flow	Groundwater	TBD	-	1
					Subtotal:	4	3
Quality Control Samples	TBD	FD-1	Field Duplicate	Groundwater (Same as Parent Sample)	1 per 20	1	1
	TBD	XXX-XXXX-XX(MS/MSD)	Matrix Spike/Matrix Spike Duplicate	Groundwater (Same as Parent Sample)	1 per 20	1	1
	--	EB-1	Equipment Blank	Rinsate Water	1 per Day	1	1
					Subtotal:	3	3
					Total:	**7**	**6**

Notes:
PAHs - polycyclic aromatic hydrocarbons
RCRA - Resource Conservation & Recovery Act
SIM - selective ion monitoring
TBD - to be determined

Table 3: Sample Containers, Preservation, and Hold Times
Supplemental Phase II Environmental Site Assessment
145, 249, 256, and 258 Bay Street, St. Johnsbury, VT

Analytical Group (Concentration Level)	Matrix	Analytical Method	Containers (number, size, type per sample)	Minimum Volume (mL) or Amount (grams)	Preservation Requirements (chemical, temperature, light protected)	Technical Hold Time (Sample Preparation)	Technical Hold Time (Analysis)
SVOCs/PAHs by SIM (Trace)	Soil	SW-846 8270D/E	One 8-oz glass wide mouth jar with PTFE-lined lid	20 grams	Iced to ≤ 6ºC, not frozen	14 days (sampling to extraction)	40 days (extraction to analysis)
ICP-AES Metals (Low) or ICP-MS Metals (Trace)	Soil	SW-846 6010C/D	One 4-oz glass wide mouth jar	1.5 grams	Iced to ≤ 6ºC, not frozen	None	6 months
Mercury (Low)	Soil	SW-846 7471B	One 4-oz glass wide mouth jar	0.6 grams	Iced to ≤ 6ºC, not frozen	None	28 days
SVOCs/PAHs by SIM (Trace)	Water	SW-846 8270D/E	Two 1-L amber glass with PTFE-lined lid	One 100mL amber glass with PTFE-lined lid	Iced to ≤ 6ºC, not frozen	7 days (sampling to extraction)	40 days (extraction to analysis)
PFAS	Water	EPA 1633	Two 500-ml HDPE container	One 500 mL HDPE container	Iced to ≤ 6ºC, not frozen	28 days (sampling to extraction)	28 days (extraction to analysis)

Notes
- VTDEC does not accept filtered groundwater samples. All groundwater samples submitted will be a total analysis.
- Container requirements in this table are based on the CLP Samplers Guide and/or SW846 Chapters 3 and 4 and are considered sufficient volumes for most laboratories. Sample volumes needed by laboratories may vary depending on equipment for preparation methods used by the individual laboratories. Volumes presented in this table should be considered maximum sample amounts needed by the laboratory and include sufficient sample for re-extraction/re-digestion if needed.
- All bottleware is to be QC grade with Certificates of Analysis.

Abbreviations:
HDPE = high-density polyethylene
ICP-MS = Inductively Coupled Plasma-Mass Spectrometer
L = liter
mL = milliliter
PAH = Polynuclear Aromatic Hydrocarbon
PFAS = Per-and Polyfluoroalkyl Substances
PTFE = Polytetrafluoroethylene
QC = quality control
SIM = selected ion monitoring
SVOC = Semivolatile Organic Compound

Appendix A QAPP Worksheet #9

Worksheet #9: PROJECT PLANNING SESSION SUMMARY AND SCOPING MEETINGS

Project Scoping/Planning Session Partcipants Sheet

Project Name	Brownfields Multipurpose Grant (Cooperative Agreement No. BF-00A01669)	Site Name	rkMILES
Projected Date(s) of Sampling	Within 60 days of Phase II ESA Workplan Approval or as Weather Permits (August 2026)	Site Location	145, 249, 256, and 258 Bay Street St. Johnsbury, Vermont 05819
Program Manager	Andrea Pedersen		
Date of Session	TBD, will occur at least two weeks prior to field mobilization activities		
Scoping/Planning Session Purpose:	TBD, typically a kick-off meeting to discuss site work and schedule		

Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
Kimberly Caldwell	Project Manager	VTDEC	802-461-5857	kimberly.caldwell@vermont.gov	VTDEC Project Manager
Daniella Feistritzer	Project Engineer	EPA Region 1	617-918-1286	feistritzer.daniella@epa.gov	EPA Project Officer
Carly Boyd	QA Reviewer	EPA Region 1	TBD	boyd.carly@epa.gov	EPA QA Officer
David Snedeker	Executive Director	NVDA	802-748-8303	dsnedeker@nvda.net	Project Manager
Joe Kasprzak	Owner Contact	Town of St. Johnsbury	802-738-3962	jkasprzak@stjvt.com	Owner Contact
Andrea Pedersen	Senior Environmental Professional III	Onterris	425-308-1727	anpedersen@montrose-env.com	Grantee Program Manager
Lydia Work	Principal Chemist / Director of Operations	Onterris	304-552-1442	lwork@montrose-env.com	Quality Assurance Manager
Ryan Malia	Staff Geologist III	Onterris	585-736-6641	ryanmalia@montrose-env.com	Field Team Leader

Comments/Decisions: *Discuss schedule and anticipated scope of work*

Action Items: *TBD*

Notes:

EPA: U.S. Environmental Protection Agency

VTDEC: Vermont Department of Environmental Conservation

Appendix B Standard Operating Procedures

CONSIDERATIONS WHEN COLLECTING SAMPLES FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) ANALYSIS
(Standard Operating Procedure 030)

Revision No: 0

Revision Date: N/A

Original Date: May 27, 2025

SOP Approval: _____ Date: May 27, 2025
Kevin Ignaszak, P.E., Senior Principal Engineer

SOP Approval: _____ Date: May 27, 2025
Eric White, P.G., Associate Geologist

CONSIDERATIONS WHEN COLLECTING SAMPLES FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) ANALYSIS
(Standard Operating Procedure 030)

TABLE OF CONTENTS

TABLE

ATTACHMENT

CONSIDERATIONS WHEN COLLECTING SAMPLES FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) ANALYSIS
(Standard Operating Procedure 030)

1.0 PURPOSE AND INTRODUCTION

The purpose of this standard operating procedure (SOP) is to supplement the existing Onterris USA, Inc. – formerly Montrose Environmental Solutions, Inc. – SOPs with technical guidance and procedures for the sampling and handling of potable water, surface water, groundwater, soil, and sediment and includes guidance to minimize potential cross-contamination from materials containing per- and polyfluoroalkyl substances (PFAS). This SOP outlines precautions and procedures on how to collect representative aqueous and solid samples for the analysis of PFAS. As such, this SOP is intended supplement – but not supersede – other Onterris SOPs and sampling plans. The Interstate Technology Regulatory Council (ITRC) Sampling Precautions and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances fact sheet is included as Attachment 1 and provides additional sampling guidance and considerations.

2.0 GENERAL PRECAUTIONS

This SOP describes considerations for aqueous and solid sample collection to address possible sources of cross-contamination between the sampler's clothing, sampling equipment, and the collected samples. This SOP applies to but is not necessarily limited to the following Onterris SOPs: SOP-004, SOP-005, SOP-006, SOP-007, SOP-008, SOP-009, SOP-011, SOP-012, and SOP-013.

The procedures and precautions described herein are designed to limit the exposure to commonly used field sampling equipment known to contain PFAS as well as other cross-contamination sources. Table 1 lists acceptable alternatives to materials that should not be used when collecting samples for PFAS analysis. Field personnel shall consider the proposed analytical parameters and use equipment and materials that will minimize the potential for cross-contamination of samples. Consider the following when designing and implementing a program to collect aqueous or solid samples for PFAS analysis.

2.1 General Sampling Considerations

- **Personnel training:** Ensure that sampling personnel are adequately trained in PFAS sampling protocols, including proper decontamination procedures and sample handling.
- **Do not handle or consume bottled water, snacks, or lunch supplies in areas where samples are being collected**. Wash hands after handling these items and prior to collecting samples.
- **Use care to prevent cross contamination from clothing and equipment.** Virgin nitrile gloves are to be donned prior to handling bottles in the field or office and sample collection (changing gloves immediately prior to sampling).
- **Clothing containing Gore-Tex® or equivalent waterproof materials should not be worn** while collecting samples for PFAS analysis. Rubber boots may be used instead of leather boots. If inclement weather is anticipated, rubber raingear is acceptable. Non-rubber raingear and footwear is not approved.
- **Sunscreen, cosmetics, moisturizers, hand cream, and other personal products should not be used the day of sampling.** If circumstances necessitate the use of sunscreen, see Table 1 for acceptable products.

- **The use of insect repellants or clothing with integrated insect repellants, such as Insect Shield® or permethrin, should be avoided**. Long-sleeve shirts and mesh head nets are to be worn as alternatives to insect repellant if conditions require.
- **Decontamination:** Thoroughly decontaminate reusable sampling equipment between sampling events to prevent cross-contamination. Use PFAS-free detergents and follow established decontamination procedures. In general, sampling equipment requiring decontamination should avoided to the degree possible.
- If possible, **avoid the use of waterproof field logbooks and paper.** If it is necessary to use these items, document the use in the field logbook.
- **Avoid materials that may contain trace levels of PFAS** such as adhesive notes, waterproof field logbooks or paper, aluminum foil, permanent markers, and methanol.
- **Sample containers and equipment:** Use PFAS-free materials for all sample containers and equipment, such as high-density polyethylene (HDPE). Avoid materials such as polytetrafluoroethylene (PTFE, aka Teflon) and low-density polyethylene (LDPE) which may contain PFAS and glass as PFAS may adsorb to glass surfaces.
- **Sample preservation:** Properly preserve samples to prevent degradation of PFAS compounds. Follow established preservation methods, such as refrigeration or freezing.
- **For temperature preservation, double-bagged wet ice** will be used. Do not use “blue ice”.

Groundwater Sampling

- **Groundwater sampling:** If possible, employ low-flow sampling methods to minimize disturbance of the aquifer and reduce the potential for volatilization of PFAS compounds. Consider using purging techniques to remove contaminated water before sample collection.
- **Do not use tubing that contains LDPE or PTFE,** for monitoring well purging and sampling – no Teflon tubing allowed. Document the type of tubing type used.

Soil/Sediment Sampling

- **Soil/sediment sampling:** Collect soil and sediment samples using appropriate techniques to obtain representative samples. Consider depth intervals based on site-specific conditions and project objectives.
- When collecting soil samples using direct-push technology use **sleeves made of HDPE.** Do not use LDPE or PTFE- lined sleeves or tubing.

Potable Water Sampling

- When collecting water samples from production wells, if feasible, avoid contact with PTFE tape or pipe thread paste on the water supply discharge pipe.
- Discharge water should be purged through the sampling tap on the discharge pipe for a minimum of 20 minutes prior to collection of samples.

2.2 Analytical Laboratory Considerations

- **Sample bottleware:** Sample bottles are to be provided by the laboratory that will be analyzing the samples. HDPE or polypropylene bottles will typically be provided. Bottles constructed with PTFE or PTFE-lined caps should not be used. Store sample bottles separately from other containers that may contain PFAS (e.g., bottles with PTFE lined caps).
- **Chain of custody:** Maintain a detailed chain of custody record for each sample, including sample identification, collection date, time, and personnel involved.
- **Sample shipment:** Transport samples to the laboratory under appropriate conditions to protect sample integrity.
- **Method selection:** Select the appropriate analytical methods for the target PFAS compounds based on their concentrations and the project objectives. Onterris typically requests US EPA Method 1633 for matrices other than drinking water. For the analysis of drinking water (potable water), US EPA Method 537.1 is requested.
- **PFAS-free water used for decontamination and QA/QC** samples will be certified by the laboratory analyzing the samples and stored in PFAS-free containers.
- **Laboratory QA/QC:** Ensure that the laboratory follows rigorous QA/QC procedures to produce reliable analytical results.
- **Data validation:** Review and validate laboratory data for accuracy, completeness, and consistency.

2.3 QA/QC Samples

Field QC samples may include reagent blanks, equipment rinsate blanks, field duplicates, matrix spikes, and method blanks. Refer to the Field Quality Control Sampling Procedures SOP (SOP-015) for a description of common field QC samples and the associated collection methods. Review the project control documents to determine what specific QA/QC samples are required for each project and sampling event.

Field reagent blanks are collected to evaluate whether contaminants have been introduced during the overall sample collection and handling process, including the water used by the laboratory for its method blanks, the sample containers, and exposure of the samples to the sampling location environment.

To collect a field reagent blank, two appropriate containers (one containing PFAS-free water and the other empty) are supplied by the project analytical laboratory. During the sampling event, the field personnel will transfer the PFAS-free water from one container into the other container (preserved if required), replace the caps, and place the sample containers into the cooler containing other samples. It is recommended that a minimum of one field reagent blank be collected during a PFAS sampling event.

If sampling equipment is decontaminated and reused, an equipment rinsate blank should be collected. The equipment rinsate blank is collected by running PFAS-free water over and through the properly decontaminated equipment and then collecting the water directly into laboratory

provided bottleware. The recommended frequency for equipment rinsate blank sample collection is one per each day of sampling.

2.4 Field Documentation

Adequately document sampling activities in accordance with the Field Documentation Procedure SOP (SOP-001). Document potential PFAS sources as well deviations from the project control documents and this SOP in the project field notes.

3.0 REFERENCES

US Environmental Protection Agency. Per- and Polyfluoroalkyl Substances (PFAS) Field Sampling Guide. 2023.

California State Water Resources Control Board. (2020). Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water. September 2020.

Michigan Department of Environment, Great Lakes, and Energy. General PFAS Sampling Guidance. January 2024.

Interstate Technology Regulatory Council (ITRC). Sampling Precautions and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (FPAS). September 2023.

Table 1 PFAS Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
Field Equipment	
Fluoropolymer bailers, tubing, valves, pump bladders, or pipe-thread seal tape	Disposable or dedicated equipment (no Polytetrafluoroethylene [PTFE] parts) made from HDPE, polypropylene, silicone, are stainless steel.
Waterproof field books	Acetate Liners
Plastic clipboards, binders, or spiral hard cover notebooks	Silicon Tubing
Post-It Notes®	Loose paper (non-waterproof)
Chemical (blue) ice packs	Aluminum field clipboards or Masonite
Gel pens, Sharpies®	Ballpoint pens
Chemical (blue) ice packs	Wet ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	Clothing laundered without fabric softener
Boots containing Gore-Tex	Steel-toed boots made with polyurethane and polyvinyl chloride (PVC)
Coated Tyvek® (or similar) suits	Uncoated suits or cotton clothing
Cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics **Combination Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities. Rubber rain gear.
Equipment Decontamination	
Decon 90®	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply (preferably tested prior to use)
Food Considerations	
All food and drink, with exceptions noted on right. In particular, avoid contact with pre-packaged food, fast food wrappers or containers prior to sampling.	Bottled water and hydration fluids (i.e, Gatorade® and Powerade®) to be consumed only in staging areas

Attachment 1

Interstate Technology Regulatory Council, Sampling Precautions and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances Fact Sheet

Sampling Precautions and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)

1 Introduction

Due to the widespread distribution of many PFAS and the low parts per trillion screening levels, a sampling and analysis protocol requires a heightened level of rigor to avoid cross-contamination and achieve the level of accuracy and precision required to support defensible project decisions.

This fact sheet summarizes information and describes tools to help develop a site-specific sampling and analysis program to satisfy the project data quality objectives (DQOs). Accurate, representative data support the development of a defensible conceptual site model (CSM), and ultimately the final remedy. Additional information is available in the Guidance Document.

ITRC has developed a series of fact sheets that summarizes recent science and emerging technologies regarding PFAS. The information in this and other PFAS fact sheets is more fully described in the ***ITRC PFAS Technical and Regulatory Guidance Document (Guidance Document)*** (*https://pfas-1.itrcweb.org/*).

This fact sheet describes methods for evaluating PFAS in the environment, including:

- sampling precautions
- laboratory analytical methods
- data evaluation

2 Sampling

Sampling conducted to determine PFAS concentrations in water, soil, sediment, air, biota, and other media is similar to that for other chemicals; however, unusually low screening/regulatory criteria and concentration levels can make samples susceptible to cross-contamination from PFAS in sampling materials and incidental contact with PFAS during sampling. Specific considerations and protocols are required to minimize sample bias from PFAS by using stainless steel, silicone, and high density polyethylene (HDPE) in sampling equipment, field supplies, and bottle selection.

PFAS-specific sampling protocols should be followed for sampling and decontamination procedures and sampling precautions. Ensure that materials that will come into contact with the samples do not have PFAS-containing, water-resistant coatings. Many programs have developed guidance and procedures—for example USEPA (2019 Ref#1653), MA DEP (2022), and MI EGLE (2021 Ref#1873). Sample protocols, preservation, shipping, storage, and holding times should meet the requirements contained in the analytical methods that are to be used.

Some matrix-specific considerations include:

- For drinking water sampling, allow tap to run for 3–5 minutes before taking a sample. Take care not to flush preservative out of the sample bottle.
- For groundwater sampling, the most inert material (for example, stainless steel, silicone, and HDPE) should be used in wells whenever possible. Sample with a method that minimizes turbidity but does not filter the sample. Dedicated sampling equipment installed in existing wells prior to investigation should be thoroughly checked to ensure that the equipment is PFAS-free.
- For surface water sampling, stratification within the water column should be considered (refer to Sections 5.2, and 16.4 of the Guidance Document for more), and if possible, the container should be lowered below the water surface but above the bottom sediments.
- Before utilizing a passive sampler device, ensure use of the sampler has been validated with respect to the evaluation of the site-specific analytes of interest and is acceptable by the applicable regulatory agency.
- For sediment porewater sampling, peristaltic pumps with silicone and HDPE tubing are typically used, along with push point samplers, porewater observation devices (PODs), or drive-point piezometers. Lysimeters have been used to aid in the characterization of soil porewater.
- For fish sampling, studies have shown the majority of the PFAS in fish are stored in the organs, not the flesh (Martin et al. 2004 Ref#313; Yamada et al. 2014). Communicating project objectives to the laboratory is important prior to field work in order to determine the necessary quantity and quality of tissue, fish handling requirements, laboratory sample preparation (including single fish or composite fish samples, and whole or fillet preparation), and packing and shipping requirements.

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- For air sampling, multiple measurement approaches are available. Draft USEPA OTM-45 was released as an "Other Test Method (OTM)" by USEPA's Emission Measurements Center to promote consistency and is considered by USEPA to represent the current best practices to sample and analyze PFAS from stationary sources. Some sampling and analysis of ambient air have been performed using modified toxic organic (TO) methods, such as TO-13A and TO-9 (USEPA 2020 Ref#2138).

Equipment and Supplies

Many materials (for example, bailers, tubing, tape, labels, gloves) used in the course of environmental investigations can potentially contain PFAS. There is limited published research or guidance on how certain materials used by field staff affect sample results (Denly et al. 2019; Rodowa et al. 2020). There are two subcategories of materials used at a site; those materials that come into direct contact with the sample and those that do not. It is recommended, when possible, to exclude materials known to contain PFAS, such as those containing polytetrafluoroethylene (PTFE), perfluorinated ethylene-propylene (FEP), ethylene fluoroethylene (ETFE), low-density polyethylene (LDPE), polyvinylidene fluoride (PVDF), pipe thread compound and tape, and waterproof coatings. The Safety Data Sheets (SDSs) of materials should be reviewed before considering materials for use. If PFAS are not listed on the SDS, PFAS may still be present since PFAS may have been used not as a component of the material, but in the manufacturing process itself. When PFAS-containing equipment and supplies cannot be eliminated, materials in question can be sampled and analyzed for PFAS, or equipment rinse blanks can provide sufficient quality assurance. Collection and analysis of QC samples, such as field reagent blanks, equipment rinse blanks, and field duplicates, are important for PFAS analyses because of very low detection limits and widespread commercial use (historical and current) of PFAS-containing products.

Bottle Selection, Sample Preservation, Shipping, Storage, and Holding Time

Sample container, preservation, shipping, storage, and holding time requirements are included in USEPA Methods 537.1 (USEPA 2020 Ref#1732), 533 (USEPA 2019 Ref#1468), SW-846 Method 3512/8327, USEPA Draft 1633 (USEPA 2023 Ref#2762), OTM 45 (USEPA 2021 Ref#2133), and DOD AFFF01 (Willey 2021). Depending on the analytical method used or program (for example, state or DOD), requirements for sample matrix may vary.

Decontamination Procedures

When possible, it is recommended that dedicated or single-use field sampling equipment be utilized. When non-dedicated equipment is used at multiple sampling locations thorough cleaning between uses is required. The SDSs of detergents or soaps used in decontamination procedures should be reviewed to ensure fluorosurfactants are not listed as ingredients. Laboratory-verified PFAS-free water, supplied by the laboratory that will perform the analysis, should be used for the final rinse during decontamination of sampling equipment. The term "PFAS-free" is a method or project-defined concentration level (for example, less than half the limit of quantitation for the specific compound of interest). Due to the extremely low PFAS screening/regulatory levels, the increased potential for PFAS to be at concentrations in the sample at higher than these levels, and the high affinity of PFAS for surfaces, decontamination procedures associated with PFAS sampling are typically more extensive than those used when sampling for other contaminants. The CSM or previous sampling may indicate areas of high concentrations of PFAS for which single-use, disposable equipment is recommended. If single-use is not possible, take additional precautions such as implementing a greater frequency of equipment rinse blanks and not reusing equipment to sample potentially low PFAS concentration samples. High concentration samples, such as aqueous film-forming foam (AFFF), should be segregated during shipping to the laboratory, and be clearly identified on the *Sample Chain of Custody.*

3 Quantitative Analysis

As the need for testing PFAS increases with respect to the list of PFAS of interest and range of sample matrices for evaluation, the need for additional analytical methods increases. Currently, there are few finalized, multi-laboratory validated, published PFAS methods (Table 11-2 and Table 11-3, see the External Data Tables on https://pfas-1.itrcweb.org). These methods vary in their sample preparation and quantitation techniques employed, achievable limits of detection and quantitation, sampling, preservation, and holding time requirements, and applicable sample media and analytes (Table 11-4, see the External Data Tables on https://pfas-1.itrcweb.org). In addition, other methods have been published as draft (Table 11-5, see the External Data Tables on https://pfas-1.itrcweb.org).

Sample Preparation

The sample preparation procedure should be specified in the sample analysis procedure and should be included as part of the sampling and analysis plan (SAP) or QAPP. This procedure should demonstrate that extreme care is taken to

prevent sample contamination during preparation and extraction. All supplies must be checked and confirmed as PFAS-free prior to sample preparation. There are some significant ways in which methods differ that need to be considered when selecting a method. They include:

- Amount of sample prepared (whole sample, whole sample plus container rinse, or aliquot of sample collected),
- Solid-phase extraction or solvent dilution, and
- Inclusion of clean-up processes and types of clean-up processes utilized.

Sample filtration is not recommended for samples with high particulate content because retention of PFAS onto filters has been noted. Centrifuging is often used to reduce sample particulates. For aqueous samples, the entire sample collected and solvent rinsate of the sample container received in the laboratory must be extracted by solid-phase extraction (SPE) in order to recover any PFAS that adhered to the sample container. Due to limitations in SPE catridge capacity, increased likelihood of cross-contamination during the extraction process, and quantitation limitations, for samples containing high concentrations of PFAS (for example, AFFF formulations) an aliquot of the sample may be used to prepare a dilution of the sample prior to SPE. It is recommended that for solid samples, the entire sample collected is homogenized in the laboratory prior to subsampling. Cleanup procedures (for example, graphitized carbon) should be used on sample extracts and all associated batch QC samples (for example, method blanks, and laboratory control samples) when matrix interferences (for example, bile salts and gasoline range organics) could be present. The analytical procedure should describe what batch QC samples are prepared with each sample matrix type. Batch QC samples might include method blank (MB), laboratory control sample (LCS), laboratory control sample duplicate (LCSD), sample duplicate (SD), matrix spike (MS), and matrix spike duplicate (MSD).

Sample Analysis

Currently, all analytical methods published by USEPA for PFAS analysis use liquid chromatography-tandem mass spectrometry (LC/MS/MS). Gas chromatography-mass spectrometry (GC/MS) can also be used for PFAS analysis; however, GC/MS analysis has limited commercial availability for PFAS analysis and there is not a published GC/MS method available. While most analytical methods used for PFAS use LC/MS/MS, just as with sample preparation, there are significant ways in which the methods differ that need to be considered when selecting a method. They include:

- The type of analytical standards used for quantitation (purity, isomeric profile),
- Analyte identification scheme used (confirmation ion transitions, ion transition ratios, and signal to noise ratio),
- Quantitation scheme used (external, internal standard, isotope dilution), and
- Instrument verification scheme used (instrument cleanliness checks (instrument blanks), calibration verifications, and limit of quantitation verifications).

Certified analytical standards for PFAS vary in their purity (known percent of impurities) or isomeric profiles (linear isomer only, linear and branched isomers), which may compromise the accuracy, precision, and reproducibility of the data generated. Currently, standards of the purity needed for quantitation, containing the branched and linear isomers of the analyte, are commercially available for perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS), perflurooctanesulfonamide (PFOSA), N-methyl perfluorooctanesulfonamide (NMeFOSA), N-ethyl perfluorooctanesulfonamide (NEtFOSA), 2-(N-methylperfluorooctanesulfonamido) acetic acid (N-MeFOSAA), 2-(N-ethylperfluorooctanesulfonamido) acetic acid (N-EtFOSAA), N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE), and N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE).

In addition to retention time, other parameters such as confirmation ion transitions and ion transition ratios can be used to distinguish analytes from sample matrix interferences. For complex matrices (matrices other than drinking water), it is recommended that two ion transitions be monitored for each analyte, when possible. Ion transition ratios in the sample should be compared to that of standards in order to detect possible bias in the sample results.

Quantification by LC/MS/MS may be accomplished by external standard, internal standard, or isotope dilution schemes. The quantitation scheme used determines whether bias associated with sample preparation, instrumentation, and matrix interference are accounted for in the sample result. Isotope dilution should be used whenever possible for quantitation since it is the only quantitation scheme that accounts for biases resulting from sample preparation steps and accounts for instrumentation and matrix interference in the most accurate and precise manner of the three quantitation schemes.

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A robust instrument verification scheme is needed to ensure the data are fit for the intended use. The instrument blanks, calibration curve, spiked blanks (LCS, Ongoing Precision and Recovery [OPR]), instrument sensitivity checks, and initial and continuing calibration verification requirements should be consistent with those published for other LC/MS/MS methods, such as USEPA Methods 537.1 (USEPA 2020 Ref#1732), 533 (USEPA 2019 Ref#1468), and Draft 1633 (USEPA 2023 Ref#2762).

4 Qualitative Techniques

In addition to the quantitative methods above, some qualitative techniques have been developed to help provide a more comprehensive assessment of the range of PFAS contamination at a site and aid in remediation efforts. These techniques are not multi-laboratory validated or promulgated methods. Depending on the technique, they can provide information on the presence of PFAS other than those identified by quantitative methods. The following four primary techniques have been developed to characterize these unknown PFAS in a sample.

- Total oxidizable precursor (TOP) assay measures the mass of perfluoroalkyl acid (PFAA) precursors or polyfluorinated compounds that can be converted to PFAAs.
- Particle-induced gamma-ray emissions (PIGE) spectroscopy measures elemental fluorine isolated on a thin surface.
- Adsorbable organic fluorine (AOF) or extractable organic fluorine (EOF), paired with combustion ion chromatography (CIC), measures the organofluorine content of a sample as fluoride on an ion chromatograph. Recently, the AOF method was published by USEPA as Draft Method 1621 (USEPA 2022 Ref#2299).
- High-resolution mass spectrometry techniques, such as quadrupole time-of-flight (qTOF) MS/MS, can tentatively identify PFAS structures through library matching or in-depth data analysis.

5 Data Evaluation

The most important goal of data validation is to evaluate the PFAS data generated with respect to the stated data needs of the project by evaluating the quality of the results compared to the DQOs of the project and identify any limitations in the use of the data due to potential uncertainty or bias. The resulting data validation report, in conjunction with the QAPP, is used by the project team to determine the overall usability of data. The USEPA (2018 Ref#1475) has guidance to aid in evaluating PFAS drinking water data generated in accordance with USEPA 537, as well as a technical bulletin to aid in the review of PFAS data generated for all other sample matrices (USEPA 2020 Ref# 1734). The USDOD EDQW has published PFAS Data Validation Guidelines for evaluation of PFAS data (USDOD 2021). A summary of key points from these data validation guidance documents, and others as noted in the table, has been compiled as Table 11-6, PFAS Analytical Data Usability Table, see Section 11.3 of the Guidance Document.

6 References and Acronyms

The references cited in this fact sheet and further references can be found at https://pfas-1.itrcweb.org/references/. Reference numbers are included in this fact sheet for non-unique citations in the Guidance Document reference list.

The acronyms used in this fact sheet and in the Guidance Document can be found at https://pfas-1.itrcweb.org/acronyms/.

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Appendix C Laboratory Detection Limits

Appendix C

Laboratory MDLs

Parameter	Vermont Groundwater Quality Standard [1] - Enforcement Action Level [2]	Pace MDL (Aqueous)	Vermont Residential Soil Standards (VSS) [3]	Pace MDL (Soil)
Semivolatiles (SVOA)				
Units	**µg/L**	**µg/L**	**mg/Kg**	**mg/Kg**
1,1'-Biphenyl	---	0.75	---	0.048
1,2,4,5-Tetrachlorobenzene	---	0.92	---	0.043
2,2'-oxybis[1-chloropropane]	---	0.82	---	0.089
1-Methylnaphthalene	---	0.72	---	0.0063
2,3,4,6-Tetrachlorophenol	---	4.7	---	0.041
2,4,5-Trichlorophenol	---	0.78	---	0.44
2,4,6-Trichlorophenol	---	0.68	---	0.04
2,4-Dichlorophenol	---	0.9	---	0.044
2,4-Dimethylphenol	---	0.66	---	0.075
2,4-Dinitrophenol	---	0.87	---	0.32
2,4-Dinitrotoluene	---	0.64	---	0.15
2,6-Dinitrotoluene	---	1.1	---	0.052
2-Chloronaphthalene	---	1.1	---	0.037
2-Chlorophenol	---	0.91	---	0.04
2-Methylnaphthalene	---	1	---	0.0061
2-Methylphenol	---	0.66	---	0.041
2-Nitroaniline	---	1.1	---	0.065
2-Nitrophenol	---	3.5	---	0.042
3,3'-Dichlorobenzidine	---	0.7	---	0.07
3/4-Methylphenol	---	0.39	---	0.06
3-Nitroaniline	---	0.91	---	0.062
4,6-Dinitro-2-methylphenol	---	1.2	---	0.22
4-Bromophenyl phenyl ether	---	0.55	---	0.044
4-Chloro-3-methylphenol	---	3.3	---	0.051
4-Chloroaniline	---	3.3	---	0.058
4-Chlorophenyl phenyl ether	---	0.52	---	0.047
4-Nitroaniline	---	0.79	---	0.064
4-Nitrophenol	---	2.8	---	0.14
Acenaphthene	---	0.57	---	0.0068
Acenaphthylene	---	0.46	---	0.0059
Acetophenone	---	0.7	---	0.048
Anthracene	2,100	0.56	---	0.0061
Benzaldehyde	---	4.8	---	0.042
Benzo[a]anthracene	---	0.73	---	0.0068
Benzo[a]pyrene	0.2	0.018	0.07	0.01
Benzo[b]fluoranthene	---	0.72	---	0.0084
Benzo[g,h,i]perylene	---	0.82	---	0.012
Benzo[k]fluoranthene	---	0.82	---	0.0079
Bis(2-chloroethoxy)methane	---	0.82	---	0.051
Bis(2-chloroethyl)ether	300	0.8	---	0.057
Bis(2-ethylhexyl) phthalate	---	0.15	20	0.063
Butyl benzyl phthalate	---	0.15	---	0.05
Caprolactam	---	4.9	---	0.068
Carbazole	---	0.87	---	0.048
Chrysene	---	0.89	---	0.0078
Dibenz(a,h)anthracene	---	0.67	---	0.014
Dibenzofuran	---	0.49	---	0.048
Diethyl phthalate	---	0.9	---	0.049
Dimethyl phthalate	---	0.77	---	0.046
Di-n-butyl phthalate	---	0.94	---	0.048
Di-n-octyl phthalate	---	0.81	---	0.063
Fluoranthene	280	0.89	2,301	0.0073
Fluorene	280	0.33	2,301	0.0069
Hexachlorobenzene	1	0.6	0.13	0.046
Hexachlorobutadiene	1	0.35	---	0.045
Hexachlorocyclopentadiene	50	3.2	---	0.14
Hexachloroethane	---	0.33	---	0.041
Indeno[1,2,3-cd]pyrene	---	0.7	---	0.014
Isophorone	100	0.94	---	0.052
Naphthalene	20	1.2	2.7	0.0063
Nitrobenzene	---	1.1	---	0.049
N-Nitrosodi-n-propylamine	---	2.6	---	0.056
N-Nitrosodiphenylamine	---	0.4	---	0.052
Pentachlorophenol	---	3.5	0.48	0.037
Phenanthrene	---	0.49	---	0.0067
Phenol	2,100	0.21	---	0.046
Pyrene	---	0.77	---	0.0082
Pyridine	---	0.28	---	0.044

Notes:

(1) Vermont Groundwater Quality Standards, Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule, 2019 update. Appendix One, Table 1 (Primary Groundwater Quality Standards).

(2) Enforcement Action Level is the value at which reaching or exceeding action under Section 12-804 of Vermont Groundwater Quality Standars, Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule, 2019 update.

E - Groundwater Enforcement Standard of 0.02 ug/L for any combination of PFOA, PFOS, PFHxS, PFHpA, and PFNA.

F - PFAS - Sum of PFHpA, PFHxS, PFNA, PFOS and PFOA not to exceed applicable resident or non-resident values.

I - Total Chromium Soil Standard compared to Hexavalent Chromium standard

Appendix C

Laboratory MDLs

Parameter	Vermont Groundwater Quality Standard [1] - Enforcement Action Level [2]	Pace MDL (Aqueous)	Vermont Residential Soil Standards (VSS) [3]	Pace MDL (Soil)
PFAS				
Units	**µg/L**	**µg/L**	**mg/Kg**	**mg/Kg**
(8:2FTS A) Perfluorodecanoic acid (PFDA)	---	0.355	---	0.14
(FBSA) Perfluorohexanesulfonic acid (PFHxS)	0.02 E	0.38	1.22 F	0.119
Hexafluoropropylene oxide dimer acid (HFPO-DA) 8:2 Fluorotelomersulfonic acid	---	1.13	---	0.587
11Cl-PF3OUdS (F53B Major)	---	1.36	---	0.594
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	---	0.905	---	0.503
4:2 Fluorotelomersulfonic acid (4:2FTS A) Perfluorodecanesulfonic acid (PFDS)	---	0.408	---	0.139
6:2 Fluorotelomersulfonic acid (6:2FTS A) Perfluoropentanesulfonic acid (PFPeS)	---	0.299	---	0.123
9Cl-PF3ONS (F53B Minor)	---	1.33	---	0.551
N-EtFOSAA (NEtFOSAA)	---	0.56	---	0.121
N-MeFOSAA (NMeFOSAA)	---	0.95	---	0.12
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA) Perfluoroheptanoic acid (PFHpA)	0.02 E	0.31	1.22 F	0.133
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA) Perfluoroheptanesulfonic acid (PFHpS)	---	0.441	---	0.134
Perfluorobutanesulfonic acid (PFBS)	---	0.268	---	0.121
Perfluorobutanoic acid (PFBA)	---	0.884	---	0.533
Perfluorododecanoic acid (PFDoA)	---	0.303	---	0.129
Perfluorohexanoic acid (PFHxA)	---	0.268	---	0.132
Perfluorononanesulfonic acid (PFNS)	---	0.365	---	0.132
Perfluorononanoic acid (PFNA)	0.02 E	0.381	1.22 F	0.133
Perfluorooctanesulfonamide (FOSA)	---	0.305	---	0.125
Perfluorooctanesulfonic acid (PFOS)	0.02 E	0.403	1.22 F	0.131
Perfluorooctanoic acid (PFOA)	0.02 E	0.946	1.22 F	0.143
Perfluoropentanoic acid (PFPeA)	---	0.555	---	0.262
Perfluorotetradecanoic acid (PFTA)	---	0.245	---	0.145
Perfluorotridecanoic acid (PFTrDA)	---	0.284	---	0.134
Perfluoroundecanoic acid (PFUnA)	---	0.342	---	0.15

Notes:

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Appendix C

Laboratory MDLs

Parameter	Vermont Groundwater Quality Standard [1] - Enforcement Action Level [2]	Pace MDL (Aqueous)	Vermont Residential Soil Standards (VSS) [3]	Pace MDL (Soil)
Inorganic				
Units	**µg/L**	**µg/L**	**mg/Kg**	**mg/Kg**
Aluminum	---	3.27	72,507	1.3
Antimony	6	0.429	26	1.54
Arsenic	10	0.165	16	0.1728
Barium	2,000	0.173	11,247	0.0424
Beryllium	4	0.107	35	0.022
Cadmium	5	0.0599	6.9	0.022
Calcium	---	39.9	---	2.268
Chromium (Total)	100	0.178	0.09 I	0.3392
Cobalt	---	0.163	22	0.0992
Copper	1,300	0.384	10,407	0.0908
Iron	---	19.1	51,302	3.2
Lead	15	0.343	400	0.0952
Magnesium	---	24.2	---	0.652
Manganese	840	0.44	1,118	0.2144
Mercury	2	0.09	3.1	0.05216
Nickel	100	0.556	940	0.3232
Potassium	---	30.9	---	20.28
Selenium	50	1.73	366	0.1316
Silver	---	0.163	237	0.1192
Sodium	---	29.3	---	42.4
Thallium	2	0.143	0.73	0.3608
Vanadium	---	1.57	2.8	0.0604
Zinc	---	3.41	21,986	0.2424

Notes:

(1) Vermont Groundwater Quality Standards, Chapter 12 of the Environmental Protection Rules: Groundwater Protection Rule, 2019 update. Appendix One, Table 1 (Primary Groundwater Quality Standards).

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