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SITE SPECIFIC QUALITY ASSURANCE PROJECT PLAN

W.W. Cross Property
39 Webster Street
Jaffrey, New Hampshire
NHDES Project No.: 0037735

Project Type: Brownfields
NHDES Site Number: 198708007

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December 19, 2022

1. TITLE AND APPROVAL PAGE

SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN (SSQAPP) ADDENDUM TO CREDERE GENERIC QAPP FOR BROWNFIELDS WORK IN MAINE, NEW HAMPSHIRE, MASSACHUSETTS, AND VERMONT RFA #19043

PROPERTY:

W.W. Cross Property
39 Webster Street
Jaffrey, New Hampshire
EPA Brownfields Assessment Grant #00A00997
NHDES Site No. 198708007; SITEEVALHW Project #37735

PREPARED BY:

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December 19, 2022

Below is a listing of the names, titles, signatures, and signature dates of officials approving this Site-Specific Quality Assurance Project Plan (SSQAPP) Addendum:

Christine Lombard
EPA Brownfields Project Officer

Date

Jessica Iverson
EPA Quality Assurance Officer

Date

Scott Drew, PG
NHDES Project Manager

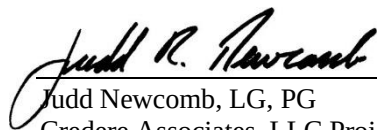
Date

Jo Anne Carr

1/3/23

Jo Anne Carr
Town of Jaffrey, Brownfields Grantee

Date


Judd Newcomb, LG, PG
Credere Associates, LLC Project Manager

12/19/22

Date



12/19/22

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2. INTRODUCTION

Credere Associates, LLC (Credere) was retained by the Town of Jaffrey (Jaffrey) to prepare this Site-Specific Quality Assurance Project Plan (SSQAPP) for the former W.W. Cross Property located at 39 Webster Street in the Town of Jaffrey, New Hampshire (Site). The Town of Jaffrey is using funding from a U.S. Environmental Protection Agency (EPA) Brownfields Assessment Grant (#00A00997) to conduct these assessment activities.

This SSQAPP presents the following information:

- Problem definition including a Site description and summary of background information for the Site
- Project description and timeline
- Preliminary conceptual site model (CSM)
- Assessment objectives and proposed sampling design and rationale
- Site-specific field sampling and analytical methodology
- Regulatory standards applicable to the Site for each proposed sampling media

This SSQAPP was prepared to be used in concert with Credere's Generic Quality Assurance Project Plan (QAPP) for Brownfields Work in Maine, New Hampshire, Massachusetts, and Vermont, EPA Quality Assurance Tracking: Request for Assistance (RFA) #19043, Revision 3 dated June 2022, which was prepared for all of Credere's EPA Brownfields work. The quality assurance and quality control (QA/QC) procedures outlined in Credere's Generic QAPP will be followed for this investigation program including sample collection, handling, and analysis of samples; chain-of-custody; and data management, documentation, validation, and usability assessment. Sampling as outlined in this SSQAPP will not occur until receipt of approval from EPA and the New Hampshire Department of Environmental Services (NHDES).

The following figures are included to add clarity to the plan:

- **Figure 1** – Site Location Plan
- **Figure 2** – Proposed Sampling Plan
- **Figure 3** – Groundwater Exceedances
- **Figure 4** – Project Organization Flow Chart



3. PROBLEM DEFINITION

3.1 SITE DESCRIPTION

The Site comprises one 11.29-acre parcel identified as 39 Webster Street. The Site is improved with one 97,914-square foot commercial/industrial building. The building was built in 1915 and used as the W.W. Cross Factory, which manufactured tacks and fasteners for the upholstery, carpeting and shoe industry. In 2020, the building suffered a fire and the eastern and central portions of the building have been demolished.

Paved parking areas are located to the southwest and west of the Site building. A grassy area is located directly east of the site building that serves as a cap for a waste tack landfill, and two retaining ponds are located on the eastern end of the Site separated by an earthen berm. The remainder of the exterior portions are wooded.

3.2 SITE UTILITIES

As the Site building is vacant and fire damaged, utilities have been discontinued to the Site. Public water/wastewater service is not currently active but are available from the Town of Jaffrey.

Historical Sanborn maps depict extensive hydrant utilities throughout the Site, which may serve as preferential pathways including a conduit to the onsite ponds where a pumphouse formerly pumped water for fire suppression.

3.3 SITE HISTORY

Site History

Prior to 1915, the Site was undeveloped with only a small pond. The Site was first developed with the original Site building (today the northernmost section) by W.W. Cross by 1924. The initial building configuration had the factory occupying the northeastern most portion of the building. By 1941, the Site building had been expanded to the south expanding the factory space and adding additional storage in the southwest. Factory space was further expanded by 1953. These additions created a building footprint similar to today.

By 1953, a boiler room was added to the west of the side building. Between 1955 and 1975, a separate aboveground storage tank (AST) structure was built adjacent to the boiler room. Between 1975 and 1999, an eastern portion of the building was demolished. By 2000, W.W. Cross had vacated the Site. Between 2007 and 2012, the building was used by various commercial businesses after being divided into tenant commercial spaces. On June 21, 2020, a five-alarm fire was discovered at the Site affecting an eighth of the building.

Surrounding Area

The surrounding areas to the south and west have been a combination of undeveloped land, later developed into the American Legion Hall, and residential properties. By 1915, the surrounding area to the east was undeveloped land utilized by the W.W. Cross company as a “surface impoundment area”. By 1982, this land was enclosed with fencing but is still undeveloped. Prior



to 1915, the north of the Site was a railroad corridor and then developed property. By 1915, the Bean & Symonds Factory for woodworking had been constructed on the north side of the railroad tracks. By 1970, the woodworking factory has been removed and the property was vacant. By 1980, a retail shopping plaza had been constructed, which remains to present day.

3.4 PRIOR SITE INVESTIGATIONS AND NHDES DOCUMENTATION

3.4.1 Offsite W.W. Cross Surface Impoundment

Surface Impoundment Early Correspondence and Post-Closure Plan, E.C. Jordan Co., 1982-1995

The surface impoundment related to prior Site operation is considered offsite under current property boundaries; thus, only a brief general history of the status of this portion of the W.W. Cross operations is provided.

Records related to the surface impoundment area date back to 1982 when discussions regarding the appropriate discharge of effluent from the factory began and Resource Conservation and recovery Act (RCRA) permitting was initiated. Cyanide and other metals were present in the effluent being discharged via an overhead sluiceway to the lagoons, which required pretreatment and monitoring of groundwater around the lagoons to comply with EPA and NHDES RCRA regulations at the time. The decision was made to reroute effluent to the Jaffrey Wastewater Treatment facility, but only after use of an approved pretreatment system. This pre-treatment and rerouting of waste occurred in 1983.

After eliminating the effluent to the lagoons, the lagoon required closure. E.C. Jordan Co. prepared the post closure plan dated 1988 to outline procedures for long-term monitoring and maintenance of the closed surface impoundment east of the Site. This Plan was developed to supplement the Filter Bed Closure Plan prepared by the same company (July 1985). Documentation of the completion of remedial action was provided in Certificate of Closure dated 1987. The closure activity included excavation, removal, and disposal of sludge and contaminated soil, and backfilling, grading, and capping of the filter bed with a low permeability cap. The Post Closure Plan required groundwater and surface water monitoring under Groundwater Management Permits (GMP) GWP8810-45J and later GWP-870807-J-001, and cover system monitoring as well as maintenance.

Groundwater was monitored with financial assurance provided through 2012 when additional soil characterization was done to assess conditions against current standards. As cyanide concentrations from the surface impoundment were below the Soil Remediation Standards (SRSS) at the time, NHDES issued a Discharge and Release of Notice of GMP on June 13, 2013. Based on this condition, no impacts to the Site related to the surface impoundment area are anticipated.

3.4.2 Waste Tack Pile

Waste Tack Pile Investigation, Loureiro Engineering Associates, Inc., September 28, 1994

Loureiro Engineering Associates, Inc. (Loureiro) was retained by Black and Decker Corporation to conduct a subsurface investigation to determine the characteristics of the tack pile where waste



tacks and nails as well as spent kerosene were reportedly disposed. Tacks were reportedly constructed using primarily steel, with occasional batches of brass (copper/zinc alloy), aluminum and stainless-steel tacks.

Samples from seven test pits were collected to assess the nature and extent of environmental impacts related to the waste tacks. Sample results indicated the presence of volatile organic compounds (VOCs), primarily tetrachloroethene (PCE), trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE), petroleum, metals, and cyanide. No metals were present at concentrations characterizing this material as hazardous waste due to metals concentrations. This investigation confirmed the presence of contaminants in the tack pile but required further investigation.

Supplemental Subsurface Investigation Report and Remedial Option Evaluation, Loureiro Engineering Associates, Inc., November 6, 1995

Loureiro conducted a supplemental subsurface investigation to delineate the horizontal and vertical extent of the tack pile to evaluate options for closure and develop a remedial strategy for the cyanide contaminated material. It was estimated the tack pile comprised 4,500 to 5,500 cubic yards of material, which if removed would be considered a hazardous waste due to cyanide content.

Consolidation of materials outside the sloped area (i.e., nearest the building and near to the pump house) and construction of an impermeable capping system was chosen as the most cost effective remedial option based on the data.

Hydrogeologic Investigation, Loureiro Engineering Associates, Inc., July 22, 1996

Loureiro conducted a hydrogeologic investigation to assess the impact of the tack pile on groundwater at the Site. The report details the intention to install 13 groundwater monitoring wells, soil sampling and characterization, well development, groundwater sampling, surveying and collection of water-level measurements, and aquifer testing. The results of the implementation of this work plan was incorporated into subsequent documents.

Site Characterization Work Plan, Loureiro Engineering Associates, Inc., January 1998

Loureiro prepared this work plan to comply with NHDES Site Remediation Program. The work plan intended to:

- Determine the levels of cyanide contained through the tack pile
- Determine the extent of the gelatinous cyanide sludge wastes
- Install an additional groundwater monitoring well

Remedial Action Plan (RAP), Loureiro Engineering Associates, Inc., May 14, 1999

Considering the results of the above two work plans (Hydrogeologic Investigation & Site Characterization Work Plan), Loureiro prepared a Remedial Action Plan (RAP) for the closure of the tack pile. This work plan details:



- Removal of the “blue gelatinous material” in the vicinity of TP-3
- Construction of an impermeable cap over the landfill
- Groundwater monitoring in accordance with the Groundwater Management Permit

Final Closure Plan, Loureiro Engineering Associates, Inc., July 2, 1999, Rev. August 16, 1999

A Final Closure Plan was prepared by Loureiro, which outline the specifications for the impermeable cap, groundwater and surface water monitoring requirements, cap maintenance and inspection, and documentation requirements. The excavation of the blue gelatinous material was completed in August 1999 and the tack pile cap was installed in December 1999.

GMP Renewal Application, November 30, 2000, and GMP, May 12, 2021, Loureiro

As part of the existing GMP renewal for the Surface Impoundment, addition of the tack pile monitoring requirements was recommended to meet the groundwater monitoring requirements of the RAP. The monitoring of the tack pile was incorporated into the revised GMP GWP-198708007-J-002, which was renewed most recently as GWP-198708007-J-006, and required monitoring of monitoring wells MW-2, MW-4S, MW-4D, MW-5S, MW-5D, MW-6D, MW-6S, MW-7, MW-14, MW-16S, MW-16M, MW-16D, MW-17S, MW-17D, MW-202A, and MW-202B, piezometer PZ-101A, and surface water locations SW-1, SW-3, and SW-4 in April annually with a few locations biannually. Analyses vary by location. Groundwater Management Zone (GMZ) is depicted on **Figure 2**.

October 2002 through April 2021 Tack Pile Monitoring Results, Loureiro Engineering Associates, Inc.

Loureiro performed groundwater monitoring and an annual RCRA cover system inspection for the tack pile from issuance of the new GMP in 2000 through April 2021. The most recent results were reported on June 18, 2021, for the April 2021 event. Groundwater elevation data indicated groundwater flow was to the east, consistent with past data. It was noted that PCE concentrations have shown an apparent increasing trend based on trend graphs since 2016 in MW-6D and MW-2. Cadmium also shows an increasing graph trend in MW-6D, but a highly variable cadmium trend at PZ-101A. The following exceedances of the Ambient Groundwater Quality Standards (AGQS) remain as of April 2021:

- MW-2 1,4-dioxane
- MW-6S cadmium (below AGQS in 2021, but exceeded two prior rounds)
- MW-6D cadmium, sulfate, PCE, 1,4-dioxane
- MW-7 total cyanide
- PZ-101A cadmium, total cyanide

Based on the 2021 monitoring it was determined that the Groundwater Management Zone and the current remedial action plan continue to be appropriate, although it is recommended that per- and



polyfluoroalkyl substances (PFAS) be included again in the 2022 monitoring event for wells MW-2, MW-6S, MW-6D, MW-7, MW-14, MW-17S, MW-17D, and MW-202A.

Pond Evaluation and Supplemental Surface Water Sampling, Loureiro, December 13, 2010

A pond evaluation was completed in 2010 to assess potential ecological risk related to cyanide and cadmium concentrations that have been consistently detected immediately adjacent to the pond in MW-6D and PZ-101A and within the pond surface water. Surface water samples were collected and biota were inventoried. The assessment concluded cadmium and free cyanide were below the water quality criteria in the pond but that downstream locations were slightly elevated above the criteria. There were little valuable ecological resources in the pond due to shallow depth and general lack of observed life. Based on the cumulative observed data, use of SW-5 or SW-2 at the discharge of the upper pond was recommended compared to SW-4.

Annual RCRA Cover Inspection Report, Loureiro Engineering Associates, Inc., June 18, 2021

This report submitted by Loureiro details the 2020/2021 annual RCRA cover inspections performed at the Site. Annual cap inspections of the closed former Tack Pile are required. The inspection concluded the tack pile was in good condition after removal of recently discarded tires from within the fenced area and replacement of signage.

Water quality monitoring was also evaluated to assess the effectiveness of the cap. It was determined that groundwater quality at the Site is not considered to be negatively affecting water quality outside the GMZ and the Site is considered in compliance with the current requirements.

DES Response Letter, NHDES, July 12, 2021

The response letter from NHDES detailed their receiving of the April 2021 and 2020/2021 Annual Water Quality Monitoring Report, the Financial Assurance Mechanism Update Annual Post-Closure Cost Estimate 30-Year Interval, and the Annual RCRA Cover Inspection Report all prepared by Loureiro, as well as detailing some changes the NHDES requires to the Financial Assurance Mechanism Update.

3.4.3 Factory Area

Potential Aboveground Storage Tank Closure Violations, NHDES, January 25, 2017

The notice of findings from the NHDES details that an AST has been abandoned at the Site. Potential deficiencies were identified and information about the condition of the tank, and its future removal were requested.

Hazardous Building Materials Inventory, Ransom Consulting, Inc. September 22, 2017

Ransom Consulting, Inc. (Ransom) completed a Hazardous Building Materials Inventory (HBMI) for the Southwest Region Planning Commission (SWRPC) on behalf of the Town of Jaffrey, New Hampshire, for the Site. The HBMI included sampling for asbestos-containing materials (ACMs),



a lead-based paint survey, field screening and sampling of surficial soils and sampling for polychlorinated biphenyl (PCB)-containing building materials, and a universal waste inventory.

The HBMI identified the following:

- ACMs were identified at the Site building
- Lead-based paint was identified at the Site building.
- Elevated lead concentrations were detected during the field-screening and laboratory analysis of surficial soils tested from the “drip line” around the Site building perimeter.
- No PCB bulk product waste (i.e., building materials containing PCBs at concentrations equal to or greater than 50 milligrams per kilogram (mg/kg) under 40 CFR 761) was identified in the building materials tested
- Universal wastes were identified and inventoried at the Site

ASTM Phase I Environmental Site Assessment, Ransom Consulting, Inc., October 31, 2017

Ransom completed a Phase I ESA for the SWRPC on behalf of the Town of Jaffrey, New Hampshire, for the Site. This Phase I ESA was completed in accordance with ASTM International (ASTM) Standard Practice E 1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for the purpose of environmental due diligence and identifying Recognized Environmental Conditions (RECs) at the Site. At the request of the users, the findings, conclusions, and recommendations are applicable to the western 40% of the Site which has been identified for possible sale and redevelopment. The eastern 60% of the Site contains known groundwater and soils regulated by the NHDES due to the presence of contamination from historical Site use and has been excluded from the recommendations contained within the Phase I ESA.

Based on review of historical sources, environmental databases, interviews, User provided information, Site reconnaissance, and judgment by the Environmental Professional, the Phase I ESA identified the following RECs in connection with the Western 40% of the Site:

- A non-compliant 20,000-gallon No. 6 oil AST is located in a cement block structure on the Site. The condition and volume of oil remaining in the AST, if any, is unknown and the ground surface below the tank could not be observed for staining related to a reported release of fuel oil. A release of vermiculite (presumed asbestos-containing) was noted on the ground surface adjacent to the cement block. *It should be noted that Credere conducted a site visit on July 22, 2022, and the AST structure could not be accessed to further observed conditions within the building.*
- Historically, an oil underground storage tank (UST) (size unknown) was located beneath the current central portion of the Site building. No records identifying the removal of this UST were identified during the course of the Phase I ESA, which would date to prior to 1941 when the building was expanded over the UST location. The historic presence of this UST and associated petroleum storage have the potential for adverse impacts to the Site soils and/or groundwater;



- Floor drains and sumps historically received process derived wastewater, including OHM, across the manufacturing/industrial portion of the Site building. Most of these structures were closed in place and have the potential to impact Site soils and/or groundwater beneath and adjacent to these drains/sumps.
- The detection of cyanide and/or PCE in groundwater samples from monitoring wells MW-14 and MW-2, including exceedances of AGQs as recently as 2012 and/or 2014, could indicate the potential for unassessed or unidentified source areas, including areas on the western portion of the Site.
- A neighboring former drycleaning facility has adversely impacted groundwater on numerous parcels in the vicinity of the Site, including the detection of impacted groundwater above AGQS immediately abutting the Site and in an inferred upgradient position; the contaminated groundwater plume likely extends onto the Site.

Ransom recommended a Phase II ESA at the Site, including the advancement of soil borings, installation of groundwater monitoring wells, and laboratory analyses of Site soils and groundwater to assess and evaluate the RECs and areas of environmental concern.

The Phase I ESA also identified the following RECs in connection with the Eastern 60% of the Site:

- Groundwater contaminant concentrations for several wells with upward concentration trends over the past five to seven years, which may indicate additional possible source areas and subsequently corrective actions could be required in the future.

The Phase I ESA also identified the following CRECs in connection with the Eastern 60% of the Site:

- Waste tanks and other industrial wastes were deposited over the banking on the eastern portion of the Site from circa 1915 to the mid-1970s. As required by NHDES, targeted soils were excavated and removed from the Site, and adjoining soils were consolidated beneath an engineered cap in the unlined landfill. Access is restricted by fencing; disturbance of this area is controlled by a deed restriction, and groundwater and surface water impacts are monitored under a NHDES GMP.
- Untreated process derived wastewater was disposed of on the east abutting property via a surface impoundment area and pond system, from circa 1915 to circa 1981. Remedial efforts were conducted as required by the NHDES, sludge and shallow impacted soils were removed, the impoundment/filtration bed area (off-Site to the east) was capped and fenced. Groundwater and surface water impacts were being monitored under a NHDES GMP until 2013.

Although not considered RECs, and assessed separately as the eastern and western portions of the building, Ransom identified the following potential environmental AOCs in connection with the Site buildings:

- Given the unsecured nature of the Site building and the number of OHM containers that were observed to be remaining in the Site building, there is a threat of additional OHM releases.
- Additional investigations are necessary to assess whether petroleum and hazardous substance handling over many years of operation in loading/unloading areas may have resulted in releases of OHM in those areas.
- Additional investigations are necessary to assess whether potential releases of OHM from relatively high-risk properties located to the north and south have impacted groundwater quality on the Site.
- Given the probably former PCB content of the units, soils adjacent to the fenced enclosure housing three pad-mounted transformers should be assessed for possible past undocumented releases of PCBs.

Ransom also provided the following non-scope recommendations:

- An HBMI is being conducted at the Site at the time of this report. Prior to any renovation or demolition, hazardous building materials must be abated/removed and disposed of as required.
- Assessment of the OHM containers remaining at the Site and their removal and disposal
- The 20,000-gallon No. 6 oil AST should be removed.
- Copies of potential agreements made between the historical responsible party, NHDES, and the current or past owners should be obtained and reviewed to assess what contractual limitations of liability and corrective action obligations may be available to a prospective purchaser.

Site-Specific Quality Assurance Project Plan, Ransom Consulting, Inc., August 2018

Ransom completed a SSQAPP for a Phase II ESA. The SSQAPP detailed the sampling strategy, design, sample locations, analytical methods, and schedule for the work. The Phase II ESA performed by Ransom is detailed below.

Notification of Groundwater Quality Violation, Ransom Consulting, Inc., October 24, 2018

Ransom formally notified the NHDES of violation of the groundwater quality at the Site based on VOC detections analyzed as part of the Phase II ESA detailed below.

Phase II Environmental Site Assessment, Ransom Consulting, Inc., March 19, 2019

Ransom completed a Phase II ESA for the western 40% of the parcel for the SWRPC. To evaluate the RECs and potential environmental concerns identified in their October 31, 2017, Phase I ESA, the following areas of concern were developed

- AOC 1 – Wastewater Disposal Systems (Drains and Sewer)
- AOC 2 – Former Plating Area



- AOC 3 – Former Fuel Oil UST Area
- AOC 4 – Inactive Fuel Oil AST Area
- AOC 5 – Facility Loading/Unloading Areas
- AOC 6 – Off-Site Sources

The Phase II included advancement of soil borings and the collection and analyses of soil samples, installation of eight monitoring wells, and the collection and laboratory analyses of groundwater samples. The following are the results of the Phase II:

- Polycyclic aromatic hydrocarbons (PAHs) documented in the soil may be indicative of a release in the area of the non-compliant 20,000-gallon No.6 oil AST in that area (B5 and B22). Although there were no AGQS exceedances, VOCs were detected in the groundwater sample MW105.
- Evidence of petroleum was identified in the vicinity of the historical oil UST, but no violations of standards were documented.
- Floor drains and sumps that historically received process derived wastewater were confirmed to have resulted in release of cadmium in soil at location B2 and cyanide in groundwater at MW102, primarily associated with the plating area. PCE impacts to groundwater in MW102 and MW104 were also suspected to may also be related to floor drains or an offsite source.
- Contaminated groundwater (cyanide and PCE) in monitoring wells located on the eastern portion of the Site (e.g., MW-14 and MW-2) that could indicate the potential for unassessed or unidentified source areas was confirmed based on similar contaminants detected further west beneath the building, particularly PCE in MW102 and MW104.
- Contaminants from a neighboring former dry-cleaning facility were undetermined.

Additionally, PAHs were identified in the following three areas with unknown specific sources:

- Vicinity of B3 south of building
- B12 and B25 near southwest loading dock
- Along railroad on north side of the Site

Ransom recommended additional investigation to further delineate the extent of the following:

- Cadmium, cyanide, and PCE impacts to soils and/or groundwater in proximity to the former plating and wastewater treatment areas near MW102/B2
- PCE impacts to groundwater surrounding MW104 and MW102
- PAH impacts to soil near B12 and B26 and naphthalene impacts to groundwater at MW108
- PAH impacts to soil in the area of the inactive No. 6 oil AST (B5 and B22)

Site-Specific Quality Assurance Project Plan, Ransom Consulting, Inc., May 14, 2019

Ransom completed a SSQAPP for the Supplemental Phase II ESA they conducted at the Site. This SSQAPP detailed the sampling design, sample locations, analytical methods, and schedule for the work. The Supplemental Phase II ESA performed by Ransom is detailed below.

Supplemental Phase II Environmental Site Assessment, Ransom Consulting, Inc., March 31, 2020

Ransom completed a Supplemental Phase II ESA for the western 40% of the parcel for the SWRPC. To evaluate the additional recommended investigation from the March 19, 2019, Phase II ESA as listed above, the following AOCs were developed:

- AOC A – PCE impacts to groundwater
- AOC B – Further investigation of cadmium, cyanide, and PCE impacts
- AOC C – Delineation of PAHs in Soil/Further investigation of petroleum in groundwater

The Supplemental Phase II included advancement of soil borings and the collection and analyses of soil samples, installation of three additional monitoring wells, and the collection and laboratory analyses of groundwater samples. The following are the results of the Supplemental Phase II ESA:

- AOC A - Relatively low concentrations of dissolved PCE were inferred to be migrating onto the Site with groundwater from the northwest based on the lack of PCE above the AGQS and presence of 1,2-cis-DCE in the upgradient wells, suggesting this area to be a downgradient lobe of a plume. This area of the Site is inferred to be separate from a low-level on-site plume with PCE and TCE impacts near MW102 and MW104. No residual PCE source area has been identified on the Site, although impacted groundwater from the onsite plume does slightly exceed the PCE AGQS.
- AOC B - No additional source areas for cadmium or cyanide were documented suggesting a localized source beneath the former plating room. A minor PCE source proximal to the former plating room and wastewater treatment area was inferred to likely be associated with past industrial operations.
- AOC C - The extent of PAHs (and VOCs in one location) in Site soils above SRSs has been delineated in shallow fill soils in the general area of the southwest corner of the building and was likely associated with creosote or coal tar type impacts to shallow soils. PAH impacts above SRSs were also noted in fill soils to the east of the inactive heating oil AST and were previously identified as proximal to a sewer manhole and in shallow surface soils along the north-abutting railroad corridor. No impacts to groundwater exceeding AGQS have been identified for PAHs or VOCs.



Ransom recommended the following based on the results of this Supplemental Phase II:

- Assessment of soils beneath the inactive heating oil AST in coordination with the removal and closure of that system
- Several additional borings to confirm the spatial extent of PAH impacted soils near the southwest portion of the building
- Additional assessment of the eastern 60% of the property including at minimum beneath the east portion of the building and adjacent to the electrical transformers
- Completion of a RAP consistent with the requirements of Env-Or 600, which could include monitoring of attenuation, management of soils in place under an AUR and/or limited soils removal and disposal
- Groundwater monitoring under a GMP will be required for impacts to groundwater above AGQS. An additional round of groundwater sampling is recommended to help clarify which wells should be included in future monitoring events.
- A soils management plan (SMP) should be completed and approved by NHDES for soils management during Site redevelopment.
- Appropriate pre-acquisition environmental due diligence and an application should be made to the New Hampshire Brownfields Covenant Program should be made to provide additional liability relief.

3.4.4 EPA Removal Action

Pollution/Situation Report #1, EPA, October 27, 2021

The Pollution/Situation Report from EPA detailed their involvement with the Site after the June 2020 fire that damaged the building. As part of the EPA's involvement, approximately 100 cubic yards of ACM fire debris was observed at the Site. This debris is exposed to the elements and could migrate to the nearby community. From October 25 to October 29, 2021, the EPA established the Site work zones, and confirmed all abandoned electrical lines and transformers were deenergized.

Pollution/Situation Report #2, EPA, November 8, 2021

From November 1 to 5, 2021, the EPA finished setting up work equipment at the Site, removed all overhead de energized cables, and began consolidating ACM fire debris into piles.

Pollution/Situation Report #3, EPA, November 15, 2021

From November 8 to 12, 2021, the EPA continued consolidating ACM fire debris, began structural stabilization of the north, west, and south footprint of the fire, and completed demolition of the western and southern extents.



Pollution/Situation Report #4, EPA, November 28, 2021

From November 16 to 19, 2021, the EPA continued perimeter air monitoring and dust control measures, continued consolidating ACM fire debris, continued structural stabilization of the northern building and demolition everywhere else, and received T&D bids from subcontractors.

From November 22 to 24, 2021, the EPA continued perimeter air monitoring and dust control measures, continued consolidating ACM fire debris, and completed demolition.

Pollution/Situation Report #5, EPA, December 14, 2021

From November 29 to December 10, 2021, the EPA continued perimeter air monitoring and dust control measures, continued consolidating ACM fire debris, and coordinated with receiving waste facility and trucking company.

Pollution/Situation Report #6, EPA, January 3, 2022

From December 13 to December 17, 2021, the EPA continued perimeter air monitoring and dust control measures, completed consolidation of ACM fire debris, and completed all demo and segregated all non-ACM material that will remain on site.

From December 20 to 22, 2021, the EPA prepared the Site for the holiday shutdown.

Pollution/Situation Report #7, EPA, May 25, 2022

From April 8 through 10, 2022, the EPA remobilized after the winter shutdown, continued perimeter air monitoring, and prepared ACM debris piles for load out.

From April 11 through 17, 2022, the EPA continued perimeter air monitoring and dust control measures and loaded 19 trucks for disposal.

From April 18 through 21, 2022, the EPA continued perimeter air monitoring and dust control measures and loaded 13 trucks for disposal and 6 trucks for scrap metal recycling.

From April 25 through 28, 2022, the EPA installed a fence to limit access, conducted final cleaning or the Site and demobilized. The Site was officially demobilized on April 28, 2022.



4. PROJECT DESCRIPTION & TIMELINE

4.1 REDEVELOPMENT SCENARIO

The Site is intended to be redeveloped; however, specific design plans have not yet been developed. It is assumed the building will be demolished given the extent of the fire damage to the building and the subsequent building deterioration.

4.2 PROPOSED PROJECT TIMELINE

The following schedule is proposed for the assessment work. This is a dynamic schedule and tasks may be performed later or earlier based on document regulatory review time and contractor availability.

TENTATIVE DATE	ACTION
September 2022	Submit Draft SSQAPP
September 2022	EPA and NHDES Review Period
December 2022	Finalize SSQAPP
January/February 2023	Execute Field Investigation
March/April 2023	Submit Draft Phase II ESA Report
April 2023	NHDES Review Period
May 2023	Finalize Phase II ESA Report

5. CONCEPTUAL SITE MODEL

A CSM was developed using the findings from the past Site investigations and will be updated in subsequent reports as new information becomes available. This CSM includes a Site description, Site history, description of the physical setting of the Site, source areas and contaminants of potential concern (COPCs), nature and extent of contamination, exposure pathways, and potential human and environmental receptors.

5.1 SITE DESCRIPTION

A detailed Site description consisting of Site use, Site location as depicted on **Figure 1**, and Site utilities is included in **Section 3.1**.

5.2 SITE HISTORY

A brief description of Site history as it relates to current environmental conditions at the Site is included in **Section 3.3**.

5.3 PHYSICAL SETTING

Topography

According to the topographic map, the Site is located approximately 990 feet above mean sea level (AMSL). Based on Credere's Site observations, and the United States Geological Survey (USGS) Topographic Map of the Monadnock Mountain Quadrangle, topography at the Site and vicinity in non-paved areas slopes downgradient to the east southeast. An excerpt from the USGS map is included as **Figure 1**.

Geology

Surficial Geology

Surficial geology at the Site was observed during prior environmental investigations to consist of fine to medium sands, with little fine to medium gravels and silt. Soil density as cobbles were noted to increase with depth. Overburden thickness ranged on average between 10-12 feet bgs throughout the Site. Shallower refusal was encountered in some locations, particularly beneath the building; however, it is unknown if these shallower refusals were geologic refusal or related to limitations on the drilling equipment used for interior borings. A creosote type material was noted as a "thin black layer" with creosote odor, and a lens of black in some soils around the southwestern corner of the building.

Bedrock Geology

According to the Bedrock Geologic Map of New Hampshire, the Site is underlain by Spaulding Tonalite, weakly foliated to non-foliated, spotted biotite quartz diorite, tonalite, granodiorite, and granite. Previous work did not investigate bedrock.



Hydrology

The Site and vicinity are located within the surficial drainage basin of the Cheshire Pond to the northeast of the Site. An unnamed stream flows north into the two onsite ponds on the eastern end of the Site, and then north out of those ponds into Cheshire Pond. Cheshire Pond empties into the Contoocook River, which flows south to the Mountain Brook Reservoir. Surface water likely infiltrates the ground in vegetated areas of the Site, and excess surface water likely flows overland to the onsite ponds.

Based on prior Site investigation, groundwater at the Site is mapped to flow east/southeast to the two ponds on the Site. The ponds are noted to flow north to the Cheshire Pond just to the north of the Site. According to prior investigations, depth to groundwater for the wells ranged between ~3 to ~10 feet bgs, with the shallowest depth to groundwater observed in MW-106 in the western portion of the Site, 20-25 feet bgs near to the eastern end of the building (MW-2 and MW-14), and only 4 to 7 feet bgs east of the tack pile (MW-5 and MW-6). As the Site has been assessed previously in two parts, a full Sitewide groundwater contouring event has not been completed and will be completed as part of this investigation.

5.4 SOURCE AREA & CURRENT CONTAMINANTS OF POTENTIAL CONCERN

Source Area

The following source areas have been identified at the Site:

- Tack landfill
- Creosote – type material identified in the general area of the southwest corner of the Site building.
- Former plating room/wastewater treatment area in the center of the building.
- Offsite PCE plume that extends onto the Site from the west
- Historical UST beneath central portion of building
- Current 20,000-gallon No. 6 fuel oil AST/building
- Historical industrial work at the Site (site-wide)
- Site building components/hazardous building materials

Contaminants of Potential Concern

Based on the historical use of the Site, prior investigations, and above source areas, current COPCs include the following:

- Chlorinated VOCs (CVOCs), i.e., PCE and daughter products
- 1,4-Dioxane
- PAHs
- Metals (particularly cadmium & arsenic)



- Cyanide
- PCBs
- Total petroleum hydrocarbons (TPH)
- PFAS
- Asbestos
- Lead

5.5 NATURE AND EXTENT OF CONTAMINATION

Tack Pile

During Site operations a tack pile was created where waste tacks and nails as well as spent kerosene was reportedly disposed of. Prior environmental assessments found the presence of CVOCs, petroleum, metals, and cyanide within the tack pile. Cyanide was identified sporadically within the tack pile and at concentrations that would characterize that material as hazardous waste. Efforts to delineate the cyanide to refine the remedial options were not successful. In 1999, portions of the cyanide impacted areas of the tack pile were excavated for offsite disposal, and the remainder of the tack pile was remediated through consolidation and the installation of an impermeable cap. The extent of the tack pile is shown on **Figure 2**.

CVOCs, cadmium, and cyanide are documented to have leached from the tack pile to monitoring wells MW-7 located on the southern extent of the tack pile (cyanide) and MW-6S and MW-6D (cadmium and PCE) in the downgradient position. MW-7 cyanide concentrations have remained relatively consistent with only a slight increase over time. Despite the impermeable cap, concentrations of cadmium and PCE have been increasing since approximately 2014, particularly in the monitoring well MW-6D deeper interval well. This suggests horizontal surface water infiltration and/or groundwater flow through the tack pile is contributing to migration. Lastly, PCE is also present in the upgradient monitoring well MW-2 and other wells beneath the mill building, indicating another contributing source of CVOCs may be present, which is further discussed in the following CVOC section. Data supporting this discussion is summarized on **Figure 3** along with the extent of current AGQS exceedances for cyanide, PCE and 1,4-dioxane.

The piezometer, PZ-101A, in the pond adjoining monitoring wells MW-6S/6D contains elevated concentrations of cadmium and periodic spikes of cyanide. It is assumed this piezometer is sampling pore water within pond sediment that is discharging from groundwater to the pond. Concentrations are generally similar to those in monitoring well MW-6D. Cyanide concentrations at the piezometer are higher, but these concentrations may be the result of periodic elevated turbidity in the samples. An ecological risk assessment completed in 2010 concluded there was little valuable ecological resources in the pond due to depth and general lack of observed life; therefore, ecological exposure in the ponds is not a concern. However, the sediment in the ponds has not been assessed to date to determine the presence of potential cyanide that may be contributing to the spikes in pore water results. There is no current human exposure to the pond sediments as they are overgrown and generally inaccessible; therefore, do not warrant additional



assessment at this time; however, any future redevelopment that may impact these ponds would warrant assessment.

The tack pile also has the potential to contribute CVOCs to soil vapor. No vapor assessment has been done to date at the Site. As there are no buildings currently present over the tack pile and since the tack pile would not likely structurally support any future building, there is no exposure to vapor specifically at the tack pile. Vapor in the adjoining building will be discussed in the following general CVOC section.

Twice yearly groundwater monitoring has been completed since 2002, which has indicated exceedances of AGQS of 1,4-dioxane, cadmium, sulfate, PCE, and total cyanide in various wells including MW-2, MW-6S, MW-6D, MW-7, and the piezometer PZ-101A. Recent groundwater results and historical maximum concentrations of this monitoring are summarized on **Figure 3**. Despite the apparent increasing concentrations, the tack pile cap inspections indicate the cap is intact and preventing exposure to the tack pile contents and ongoing monitoring has been compliant with the GMP. Therefore, no further assessment of this area beyond the continued monitoring under the GMP is warranted at this time.

CVOCs and 1,4-Dioxane Upgradient of Tack Pile

Prior environmental assessment at the Site has identified PCE in groundwater above the AGQS in wells beneath the central and eastern portion of the building (MW102 and MW104), east of the building (MW-2) and was detected (below AGQS) in the upgradient Site position (MW106 and MW201). Historically, MW-15I also had elevated PCE, most recently 17 µg/L and TCE, 6 µg/L in May 2022 (see July 2022, Annual Groundwater Summary Report for the Former Elite Laundry Site). Based on the differing detected CVOCs between MW106 (PCE and cis-1,2-DCE) and the eastern portion of the Site (MW102, MW104 and MW-2 where only PCE and TCE are detected), these are believed to be separate sources of CVOCs with a plume near MW106 and MW15I coming from an offsite source, and the other originating beneath the Site building. Data supporting this discussion is summarized on **Figure 3** along with the extent of current AGQS exceedances for cyanide, PCE and 1,4-dioxane.

The offsite source is suspected to be either the neighboring former drycleaner, the former Elite Laundry, previously located to the northwest, or the neighboring wood working shop previously located to the adjacent north. The presence of cis-1,2-DCE suggests dechlorination in the downgradient extent of plume. No vinyl chloride or TCE was detected.

The onsite source may be the previously detailed plating room, or another unidentified source area below the building related to historical operations. Onsite monitoring wells indicate a source of CVOCs containing PCE and TCE is present, with no cis-1,2-DCE suggesting the wells are located closer to the CVOC source or are associated with a less attenuated source. PCE has been detected in soil at only trace concentrations at B3, B14, and B110 along the southern side of the building. PCE in B14 corresponds to elevated PID readings (125 ppm), but PID readings were <1 ppm in B3 and B110. No VOCs were detected in soil in the two well locations despite PID readings (171



ppm max in B2/MW102 and 17 ppm B21/MW104) in those borings. Further refinement of the plume in the eastern portion of the building that was not previously assessed remains a data gap.

1,4-dioxane has also been identified as an increasing concentration in MW-2 and MW-6D with an increase to above the AGQS in recent years (since 2019) in these two wells. VOC analysis in the monitoring wells in the western portion of the Site have not assessed for 1,4-dioxane at a reporting limit low enough to evaluate the potential for a source area or additional extension of the plume in that direction, which is considered a data gap. It is also not known if the 1,4-dioxane plume correlates to the CVOC plume, which is also a data gap

CVOC concentrations identified to date do not exceed the GW-2 standards that would indicate concentrations high enough to attenuate/migrate to indoor air. However, the maximum concentration within the tack pile is not known, concentrations in groundwater beneath the eastern portion of the building have not been assessed, and the nature of the likely unconsolidated tack pile could facilitate migration of vapors due to the suspected high porosity (i.e., vapor space). As such, vapor from the tack pile could migrate toward the eastern portion of the existing building area. Therefore, the presence of CVOC vapors cannot be dismissed. As the building is not currently occupied nor is it expected to be redevelop-able in its current condition, exposure to vapor would be limited to a future redevelopment.

Creosote Type Material – PAHs and PCBs

Prior environmental assessment at the Site has identified an area of creosote-type soil impacts below and outside the southwestern portion of the building. This observable material corresponds with identified PAH detections in the soil. The boundaries of this material have been partially delineated as shown on **Figure 4**; however, the horizontal extents to the west, north, south, and particularly the southeast of the building, have not been defined. The highest concentrations focus around B111 and B117 at the surface (0-2 feet bgs), which are at the northern and southern extent of the current delineation, respectively. The vertical extent of this material is delineated with analytical data but can generally be assumed to be visually delineated from prior boring logs documenting a transition from fill materials to tan soil between 2 to 5 feet bgs. Delineation of the extent of this release area remains a data gap.

Additionally, this oily material has not been sampled for PCBs, which is common in waste oil, and therefore remains a data gap due to an unknown oil source.

Both PAHs and PCBs have an affinity to bond to soil and do not readily dissolve in water; therefore, migration to groundwater is not currently considered a concern for this release area.

Plating Room

A plating and wastewater treatment room was situated in the center of the Site building. Prior environmental assessment identified a release of cadmium in soil at location B2 (253 mg/kg). Cyanide is present in the groundwater at MW102 but was not identified in soil at the corresponding boring B2. Metals results for B1, B14, B18, B19, B103, and B113 generally indicate cadmium is horizontally confined to the one B2 location within the plating room. The vertical extent of



cadmium at this location is a data gap. As this delineation is approximately 50 feet from the central B2 location, a more refined delineation to support remedial planning is considered a data gap. The current extent of cadmium is shown on **Figure 4**.

Arsenic was identified above the SRS at B18, and is defined by B19, B1 and B2. The extent to the southwest and south remains a data gap. Without a known source, arsenic is anomalous in this location relative to other results across the Site.

General Historical Operations

On Site Ponds

Throughout the history of the Site, two ponds have existed on the Site. These ponds sit between the Waste Tack Pile, and the (offsite) surface impoundment area to the east that received wastewater prior to the 1980s. In the 1940s the wastewater sluiceway berm had been constructed, which bisected the two ponds, and emptied into the offsite impoundment area. The sluiceway was reportedly open with the potential to overflow, particularly if it was backed up or clogged, which would have released to the ponds. The pond sediment represents a data gap with potential impacts to both site soils and groundwater. As discussed above, an ecological risk assessment concluded there was little valuable ecological resources in the pond due to shallow depth and general lack of observed life; therefore, ecological exposure in the ponds is not a concern. However, the sediment in the ponds has not been assessed to date to determine the presence of potential contaminants related to historical operations. There is no current human exposure to the pond sediments as they are overgrown and generally inaccessible and do not warrant assessment at this time; however, any future redevelopment that may impact these ponds would warrant assessment.

Historical UST

During past historical record review, an oil UST of unknown size was identified below the current day central portion of the Site building (see **Figure 2**). Prior environmental assessment has not identified petroleum contamination associated with this historical UST, but the lack of a GPR survey to identify if the UST remains onsite represents a data gap, as it could represent a threat of future release if it still contains oil, and would require proper closure/removal if the building were demolished during redevelopment.

Current 20,000-gallon No. 6 oil AST

A non-compliant 20,000-gallon No. 6 oil AST has been identified onsite contained within a cement block structure. The condition of the AST, condition and material of the flooring, and volume of any oil remaining are all data gaps. This building is listed as containing a large quantity of loose vermiculite insulation which has been identified as asbestos-containing. Analytical results from prior soil borings/monitoring wells B5/MW105, B22, B114, and B115 indicate minor petroleum constituents in soil and groundwater; but no evidence of a significant release from the AST or concentrations above the SRS or AGQS were identified with the exception of marginal exceedances of PAHs in B5 and just benzo(a)pyrene in B22. Based on these results, no further assessment of the AST vicinity is warranted; however, the AST will require proper decommissioning as part of redevelopment.



Transformer Pen

A transformer pen is located southeast of the Site building. Two large transformers remain onsite that are labeled to contain 204 gallons of No. 10-C transformer oil analyzed to contain less than 50 parts per million PCBs. More modern transformers are labeled to contain less than 1 ppm PCBs; therefore, this label is presumed to mean the oil was replaced from a prior PCB type either as a result of a leak or general maintenance, with oil less than 50 ppm or that the oil may contain PCBs between 0 and 50 ppm. In either case, there is potential for the oil to contain PCBs that would be regulated by EPA and/or NHDES if released to surrounding soil.

Based on the age and condition of the transformers, and the potential for the transformer oil to have been replaced, there is the potential for a leak or spills of PCB-containing transformer oil to have occurred over time. Additionally, since the mill operated dating back to the 20s, older PCB-containing transformers that were replaced may have preceded these transformers. Any release of oil would likely have been to the transformer pad or soil surrounding the pads. PCBs typically sorb to soil, and with limited migration other than by foot traffic in and out of the transformer pen, and/or wind dispersion, would most likely be confined to the pen. As PCB's generally are not soluble unless at very high concentrations, without additional data indicating very high concentration are present, migration of PCBs to groundwater is not anticipated at this time.

PFAS

PFAS were detected in groundwater samples collected from MW-6S and MW-7 on the eastern portion of the Site as part of the April 2021 monitoring event. PFAS have not been analyzed for on the western portion of the Site and thus represent a data gap.

Hazardous Building Materials

ACM are known to exist at the Site and PCB-containing building materials are likely present given common construction practices at the time the Site buildings were constructed, renovated, or expanded in the 1940s and 50s.

Identified ACMs from the 2017 HBMI include the following (note this is prior to EPA conducting removal actions of a portion of the below asbestos):

- multiple mastics, 720 square feet (sf) in the office area, 75 sf in Room 22, 25 sf in the office entryway,
- window glazing, 2 windows in the office area, 2 windows in Room 17, 6 windows on the exterior,
- 9" x 9" floor tiles, 660 sf in Room 4, 80 sf in Room 2
- caulk on the exterior of the boiler room, 105 linear feet
- Vermiculite in the AST bunker, 2,933 cubic feet
- Roofing materials including wall flashing, penetration flashing, perimeter flashing, sawtooth flashing, skylight flashing, and sawtooth for a combined quantity of 37,736 sf.



- 13 Fire doors

While no materials were identified during prior testing to contain concentrations of PCBs above the US EPA regulatory standard, additional testing is warranted, as the suspect PCB-containing building materials observed during the initial HBMI wasn't inclusive of all suspect PCB-containing building materials observed during Credere's recent Site reconnaissance.

The June 2020 structure fire caused the deterioration and subsequent release of some of these materials, particularly the roofing materials. The EPA conducted partial demolition of the Site building to help to stabilize the portions that remain and disposed of fire and demolition debris as well as disposed of asbestos on those areas. Due to the fire and resulting partial building demolition, further assessment and mapping of the remaining ACM is warranted.

Lead

Lead was identified in surface soil during the 2017 HBMI through a combination of field-based XRF assessment and limited laboratory analysis of soil samples. The concentrations were discontinuous and sporadic, ranging from <10 mg/kg, to 1,728 mg/kg, indicating a highly heterogeneous distribution of lead. The lead was presumed to be from the release of lead paint to the structure drip line but is suspect due to heterogenous condition. Clinker was later identified as a major component throughout the soil on the north side of the building. Three samples, SS104, SS105, and SS106 were noted to have concentrations exceeding NHDHES SRSs standards for lead in soil, at 458 mg/kg, 797 mg/kg, and 1,730 mg/kg respectively. These samples were all taken along the northern side of the building. Therefore, sampling of other broad areas of the Site surface soil to assess general background conditions and possibly a greater ubiquitous presence of lead (and/or PAHs) related to historical industrial operations remains a data gap. If lead is not identified as an ubiquitous background contaminant, further delineation of the northern side of the building may be required.

5.6 EXPOSURE PATHWAYS AND POTENTIAL RECEPTORS

Exposure pathways describe how a human or environmental receptor comes into contact with contaminants that may be present at the Site. Potential migration pathways through groundwater, surface water, air, soils, sub-slab soil vapor, and sediments, were considered for each COPC and each source. A migration pathway is considered an exposure pathway if there is a mechanism of contaminant release from primary or secondary sources, a transport medium, and a point of potential contact with receptors. Both current and potential future releases and migration pathways to receptors are considered.

Inhalation: This pathway is primarily associated with groundwater contamination within 30 feet of an occupied structure when groundwater elevation is less than 15 feet below surface grade, or when depth to groundwater is unknown. This pathway is applicable when receptors may inhale impacted media in the form of contaminated vapor. This pathway is also applicable when contaminated soil and/or groundwater are exposed via an excavation.



Dermal Absorption:	Exposure via dermal absorption occurs when receptors are exposed to chemical concentrations present in soil, groundwater, surface water, or hazardous building materials through direct contact with the skin.
Active Ingestion:	The active ingestion pathway represents exposure which may occur through the active ingestion of contaminant concentrations via a drinking water supply well, through agricultural products, or through direct consumption of soil (e.g., typically by children or improper hygiene/health and safety of soil workers).
Incidental Uptake:	This pathway is applicable when receptors may incidentally inhale or ingest impacted media in the form of contaminated dust, chips, or airborne asbestos fibers.

Potential Receptors are categorized by duration of exposure and intensity of use at the Site. The receptor categories described in the CSM include the following:

Resident:	The residential receptor category is defined by high durational exposure and high intensity usage that may occur through gardening, digging, and recreational sports. This group includes the occupants of a residential property or a residential neighborhood, or a daycare.
Commercial Workers:	Commercial receptors are those which are present at the Site for long durations but with low intensity exposure such as indoor office workers.
Recreational/ Park/ Passive User:	Park users are characterized by low duration, i.e., less than two hours per day, and low intensity usage such as that which would occur during activities such as walking, shopping, and bird watching.
Excavation or Construction Worker:	Excavation or construction workers are present at the Site for short durations though intensity of use is high, such as during non-routine activities including construction or utility work. Examples include utility and construction contractors and landscapers.

5.7 EXPOSURE PATHWAY AND RECEPTOR SUMMARY

Under current conditions, exposure to Site COPCs includes only trespassers (passive users), as the Site is not regularly in use or occupied. The tack pile is fenced to further restrict access to this area. However, future redevelopment may broaden potential exposure to the other receptor groups depending on the redevelopment use. These groups include construction workers during redevelopment, and possible future residents, patrons, recreational users, and/or commercial workers.

Exposure pathways include inhalation of volatiles by construction workers in open excavations, inhalation of volatiles by all receptors in potential future Site buildings, incidental uptake of contaminated dust by all receptors, dermal absorption through contact with impacted media by all receptors, and active ingestion by future occupants or construction workers employing poor hygiene.



6. SAMPLING DESIGN

6.1 OBJECTIVES

The main objective of this project is to further assess the extent of previously identified contamination during prior investigations at the Site. The focus of the assessment will be to support a complete CSM and for remedial design considerations. The following specific objectives were established for the Site:

- Further delineate the PCE plume previously identified at the Site in the eastern portion of the building area
- Sample for 1,4-dioxane with improved data quality for further understanding of the comingled plume
- Further delineate the horizontal and vertical extend of PAHs previously identified under and in the general area of the southwest portion of the Site building.
- Further refine the horizontal and vertical delineation of cadmium below the former plating room pit/wastewater treatment area
- Inventory and update the map of ACM locations post the structure fire and EPA Removal Action, conduct additional asbestos sampling as warranted to comply with state regulations, sample potential PCB-containing building materials, and delineate previously identified lead in soil
- Assess the presence of the historical UST beneath the building
- Assess surface soil surrounding the transformer pad for the presence of PCBs
- Assess broader areas of Site surface soils for general impacts related to historical industrial operations

Specific sampling methodologies are described in **Section 7**. **Table 1** includes the number and type of samples that are proposed to be collected with accompanying rationale, selected analytical methods, and sample volume and preservation details. **Table 2** is a Standard Operating Procedure (SOP) reference table detailing the version of each SOP that will be used during the field sampling program.

6.2 GEOPHYSICAL SURVEY & UTILITY CLEARANCE

Credere will contract Ground Penetrating Radar Systems Incorporated (GPRS) to conduct a geophysical ground penetrating radar (GPR) survey to clear proposed boring locations for subsurface utilities/obstructions. Prior to commencing drilling activities, locations will also be cleared for subsurface utilities/obstructions by the DigSafe Network member utilities and by individually contacting local non-member utilities.

GPRS will also conduct a survey of the area where the historical UST is depicted as being located on the 1924 Sanborn Map to try and identify if the tank still exists below the building slab. This



attempt to locate the UST is considered incidental to the utility clearance as there is the potential that using geophysics inside the building will not be feasible due to rebar in the foundation slab.

The proposed GPR survey area is depicted on **Figure 2** and will also occur in an approximate 10-foot perimeter around each proposed boring location.

6.3 SOIL BORINGS AND SOIL SAMPLING

Following clearance work, 27 borings (CA-SB-01 through CA-SB-27), will be advanced at the Site using direct-push drilling methodologies.

- CA-SB-01 through CA-SB-09 will be advanced to 5 feet bgs or until 2 feet past evidence of contamination. These locations will be used to further delineate the extent of impacts to soil from a known creosote-type material. Additionally, borings B111 and B117 will be readvanced as B111R and B117R to sample beneath previous evidence of contamination to confirm that visual observation of the creosote-like material can be used to vertically delineate this release area. Sample target depths in **Table 1** are based on observations noted in the prior borings logs for B111 and B117. Samples from CA-SB-01 through CA-SB-09 will be collected from 0-2 bgs or from evidence of contamination if deeper than 0-2 bgs.
- CA-SB-10 through CA-SB-14 will be advanced to refusal to refine the delineation of cadmium identified below the former plating room in boring B2. Samples will also be sampled for cyanide to further assess if cyanide is present. Cyanide is present in groundwater at this location but most samples from this vicinity were not previously analyzed for cyanide. CA-SB-14 will be sampled below the depth of the prior cadmium exceedances from 7.5-9.5 bgs. The remaining borings will be screened with an XRF in 2-foot intervals. The sample with the highest cadmium results by XRF from each boring will be submitted for laboratory analysis.
- CA-SB-15 through CA-SB-17 will be advanced to refusal to further delineate identified PCE impacts on the eastern portion of the building area of the Site. One soil sample will be collected from each boring from the depth of greatest observed contamination or above refusal if no evidence of contamination is observed. If CA-SB-17 is inaccessible by drill rig the location will be moved onto the building pad.
- CA-SB-18 through CA-SB-27 will be advanced to 5 feet bgs to assess site-wide metals, primarily lead, and PAH concentrations, both likely associated with historical industrial use across the Site in surface soil (0-2 feet bgs). Borings will be continued vertically if evidence of contamination is encountered such as visible fill, odor or PID response. If CA-SB-27 is inaccessible by drill rig the location will be moved onto the building pad.

The need to collect more than one sample will be assessed and discussed with the project team, as needed.

Four composite soil samples CA-CP-1 through CA-CP-4 will be collected from each side of the transformer pad within the transformer pen to assess the presence of PCBs in surface soil.



Composite samples will comprise of 8-point composites from 0-0.5 feet bgs following removal of organic detritus (i.e., sticks, leaves, roots, etc.). If PCBs are detected in the composite samples, additional discrete sampling within the composite area will be warranted to attain the maximum PCB concentration within the area.

Proposed soil boring and locations are depicted on **Figure 2**. The rationale for each location is summarized on **Table 1**.

6.4 MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING

CA-SB-14 through CA-SB-17 will be completed as groundwater monitoring wells CA-MW-301, CA-MW-302, CA-MW-303, and CA-MW-304, respectively. CA-MW-301 will be an attempt at a deeper couplet with MW102 as during the original soil boring and installation refusal on bedrock was not achieved. A groundwater sample will be collected from the newly installed wells after development and following at least a 14-day stabilization period. CA-MW-301 will be sampled to assess contamination previously identified below the former plating room. CA-MW-302, CA-MW-303, and CA-MW-304 will be sampled to further delineate identified impacts at the Site.

Monitoring wells will be constructed with a 10-foot screen and will be installed at refusal as deeper interval wells in the downgradient position have the higher concentrations and PCE is expected to migrate vertically to a confining interval. (“Deeper” interval well construction is not known as historical boring logs for wells constructed in the eastern portion of the Site from the Tack Pile investigation were not able to be obtained during records review for this SSQAPP. These wells are presumably bedrock wells or installed at bedrock refusal.)

In addition, previously installed monitoring wells MW-102, MW-103, MW-105, MW-106, MW-108, MW-203, MW-2, MW-6D, and MW-14 will be sampled for the purposes of completing a synoptic round of sampling across the Site. An inspection of the Site in July 2022 indicated MW-101, MW-104, and MW-201 could not be located or have been destroyed by recent fire or cleanup activities; therefore, these wells are not anticipated to be sampled.

Proposed monitoring well sample locations are depicted on **Figure 2**, and the rationale for each location is summarized on **Table 1**.

6.5 ASBESTOS SAMPLING

Credere will perform a potential ACM inventory using the prior asbestos survey to assess the materials that remain in place after the fire and EPA Removal Action. This updated inventory will allow for remedial planning for future abatement.

Any previously unidentified asbestos-containing building materials in the Site building will be sampled, as well as supplemental sampling to comply with state and federal regulations. Sample results will be used to properly manage ACM during renovation or demolition of the Site buildings. Up to 20 suspect ACMs will be collected in triplicate (i.e., 60 total ACM samples). This sampling will be performed in accordance with NHDES Chapter Env-A 1800 – Asbestos Management and Control. The number of samples collected will be dependent on the number and volume of suspect

ACMs that are encountered but will not exceed 20 materials collected in triplicate (60 individual samples) without project team approval.

6.6 PCB-CONTAINING BUILDING MATERIAL SAMPLING

Based on the prior HBMI, some potential PCB-containing caulk and paint was assessed for potential sampling; and five samples were collected. Based on Credere's experience, significant additional potential PCB-containing materials including paints, mastics, adhesives, etc. may contain PCBs. Therefore, additional potential PCB-containing materials inventory and sampling will be conducted. As such, up to twenty (CA-PCB-1 through CA-PCB-20) previously unidentified suspect PCB-containing building materials will be collected for analysis from the Site building. Samples will be collected to assess if any hazards are present associated with PCBs in building materials and if the building materials are regulated as PCB bulk product waste as defined by 40 CFR 761.3. If, based on the initial results, additional assessment of PCB-containing building materials is needed, approval for additional samples will be proposed and approved under a separate SSQAPP amendment. Data will be used to properly manage building materials that may contain PCBs during renovation of the Site buildings.



7. SAMPLING & ANALYTICAL METHODS REQUIREMENTS

The proposed sampling activities will be conducted according to **Table 1**. Field activities will be conducted in accordance with Credere's Generic QAPP and the SOPs referenced on **Table 2**.

7.1 GEOPHYSICAL SURVEY

GPRS will perform their GPR survey by transecting the Site in the areas shown where soil borings are to be performed, and where the UST is mapped to be as shown on **Figure 2**. Anomalies will be reported to Credere in real time. Credere will document the location of the anomalies, if any, and the UST if identifiable, in the field with marking paint. Each soil boring/monitoring well location will also be cleared for utilities and locations will be adjusted in real time in the field if obstructions are identified by the survey.

7.2 SOIL BORING AND SOIL SAMPLING

Soil borings will be advanced to refusal (CA-SB-10 through CA-SB-17) or to 5 feet bgs (CA-SB-01 through CA-SB-09, and CA-SB-18 through CA-SB-27) unless refusal is encountered first. B111R and B117R will be advanced to the target sample depth based on the prior sample depths. CA-SB-01 through CA-SB-09 will also be advanced deeper if visible contamination extends beyond the initial 5 feet with a goal of advancing at least 2 feet beyond observable contamination. Surface soil composite sampling (CA-CP-1 through CA-CP-4) around the transformer pad will be completed using hand tools.

Borings will be advanced using direct-push with auger attachments, except installation of the 3 exterior wells, CA-MW-302, CA-MW-303, and CA-MW-304, which will be advanced using hollow stem auger. Soil cores will be collected continuously using 5-foot stainless-steel macrocores. Cores will be individually logged, evidence of contamination will be noted, and soil will be field screened for total VOCs in accordance with Credere SOP CA-7 for Headspace Screening using a ppbRae 3000 (or similar) calibrated with a 10-parts per million by volume (ppm_v) isobutylene gas standard and an instrument response factor of 1.0.

Sample target depths are summarized in **Section 6.3** and on **Table 1**, which is to be used as a field guide.

Visible asphalt and base materials, landscaping materials, and other organic detritus will be removed prior to sampling. Representative soil from an appropriate interval (no larger than 2 feet) will be collected while wearing new nitrile gloves and using decontaminated hand tools (e.g., stainless steel spoon or spade). VOC samples will be collected directly from the core or sidewall of the surface soil sample location using a dedicated soil syringe immediately after opening to prevent loss of volatiles or degradation. For the remaining analysis, representative soil will be placed in a decontaminated stainless-steel bowl, homogenized, and placed in laboratory provided glassware. Proposed sample analysis for each respective sample as well as the required volume and preservation method is provided in **Table 1**. Soil samples will be stored on ice and submitted to Absolute Resource Associates (ARA) of Portsmouth, New Hampshire, for analysis.

Excess soil at each location will be returned to its place of origin within the boreholes or to the surface surrounding the boreholes.

Soil at CA-SB-10 to CA-SB-13 will be sampled in 2-foot intervals and screened for the highest cadmium concentrations using an X-ray fluorescence meter (XRF) in 2-foot intervals. The screening sample bags will be labeled and screened in the field using an XRF in accordance with EPA Method 6200 (EPA, 2007). To ensure adequate precision in the data, each bag of soil will be screened using a 3-minute screening time. Results will be recorded in the field log. Sample results can be biased by moisture and particle size distribution. Screening during rain or saturated conditions will be limited and bags will be handled to minimize settling of fines.

The XRF will be checked against a 0 mg/kg and 735 mg/kg standard by screening the standards three times. The average of the three results should be within ± 20 mg/kg of the standard. The XRF will be checked against the 735 mg/kg standard at the beginning, middle, and end of each day to assess instrument drift. One (1) in 20 screening samples will be screened seven (7) times in replicate to assess the relative standard deviation (RSD). The RSD should remain within 20 percent.

Soil samples selected for screening will be transferred in their entirety from the bag to a laboratory provided sample jar. Lab samples will also be recorded in the field log to allow for later correlation of field screening and laboratory results.

7.3 MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING

The groundwater monitoring wells will be constructed using 10 feet of 2-inch diameter 0.010-inch slotted polyvinyl chloride (PVC) screen installed at refusal and enough solid PVC riser to reach the ground surface. The well annulus will be filled with No. 2 washed silica sand, and a bentonite seal will be installed above the screen. Each well will be flush mounted with a concrete road box.

Following installation, the elevation of each well (top of PVC) will be surveyed to an onsite benchmark and tied into the existing well network at the Site, if available, or an arbitrary datum, if necessary. Depth to groundwater and LNAPL and/or DNAPL thicknesses, if present, will then be measured relative to the top of well elevations in all accessible Site wells to allow for the calculation of relative groundwater elevations and the determination of groundwater flow direction at the Site.

Each well will be developed by over-pumping and agitation methods. The wells will be purged until a total of at least three well volumes have been removed and turbidity has been reduced to less than 10 nephelometric turbidity units (NTUs). During all development and sampling purge water will be discharged to a vegetation surface nearest to the well heads. If gross contamination is observed or identified through field screening, purge water will be containerized or treated onsite. Credere will allow at least 14 days for the monitoring wells to equilibrate with the surrounding aquifer prior to sampling.

After an appropriate equilibration period, Credere will sample the wells using low-flow sampling methodologies or no-purge methodologies, when appropriate. Wells will be pumped using

peristaltic pumps for shallow wells and bladder pumps for wells where the water table is deeper than 30 feet. Low density polyethylene (LDPE) tubing will be used for all development scenarios on this project. Teflon tubing will not be used due to PFAS sampling. Wells will be purged at a stable flow rate to avoid drawdown of the water level. Purging will occur by one of the following methods:

1. If a stable flow rate is achieved, groundwater will be periodically monitored for temperature, pH, oxidation-reduction potential (ORP), specific conductivity, and dissolved oxygen (DO) using a multi-parameter meter and an in-line flow-through cell until parameters have stabilized over a period of three readings, spaced at least 5 minutes apart or at a spacing to allow for a complete exchange of flow through the flow-through cell based on the flow-through cell volume and flow rate. Turbidity will be monitored using a separate turbidity meter. If parameters do not stabilize within a period of 2 hours or before a maximum purge volume of 5 well volumes, samples will be collected with field note justification of attempts to achieve stabilization and data will be reviewed for evidence of bias.
2. If a stable flow rate cannot be achieved, purging will be ceased, and the no-purge sampling method will be implemented. Tubing will be placed at the desired pump intake, one tubing volume will be purged, and samples will be collected. The wells will not be permitted to be pumped dry.

Groundwater samples will be collected immediately after the pump and directly into the appropriately preserved sample containers. Proposed sample analysis for each respective sample, as well as the required volume and preservation, is provided in **Table 1**. Groundwater samples will be stored on ice and submitted to Alpha Analytical, Inc. (Alpha) of Westborough, Massachusetts, for analysis.

7.4 ASBESTOS SAMPLING

Any sampling of suspect ACM at the Site will be conducted by a New Hampshire Certified Asbestos Inspector and in accordance with New Hampshire Chapter Env-A 1800 – Asbestos Management and Control. Three discrete bulk samples will be collected from each type of newly identified homogenous suspect ACM (up to 20 suspected ACMs sampled in triplicate for a total of 60 samples). Minor destructive sampling may be required. Samples will be analyzed by EMSL Analytical, Inc. (EMSL) of South Portland, Maine, using Polarized Light Microscopy (PLM) according to EPA Method 600/R-93/116.

7.5 PCB-CONTAINING BUILDING MATERIAL SAMPLING

To assess the potential presence of PCB-containing building materials, the Site building on the parcel will be inspected, and suspect materials will be inventoried and considered for sampling. Materials that typically contain PCBs include caulk/sealants, paint, and mastics/adhesives that were manufactured between approximately 1930 and 1980 and are most commonly in areas that endure high wear, weather, high heat, or moisture. Typical materials and locations that PCBs are encountered include, but are not limited to:

- Caulks and sealants around doors and windows or within expansion joints.



- Wall paints in high heat or moisture areas such as boiler rooms, equipment rooms, or basements.
- Floor paints in high traffic areas such as hallways, stairs, or building entrances.
- Mastics beneath floor tiles.

The Site buildings will be surveyed to locate the materials that are likely to contain concentrations of PCBs exceeding the PCB bulk waste criteria. Samples will be collected using dedicated disposable tools and placed in laboratory provided glassware. Each sample will require a minimum of 20 grams of materials for analysis to be confirmed with a scale at the time of sampling. Samples will be submitted to ARA for analysis of PCBs by EPA Method 8082 using Soxhlet extraction method 3540C.



8. REGULATORY STANDARDS

Sample results will be compared to the applicable state and/or federal standards/guidelines described below. **Appendix A** includes Analytical Sensitivity and Project Criteria Tables for the Site, which compares regulatory standards for each contaminant to the analytical limits of the laboratory method used. Additionally, any new SOPs that are not included in the Generic QAPP are included as **Appendix B**.

The practical quantitation limit (PQL) for several compounds have been identified as insufficient to meet the regulatory comparison criteria. Based on existing data for the Site, these compounds are not considered specific COPCs. It is expected that these compounds will be reported by the laboratory as non-detect with concentrations below the PQLs. If no other information has surfaced during the Phase II ESA to warrant reevaluation of these compounds as possible COPCs, then the results will not be reported as potential exceedances of the regulatory criteria but will be evaluated relative to other Site data and indicated to have limited usability in the data usability assessment (DUA). In the case of 1,4-dioxane in the VOC analysis, this compound is considered a COPC and is planned to be further analyzed by selective ion monitoring (SIM) to obtain improved data quality for these results. The SOP for this analysis is included in **Appendix B**.

8.1 SOIL

Soil analytical results will be compared to the current New Hampshire Code of Administrative Rules Chapter Env-Or 600 – Contaminated Site Management Table 600-2 SRSs and Appendix E Method 1 Soil Standards from NHDES RCMP.

8.2 GROUNDWATER

Groundwater analytical results will be compared to the current New Hampshire Code of Administrative Rules Chapter Env-Or 600 – Contaminated Site Management Table 600-1 AGQS and Table 2, Method 1 Groundwater Standards for NHDES RCMP for GW-2 standards.

8.3 ASBESTOS

Laboratory analytical results for asbestos bulk samples will be compared to the 1% limit specified in New Hampshire Chapter Env-A 1800 – Asbestos Management and Control.

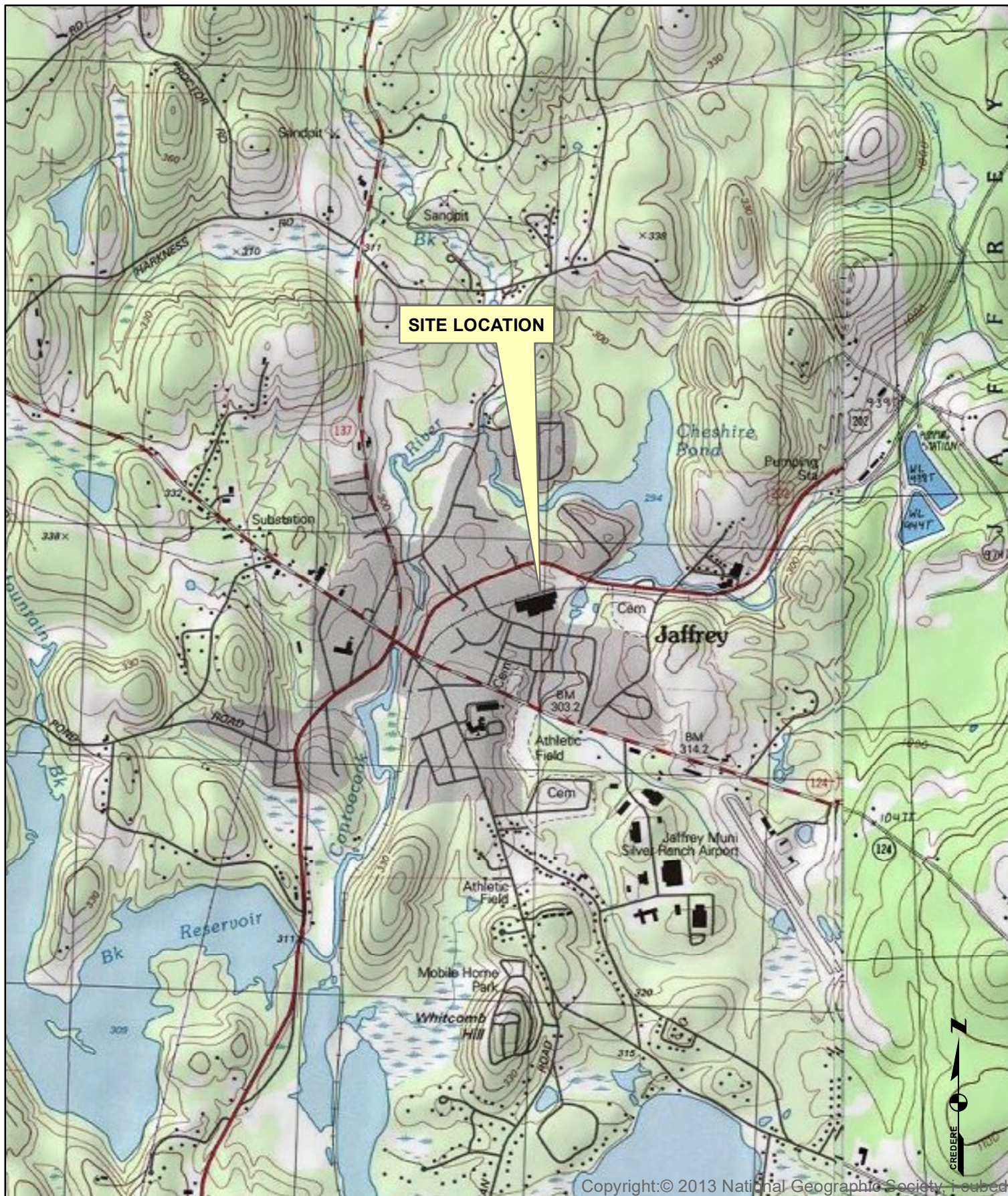
8.4 PCB-CONTAINING BUILDING MATERIALS

PCB-containing building material analytical results will be compared to the TSCA Title 40 CFR Part 761.3 definition of PCB Bulk Product Waste threshold criteria (≥ 50 milligrams per kilogram [mg/kg]). According to Part 761.20(a), materials with PCB concentrations ≥ 50 mg/kg require removal from use and proper disposal. Materials that contain PCB concentrations ≤ 50 mg/kg are not regulated by TSCA for removal as long as they remain in use. However, when these materials are removed from use (e.g., during renovation or demolition), they must be disposed at a facility that is licensed to accept this waste in accordance with 40 CFR §761.61(a)(5)(i)(B)(2)(ii). Building materials with total PCBs at concentrations less than 1 mg/kg are unrestricted for future use and/or disposal (40 CFR §761.61(a)(4)(i)(A)).



FIGURES





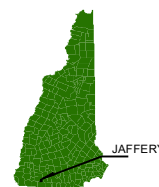
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CHECKED BY: JRN	PROJECT: 21001639

FIGURE 1 SITE LOCATION PLAN

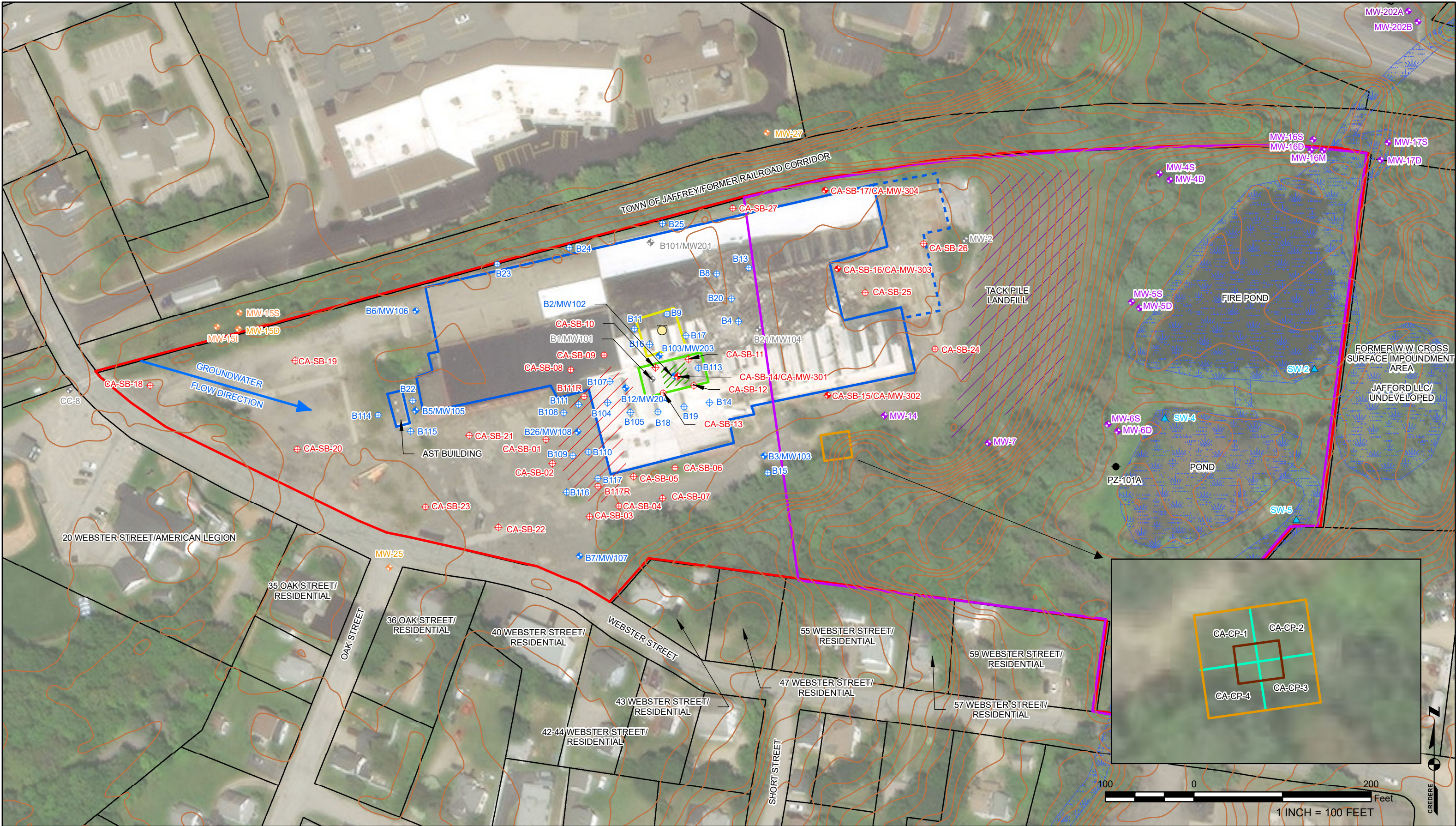
W.W CROSS PROPERTY
39 WEBSTER STREET
JAFFREY, NEW HAMPSHIRE

1,300 0 2,600
Feet
1 INCH = 2,000 FEET

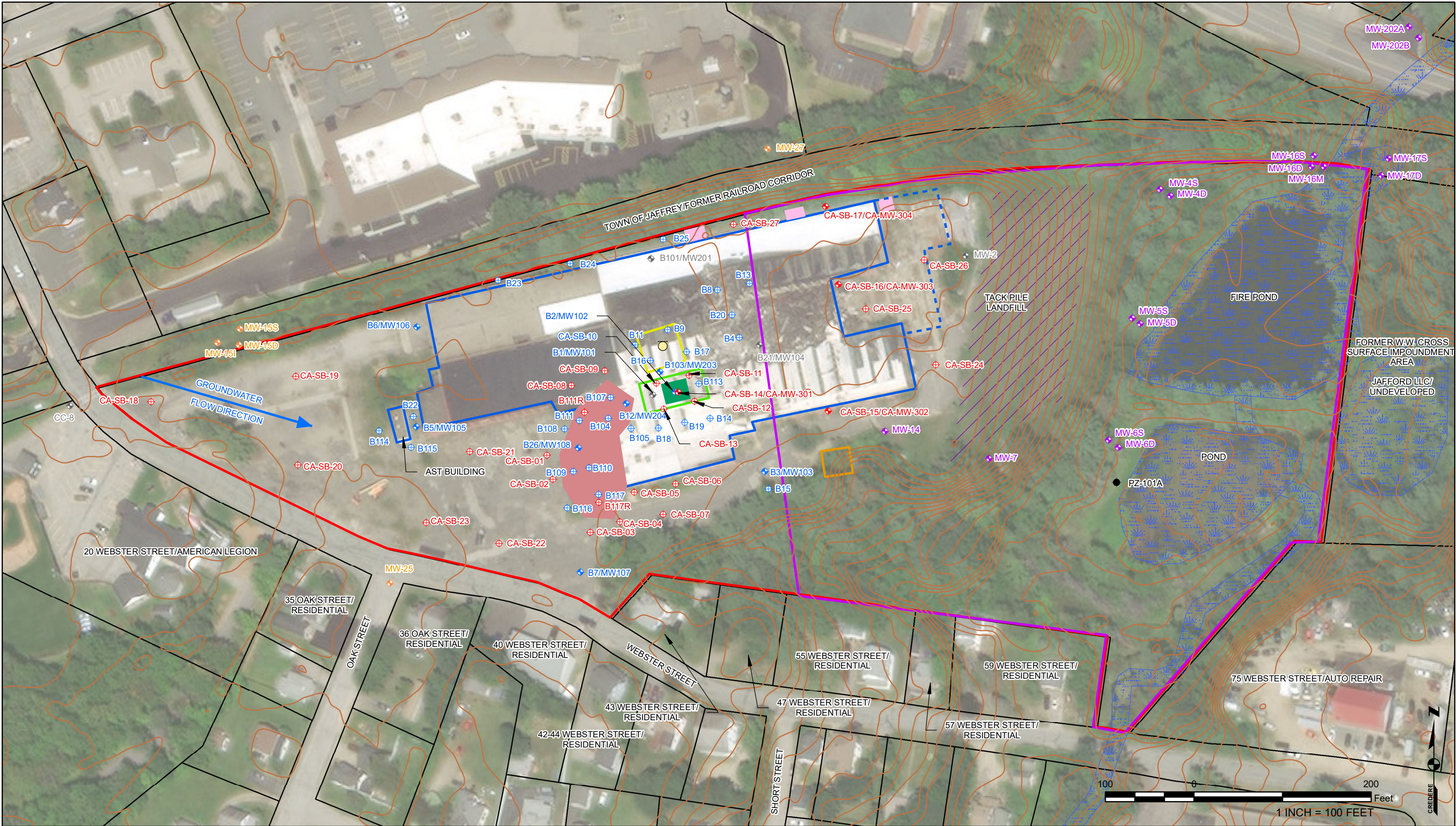


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DRAWN BY: MAW CHECKED BY: JRN	DATE: 12/13/2022 PROJECT: 21001639	FIGURE 2 PROPOSED SAMPLE LOCATIONS W.W. CROSS 39 WEBSTER STREET JAFFREY, NEW HAMPSHIRE	- PREEXISTING MONITORING WELL - FORMER ELITE LAUNDRY WELLS - MONITORING WELLS UNABLE TO BE LOCATED - RANDOM ENV. SOIL BORINGS - RANDOM ENV. SOIL BORINGS & MONITORING WELLS - PIEZOMETER - PROPOSED SOIL BORINGS - PROPOSED SOIL BORING/MONITORING WELL	- SURFACE WATER LOCATIONS - APPROX. HISTORICAL UST - FORMER BUILDING FOOTPRINT 2-FT TOPOGRAPHIC CONTOUR - SITE BOUNDARY - SITE BUILDING - TRANSFORMERS - FORMER PLATING AND WASTEWATER TREATMENT	- GROUNDWATER MANAGEMENT ZONE - TACK PILE LANDFILL - CREOSOTE-TYPE SOIL IMPACTS - CADMIUM SOIL IMPACTS - GPR AREA - WETLANDS - FORMER PAD - COMPOSITE SAMPLING BOUNDARIES	NOTES: EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM THE TOWN OF JAFFREY ONLINE GIS DATA, NEW HAMPSHIRE GIS PARCEL LAYER, 2021 ORTHO PHOTOS, AND SITE VISIT PERFORMED ON JULY 22, 2022.
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Community

Economy

Environment

Drawn By: MAW

Checked By: JRN

DATE: 12/13/2022

PROJECT: 21001639

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FIGURE 4

SOIL EXCEEDANCES

W.W. CROSS

39 WEBSTER STREET

JAFFREY, NEW HAMPSHIRE

MONITORING WELLS UNABLE TO BE LOCATED	APPROX. HISTORICAL UST	FORMER PLATING AND WASTEWATER TREATMENT
FORMER ELITE LAUNDRY WELL	FORMER BUILDING FOOTPRINT	GROUNDWATER MANAGEMENT ZONE
PREEXISTING MONITORING WELL	2-FT TOPOGRAPHIC CONTOUR	TACK PILE LANDFILL
RANSOM ENV. SOIL BORINGS	SITE BOUNDARY	CREOSOTE TYPE SOIL IMPACTS
RANSOM ENV. SOIL BORINGS & MONITORING WELLS	GPR AREA	CADMIUM SOIL IMPACTS
PIEZOMETER	SITE BUILDING	LEAD IN SOIL IMPACTS
PROPOSED SOIL BORINGS	TRANSFORMERS	WETLANDS
PROPOSED SOIL BORING/MONITORING WELL		PARCEL BOUNDARY

NOTES:
EXISTING CONDITIONS AND FEATURES SHOWN ON THIS PLAN ARE APPROXIMATE AND ARE BASED ON INFORMATION OBTAINED FROM THE TOWN OF JAFFREY ONLINE GIS DATA, NH GIS PARCEL LAYER, 2021 ORTHO PHOTOS, AND SITE VISIT PERFORMED ON JULY 22, 2022.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Document Path: T:\Data\NH\Town\Jaffrey\21001639 W. W. Cross Property\Figure 4 - Soil Extents_9.6.mxd

TABLES



Table 1: Sample Reference Table
W.W. Cross Property
NHDES Site No. 198708007
39 Webster Street, Jaffrey, New Hampshire

Media to be Collected	Proposed Sample IDs	QA/QC Samples (per sample type)	Boring/Screen Target Depth	Sample Depth (feet bgs)	Sample/Location Rationale	Field Analysis/ Observations	Analytical Methods	Sample Container Information & Preservative (per location) ¹	Laboratory To be Used
Soil	CA-SB-01	SB-DUP-1	5 feet bgs or 2 ft past evidence of contamination	0-2, or depth of greatest observed contamination	To further delineate horizontal PAH impacts to soil from known creosote-type material.	PID screening, visual, olfactory. Specific observation of creosote-type material depth/thickness	PAHs (EPA Method 8270E) PCBs (EPA Method 8082A) TPH (EPA Method 8015C)	(2) 4oz amber with Teflon lined cap	Absolute Resource Associates, Portsmouth, New Hampshire
	CA-SB-02	MS/MSD						(3) 4oz amber with Teflon lined cap	
	CA-SB-03	None						(1) 4oz amber with Teflon lined cap	
	CA-SB-04							(1) 4oz amber with Teflon lined cap	
	CA-SB-05							(1) 4oz amber with Teflon lined cap	
	CA-SB-06							(1) 4oz amber with Teflon lined cap	
	CA-SB-07							(1) 4oz amber with Teflon lined cap	
	CA-SB-08							(1) 4oz amber with Teflon lined cap	
	CA-SB-09							(1) 4oz amber with Teflon lined cap	
	B111R	10 feet bgs	6-8 or below observable contamination	To vertically delineate PAHs at two location previously documented to have the highest PAHs for correlation to visual observations	PID screening, visual, olfactory	Cadmium (EPA Method 6020A) Cyanide (EPA Method 9014)	(1) 4oz amber with Teflon lined cap		
	B117R	5 feet bgs	2-4 or below observation contamination				(1) 4oz amber with Teflon lined cap		
	CA-SB-10	Refusal	Below prior exceedances	To further delineate contamination identified below the former plating room and to further assess cyanide and cadmium	PID screening, XRF screening, visual, olfactory	Cadmium (EPA Method 6020A) Cyanide (EPA Method 9014)	(1) 4oz amber with Teflon lined cap		
	CA-SB-11						SB-DUP-2	(2) 4oz amber with Teflon lined cap	
	CA-SB-12		None	7.5-9.5	To further delineate identified PCE impacts at the Site	PID screening, visual, olfactory	VOCs (EPA Method 8260D)	(1) 4oz amber with Teflon lined cap	
	CA-SB-13		MS/MSD					(3) 4oz amber with Teflon lined cap	
	CA-SB-14	None	Depth of greatest observed contamination, or above refusal	To further delineate identified PCE impacts at the Site	PID screening, visual, olfactory	VOCs (EPA Method 8260D)	(1) 4oz amber with Teflon lined cap		
	CA-SB-15						(1) 40 mL VOA (MeOH) (1) 4oz amber with Teflon lined cap		
	CA-SB-16						SB-DUP-3	(2) 40 mL VOA (MeOH) (2) 4oz amber with Teflon lined cap	
	CA-SB-17	MS/MSD	(3) 40 mL VOA (MeOH) (1) 4oz amber with Teflon lined cap						
	CA-SB-18	None	5 feet bgs	0-2 feet, (below asphalt/concrete)	To assess background metals and PAH concentrations across the Site.	PID screening, visual, olfactory	PAHs (EPA Method 8270E) RCRA 8 Metals (EPA Method 6020A and 7471B)	(1) 4oz amber with Teflon lined cap	
	CA-SB-19							(1) 4oz amber with Teflon lined cap	
	CA-SB-20							(1) 4oz amber with Teflon lined cap	
	CA-SB-21							(1) 4oz amber with Teflon lined cap	
	CA-SB-22							(1) 4oz amber with Teflon lined cap	
	CA-SB-23							(1) 4oz amber with Teflon lined cap	
	CA-SB-24							(1) 4oz amber with Teflon lined cap	
	CA-SB-25							(1) 4oz amber with Teflon lined cap	
	CA-SB-26							(1) 4oz amber with Teflon lined cap	
	CA-SB-27							(1) 4oz amber with Teflon lined cap	
	CA-CP-1	None	NA	0-0.5	8 point composite to assess surface soil surrounding transformer pad	PID screening, visual, olfactory	PCBs (EPA Method 8082A)	(1) 4oz amber with Teflon lined cap	
	CA-CP-2	CP-DUP-4						(2) 4oz amber with Teflon lined cap	
	CA-CP-3	MS/MSD						(1) 4oz amber with Teflon lined cap	
	CA-CP-4	None						(1) 4oz amber with Teflon lined cap	
	TB-SOIL-1	Trip Blank	NA	NA	Laboratory QC samples	NA	VOCs (EPA Method 8260D)	(1) 40 mL VOA (MeOH) Unopened Laboratory prepared	

Table 1: Sample Reference Table
W.W. Cross Property
NHDES Site No. 198708007
39 Webster Street, Jaffrey, New Hampshire

Media to be Collected	Proposed Sample IDs	QA/QC Samples (per sample type)	Boring/Screen Target Depth	Sample Depth (feet bgs)	Sample/Location Rationale	Field Analysis/ Observations	Analytical Methods	Sample Container Information & Preservative (per location) ¹	Laboratory To be Used
Water	CA-MW-301	MW-DUP-1	Installed at refusal	Screened interval	To reinstall the monitoring well and assess contamination identified below the former plating room.	Visual, olfactory, temperature, DO, pH, ORP, specific conductivity, turbidity	VOCs (EPA Method 8260D) 1,4 dioxane SIM (EPA Method 8270D with SIM) RCRA 8 dissolved metals (EPA Method 6020A and 7470A, FIELD FILTERED) Cyanide (Method 4500CN-E,C) PFAS (EPA Method 537.1)	(6) 40 mL VOA (HCl) (4) 250 mL amber (2) 250 mL HDPE (HNO3) (2) 250 mL HDPE (NaOH) (4) 250 mL HDPE	Alpha Analytical of Westborough, MA
	CA-MW-302	MS/MSD			(9) 40 mL VOA (HCl) (6) 250 mL amber (3) 250 mL HDPE (HNO3) (3) 250 mL HDPE (NaOH) (6) 250 mL HDPE				
	CA-MW-303	None			(3) 40 mL VOA (HCl) (2) 250 mL amber (1) 250 mL HDPE (HNO3) (1) 250 mL HDPE (NaOH) (2) 250 mL HDPE				
	CA-MW-304								
	MW-102								
	MW-103								
	MW-105								
	MW-106								
	MW-108	Existing well	(3) 40 mL VOA (HCl) (2) 250 mL amber (1) 250 mL HDPE (HNO3) (1) 250 mL HDPE (NaOH)						
	MW-203		(3) 40 mL VOA (HCl) (2) 250 mL amber (1) 250 mL HDPE (HNO3) (1) 250 mL HDPE (NaOH)						
	MW-2		MW-DUP-2	(6) 40 mL VOA (HCl) (4) 250 mL amber (2) 250 mL HDPE (HNO3) (2) 250 mL HDPE (NaOH)					
	MW-6D		None	(3) 40 mL VOA (HCl) (2) 250 mL amber (1) 250 mL HDPE (HNO3) (1) 250 mL HDPE (NaOH)					
	MW-14								
	FB-MW-1	Field Blank	NA	NA	Field QC Samples	NA	PFAS (EPA Method 537.1)	(1) 250 mL HDPE with laboratory-provided PFAS free water	
	TB-MW-1	Trip Blank					VOCs (EPA Method 8260D)	(1) 40 mL VOA (HCl) Unopened Laboratory prepared	

Table 1: Sample Reference Table W.W. Cross Property NHDES Site No. 198708007 39 Webster Street, Jaffrey, New Hampshire									
Media to be Collected	Proposed Sample IDs	QA/QC Samples (per sample type)	Boring/Screen Target Depth	Sample Depth (feet bgs)	Sample/Location Rationale	Field Analysis/ Observations	Analytical Methods	Sample Container Information & Preservative (per location) ¹	Laboratory To be Used
Building Materials	CA-SACM-1 (A-C) through CA-SACM-20 (A-C)	Triplicate Sampling	Potential asbestos-containing materials	NA	To assess for the presence of previously unidentified asbestos-containing building materials in the Site building as well as supplemental sampling to comply with state and federal regulations	Visual	Polarized Light Microscopy EPA 600/R-93/116	Plastic zipper bags	EMSL Analytical, Inc., South Portland, Maine
	CA-PCB-1 through CA-PCB-20	PCB-DUP-1	Potential PCB-containing building materials	NA	To assess for the presence of previously unidentified PCB-containing building materials in the Site building	Visual	PCBs (EPA Method 8082A with soxhlet extraction method 3540C)	(5) 4oz glass with Teflon lined cap and at least 20 grams of sample	Absolute Resource Associates, Portsmouth, New Hampshire

Notes:

1 - Soil, groundwater, and PCB-containing building material samples will be chilled to 4°C (+/- 2°C) and submitted to the laboratory on ice. Additional details regarding analytical method, sample preservation, sample volume and hold times can be found in Table 7-3 of Credere's Generic QAPP For Brownfields Work in Maine, New Hampshire, Massachusetts, and Vermont RFA #19043.

*Boring will extend below 2 feet bgs only if evidence of contamination extends to bottom of 2 foot split spoon.

"greatest contamination" shall be defined as the interval of highest PID response above ambient background, visual staining or sheens, or strong odors.

SB - soil boring

SS - surface soil

MW - monitoring well

VP - vapor point

EPA - US Environmental Protection Agency

PFAS - per- and polyfluoroalkyl substance

IA - indoor air

PACM - potential asbestos-containing material

LP - lead paint

PCB - polychlorinated biphenyls

DO - dissolved oxygen

HDPE - high density polyethylene

QA/QC - quality assurance/quality control

bgs - below ground surface

PID - photoionization detector

NA - not applicable

ORP - oxidation-reduction potential

VOCs - volatile organic compounds

PAHs - polycyclic aromatic hydrocarbons

TPH - total petroleum hydrocarbons

VOA - volatile organic analyte (vial)

PP - priority pollutant

Table 2: Standard Operating Procedure Reference Table
W.W. Cross Property
NHDES Site No. 198708007
39 Webster Street, Jaffrey, New Hampshire

Credere Field SOPs			
SOP		SOP Description	Date
CA-1		Field Activity Documentation	Rev #1, August 2, 2016
CA-2		Equipment Decontamination Procedures	Rev #0, March 17, 2016
CA-4		Soil Description	Rev #0, March 17, 2016
CA-5		Environmental Soil Sampling	Rev #1, March 9, 2018
CA-7		Headspace Field Screening	Rev #0, May 20, 2016
CA-8		Monitoring Well Installation	Rev #1, October 20, 2017
CA-9		Monitoring Well Development	Rev #1, October 20, 2017
CA-10		Monitoring Well Gauging	Rev #0, August 29, 2016
CA-11		Water Quality Field Instrument Calibration	Rev #1, September 28, 2018
CA-12		Groundwater Sampling	Rev #3, September 28, 2019
CA-15		Asbestos Containing Materials (ACM) Surveys, and Asbestos Abatement Air Monitoring and Clearances	Rev #0, December 3, 2018
CA-16		Chain of Custody	Rev #0, November 29, 2017
CA-17		Packaging and Shipping Samples	Rev #0, August, 22, 2017
CA-20		Relative Elevation Survey & Trimble GNSS Basic Operations	Rev #0, March 6, 2019
CA-23		Collection of PCB-Containing Building Material Samples	Rev #0, October 25, 2017
Laboratory SOPs			
Lab	SOP	SOP Description	Date
Absolute Resource Associates	QA-5501	Analysis of Diesel Range Organics in Extracts of Soil and Water by Method 8015 and Method 8100, Revision 15	March 2022
	QA-5120	Analysis of VOCs in Water and Solid Samples by EPA Method 8260D, Revision 19	March 2022
	QA-5303	Analysis of Polychlorinated biphenyls in Soil and Water Extracts by EPA 8082A, Revision 25	April 2022
	QA-5305	Soxhlet Extraction by EPA method 3540C, Revision 13	March 2022
	QA-5515	Preparation and analysis of PAHs, Base/Neutrals, and Acids by EPA Method 8270E, Revision 16	March 2022
	QA-5600	Mercury Analysis by Cold Vapor Methods 245.1, 7471A/7471B, Revision 21	March 2022
	QA-5605	Determination of Metals and Trace Elements in Water, Solids, and Wastes by Inductively Coupled Plasma/Mass Spectrometry by 200.8/6020A, Revision 10	March 2022
	QA-5814	Cyanide by EPA Methods 4500CN-E.C and EPA 9014, Revision 18	March 2022
Alpha Analytical	2108	Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), EPA 8260, Revision 25	August 3, 2021
	2164	1,4-dioxane by Gas Chromatography/Mass Spectrometry in Selected Ion Mode (GC/MS-SIM) with Isotope Dilution Modification, revision 18	January 12, 2022
	23528	Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS), Revision 13	May 13, 2020
	26797	Inductively Coupled Plasma – Mass Spectrometry 6020B, Revision 4	25-Jan-22
	2139	Mercury Determination in Solids by Cold Vapor Atomic Absorption Technique (CVAA), Revision 7	July 29, 2015
	2210	Total and Amenable Cyanide, EPA 9010C & 9012B, SM 4500CN, Modified 9014, Revision 13	January 6, 2022
EMSL Analytical, Inc.	ASB-SOP-200-PLM	Polarized Light Microscopy SOP, revision 12.14	May 30, 2017

All SOPs are referenced in Credere's Generic QAPP For Brownfields Work in Maine, New Hampshire, Massachusetts, and Vermont RFA #19043

Laboratory SOPs are from the labs indicated in Table 1

APPENDIX A

Analytical Sensitivity and Project Criteria Tables

As of the date of this SSQAPP, the current state and/or federal standards have been reviewed for accuracy.

Asbestos in Solids by PLM by EPA Method 600/R		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
Asbestos	0.20%	1%

Notes:

1 - New Hampshire Code of Administrative Rules Chapter Env-A 1800: Asbestos Management Control, October 21, 2008.
PQL from EMSL of South Portland, Maine

VOCs in Soil by EPA Method 8260D

Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
1,1,1,2-tetrachloroethane	0.1	0.8
1,1,1-trichloroethane	0.1	78
1,1,2,2-tetrachloroethane	0.1	4
1,1,2-trichloroethane	0.1	0.1
1,1-dichloroethane	0.1	3
1,1-dichloroethene	0.1	14
1,1-dichloropropene	0.1	NE
1,2,3-trichlorobenzene	0.1	6.3*
1,2,3-trichloropropane	0.1	0.1
1,2,4-trichlorobenzene	0.1	19
1,2,4-trimethylbenzene	0.1	130
1,2-dibromo-3-chloropropane (DBCP)	0.1	0.0053*
1,2-dibromoethane (EDB)	0.1	0.1
1,2-dichlorobenzene	0.1	88
1,2-dichloroethane	0.1	0.1
1,2-dichloropropane	0.1	0.1
1,3,5-trimethylbenzene	0.1	96
1,3-dichlorobenzene	0.1	150
1,3-dichloropropane	0.1	160*
1,4-dichlorobenzene	0.1	7
1,4-dioxane	2.5	5
2,2-dichloropropane	0.1	NE
2-butanone (MEK)	0.3	51
2-chlorotoluene	0.1	15
2-hexanone	0.5	20*
4-chlorotoluene	0.1	680
4-isopropyltoluene	0.1	NE
4-methyl-2-pentanone (MIBK)	0.45	29
acetone	2.5	75
benzene	0.1	0.3
bromobenzene	0.1	29*
bromochloromethane	0.1	15*
bromodichloromethane	0.1	0.1
bromoform	0.1	0.1
bromomethane	0.25	0.3
carbon disulfide	0.1	460
carbon tetrachloride	0.1	12
chlorobenzene	0.1	28*
chloroethane	0.1	1400*
chloroform	0.1	3
chloromethane	0.1	3
cis-1,2-dichloroethene	0.1	2
cis-1,3-dichloropropene	0.1	0.1
dibromochloromethane	0.1	1
dibromomethane	0.1	2.4*
dichlorodifluoromethane	0.1	1,000
diethyl ether	0.1	3,900
ethylbenzene	0.1	120
hexachlorobutadiene	0.1	17

VOCs in Soil by EPA Method 8260D		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
isopropylbenzene	0.1	330
m&p-xylenes	0.1	500
methyl t-butyl ether (MTBE)	0.1	0.2
methylene chloride	0.1	0.1
naphthalene	0.1	28
n-butylbenzene	0.1	110
n-propylbenzene	0.1	85
o-xylene	0.1	500
sec-butylbenzene	0.1	130
styrene	0.1	17
tert-butylbenzene	0.1	100
tetrachloroethene (PCE)	0.1	2
tetrahydrofuran (THF)	0.5	1,800*
toluene	0.1	100
trans-1,2-dichloroethene (ethylene)	0.1	9
trans-1,3-dichloropropene	0.1	NE
trichloroethene (TCE)	0.1	0.8
trichlorofluoromethane	0.1	1,000
vinyl chloride	0.1	1

Notes:

All values are in milligrams per kilogram (mg/kg)

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards (SRSs) and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy, revised September 2018 (RCMP). If SRSs differ from RCMP, the RCMP value is shown as it has been updated more recently.

* - United States Environmental Protection Agency Regions 3, 6, and 9. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

BOLD - PQLs exceed regulatory criteria. Bold compounds are not specific contaminants of interest (COI). Should assessment results indicate the compounds to be a COI, more sensitive analytical methods will be evaluated for subsequent sampling rounds.

NE = Regulatory guideline not established

PAHs in Soil by EPA Method 8270E		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
2-methylnaphthalene	0.05	96
acenaphthene	0.05	340
acenaphthylene	0.05	490
anthracene	0.05	1,000
benzo(a)anthracene	0.05	1
benzo(a)pyrene	0.05	0.7
benzo(b)fluoranthene	0.05	1
benzo(g,h,i)perylene	0.05	NE
benzo(k)fluoranthene	0.05	12
chrysene	0.05	120
dibenzo(a,h)anthracene	0.05	0.7
dibenzofuran	0.05	7.8*
fluoranthene	0.05	960
fluorene	0.05	77
indeno(1,2,3-cd)pyrene	0.05	1
naphthalene	0.05	28
phenanthrene	0.05	NE
pyrene	0.05	720

Notes:

All values are in milligrams per kilogram (mg/kg)

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards (SRSs) and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy (RCMP), revised September 2018. If the SRSs differ from the RCMP, the RCMP value is shown as those have been updated more recently

* - United States Environmental Protection Agency Regions 3, 6, and 9. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

NE = Regulatory guideline not established

PCBs in Soil by EPA Method 8082A		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
PCB-1016	0.17	1 (Total)
PCB-1221	0.17	
PCB-1232	0.17	
PCB-1242	0.17	
PCB-1248	0.17	
PCB-1254	0.17	
PCB-1260	0.17	

Notes:

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards (SRSs) and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy (RCMP), revised September 2018.

All values are in milligrams per kilogram (mg/kg)

NE = Regulatory guideline not established

PCBs in Building Materials by EPA Method 8082A with Soxhlet Extraction by EPA Method 3540C				
Analyte	Laboratory Practical Quantitation Limit	Remediation Waste Cleanup Goals 40 CFR 761.61		Regulatory Standard (40 CFR 761.3)
		High Occupancy	Low Occupancy	
PCB-1016	0.17	1 (Total)	25 (Total)	50 (Total)
PCB-1221	0.17			
PCB-1232	0.17			
PCB-1242	0.17			
PCB-1248	0.17			
PCB-1254	0.17			
PCB-1260	0.17			

Notes:

All values are in mg/kg.

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

RCRA 8 Metals in Soil by EPA Methods 6020A		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
Arsenic	2.5	11
Barium	5	1,000
Cadmium	0.5	33
Chromium (III)	5	1,000
Chromium (total)**		130
Lead	2.5	400
Selenium	5	180
Silver	2.5	89

Notes:

All values are in milligrams per kilogram (mg/kg)

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

** - The chromium VI standard was used because it is the lowest and most conservative chromium standard.

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy, revised September 2018.

Mercury (Hg) in Soil by EPA Method 7471B		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard¹
Mercury	0.14	7

Notes:

All values are in milligrams per kilogram (mg/kg)

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards (SRSs) and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy (RCMP), revised September 2018.

TPH in Solids by EPA Method 8015C		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
Total Petroleum Hydrocarbons	200	10,000

Notes:

All values are in milligrams per kilogram (mg/kg)

PQLs from Absolute Resource Associates of Portsmouth, New Hampshire

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Soil Remediation Standards (SRSs) and Appendix E, Method 1 Soil Standards from NHDES Risk Characterization and Management Policy (RCMP), revised September 2018.

VOCs in Groundwater by EPA Method 8260D

Analyte	Laboratory Practical Quantitation Limit	Regulatory Standards ¹	
		AGQS and GW-1	GW-2
1,1,1,2-tetrachloroethane	0.5	70	NE
1,1,1-trichloroethane	0.5	200	27,000
1,1,2,2-tetrachloroethane	0.5	2	120
1,1,2-trichloroethane	0.75	5	20
1,1-dichloroethane	0.75	81	130
1,1-dichloroethene	0.5	7	630
1,1-dichloropropene	1	NE	NE
1,2,3-trichlorobenzene	1	0.3*	NE
1,2,3-trichloropropane	1	0.5	NE
1,2,4-trichlorobenzene	1	70	150
1,2,4-trimethylbenzene	1	330	1,300
1,2-dibromo-3-chloropropane (DBCP)	1	0.00033*	NE
1,2-dibromoethane (EDB)	1	0.05	35
1,2-dichlorobenzene	1	600	14,000
1,2-dichloroethane	0.5	5	50
1,3,5-trichlorobenzene	2	40	NE
1,3,5-trimethylbenzene	1	330	NE
1,3-dichlorobenzene	1	600	NE
1,3-dichloropropane	1	37*	NE
1,4-dichlorobenzene	1	75	80
1,4-dioxane	250	0.32	NE
2,2-dichloropropane	1	NE	NE
2-butanone (MEK)	5	4,000	50,000
2-chlorotoluene	1	24*	NE
2-hexanone	5	3.8*	NE
4-chlorotoluene	1	25*	NE
4-isopropyltoluene	0.5	260	NE
4-methyl-2-pentanone (MIBK)	5	2,000	NE
acetone	5	6,000	NE
benzene	0.5	5	2,900
bromobenzene	1	60	NE
bromochloromethane	1	8.3*	NE
bromodichloromethane	0.5	0.6	NE
bromoform	1	4	2,800
bromomethane	1	10	10
carbon disulfide	1	70	NE
carbon tetrachloride	0.5	5	10
chlorobenzene	0.5	7.8*	1,500
chloroethane	1	2100*	NE
chloroform	0.75	70	70
chloromethane	2	30	NE
cis-1,2-dichloroethene	0.5	70	NE
cis-1,3-dichloropropene	0.5	0.5	NE
dibromochloromethane	0.5	60	NE
dibromomethane	1	0.83*	NE

VOCs in Groundwater by EPA Method 8260D			
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standards ¹	
		AGQS and GW-1	GW-2
dichlorodifluoromethane	2	1,000	NE
diethyl ether	1	1,400	NE
ethylbenzene	0.5	700	1,500
hexachlorobutadiene	0.5	0.5	NE
isopropylbenzene	0.5	800	NE
m&p-xylenes	1	10,000	17,000
methyl t-butyl ether (MTBE)	1	13	2,600
methylene chloride	3	5	24,000
naphthalene	0.5	100	1,700
n-butylbenzene	0.5	260	NE
n-propylbenzene	0.5	260	NE
o-xylene	1	10,000	17,000
sec-butylbenzene	0.5	260	NE
styrene	1	100	43,000
tert-butylbenzene	1	260	NE
tetrachloroethene	0.5	5	240
tetrahydrofuran (THF)	2	600	NE
toluene	0.75	1,000	50,000
trans-1,2-dichloroethene	0.75	100	560
trans-1,3-dichloropropene	0.5	NE	NE
trichloroethene	0.5	5	20
trichlorofluoromethane	1	2,000	NE
vinyl chloride	0.2	2	4

Notes:

All values are in micrograms per liter (ug/L)

PQLs from Alpha Analytical of Westborough, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

* - United States Environmental Protection Agency Regions 3, 6, and 9. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

NE = Regulatory guideline not established.

BOLD - PQLs exceed regulatory criteria. Bold compounds are not specific contaminants of interest (COI). Should assessment results indicate the compounds to be a COI, more sensitive analytical methods will be evaluated for subsequent sampling rounds.

VOCs in Groundwater by EPA Method 8260C with SIM			
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standards ¹	
		AGQS and GW-1	GW-2
1,4-Dioxane	3.0	0.32	NE

Notes:

All values are in micrograms per liter (ug/L)

PQLs from Alpha Analytical of Westborough, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

NE = Regulatory guideline not established.

BOLD - laboratory PQL exceeds regulatory criteria. PQL will be considered regulatory criteria unless the compound is identified as a COC.

* - United States Environmental Protection Agency Regions 3, 6, and 9. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

Metals in Water by EPA Method 6010C/6020A		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
Aluminum	100	2000*
Antimony [^]	4	6
Arsenic [^]	0.5	5
Barium	10	2,000
Beryllium	5	4
Boron	30	620
Cadmium [^]	0.2	5
Chromium (total)	10	100
Cobalt [^]	0.5	0.6*
Copper	10	1,300
Lead [^]	1	15
Nickel	25	100
Selenium	10	50
Silver	10	100
Sodium	2000	NE
Thallium	0.2	2
Tin	50	1,200
Vanadium [^]	5	8.6*
Zinc	50	600*

Notes:

All values are in micrograms per liter (ug/L)

PQLs from Alpha Analytical of Mansfield, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

* - United States Environmental Protection Agency Regions 3, 6, and 9. Regional Screening Levels for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm

[^]Indicates metal analyzed by EPA Method 6020A

Hg in Groundwater by EPA Methods 7470A		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
Mercury	0.2	2

Notes:

All values are in micrograms per liter (ug/L)

PQLs from Alpha Analytical of Mansfield, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

PCBs in Groundwater by EPA Method 8082A		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
PCB-1016	0.25	0.5 (total)
PCB-1221	0.25	
PCB-1232	0.25	
PCB-1242	0.25	
PCB-1248	0.25	
PCB-1254	0.25	
PCB-1260	0.25	

Notes:

All values are in micrograms per liter (ug/L)

PQLs from Alpha Analytical of Westborough, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

Per- and Polyfluorinated Alkyl Substances (PFASs) in Groundwater by EPA Method 537 with Isotope Dilution		
Analyte	Laboratory Practical Quantitation Limit	Regulatory Standard ¹
PFTeA	0.002	NE
PFTTrA	0.002	NE
PFDoA	0.002	NE
PFUnA	0.002	NE
PFDA	0.002	NE
PFNA	0.002	0.011
PFOA**	0.002	0.012
PFHpA	0.002	NE
PFHxA	0.002	NE
PFPeA	0.002	NE
PFBA	0.002	NE
PFDS	0.002	NE
PFNS	0.002	NE
PFOS**	0.002	0.015
PFHpS	0.002	NE
PFHxS	0.002	0.018
PFPeS	0.002	NE
PFBS	0.002	NE
8:2 FTSA	0.002	NE
6:2 FTSA	0.002	NE
4:2 FTSA	0.002	NE
FOSA	0.002	NE
EtFOSAA	0.002	NE
MeFOSAA	0.002	NE

Notes:

All values are in micrograms per liter (µg/L)

PQLs from Alpha Analytical of Westborough, Massachusetts

1 - New Hampshire Code of Administrative Rules Chapter Env-Or 600 Contaminated Sites Management, Ambient Groundwater Quality Standards (AGQS) and Table 2, Method 1 Groundwater Standards for NHDES Risk Characterization and Management Policy (Section. 7.4(4)).

** - Combined PFOA and PFOS also compared to 70 ppt Healthy Advisory Level.

APPENDIX B

Supplemental SOPs

1,4-Dioxane

By Gas Chromatography / Mass Spectrometry in Selected Ion Mode (GC/MS-SIM) with Isotope Dilution Modification

References:

EPA 8270E, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision VI (Phase II), June 2018.

EPA 8000C, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846. Update III, March 2003.

1,4-Dioxane Analytical Notes, Appendix II-B-4, WSC-CAM-II-B, Revision 1, July 2010, (Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup).

1. Scope and Application

Matrices: Aqueous, soil/sediment and non-aqueous waste matrices

Definitions: Refer to Alpha Analytical Quality Manual.

This method is applicable to the quantification of 1,4-Dioxane extracted from aqueous samples in methylene chloride and analyzed by GC/MS-SIM. The extraction method is listed below and should be referenced for more details. Detection limits will vary with instrument calibration range, and volume of sample analyzed. 1,4-Dioxane detected over the calibration ranges of the instrument it is being analyzed on will be diluted and re-analyzed for accurate quantification.

The following extraction method applies:

- *Extraction of Water Samples by Separatory Funnel* (SOP 2165)
- *Microscale Solvent Extraction (MSE)* (SOP 2172)
- *Organic Waste Dilution Extraction* (SOP 2265)

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/MS-SIM and in the interpretation of GC/MS-SIM data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

250mL, 500mL or 1000mL of aqueous samples are serially extracted with methylene chloride in a 2 Liter Separatory Funnel (Method 3510) at a neutral pH. The extract is concentrated in MeCl₂ to a 2.5mL to 10mL final volume respectively depending on the volume of sample extracted. Soil/sediment samples are extracted by Microscale Solvent Extraction (MSE Method 3570). Approximately 5g of sample is extracted and concentrated to a 4mL final volume. Non-aqueous waste samples are extracted by Organic Waste Dilution Extraction (Method 3580). Approximately 1g is diluted to 10mL

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final volume.

Analytes are introduced into the GC/MS using a large volume injector and injecting 3ul of the calibration standards, quality control samples, and sample extracts into the GC equipped with a narrow-bore capillary column. The GC column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS) in selective ion mode. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of the calibration standards. Concentrations are determined using mean relative response factors from a multi-level calibration curve. Response factors for target analytes and surrogate compounds are determined relative to the internal standards.

Isotope dilution quantification is achieved by spiking 1,4-Dioxane-d8 at extraction which is then in turn used as both an internal standard (IS) and surrogate. For quantification, the 1,4-Dioxane-d8 IS quantifies 1,4-Dioxane in samples. An additional IS added prior to analysis, 1,4-Dichlorobenzene-d4, quantifies 1,4-Dioxane-d8 as a surrogate.

2.1 Method Modifications from Reference

SIM option with Isotope dilution is utilized to increase sensitivity for this analyte. Note that while this method may be used for the evaluation of 1,4-Dioxane in soil/sediment samples, the MA DEP CAM does not approve of this method for determining presumptive certainty for MA DEP cleanup sites. Method 8260 should be employed in these cases.

3. Reporting Limits

Concentrations for 1,4-Dioxane can be detected in water samples in the range of 150ng/L to 100,000ng/L. Soil/sediment samples can be detected in the range of 8ug/Kg to 8,000ug/Kg. Standard reporting limits for aqueous samples are 150ng/L and for soil/sediment samples 8ug/kg respectively.

4. Interferences

- 4.1 Phthalate esters can be a major source of contamination if any material containing plasticizers (phthalates) comes in contact with the sample during the extraction process. Use of plastic or any material containing plasticizers (phthalates) should be avoided during extraction or analysis.
- 4.2 The injection port of the gas chromatograph can become contaminated with high boiling compounds resulting in the loss of sensitivity. It may be necessary to replace the injection port liner routinely to prevent this loss of sensitivity. Clipping off approximately four inches of the column at the injection end may also increase sensitivity. Low instrument response can be detected during the daily tuning procedure by including pentachlorophenol and benzidine in the daily tuning mix.
- 4.3 Raw GC/MS data from all blanks, samples, and spikes must be evaluated for interferences or carryover. Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed.
- 4.4 Solvents, reagents and glassware may introduce interferences. These must be demonstrated to be free of interferences by the analysis of a method blank. See the SOP *Reagent, Solvent and Standard Control* (G-008) and *Laboratory Glassware Cleaning* (G-002), for additional details.
- 4.5 It should be noted that there are some chromatographic consequences observed due to the acetone used in the MSE extraction process. This is characterized by a shift in retention time

for 1,4-Dioxane and the 1,4-Dioxane-d8 surrogate (~0.4minutes), as well as the presence of a large peak (likely acetone) in all chromatograms.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Solid samples: A minimum of 100grams of sample must be collected in a glass jar with a Teflon lined screw cap.

Water samples: A minimum of 0.25 to 1 liters of sample must be collected in amber glass bottles.

6.2 Sample Preservation

Solid samples: The sample must be refrigerated and maintained at 4 ± 2 °C until extraction and analysis. Sediment samples can be frozen at -20 ± 5 °C until extraction to extend hold time. The extracts must be refrigerated and maintained at 4 ± 2 °C until analysis.

Water samples: The samples must not be preserved except by refrigeration at 4 ± 2 °C until extraction and analysis. The extracts must be refrigerated and maintained at 4 ± 2 °C until analysis.

Non-aqueous waste samples: Concentrated sample extracts must be stored in contaminant-free containers and preserved in a refrigerator when not used for more than four hours.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Solid samples: All solid samples must be extracted within 14 days from the date of collection. Frozen sample hold times are monitored up to 14 days from the date removed from freezer. The extracts must be refrigerated and maintained at 4 ± 2 °C until analysis. Sample extracts must be analyzed within 40 days from date of extraction.

Water samples: All water samples must be extracted within 7 days from the date of collection. Sample extracts must be analyzed within 40 days from date of extraction.

Non-aqueous waste samples: Hold times do not apply to neat oils/NAPL/product samples.

7. Equipment and Supplies

7.1 Gas chromatograph – Programmable, heating range from 40C to 350C; splitless-type inlet system, (Hewlett Packard 6890N Series II or similar); mass selective detector (Hewlett Packard 5973, or similar); automatic injector (Hewlett Packard 7683B or similar).

7.2 Chromatography Column – Fused silica capillary column, 0.25mm ID x 60m length, 0.25um film thickness RTX-5, Restek Corporation, 5% diphenyl-95% dimethyl polysiloxane, Fused silica capillary column, 0.18mm ID x 60m length, 0.18um film thickness RTX-PCB, Restek Corporation, Fused silica capillary column, 0.25mm ID x 30m length, .25um film thickness (Zebron ZB-SemiVolatiles, Phenomenex Corporation, 5% Polysilarylene - 95% Polydimethylsiloxane) , or equivalent.

7.3 Gerstel Large Volume Injection System – Temperature programmable range from 0C to 350C; pressure programmable; capable of split or splitless injection; Injection volumes range from 1 to 50uL and Cryo cooling availability to allow for cold injections.

7.4 Agilent Split/Splitless injector System

7.5 Data Acquisition System - Computerized system for collecting, storing, and processing detector output (Hewlett Packard Enviroquant target software) or equivalent.

7.6 Gases - BIP Ultra high purity helium (99.9995%); Compressed nitrogen for N-Evap. Carbon dioxide (siphon type) for Gerstel.

7.7 Syringes – 10uL to 1.0mL

7.8 Vials- including 2ml, 4ml, 10ml, 40ml and other sizes as necessary.

7.9 Hamilton Gas tight Syringes - varying sizes

7.10 Gerstel Single baffle injection port liners- packed lightly with glass wool.

7.11 GC Injection Port Liner: Phenomenex Direct Connect Top Hole

7.12 Class A Volumetric flasks: Including 10ml, 20 ml, 50 ml, 100ml and other sizes as necessary

8. Reagents and Standards

Use reagent grade chemicals for all reagents. Deionized (DI) water is ASTM Type II laboratory reagent grade water.

8.1 Solvents: All solvent expirations determined as indicated by manufacturer guidelines

8.1.1 Methylene Chloride, ACS approved, Pesticide grade, see SOP *Reagent, Solvent and Standard Control* (SOP 1816) for additional details regarding solvent purity. Used to extract samples and prepare instrument/analytical standards.

8.1.2 Acetone, ACS approved, Pesticide grade, see SOP *Reagent, Solvent and Standard Control* (SOP 1816) for additional details regarding solvent purity. This water soluble solvent is used for surrogate and LCS/MS preparation.

8.1.3 Methanol, ACS approved, Pesticide grade, *Reagent, Solvent and Standard Control* SOP (SOP 1816) for additional details regarding solvent purity.

8.2 Analytical Standards: Standards should be stored at -10C or less, away from light when not in use. They should be discarded after 1 year unless the vendor expiration date states otherwise or, if degradation is observed. Stock standards are given a 1 year expiration from the preparation date or the expiration of the primary vendor solution, whichever occurs first. Working standards are given six month expiration from the preparation date or the expiration of the primary solution whichever occurs first. All analytical standards are made up in Methylene Chloride. All prep standards are made up in Acetone.

8.3 Surrogate/Internal Standard (IS):

- 8.3.1 A 1,4-Dioxane-d8 Primary neat standard is commercially obtained from Cambridge Isotope (Cat #DLM-28-10 or equivalent). A stock surrogate/internal standard solution is prepared by weighing 0.1 g of the primary neat standard and diluting volumetrically in 10 mls methylene chloride (or equivalent preparation) to obtain a concentration of ~10,000 ug/ml.
- 8.3.2 From this stock (Section 8.3.1), the Surrogate spiking solution is made by a serial dilution (1 ml diluted up in a 50 ml volumetric flask, followed by a 0.5 ml of this solution diluted up in a 20 ml volumetric flask or equivalent preparations) in Acetone to achieve a concentration of 5 ug/mL. Of this surrogate solution, 1 mL is spiked into each water sample, and 0.4 mL is spiked into each soil/sediment sample for a surrogate/IS concentration of 500 ng/mL in samples.
- 8.3.3 The initial stock solution (Section 8.3.1) is diluted volumetrically (250 uL diluted up in a 100 ml volumetric flask or equivalent preparation) in methylene chloride to obtain an IS solution at a concentration of 25 ug/ml for the spiking of only the analytical standards (i.e. calibration curve and continuing calibration).

8.4 Internal Standard: 1,4-Dichlorobenzene-d4 commercially obtained from Restek (Cat #31206 or equivalent). This primary solution is at 2000 ug/mL and contains other Semivolatile Internal standards, however this method only utilizes the 1,4-Dichlorobenzene-d4. This solution is diluted volumetrically (250 uL diluted up in a 50 ml volumetric flask or equivalent preparation) in methylene chloride to obtain a SIM-IS solution at a concentration of 25 ug/ml. All samples and standards are spiked with 20uL of internal standard before analysis. This IS is intended to be used for both quantitation (of the surrogate 1,4-Dioxane-d8) and the establishment of relative retention times.

8.5 Matrix Spike/Laboratory Control Spike Solutions (MS/LCS) – 1,4-Dioxane primary spike solution is commercially obtained from Restek at 2000 ug/mL (Cat #31853 or equivalent). To prepare the working spike solution, syringe measure 0.25 mL of stock and bring to 100 mL in acetone (or equivalent preparation) for a 5 ug/mL concentration. From this solution, 1 mL is spiked into each MS/LCS QC water sample and 0.4 mL is spiked into each soil/sediment sample. The final concentration in a 10 mL water extract and in a 4 mL soil/sediment sample will be 500 ng/mL.

8.6 Stock Calibration Standards are prepared from a primary standard commercially obtained from Restek at a concentration of 2000 ug/ml (Cat #31853 or equivalent). The primary standard is used to appropriately prepare a stock standard at a concentration of 10,000 ng/ml (125 uL diluted up in a 25 ml volumetric flask or equivalent preparation). The stock solution is generally made up in 25 ml increments. The stock solution then doubles as a high level standard for the calibration curve, as well as a stock solution by which to serially dilute to prepare the other calibration standards. Except for the high level standard, the calibration curve levels are generally each made at 10 ml. Refer to the table below for example calibration curve levels. All the calibration curve levels, once aliquoted at 1 ml increments for injection, have 20 ul of 1,4

Dichlorobenzene IS (SIM IS – Section 8.4) added as well as 20 uL of 1,4 Dioxane-d8 IS/Surrogate (Section 8.3.3) added.

8.7 Curve Preparation: The following 7 levels are the possible levels that can be analyzed for an ICAL.

<i>Calibration Level</i>	<i>Volume of Stock Std Added Into 10 ml of DCM</i>
Level 1 (10 ng/mL)	10 uL
Level 2 (50 ng/mL)	50 uL
Level 3 (100 ng/mL)	100 uL
Level 4 (500 ng/mL)	500 uL
Level 5 (1000 ng/mL) - CCV	1.0 mL
Level 6 (5000 ng/mL)	5.0 mL
Level 7 (10,000 ng/mL)	NA

8.8 The Independent Check Verification Standard is prepared from a Primary standard solution commercially obtained from Ultra (Cat NV-150-1 or equivalent) at a concentration of 100 ug/ml. The primary solution is diluted volumetrically (100 ul diluted up in a 10 ml volumetric flask or equivalent preparation) in methylene chloride to create a working ICV solution at a concentration of 1000 ng/ml. The working ICV solution is aliquoted into 1 ml increments as needed to inject with each calibration curve. Additionally, 20 ul of SIM IS (Section 8.4) and 20 ul of 1,4-Dioxane-d8 IS (Section 8.3.3) is added into the 1 ml aliquot.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A method blank must be prepared once per every 20 samples or per extraction batch, whichever is more frequent.

Organic compounds of interest must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: For contaminated blanks, all efforts must be made to identify and eliminate the source of contamination. The presence of analytes at concentrations at or above the reporting limit will warrant application of a "B" qualifier to that target compound(s) on all associated report forms, and perhaps re-extraction of all associated samples. Re-extraction of the method blank and all associated samples must be performed until the blank is in control. Surrogate recoveries must meet the QC limits for the method blank. Re-extraction must be initiated immediately so that minimum time is wasted before re-extraction can occur - if at all possible-this re-extraction should take place within holding time. Re-extraction *corrective action* that would exceed the sample holding time criteria should be discussed with the Organics Supervisor, Project Manager, client, and Operations Manager prior to implementation. Exceptions may be made with approval of the Organics Section Supervisor if the samples associated with an out of control method blank are non-detect for the affected compound(s) or if the concentration of the affected compound(s) in the sample is greater than 10x the blank level. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified, via the project narrative, of any method blank non-compliance associated with sample results

9.2 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Laboratory control samples (LCS/LCSD) must be prepared once per every 20 samples or per extraction batch, whichever is more frequent, and spiked with 1,4 Dioxane spike solution (Section 8.5) and surrogate (Section 8.3.2) before extraction. The IS (Section 8.4) is spiked after extraction and before the analysis.

Acceptable Recovery limits are 40% - 140%. The relative percent difference (RPD) between the LCS/LCSD is 30%. Limits are adapted from MCP protocol and are generally monitored and documented in-house through control charts.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the LCS/LCSD recoveries and/or %RPD are still out of control, re-extract and re-analyze the LCS/LCSD and all associated samples. Samples cannot be reported until an acceptable LCS is obtained.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike / Matrix Spike Duplicate (MS/MSD)

Matrix spike / matrix spike duplicate (MS/MSD) samples are performed upon project specifications. They are performed per client request. The sample is spiked with 1,4-Dioxane spike solution (Section 8.5) and surrogate (Section 8.3.2) before extraction. The IS (Section 8.4) is spiked after extraction and before the analysis. The recovery limits are 40% - 140% and the RPD limit is 30%. Limits are adapted from MCP protocol and are generally monitored and documented in-house through control charts.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the % recovery and/or %RPD still exceeds the control limits and the LCS/LCSD is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the reported results as evidenced by MS/MSD recoveries and/or %RPD outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses are performed upon client and/or workplan request. *For Organic analyses, the matrix duplicate is usually in the form of the matrix spike duplicate, see Section 9.5.*

Acceptable relative percent difference (RPD) of duplicates is 30%. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{R1 + R2}{2}} \times 100$$

where:

R1 = sample Replicate #1

R2 = sample Replicate #2

The RPD limits should be monitored and documented in-house through control charts and updated as needed.

Corrective Action: Analysis must be repeated if an analytical error is suspected.. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported results as evidenced by the matrix duplicate % RPD exceedence.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

Surrogate spikes (Section 8.3.2 and Section 8.3.3) must be added to QC and field samples to evaluate the extraction method performance.

The acceptable surrogate recovery limits are 15% - 110%. Limits are adapted from MCP protocol.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the % recovery still exceeds the control limits the sample must be re-extracted and re-analyzed to confirm the sample matrix. If *obvious* matrix interferences are noted, consultation with the Organic Supervisor or Operations Manager may be in order to confirm the need for sample re-extraction. If no re-extraction occurs, the surrogate results and reasons for the decision not to re-extract must be discussed in the project narrative to the client. Due to the isotope dilution nature of this method, the analyst must pay close attention to surrogate recoveries and areas as this recovery is then used to surrogate correct (as an Internal standard) the response of 1,4-Dioxane.

9.7.2 Internal Standards

Internal standards must be added to all sample extracts, QC samples and standards for quantitation purposes. For sample extracts, only the 1,4-Dichlorobenzene-d4 IS (SIM IS – Section 8.4) should be added since the extraction surrogate is then used as an Internal Standard upon analysis. However, all Calibration standards must be spiked with both 1,4-Dichlorobenzene-d4 as well as 1,4-Dioxane-d8 (Section 8.3.3). In the sample extracts the area counts for 1,4-Dioxane-d8 will vary based on the extraction, however the 1,4-Dichlorobenzene-d4 area counts should remain fairly constant. The 1,4-Dichlorobenzene-d4 internal standard should also remain constant with respect to the continuing calibration analyzed at the beginning of the run. Sample IS areas must be –50% to +100% of the Internal Standards in the Continuing Calibration – applies only to 1,4-Dichlorobenzene-d4. Additionally, the IS retention times should not differ more than 30 seconds from the Continuing Calibration.

Corrective Action: Analysis must be repeated once unless there are obvious samples matrix interferences, i.e., the sample extract was very colored and viscous, or there are obvious chromatographic interferences. If *obvious* matrix interferences are noted, consultation with the Organic Supervisor or Operations Manager may be in order to confirm the need for sample re-analysis or re-extraction.

9.8 Method Sequence

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- Tune
- CCV
- Method Blank
- LCS
- LCSD
- Samples

10. Procedure

10.1 Equipment Set-up

10.1.1 The instrument used for the analysis is a HP 6890N Series gas chromatograph. The HP system is equipped with a Gerstel large volume injection system, and a 7683B-type autosampler or equivalent. The mass spectrometer is an HP 5973 or 5975 with the HP Enviroquant data system. The method is modified for selective ion monitoring. The table below lists the ions monitored in one SIM window. This method must only be set up and analyzed by an experienced mass spectrometrists.

<i>Compound</i>	<i>Primary Ion</i>	<i>Secondary Ion</i>
1,4-Dioxane	88	58, 43
1,4-Dioxane-d8	64	96
1,4-Dichlorobenzene-d4	152	115

10.1.2 The basic GC parameters are as follows for the Gerstel Large Volume Injection System:

Oven Equib Time: 0.10 min
Oven Max: 325
Initial Temp.: 45°C
Initial Time: 6.00 min

<u>Level</u>	<u>Rate (°C/min)</u>	<u>Final Temp. (°C)</u>	<u>Final Time (min)</u>
1	19.00	120	1.0
2	11.00	150	1.00
3	19.00	305	4.00

Final Time: 26.83

10.1.3 The basic injection port parameters are as follows for the Gerstel Large Volume Injection System:

"Splitless" mode
Initial Temp: 46 °C
Initial Time: 0.30 min
Ramp Rate: 300°/second
Final Temp: 300°C
Final Time: 30.0
Cryo: ON
Cryo Use temp: 25 °C
Cryo Timeout: 30.0 min
Cryo Fault: ON
Purge Flow: 25 ml/min

Purge Time: 2.50 min
Gas Saver: off
Gas: Helium

Mode: Constant Pressure
Average Velocity: 30cm/sec
Initial flow: 1.3 ml/min

10.1.4 The basic GC parameters are as follows for the Agilent Split/Splitless injector System:

Oven Equib Time: 0.20 min
Oven Max: 325°C
Initial Temp.: 30°C

<u>Level</u>	<u>Rate (°C/min)</u>	<u>Final Temp. (°C)</u>	<u>Final Time (min)</u>
1	0	30	2.00
2	5	50	0.00
3	50	300	2.00

Final Time: 13.00

10.1.5 The basic injection port parameters are as follows for the Agilent Split/Splitless injector System:

Mode: Splitless
Temperature: 200 °C
Flow: 1.0 mL/min
Velocity: 36.074 cm/sec
Septum Purge: 3mL/min
Purge Flow to Split Vent: 60 mL/min at 0.3 min

10.1.6 MS Acquisition Information:

Tune file: dftpp.u
Acquisition Mode: SIM
Solvent Delay: 7.70 min
MS Source temp: 280°C

10.1.7 Tuning

10.1.7.1 Before the analytical standards are analyzed the mass spectrometer must be adjusted to meet the proper ion criteria for DFTPP. This is demonstrated by injecting into the GC/MS system 1uL of a 50ug/mL DFTPP solution. After the analysis of the DFTPP, evaluate the tune as follows:

- Enter into the "Environmental Data Analysis" (off-line) screen.
- Go to "File" and select the tune data file.
- Go into "Tuner" and select "Eval DFTPP", then select "AutoFind DFTPP to Screen," to evaluate the tune file, based on the pre-set SW-846 criteria. The software will evaluate the tune by selecting three scans of the DFTPP peak

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and will display the ion intensities on the screen. That is, one scan at the apex, one scan directly preceding the apex and one scan following the apex and averages them, then takes one background subtracted scan, 20 seconds before the beginning of the DFTPP peak. If the criteria below are met, repeat, select "AutoFind to Printer", for a hardcopy of the tune evaluation for the record.

If the "AutoFind" tune evaluation does not meet the criteria below, manual evaluation of the tune can be performed by attempting either of the options below:

- Blow up the DFTPP peak on the screen and select either one single scan at the apex of the peak, or a scan immediately preceding or following the apex. Go into "Tuner" and select "Evaluate DFTPP to Screen," or "Evaluate DFTPP to Printer," as described above, OR,
- Take the average of the scans across the entire peak. Go into "Tuner" and select "Evaluate DFTPP to Screen," or "Evaluate DFTPP to Printer," as described above.

10.1.7.2 The following DFTPP mass intensity criteria should be used.

DFTPP KEY MASSES AND ABUNDANCE CRITERIA

Mass	m/z Abundance criteria
51	10-80 percent of mass 198.
68	Less than 2 percent of mass 69.
70	Less than 2 percent of mass 69.
127	10-80 percent of mass 198.
197	Less than 2 percent of mass 198.
198	Base peak, or >50 percent of Mass 442.
199	5-9 percent of mass 198.
275	10-60 percent of mass 198.
365	Greater than 1 percent of mass 198.
441	Present but less than 24 percent of mass 442.
442	Base Peak, or > 50 percent of mass 198.
443	15-24 percent of mass 442.

10.1.8 Tune acceptance should be verified at the beginning of every 12 hour analytical shift. The DFTPP may be combined with the calibration verification standard as long as both tuning and calibration acceptance criteria are met.

10.2 Initial Calibration

- 10.2.1 After the DFTPP passes criteria, a set of multi-level calibration standards listed in Section 8.7 are analyzed, from low concentration to high. A minimum of five calibration levels are analyzed. The calibration standards are stored in amber vials in the standards freezer. The labeling convention allows each standard to have a unique identifier which distinguishes it from field samples. The naming convention used throughout the laboratory identifies the standard as semivolatile, hydrocarbon, pesticide/PCB or volatile. An example of this would be SW042407E, meaning it is a semivolatile (S) working (W) standard made on April 24, 2007 and that it was the fifth standard made that day. All certificates of analysis that are shipped with standards are filed with their receipt ID written on it to insure traceability.
- 10.2.2 Once the standards have been analyzed, they are reduced by the search software of the Enviroquant data system. Once all the components are identified, a linear curve is calculated for the components. The criteria for evaluation are as follows:

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- 10.2.2.1 The average RF for each compound must be greater than 0.05.
- 10.2.2.2 The %RSD of each compound must not exceed 20%. If they do this may be an indication that the chromatographic system is too reactive for analysis to begin. This indicates the instrument may need maintenance.
- 10.2.2.3 Alternatively, a linear regression model may be employed, provided that the coefficient of determination (COD or r^2) is ≥ 0.99 . Otherwise, construct a nonlinear calibration of no more than a third order equation. Statistical considerations in developing a non-linear calibration model require more data than the more traditional linear approach. A quadratic (second order) model requires six standards, and a third order polynomial requires seven standards. In setting model parameters, do not force the line through the origin. The COD or r^2 must be greater than or equal to 0.99.
- 10.2.2.4 Once the calibration curve is reviewed, an Initial Calibration Checklist must be completed.
- 10.2.3 All samples and standards are spiked with Internal Standards (IS) before analysis. Refer to section 8.4 for specific internal standard spiking information. The IS is intended to be used for both quantitation and the establishment of relative retention times. Internal standard acceptance criteria can be found in Section 9.7.2.
- 10.2.4 Independent check standards (Section 8.8) from a separate source or different lot are analyzed after every initial calibration for evaluation against calibration standard solutions. The % Difference (%D) should not be greater than $\pm 30\%$.

10.3 Equipment Operation and Sample Processing

10.3.1 Tuning

A DFTPP standard must be analyzed and pass criteria before a continuing calibration verification standard or any samples are analyzed. The DFTPP may be combined with the calibration verification standard as long as both tuning and calibration acceptance criteria are met. A DFTPP tune standard must be analyzed before each 12 hour analytical shift. Please refer to Section 10.1.5 for tuning criteria and other information.

10.3.2 Daily Calibration

On a daily basis after the DFTPP has passed, a mid-level (usually 1000 ng/mL) continuing calibration standard which contains all of the analytes of interest is analyzed. The criteria for acceptance are:

- 10.3.2.1 All analytes must have response factors greater than 0.05.
 - 10.3.2.2 The % D must be $\pm 20\%$ D from the initial calibration.
- #### 10.3.3 Sample Analysis
- 10.3.3.1 The prep lab staff will transfer the samples to the instrument laboratory. The samples are generally brought to a 10 mL final volume for liquids or 4 mL for soil samples; 1 mL is transferred and the remaining sample volume is archived. One aliquot of each sample is then placed in the sample extract holding refrigerator located in the instrument laboratory.
 - 10.3.3.2 All of the samples at 1 mL (including the batch QC samples) are spiked with 20 μ L

internal standard (see section 8.4 for specifics regarding the internal standard). The samples are shaken briefly after the internal standard is added to ensure mixing. A sample will need a dilution for target analytes that are over calibration.

10.3.3.3 After the daily tune and CCAL have passed criteria, the analyst places the samples onto the autosampler tray. (Generally, the samples will be analyzed in order of color (lightest to darkest.) with QC samples being analyzed first. The instrument sequence is typed into the HP Chemstation Software. Next run "Simulate Sequence" (also under the "Sequence" dropdown list) without clicking the "Overwrite Files" box. Compare the order of the vials on the instrument versus the sequence to confirm all the samples and standards are in the right places. Next click "Run Sequence" also under the HP Chemstation "Sequence" dropdown list.

10.3.3.4 After the samples have been analyzed, the data files from the MS are quantitated versus the proper quantitation method. The QCPRN1.MAC macro creates a form with which to easily check internal standard and surrogate criteria are met. The following should be reviewed initially:

10.3.3.4.1 Are all the surrogates within QC criteria? Please see Section 9.7.1 for surrogate information.

10.3.3.4.2 Is the internal standard- 1,4 Dichlorobenzene-d4, within 50-200% of the daily CCAL? If not, the samples should be checked for matrix interferences that may be causing these issues. The IS peaks should also be evaluated for peak splitting or incorrect integration by the software. A sample may not need to be reanalyzed if it can be determined (with guidance from a supervisor) that the QC is exceeded due to matrix interference.

10.3.3.4.3 Are all target analytes within calibration range? If not, the sample(s) should be diluted and re-analyzed. If a dilution is performed after the internal standard has already been added, it will be necessary to add additional IS in order to make up for the impact of the original IS added also being diluted. Conversely, if a sample has been over-diluted, it may need to be analyzed at less of a dilution to detect target analytes that may have been diluted out. Note: for this method, due to the isotope dilution, it is necessary to refer to area counts to determine if dilution is required. The area response for 1,4-Dioxane should be compared to the area of the highest level of the ICAL standard for that target. If the area of 1,4-Dioxane in the extract is greater than the area of 1,4-Dioxane in the Highest level of the Calibration Curve, then a dilution is necessary. The analyst **CAN NOT** use the concentration of 1,4-Dioxane found in the extract to determine if dilution is required because the concentration of 1,4-Dioxane in the sample is surrogate corrected in Chemstation based on the use of the extraction surrogate as an Internal Standard. Once it is determined based on the peak area that a sample requires a dilution, the analyst must pay attention to the concentration of IS in the dilution. Although the analyst will adjust the 1,4-Dichlorobenzene-d4 concentration by adding the appropriate amount of additional IS to the dilution, there is no way for the analyst to make up for the dilution of the extraction surrogate 1,4 dioxane-d8 (also used as internal standard). To account for this the analyst must change the concentration of the 1,4-Dioxane-d8 within the calibration table to a value which accounts for the dilution. (Example: If the analyst performs a 10x dilution then the concentration of 1,4-Dioxane-d8 must be changed within the ICAL to 50.) The analyst must ensure that only the diluted sample is calculated against this

value and that the method is returned to the proper concentration once the analysis of the dilution is complete.

10.3.3.4.4 Are all analyses within 12 hour tune time? If a sample is analyzed outside tune time, it will need to be re-analyzed in another tune clock.

10.3.3.4.5 The sequence should also be printed out from Chemstation, initialed and dated, and placed in the logbook.

10.3.3.4.5.1 If anything in the initial review of the data indicates that there should be a re-analysis, the reason for re-analysis should be noted on the sequence.

10.3.3.4.5.2 Also, note the time the tune standard was analyzed, the time of the last sample analysis. If there are samples analyzed outside tune time, the time the last sample within tune time ran should be noted, as well as the last sample analyzed.

10.3.3.4.5.3 If a re-extract is required, the "Request for Repreparation/Reclean" book should be filled out and a photocopy of the appropriate page should be given to the Preparation Group leader or the Organics Section Head.

10.4 Continuing Calibration

Continuing Calibration Criteria is outlined in section 10.3.2

10.5 Preventive Maintenance

If performing any maintenance on any piece of equipment it must be documented in the *Instrument Maintenance Logbook* located in the laboratory specific to each instrument.

Daily

Injection port maintenance: Maintenance should be done when the daily CCAL starts to demonstrate degradation either by %D outliers or area responses <50% as compared to the ICAL areas. Several tune clocks may be injected before maintenance is needed. The type of samples analyzed will have an effect on how soon maintenance should be performed. Injection port maintenance should be done as needed. General maintenance includes replacing the single baffle liner packed lightly with glass wool, cutting about 2-4 inches off the head of the column, and replacing the septa. Refer to maintenance log for more specific information.

The Gerstel Injection port should be handled with care. The liners are quite thin. Do not force the Gerstel weldmen into place as the threads are soft metal and will cross thread. Always make sure the weldmen goes on straight. The Gerstel injection port does not require significant tightening of either the weldmen or column nut, tighten enough to seal but there is no need to crank down on it.

11. Data Evaluation, Calculations and Reporting

11.1 Qualitative Analysis

11.1.1 The qualitative identification of compounds determined by this method is based on retention time and on comparison of mass spectrum, after background correction, with

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characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by the laboratory using the conditions of this method. The characteristic ions from the reference mass spectrum are defined as the two ions of greatest relative intensity, and are over 30% relative intensity. Compounds are identified when the following criteria are met.

- 11.1.2 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other. A peak selected by the data system, based on the presence of target specific ions at a target specific retention time will be accepted as meeting these criteria.
- 11.1.3 The relative retention time of the sample component is within ± 0.06 RRT units of the RRT of the standard component.
- 11.1.4 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.) The relative intensities are monitored daily. The relative intensities will be updated when they exceed established values from the reference spectrum.
- 11.1.5 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.
- 11.1.6 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e. a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important. Selective ion monitoring eliminates this potential.

11.2 Quantitative Analysis

- 11.2.1 Response factors and % RSD to evaluate Initial Calibration acceptability.

$$RF = \frac{area_{cmp}}{area_{is}} \times \frac{conc_{is}}{conc_{cmp}}$$

Calculate RF by:

where:

area cmp = Area of the characteristic ion for the compound being measured.

area is = Area of the characteristic ion for the specific internal standard.

conc is = Concentration of the specific internal standard.

conc cmp = Concentration of the compound being measured.

Calculate % RSD by:

$$\%RSD = \frac{SD}{\bar{x}} \times 100$$

$$SD = \sqrt{\sum_{i=1}^N \frac{(x_i - \bar{x})^2}{N-1}}$$

where:

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% RSD = percent relative standard deviation
x = average of RF's
SD = standard deviation
xi = analytical results of each level in the final reporting units
N = number of results (levels)

11.2.2 Calculate % Difference (%D) by:

$$\%D = \frac{\overline{RF_i} - RF_c}{\overline{RF_i}} \times 100$$

where:

RFi - Initial Calibration average RF
RFc = Continuing Calibration RF

11.2.3 Results of Water Analysis - calculation as performed in report form:

$$\text{Concentration (ug/L)} = \frac{(\text{Conc}) (\text{Vf}) (\text{DF})}{(\text{Vi})} \times 1000$$

11.2.4 Results of Soil/Sediment Analysis – calculation as performed in report form:

$$\text{Concentration (ug/Kg)} = \frac{(\text{Conc}) (\text{Vf}) (\text{DF})}{(\text{Vi}) \%S} \times 1000$$

where:

Conc = Raw on-column concentration obtained from the quantitation report using Initial Calibration results.

Vf = Final volume of extract (mL)

Vi = Volume of sample extracted (mL), or weight of sample extracted in grams (g)

DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".

%S = percent solids, as a decimal

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager

shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

QC Parameter	Acceptance Criteria
Method Blank	No analyte above the reporting limit The results are qualified with a "B" for any associated sample concentrations that are less than 10x the blank concentration for this analyte
Surrogate Recovery	15% - 110%
Laboratory Control Samples	40% - 140% and 30% RPD
Matrix Duplicate	30% RPD
Matrix Spike	40% - 140%
Matrix Spike Duplicate	40% - 140% and 30% RPD

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)

SOP 1739 Demonstration of Capability (DOC) Generation

SOP 1731 Manual Integration & Compound Rejection

SOP 1797 Hazardous Waste and Sample Disposal

SOP 1816 Reagent, Solvent and Standard Control

16. Attachments

None