APPLICATION

Nantucket Landfill
Nantucket, Massachusetts
Application for a Minor Modification
BWP SW-22: Landfills – Minor Modification

PFAS Groundwater and Surface Water Sampling Work Plan

Prepared on behalf of:

Town of Nantucket

November 30, 2021

CDM Smith

Massachusetts Department of Environmental Protection
Bureau of Waste Prevention – Solid Waste Management

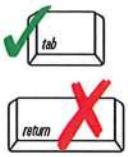
BWP SW 07 Modification of a Large Handling Facility
BWP SW 11 Landfills - Major Modification
BWP SW 16 Combustion Facilities
BWP SW 21 Modification of a Small Handling Facility
BWP SW 22 Landfills - Minor Modification
BWP SW 45 Any Facility – Presumptive Approval

Transmittal Number

Facility ID# (if known)

Application for Solid Waste Management Facility Modification

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Project Information (all applicants must complete this section)

1. Which permit category are you applying for?

☐ BWP SW 07 ☐ BWP SW 11 ☐ BWP SW 16 ☐ BWP SW 21 ☒ BWP SW 22 ☐ BWP SW 45

2. Is MEPA review required for this project? ☐ Yes ☒ No

Directions: Specify the plan/report and page numbers in which the following information is located.

	Plan/Report #	Page #	DEP USE ONLY
3. Permit Modification (310 CMR 19.029(2))			
a. General Description	Attached	Work Plan, Section 1	
(1) Effect on Current Operation	N/A	N/A	
(2) Effect on Capacity	N/A	N/A	
(3) Effect on Operating Life	N/A	N/A	
b. Effect on Public Health, Safety or the Environment	Attached	Work Plan	
4. Currently Valid Department Approvals	Attached	Existing EMP ePLACE upload	

Note: Complete only sections applicable to requested modification. Enter NA if not applicable.

Important Note: Engineering Plans must be stamped by a Registered Professional Engineer (PE). Property Line Location must be stamped by a Registered Land Surveyor (RLS).

B. Project Information

	Plan/Report #	Page #	DEP USE ONLY
1. Plan/Report Modifications and/or Revisions			
a. Waste Ban Plans (310 CMR 19.017)	N/A	N/A	
b. Facility Plan (310 CMR (19.030(2)(d))	Attached	Figure 1-2, Figure 2-1	
(1) Site Plan (310 CMR 19.030(2)(d)1)	Attached	Figure 1-2, 2-1	
(2) Facility Design Plan (310 CMR 19.030(2)(d) 3.)	N/A	N/A	

Application for Solid Waste Management Facility Modification

B. Project Information (cont.)

	Plan/Report #	Page #	DEP USE ONLY
(4) Operation and Maintenance (310 CMR 19.030(2)(d) 4.)	N/A	N/A	
(5) Closure/Post-Closure Plan (310 CMR 19.030(2)(d) 5.)	Attached	Work Plan	
(6) Hydrogeological Study (310 CMR 19.104(3))	N/A	N/A	
(7) Class II Recycling Program (310 CMR 19.303) (Engineer's Supervision sign-off not required)	N/A	N/A	

C. Permit Review Documentation and Criteria

Note: Complete all sections applicable to requested modification. Refer to referenced regulation citation for applicability. Enter NA if not applicable.

	Plan/Report #	Page #	DEP USE ONLY
1. Documentation			
a. Site Assignment Documentation (310 CMR 19.030(2)(f))	N/A	N/A	
b. MEPA Status (310 CMR 19.030(2)(g))	N/A	N/A	
c. Wetlands Order of Conditions	N/A	N/A	
d. Waste Disposal Contract (Transfer Station)	N/A	N/A	
e. Financial Assurance Estimate and Mechanism (310 CMR 19.051)	N/A	N/A	
2. Permit Criteria (310 CMR 19.038(1)(d))			
a. MEPA Compliance	N/A	N/A	
b. Site Assignment Limits	N/A	N/A	
c. Compliance with Facility Specific Regulations	N/A	N/A	
d. Health & Environmental Impact Assessment	N/A	N/A	
e. Compliance with other applicable laws and regulations	N/A	N/A	

C. Permit Review Documentation and Criteria (cont.)

		Plan/Report #	Page #	DEP USE ONLY
f.	Compliance with Waste Bans	N/A	N/A	
g.	Enforcement Status	N/A	N/A	
h.	Bird Hazard	N/A	N/A	
i.	Structural Support	N/A	N/A	
j.	Wildlife Endangerment	N/A	N/A	
k.	Capacity Utilization (N/A to Handling Facilities)	N/A	N/A	

D. Certification & Engineer's Supervision: 310 CMR 19.011

Engineer's Supervision:

All papers pertaining to design, operation, or engineering of this site or facility shall be completed under the supervision of a Massachusetts registered professional engineer knowledgeable in solid waste facility design, construction and operation, and shall bear the seal, signature and discipline of said engineer. The soils, geology, air monitoring and groundwater sections of the application or monitoring report shall be completed by competent professionals experienced in the fields of soil science and soil engineering, geology, air monitoring and groundwater, respectively, under the supervision of a Massachusetts registered professional engineer. All mapping and surveying shall be completed by a registered surveyor.

Mary C. Mancini
Print Name

Mary C Mancini
Authorized Signature

Project Engineer
Position/Title

CDM Smith
Company

41449
P.E. #

11/30/2021
Date (MM/DD/YYYY)

Responsible Official Certification:

I attest under the pains and penalties of perjury that:

a) I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification statement;
b) Based on my inquiry of those persons responsible for obtaining the information, the information contained in this submittal is, to the best of my knowledge, true, accurate and complete;
c) I am fully authorized to bind the entity required to submit these documents and to make this attestation on behalf of such entity; and
d) I am aware that there are significant penalties including, but not limited to, administrative and civil penalties for submitting false, inaccurate or incomplete information, and possible fines and imprisonment for knowingly submitting false, inaccurate or incomplete information.

C. Elizabeth Gibson
Print Name

C. Elizabeth Gibson
Authorized Signature

Town Manager
Position/Title

11/29/2021
(MM/DD/YYYY)

75 State Street, Suite 701
Boston, Massachusetts 02109
tel: 617 452-6000

November 30, 2021

Mr. Mark Dakers
Solid Waste Management Section Chief
Department of Environmental Protection
Southeast Regional Office
20 Riverside Drive
Lakeville, Massachusetts 02346

Subject: Town of Nantucket Landfill
PFAS Groundwater and Surface Water Sampling Work Plan
Application for a Minor Modification (SW-22) and
Extension of ACO Amendment #8 Deadlines
Facility No. 39529 R.O. # 172753

Dear Mr. Dakers:

On behalf of the Town of Nantucket (Town), CDM Smith Inc. (CDM Smith) submits this *SW-22 Minor Modification of a Landfill Permit* (SW-22) Application for minor modification of the existing Environmental Monitoring Plan (EMP) for the Nantucket Landfill, located on Madaket Road in Nantucket, Massachusetts.

The existing EMP requires sampling, analysis and reporting of groundwater and surface water on a semi-annual basis with landfill gas monitoring and reporting on a quarterly basis. This application seeks approval for the following changes to the existing EMP:

- Perform one round of Per- and Poly-fluoroalkyl Substances (PFAS) sampling and analysis of existing onsite groundwater and surface water monitoring locations and report results to MassDEP.

The accompanying PFAS Groundwater and Surface Water Sampling Work Plan (Work Plan) outlines the procedures and detail for the one-time PFAS sampling event. As applicable, the Massachusetts Department of Environmental Protection (MassDEP) Solid Waste and/or MassDEP Bureau of Waste Site Cleanup (BWSC) will be engaged through the reporting of PFAS sampling results, along with any additional permits or work plans deemed appropriate, and/or for planning next steps if needed for the investigation.

In addition, as discussed during a meeting held on September 17, 2021, between the Town, CDM Smith, and MassDEP, a request for an extension to the Nantucket Phase I Landfill Closure Administrative Consent Order (ACO) is included herein.

Environmental Monitoring Plan Modification

A meeting was held with MassDEP on September 17, 2021 to meet the pre-application requirement for this Work Plan prepared by CDM Smith. The PFAS Groundwater and Surface Water Sampling Work Plan is being submitted to MassDEP Solid Waste Division for approval as an *SW-22 Minor Modification of a Landfill Permit*. The SW-22 permit application is intended to supplement the existing EMP by adding a one-time PFAS sampling event to determine the presence of PFAS. The event will be conducted during an event under the existing Site EMP, as advised by MassDEP at the September 17th meeting.

This Work Plan outlines the sampling procedures and quality assurance protocols for the one-time PFAS sampling event. Following completion of the onsite groundwater and surface water PFAS assessment outlined in this Work Plan, a Data Assessment Report will be prepared to summarize the sampling event and present the analytical results. As necessary, MassDEP Solid Waste and/or MassDEP Bureau of Waste Site Cleanup (BWSC) will be engaged and consulted regarding the sampling results relative to any required notifications, additional permits or work plans, as well as for planning next steps of the PFAS assessment associated with the site.

Extension of Administrative Consent Order (ACO) Conditions

The Town of Nantucket has been the subject of an ongoing ACO from MassDEP regarding closure of the unlined municipal landfill at 188 Madaket Road (the Phase I Landfill). The ACO, which was originally issued as #ACO-SE-96-4015 with an Effective Date of July 31, 1996, has been amended on eight occasions. The most recent amendment, issued on February 27, 2014 (ACO Amendment #8), established the terms and conditions for continued landfill mining/reclamation activities in the unlined Phase I area of the Landfill (the Phase I Area). ACO Amendment #8 also set forth terms and conditions for the closing and capping of the Phase I Area and development of a modified BWP SW-25 Corrective Action Design (CAD) to reflect the Landfill's modified configuration after completion of the landfill reclamation activities to ensure compliance with 310 CMR 19.000.

In compliance with Condition 14F of ACO Amendment #8, the Town terminated the landfill mining/reclamation program on July 1, 2019. Accordingly, Condition 14M required submittal of an updated BWP SW25-CAD modification application to MassDEP within 90 days of having terminated the landfill mining/reclamation activities (i.e., by September 29, 2019).

To meet the intent of Condition 14M, the Town retained a consultant to prepare the BWP SW25-CAD application. The CAD and schedule of Landfill closure were discussed in detail at a pre-closure meeting held in April 2019 between representatives of the Town and of the Solid Waste Section of the MassDEP Southeast Regional Office. At that meeting, MassDEP expressed concerns with the occurrence and impacts at landfills of PFAS, for which new requirements and standards were then under consideration for development. As a result, notwithstanding the language of the ACO, MassDEP representatives indicated verbally at the April 2019 meeting that delays in the preparation of the updated CAD (Condition 14M of ACO Amendment #8), and the closure schedule in general, would be acceptable in

order to accommodate review of alternative closure designs due to evolving MassDEP policies regarding PFAS. Specifically, a remaining issue was whether the reclaimed soil can be used above or below the cap, dependent upon the concentrations of PFAS in those materials, and pending guidance from MassDEP on this matter. Consequently, completion of the CAD has been delayed pending receipt of such guidance.

For these reasons, the Town of Nantucket respectfully requests written confirmation from MassDEP that the delays in the ACO schedule are acceptable relative to preparation and submittal of a BWP SW25-CAD Modification application. Specifically, extensions dates will need to be established for Condition 14M. However, we proposed that such extension dates be determined in the future following completion of the proposed PFAS assessment activities planned for the Landfill Site which are the subject of this SW-22 Application.

We remain available to discuss the contents of this application and respond to any questions or comments you may have. Please feel free to contact me via phone (617) 452-6532 or email millera@cdmsmith.com, or Mary Mancini at (617) 452-6635 or mancinimc@cdmsmith.com.

Sincerely,

Andrew B. Miller, P.E.
Associate
CDM Smith Inc.

cc: Doug Coppi, MassDEP-SERO Solid Waste
Chuck Larson, Gregg Tivnan, Town of Nantucket
George Aronson, CommonWealth Resource Management Corporation
Mary Mancini, P.E., CDM Smith

WORK PLAN

PFAS Groundwater and Surface Water Sampling Work Plan – Nantucket Landfill

Nantucket, Massachusetts

Prepared on behalf of:

Town of Nantucket

November 30, 2021

CDM Smith

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Appendices

Acronyms

ACO	Administrative Consent Order
BGS	below ground surface
BOH	Board of Health
CDM Smith	CDM Smith, Inc.
CH_4	methane
CO_2	carbon dioxide
COC	chain of custody
CSA	Comprehensive Site Assessment
DO	dissolved oxygen
EDD	electronic data deliverables
EPA	Environmental Protection Agency
EMP	Environmental Monitoring Plan
ft	feet
HASP	Health and Safety Plan
HDPE	high density polyethylene
H_2S	hydrogen sulfide
ID	identification
IDW	investigative derived waste
ISA	Initial Site Assessment
ITRC	Interstate Technology Regulatory Council
L	liter
LDPE	low density polyethylene
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum Contaminant Level
mL	milliliter
MRF	material recovery facility
MSL	mean sea level

NA	not applicable
Ng/L	nanograms per liter
ORP	oxidation reduction potential
O_2	oxygen
PFAA	perflouroalkyl acid
PFAS	per- and polyfluoroalkyl substances
PFAS6	the sum of PFOS, PFOA, PFDA, PFHpA, PFHxS, and PFNA
PFDA	perfluorodecanoic acid
PFHpA	perfluoroheptanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PPE	personal protection equipment
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
PWS	public water supply
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SECOR	SECOR International Incorporated
TOC	total organic carbon
USGS	United States Geological Survey
VOC	volatile organic contaminant
WON	Waste Options Nantucket, LLC
WWTF	wastewater treatment facility

Section 1
Introduction

This Per- and Poly-fluoroalkyl Substances (PFAS) Groundwater and Surface Water Sampling Work Plan (Work Plan) for the Nantucket Landfill Site (the Site) was prepared by CDM Smith Inc. (CDM Smith) on behalf of the Town of Nantucket (the Town). The main purpose of this Work Plan is to provide an approach for groundwater and surface water sampling of PFAS at the Site. This Work Plan was developed in response to a request by the Massachusetts Department of Environmental Protection (MassDEP) to assess PFAS at the Site due to PFAS detections in the co-compost produced there.

The scope of work described in this Work Plan and the appended Quality Assurance Project Plan (QAPP) (**Appendix A**), is a proposed scope, for review and approval by MassDEP. Upon approval, field work will begin. The Health and Safety Plan (HASP) for this Work Plan is provided for information only and is located in **Appendix B.**

1.1 Purpose and Objectives

The objective of this Work Plan is to assess for the presence of PFAS in groundwater and surface water at the Site. Groundwater and surface water sampling will initially focus on existing MassDEP approved groundwater and surface water monitoring locations at the Site. If exceedances of PFAS are found in on-site groundwater and/or surface water, the need for further assessment will be considered. The applicable criteria and PFAS compounds to which it is applicable are discussed in more detail below.

Additional sampling of other on-site media, such as soil, reclaimed soil stockpiles, co-compost, sediment, and/or stormwater, are not covered in this Work Plan. Assessment of these additional media may be required in the future . If so, an addendum to the Work Plan, for sampling of other media, may be developed and submitted to MassDEP for approval.

Following completion of the groundwater and surface water PFAS assessment, outlined in this Work Plan, a Data Assessment Report will be prepared to summarize the sampling conducted and the analytical results of the field program, as detailed in **Section 2.8**, and provide recommendations for any next steps.

1.2 Site Description and History

The Site is located on Madaket Road on the western side of Nantucket Island. The Site location is shown in **Figure 1-1**.

For the purpose of this Work Plan, the Site consists of the Nantucket Landfill (the Landfill), inclusive of unlined and lined landfill cells; the material recovery facility (MRF) for source-separated recyclable and household waste; citizens drop off area; materials stockpiles; bulky waste materials storage; the co-compost facility; unpaved compost windrows; and residential and commercial recycling and transfer station. The Landfill occupies an area of approximately

15 acres on the 73 acre parcel. The Site is owned by the Town and the Town subcontracts the operation of the Landfill, the MRF, materials management, and the co-compost facility. The current operator of record is Waste Options Nantucket, LLC (WON) under subcontract to the Town. WON also owns and operates the transfer station, on area leased from the Town.

1.2.1 Site History

The Landfill portion of the Site has been operating as the sole disposal facility for the island of Nantucket since the 1940s. The Landfill operated as an open-burning dump until the 1970s. In 1979, the Nantucket Board of Health (BOH) restricted types of waste for disposal and implemented solid waste disposal regulations at the Landfill.

During the 1980s and early 1990s, Landfill inspection reports indicated poor operational practices, including inadequate daily coverage, off-hour dumping, special waste disposal, seagulls, and drainage and leachate issues (CDM 1998). In 1995, MassDEP issued a notice of noncompliance for operational violations at the landfill.

An Initial Site Assessment (ISA) was conducted by Camp Dresser & McKee (CDM Smith, formerly CDM) in 1996. A Comprehensive Site Assessment (CSA) was completed by CDM in 1998.

An Administrative Consent Order (ACO) issued by MassDEP, and signed by the Town, established the date of December 31, 1998, to cease operations in unlined Landfill areas at the Site. A new lined Landfill cell (Phase 2) was constructed adjacent to the existing unlined Landfill cell (Phase 1) along with the co-compost facility in 1998 (shown in **Figure 1-2**). These improvements were made to provide continued solid waste disposal after the unlined Phase 1 Landfill cell operations ended. The development of these improvements as well as the closure process of the unlined Landfill cell was managed by WON. To date there are three lined cells (Phase 2: Cells 2A and 2B (including a 2B expansion), and Phase 3: Cell 3A). There is limited space for permitting and construction of additional lined landfill cells at the Site.

Capping and closure activities for the inactive cells are currently under discussion with MassDEP and are being deferred, pending completion of the PFAS Assessment at the Site.

After landfilling into the Phase 1 unlined Landfill ceased, an innovative “mining” program was established. This included excavation of landfilled waste from the Phase 1 unlined cell, separation of waste and cover soils, and re-introduction of the materials as appropriate into the solid waste management cycle. The separated soil was either used as temporary daily cover or stockpiled on-site. The mining program was in place until June 2019.

CDM Smith has conducted sampling at the Site for landfill gas, groundwater, and surface water, since 1997. Sampling is currently conducted under the Site’s Environmental Monitoring Plan (EMP). All monitoring efforts and reporting are regulated under MassDEP approved EMPs.

1.2.2 Existing Environmental Monitoring Plan

The EMP for the Site was developed by SECOR International Inc. (SECOR) in 1999. The EMP outlined the monitoring program for the Site. The EMP has been modified over time with necessary MassDEP approvals, but presently includes:

- Quarterly landfill gas monitoring. Parameters monitored include methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), hydrogen sulfide (H_2S), and volatile organic compounds (VOCs). Landfill gas monitoring currently occurs at 13 landfill gas monitoring wells (LGW-1 though LGW-13). Six additional wells were previously included in the program (LGW-14 through LGW-18). These locations were added in 2008 and subsequently removed in 2012, as they were located between the lined Phase 2 and unlined Phase 1 Landfill cells. Additionally, three landfill gas probes are also now sampled quarterly at the boundary of the Site where the compost piles are located.

- Semi-annual groundwater (14 wells at 7 locations of shallow/deep couplets) and surface water (3 locations). Parameters monitored are field parameters (temperature, pH, specific conductivity, and dissolved oxygen [DO]), indicator parameters (alkalinity, total dissolved solids, nitrate, cyanide, sulfate, chloride, and chemical oxygen demand), dissolved metals, and VOCs. Refer to **Section 2.1** for on-site monitoring well construction details.

1.3 Environmental Setting

Geographically, the Site is slightly elevated with a peak of at 69.5 feet (ft) above mean sea level (MSL)(elevation from the 2019 landfill survey). The Site slopes down towards the wetland areas to the north, south, and west. Long Pond, a brackish water body, is located immediately west of the Site (**Figure 1-2**).

1.3.1 Geology

Igneous and metamorphic bedrock has been mapped by the United States Geological Survey (USGS) at a depth of approximately 1,500 ft below MSL under Nantucket (Oldale 1985). Surficial geology for the entire island of Nantucket per USGS is outwash deposits, consisting mostly of gravelly sand, with some pebbles to cobble gravel, and sparsely scattered boulders, with silt and clay, with till occurring locally in some areas (Oldale 1985).

1.3.2 Hydrogeology

The Nantucket aquifer is surrounded and underlain by salt water. The fresh groundwater lens floats on top of the underlying saline water.

The Nantucket Water Resources Management Plan, prepared by Horsley Witten Hegemann, Inc. (HWH) in 1990, is an extensive study of groundwater hydrology on the island of Nantucket. HWH (1990) indicated that groundwater flow is to the west in the vicinity of the Site, with discharge to Long Pond. Groundwater elevations measured semi-annually on-site from the 14 monitoring wells (in 7 locations, with shallow and deep couplets in slightly different strata), support a general groundwater flow direction to the west. Groundwater elevations in the most recent monitoring round in March 2021 ranged from 2.25 to 4.83 feet above MSL across the 14 wells.

1.4 PFAS Fate and Transport

PFAS are a group of man-made chemicals used in the manufacturing of a variety of household products, as well as a wide array of industrial applications. Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) are the most studied compounds of the PFAS group, and their fate and transport are the most well-documented to date.

PFAS has been detected in co-compost at the Site. Co-compost was historically produced at the on-site co-compost facility using MSW mixed with approximately 14% biosolids from the wastewater treatment facility (WWTF). Groundwater, surface water, and other media (including soil or stormwater) have not yet been sampled and assessed for PFAS compounds. In the event that PFAS compounds are detected in groundwater or surface water at the Site, general fate and transport of PFAS compounds are discussed below.

1.4.1 Fate of PFAS Compounds

The fluorinated chain of PFAS compounds—the "tail" of the molecule—is both hydrophobic (repels water) and lipophobic (repels oil), whereas the functional "head" groups of PFAS molecules are hydrophilic (attract water). These properties create a unique interaction within the soil/pore-water interface. The exact fate of PFAS compounds depends on the specific compound, as the chemical properties vary widely depending on the carbon chain length and the composition of the functional group. In general, high solubility, low sorption, and low degradation potential leads to an affinity for and general mobility in groundwater (Interstate Technology Regulatory Council [ITRC] 2018). For PFAS compounds with longer chains or in soils with a higher organic carbon content, sorption is generally higher and therefore groundwater mobility generally lower. PFAS compounds are generally significantly less volatile than many other groundwater contaminants. Perflouroalkyl acids (PFAAs) (primarily PFOA and PFOS) are relatively mobile in groundwater but can, under certain circumstances, associate with the organic carbon fraction of soil and/or sediment (ITRC 2018).

PFAAs are distinct because their carbon chain tails are fully fluorinated, meaning every carbon is substituted with a fluorine atom; the carbon-fluorine bond is the strongest bond in nature. PFAAs, such as PFOS and PFOA, are extremely unlikely to degrade or otherwise transform under ambient environmental conditions and are therefore often referred to as terminal PFAS compounds. Some "precursor" polyfluorinated substances, typically large molecules with combinations of both fully fluorinated and partially fluorinated carbon chains, may form PFAAs and other terminal PFAS compounds through biotic or abiotic transformations. Transformation of precursors into PFAAs varies significantly based on the specific precursor compound and site conditions (ITRC 2018). Hydrolysis, photolysis, oxidation, and biotransformation are all processes that may transform precursor compounds into PFAAs and other terminal compounds (ITRC 2018).

1.4.2 Transport of PFAS Compounds

Due to the mobility of PFAS in water, surface water runoff from impervious surfaces or surface soils that have come into contact with PFAS is a pathway for PFAS to enter subsurface soil and groundwater. PFAS may also be directly discharged to either surface or subsurface soil from a source via a leak or discharge.

Once PFAS has entered soil via atmospheric deposition or direct discharge, it will likely leach downward during precipitation or irrigation events (ITRC 2018). Leaching is a potentially significant driver of PFAS transport from surface soils to groundwater and surface water. Leaching potential is a function of both the properties of the media and the properties of the specific PFAS compound. Media properties impacting leaching potential include pH, redox conditions, moisture content, and soil type (ITRC 2018). PFAS chemical properties impacting leaching potential include ionic charge and chain length (ITRC 2018). Although leaching potential is relative, PFAS generally have a stronger affinity to water than soil and continue to move with water until the limit of the saturated zone is reached.

Leaching enables PFAS transport into groundwater, where advection creates a narrow PFAS plume leading downgradient from the source material (ITRC 2018). Other transport processes, such as dispersion or diffusion, are not as relevant to PFAS in groundwater, due to relatively low rates compared to advection. However, diffusion of contaminant mass into lower permeability materials such as clays, bedrock, or concrete may enhance the long-term persistence of PFAS in groundwater (ITRC 2018).

1.5 Regulatory Requirements and Process

1.5.1 MassDEP Minor Modification of a Landfill Permit SW-22

Activities at the Site are currently governed under the Massachusetts Solid Waste Management Regulations (310 CMR 19.000). As such, MassDEP is the primary regulator responsible for reviewing and approving this Work Plan and data assessment reporting for the Site. The Site is not currently a waste or release site (with release tracking number) under the MCP (310 CMR 40.00).

A meeting was held on September 17, 2021, between the Town, CDM Smith, and MassDEP, to meet the pre-application requirement for this Work Plan being prepared by CDM Smith. This Work Plan will be submitted to MassDEP Solid Waste Division for approval as an *SW-22 Minor Modification of a Landfill Permit*. The SW-22 permit application is intended to supplement the existing EMP by adding a one time PFAS sampling event to be conducted in parallel with the existing Site EMP as advised by MassDEP at the September 17th meeting. This Work Plan outlines the procedures and detail for the one time PFAS sampling event. As applicable, MassDEP Solid Waste and/or MassDEP Bureau of Waste Site Cleanup (BWSC) will be engaged through the submittal of sampling results, additional permits or work plans, or for planning for next steps if needed for the investigation. In addition, as discussed during the September 17th meeting there is an accompanying request for an extension to the landfill closure Administrative Consent Order (ACO) which is included in the permit application cover letter.

1.5.2 Massachusetts Solid Waste Management Regulations

Under the Massachusetts Solid Waste Management Regulations, surface water and groundwater results must be submitted to the MassDEP within 60 days of sample collection. If the concentrations of any of the parameters listed in 310 CMR 19.132(2)(h) exceed state or federal drinking water standards, MassDEP Maximum Contaminant Levels (MCLs), or Massachusetts Surface Water Quality Standards (314 CMR 4.00), the MassDEP must be notified within 14 days. Locations with exceedances are to be re-sampled, analyzed, and submitted to MassDEP within

60 days of original sample collection, unless other measures are warranted based on site-specific conditions and approved by MassDEP. An example of an exception might include development of a sampling plan to further characterize concentrations detected.

Under the Solid Waste Management Regulations, groundwater results are compared with current MCL values. In 2020, MassDEP amended the Massachusetts Drinking Water Regulations (310 CMR 22.00) and established a MCL for "PFAS6" substances (the sum of PFOS, PFOA, perfluorodecanoic acid (PFDA), perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS), and perfluorononanoic acid (PFNA)). The applicable criteria for the sum of PFAS6 (which assumes non-detects are zero when summing) was established at 20 nanograms per liter (ng/L). In Massachusetts, the MCL is primarily applicable for a public water supply (PWS), however MassDEP Solid Waste has not developed their criteria, and instead use the MassDEP MCLs.

There are currently no Massachusetts surface water quality standards for PFAS compounds. For pollutants not listed in 310 CMR 4.00, allowable concentrations are per the 2000 EPA National Recommended Water Quality Criteria (310 CMR 4.05(5)(e)), which does not currently list PFAS compounds. During a meeting held with MassDEP on September 17, 2021, MassDEP indicated there is an ongoing effort being conducted by the Office of Research & Standards (ORS) to determine "standards" or "criteria" for surface water.

1.5.3 MCP 310 CMR 40.00

Revisions to the MCP were promulgated on December 27, 2019, which established notification requirements and clean-up standards for PFAS in groundwater and soil. Under the MCP, GW-1 criteria are applicable to groundwater that is currently or could potentially be used as drinking water. The MCP RC GW-1 for the sum of PFAS6 compounds (PFOS, PFOA, PFDA, PFHpA, PFHxS, and PFNA) is 20 ng/L (or parts per trillion [ppt]).

Under the MCP, all aquifers located on Nantucket are classified as Potentially Productive Aquifers (PPA) (310 CMR 40.0006) and are considered a Potential Drinking Water Source Area. In this case, the RC GW-1 will apply to all groundwater samples collected at the Site. Note, there are portions of the Island that are mapped as "Non-Potential Drinking Water Source Areas" per the MassGIS Oliver Online Mapping Tool. In these cases, groundwater may be eligible for a different classification and MassDEP regulatory criteria.

"Adequately Regulated" under the MCP

The adequately regulated provisions (310 CMR 40.0110) of the MCP are intended to reduce overlap and duplication between regulatory authorities. Specifically, response actions at Solid Waste Management Facilities (310 CMR 40.0114) are considered adequately regulated if conducted in compliance with an applicable permit, approval, or order issued pursuant to the MCP. There are exceptions under certain conditions, including any release, threat of release, and/or Imminent Hazard condition, where a site is considered not adequately regulated, and MCP regulation applies.

For adequately regulated landfills, a release to the environment indicated by concentrations in groundwater equal to or greater than the applicable RC will not trigger the 120 day notification

(310 CMR 40.0114(1)(c)). However, any release, threat of release, and/or Imminent Hazard must be reported to MassDEP. Thus, MCP 2 hour and 72 hour reporting conditions apply to groundwater at adequately regulated landfills under certain circumstances. Concentrations in groundwater equal to or greater than RC GW-1 within the following must be reported orally to MassDEP BWSC:

- a private drinking water supply well (2 hour notification)
- a groundwater monitoring well within 500 feet of a private water supply well (72 hour notification)
- a groundwater monitoring well within the Zone I of a public water supply well (72 hour notification)

Additionally, the above releases must also be reported to MassDEP BWSC within 60 days using a BWSC 103 release notification form pursuant to 310 CMR 40.0330.

It is not anticipated that this first sampling program, sampling only existing on-site groundwater and surface water monitoring locations, will trigger one of the above immediate response action conditions (i.e., MCP 2 hour and 72 hour reporting conditions) that require notification to MassDEP BWSC. As a result, CDM Smith assumes that this initial round of sampling will result in a condition considered adequately regulated under Solid Waste, and the regulatory authority will be MassDEP Solid Waste. Upon receipt of sample results, CDM Smith will review the data, review the above conditions requiring notifications to MassDEP BWSC, and confirm if a notification to MassDEP BWSC is or is not required. Any future off-site groundwater sampling, if determined necessary, could have the potential to trigger 2 hour and 72 hour notifications.

N
W
E
S

NANTUCKET LANDFILL

MADAKET ROAD
MAIN STREET
UNION STREET
SPARKS AVENUE
POLPIS ROAD
POLPIS ROAD
SANKATY ROAD
MILESTONE ROAD
MAIN STREET

Landbase Features

- Airport
- Main Runway
- Airport Property
- Seaport
- Ferry Route
- Parcel Boundary
- Building Footprint
- Road Centerline
- Train
- Landfill Operations Boundary
- Landfill Property Boundary

Figure 1-1 Site Locus

Nantucket Landfill

0 3,200 6,400 12,800 Feet

1" = 6,400'

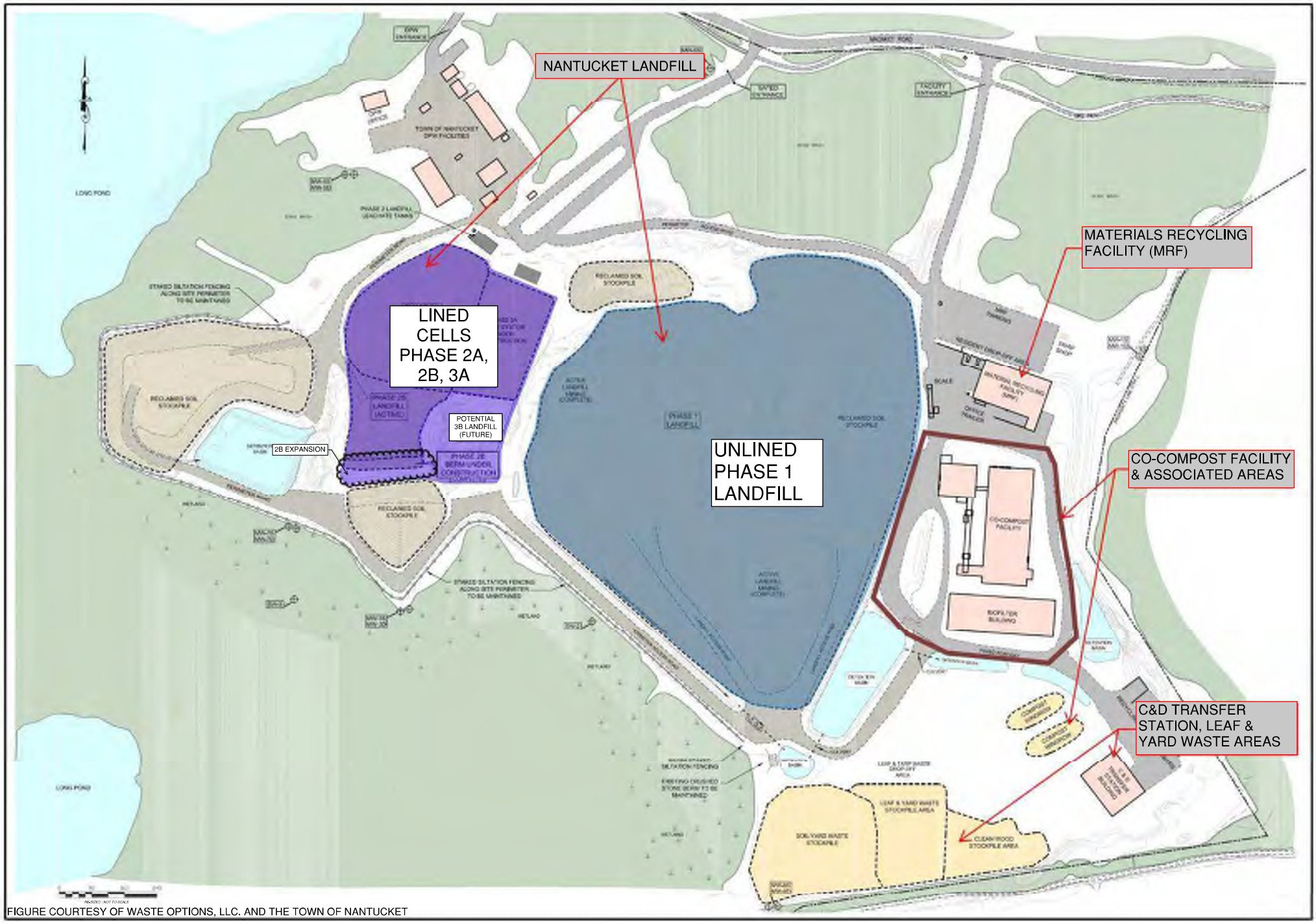


FIGURE COURTESY OF WASTE OPTIONS, LLC. AND THE TOWN OF NANTUCKET

Figure 1-2 Site Plan
Nantucket Landfill

Section 2
Work Plan Scope

This Work Plan will be performed to assess groundwater and surface water for PFAS contamination at the Site. Initially, sampling will be performed on-site and may proceed off-site if PFAS6 exceedances are encountered, to delineate the nature and extent of PFAS contamination.

This Work Plan references procedures detailed in the QAPP, included as Appendix A. The QAPP presents methods that will be used to collect field data and focuses on the analytical methods and quality assurance/quality control (QA/QC) procedures that will be used to analyze project samples. The QAPP will ensure data is of known and acceptable quality.

2.1 Groundwater Monitoring Well Sampling

All groundwater sampling will be conducted via low flow sampling methodology and will comply with the sampling procedures outlined in the QAPP. Appropriate sampling precautions for PFAS sampling will be taken, as detailed in the QAPP. Initially, the 14 existing monitoring wells identified in the EMP will be sampled. The existing EMP monitoring locations are presented in **Figure 2-1**.

Table 2-1 presents the monitoring well details including installation date and screen depth intervals. All on-site wells are screened in the overburden.

Table 2-1 On-Site Landfill Groundwater Monitoring Well Details

Monitoring Well ID	Date Installed	Top of PVC Elevation (feet MSL)	Depth to top of screen (feet BGS)	Screen Length (feet BGS)	Well Depth (feet below top of PVC)
MW-1S	Jan 1997	22.84	15	10	26.54
MW-1D	Jan 1997	23.21	64	10	76.06
MW-3S	Jan 1997	7.39	1	10	12.71
MW-3D	Jan 1997	7.66	59	10	71.81
MW-4S	Jan 2018	13.23	4	10	18.07
MW-4D	Jan 2018	12.81	49	10	61.72
MW-5S	Dec 1999	10.36	3	10	13.64
MW-5D	Jan 2000	9.79	50	10	62.31
MW-6S	Dec 1999	10.54	3	10	14.62
MW-6D	Jan 2000	11.10	50	10	62.47
MW-7S	Jan 2000	7.45	3	10	15.20
MW-7D	Jan 2000	7.59	50	10	60.89
MW-8S	Jan 2000	6.55	3	10	15.33
MW-8D	Jan 2000	7.36	50	10	42.88

Note: BGS – below ground surface, MSL – mean sea level, PVC – Polyvinyl chloride, well depth measured from top of PVC.

Initially, the 14 on-site monitoring wells included in the EMP will be sampled for PFAS analysis per EPA Method 537.1 Version 2.0 Modified. Groundwater level measurements will be collected for each monitoring well. Field parameters (temperature, pH, DO, oxidation reduction potential (ORP), and specific conductance) will also be recorded, using a multi-parameter water quality meter (e.g., YSI), for each sample.

Prior to sampling the existing monitoring wells, any installed tubing will be removed (to prevent potential PFAS cross-contamination). New high-density polyethylene (HDPE) tubing will be installed in each well. Monitoring wells will be purged at least one well volume following the procedure outlined in the QAPP. Monitoring wells will be allowed to stabilize for a minimum of 12 hours before sampling. Water purged from on-site wells will be allowed to infiltrate per the existing EMP for the Site.

Duplicate QA/QC samples will be collected at a rate of one per 10 samples as per the QAPP. Additional QA/QC samples will be collected per the assumptions stated in the QAPP.

Off-site groundwater locations may be identified for sampling if PFAS detections are identified in on-site samples. If additional off-site groundwater monitoring wells need to be installed and developed, refer to **Section 2.1.1** for details. Off-site groundwater samples will be collected as outlined above for each new location, with the exception of purge water management. Groundwater purged at off-site locations will be drummed and handled as investigation-derived waste per **Section 2.4**. New monitoring well locations will be surveyed to determine the coordinates and elevation.

2.1.1 Groundwater Monitoring Well Installation and Development Procedures

Additional off-site groundwater monitoring wells may need to be installed and developed if off-site groundwater sampling is required in the future. Any such installations would require prior approval by MassDEP.

Groundwater monitoring well installation and development procedures shall comply with general and PFAS-specific procedures described in the QAPP.

Groundwater monitoring locations will be discussed with the Town and MassDEP, with site access and any required permits coordinated with the Town. Once locations are identified, CDM Smith will engage licensed drillers to install any required groundwater monitoring wells. CDM Smith will flag proposed drilling locations and the drilling subcontractor will coordinate utility clearance (Digsafe).

Monitoring wells are expected to be 2 inch diameter PVC, with 10 feet PVC well screens. No PFAS containing materials, or procedures that may introduce PFAS into the monitoring wells, will be permitted.

2.2 Surface Water Sampling

Surface water sampling will initially be conducted at the three (3) existing sampling points identified in the EMP (SW-1, SW-2, and SW-3). Locations of each sampling point are shown on **Figure 2-1**. Surface water samples will be collected from approximately three to six inches below

the water interface, if possible, based on water depth. Field conditions at each sampling point will be recorded in field documentation.

Surface water collection procedures shall comply with general and PFAS-specific procedures described in the QAPP. A total of 3 surface water locations (SW-1, SW-2, and SW-3) will be sampled for PFAS analysis via EPA Method 537.1 Version 2.0 Modified. Field parameters (temperature, pH, DO, ORP, and specific conductance) will also be recorded, using a multi-parameter water quality meter (e.g., YSI), for each sample.

Duplicate QA/QC samples for surface water will be collected at a rate of one per 10 samples per the QAPP. Additional QA/QC samples will be collected per the assumptions stated in the QAPP.

Should the need for additional surface water sample locations be recommended in the future, MassDEP will be consulted and necessary approvals obtained prior to proceeding. Methods employed will be as outlined above for each new location. New surface water sample locations will be surveyed via handheld GPS to determine the coordinates and elevation.

2.3 Decontamination Procedures

The decontamination procedures used during sampling shall follow the procedures outlined in the attached QAPP.

Where possible, dedicated equipment (for each sample location) will be used. Equipment rinsate blanks will be collected per the assumptions stated in the QAPP.

2.4 Investigation-Derived Waste

Prior to groundwater sampling at the existing monitoring wells, any installed tubing will be removed (to prevent potential PFAS cross-contamination). Removed tubing from existing monitoring wells will be bagged and disposed of within the lined cell at the Nantucket Landfill. Once tubing is removed, PFAS free tubing will be installed, and monitoring wells will be purged following the procedure outlined in the QAPP.

It is assumed that purge water will be handled in a manner consistent with the current EMP sampling program practices for onsite sampling. This consists of collection of the purge water in a 5-gallon bucket during purging, and then discharge to the pervious ground surface at the point of extraction to allow the water to infiltrate.

If necessary, waste materials (e.g., groundwater, soil cuttings, and/or drill fluids generated during potential well installation) will be collected in new or properly conditioned 55 gallon steel drums. As soon as material is placed in a drum, it will be marked with an appropriate label containing the following information: site, location, date, container number, contents, volume, site contact, and emergency contact information. The drums will be securely sealed.

The investigation-derived waste (IDW) storage area will be identified in consultation with the Town and WON prior to beginning field work.

At the completion of field work, if IDW drums are generated waste characterization samples will be collected and sent to the laboratory for analysis. The analyses needed for waste

characterization will be determined in consultation with a IDW management subcontractor. Following receipt of characterization results, the subcontractor will develop a waste profile.

Following IDW shipment, all records, including waste characterization results, chain of custody, and transportation records will be provided to the Town.

Waste management procedures are further detailed in the Appendix A QAPP.

2.5 Laboratory Analysis and Data Verification/Evaluation

All samples will be analyzed by a MassDEP certified laboratory.

All water samples will be analyzed for PFAS compounds using US EPA Method 537.1 Version 2.0 Modified. The specific list of analytes is provided in Table 3-5 of the QAPP (Appendix A).

The laboratory will apply applicable qualifiers, if required, based on the US EPA Method 537.1 Version 2.0 criteria and associated laboratory standard operating procedures (SOPs).

CDM Smith will perform verification and evaluation of the laboratory reports and any laboratory qualifiers applied to the data. CDM Smith will confirm that the data is usable and of good quality based on the documentation in the laboratory report. If CDM Smith determines that data is not representative or cannot be used, this will be noted in the Data Assessment Report (see **Section 2.8**).

2.6 Field Documentation Procedures

Field notebooks will be used during all on-site work. A dedicated field notebook will be maintained by the field technician overseeing the site activities. In addition to the notebook, any and all original sampling forms and purge forms used during the field activities will be submitted as part of the final Data Assessment Report. Field and sampling procedures, including installation of any monitoring wells, etc., will be photo-documented. Detailed requirements for field documentation are included in the QAPP.

2.7 Sample Identification

Each sample collected will be designated by an alphanumeric code that will identify the type of sampling location, matrix sampled, and the specific numeric sample designation (identifier).

The following terminology shall be used for media samples collected during this investigation:

- Groundwater: MW-ID
- Surface Water: SW-ID

The following terminology shall be used for QA/QC samples collected during this investigation:

- Equipment Blanks: EB-Media-sequential # DATE (e.g., EB-SW-1 1-1-22)
- Field Blanks: FB-sequential # DATE (e.g., FB-1 1-1-22)
- Field Duplicates: MW/SW-sequential # (e.g., MW-9 and SW-4)

QA/QC sample descriptions and collection methods are further presented in the QAPP.

2.8 Data Assessment Report

A Data Assessment Report will be prepared that documents the work conducted; presents the results of the sample analysis, including field notes and laboratory reports; details data evaluation/verification; and provides recommendations for further investigation, if warranted.

A summary of data usability and the evaluation/verification of the laboratory data, performed in accordance with the QAPP, will be included in the Data Assessment Report to provide a thorough evaluation of analytical data.

A data deliverable will be provided for the laboratory analyses and will be submitted with/or as part of the Data Assessment Report submittal.

2.9 Project Schedule

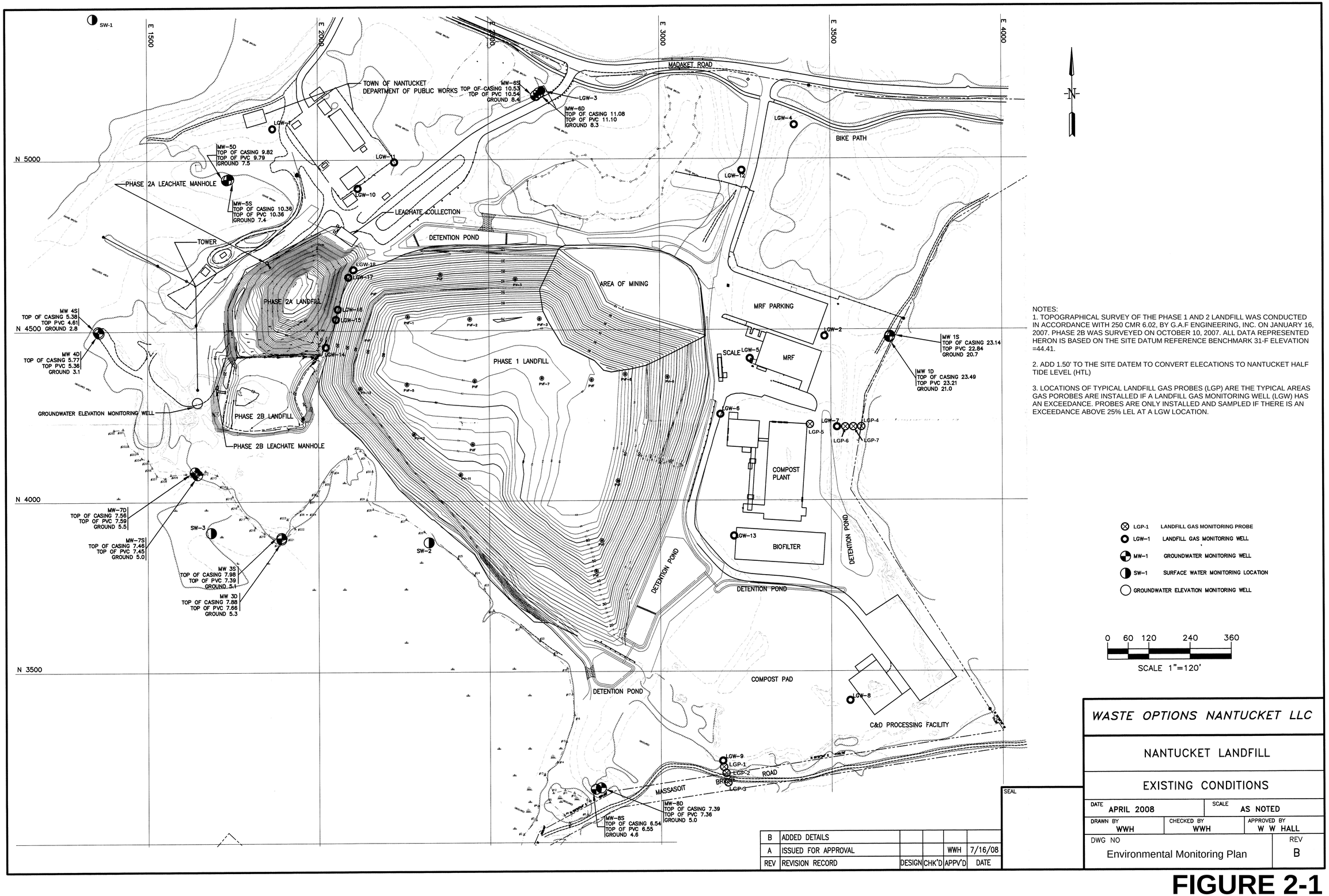
Field activity duration for the Site investigation activities is estimated to be approximately one week for the initial on-site sampling. This assumes no delays are experienced due to inclement weather, site access problems, or for other unforeseen reasons.

The standard laboratory turnaround time is 21 business days.

The schedule below is currently a general estimate and is subject to change throughout the progression of field work and reporting. If PFAS detections are encountered in on-site groundwater and surface water, the need for further sampling, inclusive of potential off-site sampling, will be assessed. . This would require preparation of a Work Plan addendum for MassDEP approval, re-mobilization, and additional event preparation.

Implementation of this Work Plan for the initial sampling event will be commenced following approval by MassDEP. This project will be executed in the following order:

- Work Plan submittal
- Work Plan approval
- Field work mobilization
- Initial on-site characterization commencement
- Data Assessment Report with any recommendations for further sampling, as appropriate. Submittal of this report will be approximately 90 days following receipt of laboratory data.
- Work Plan Addendum development for any additional sampling recommended, to be approved by MassDEP before proceeding.
- Further characterization on-site and off-site as required.



NOTES:
1. TOPOGRAPHICAL SURVEY OF THE PHASE 1 AND 2 LANDFILL WAS CONDUCTED IN ACCORDANCE WITH 250 CMR 6.02, BY G.A.F ENGINEERING, INC. ON JANUARY 16, 2007. PHASE 2B WAS SURVEYED ON OCTOBER 10, 2007. ALL DATA REPRESENTED HERON IS BASED ON THE SITE DATUM REFERENCE BENCHMARK 31-F ELEVATION =44.41.

2. ADD 1.50' TO THE SITE DATEM TO CONVERT ELECATIONS TO NANTUCKET HALF TIDE LEVEL (HTL)

3. LOCATIONS OF TYPICAL LANDFILL GAS PROBES (LGP) ARE THE TYPICAL AREAS GAS POROBES ARE INSTALLED IF A LANDFILL GAS MONITORING WELL (LGW) HAS AN EXCEEDANCE. PROBES ARE ONLY INSTALLED AND SAMPLED IF THERE IS AN EXCEEDANCE ABOVE 25% LEL AT A LGW LOCATION.

REV	REVISION RECORD	DESIGN	CHK'D	APPV'D	DATE
B	ADDED DETAILS			WWH	7/16/08
A	ISSUED FOR APPROVAL				

SEAL

WASTE OPTIONS NANTUCKET LLC

NANTUCKET LANDFILL

EXISTING CONDITIONS

DATE	SCALE	
APRIL 2008	AS NOTED	
DRAWN BY: WWH	CHECKED BY: WWH	APPROVED BY: W W HALL
DWG NO: Environmental Monitoring Plan		REV: B

FIGURE 2-1

Section 3

Quality Assurance Project Plan

A QAPP prepared for the Site is provided in **Appendix A**. The purpose of the QAPP is to provide details of the investigation procedures and to establish QC procedures and QA measures that will be used to provide reliable data.

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Section 4
Health and Safety Plan

A HASP was prepared for the Site, which is provided in **Appendix B**. The HASP describes field procedures intended to be protective of worker health.

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Section 5
References

Camp Dresser & McKee Inc. (CDM) 1998. Comprehensive Site Assessment (CSA), Nantucket Landfill.

Horsley Witten Hegemann (HWH), Inc. 1990. Nantucket Water Resources Management Plan.

Interstate Technology Regulatory Council (ITRC) 2018. Environmental Fate and Transport of Per- and Polyfluoroalykl Substances.

MassDEP 2020. Fact Sheet: Interim Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated under the Massachusetts Contingency Plan. October. Accessed: <https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas>

Oldale 1985. Geologic map of Nantucket and nearby islands, Massachusetts, U.S Geological Survey Publication.

SECOR International Incorporated (SECOR) 1999. Environmental Monitoring Program for the Nantucket Landfill.

J.A. Shoemaker and D.R. Tettenhorst (Office of Research and Development) 2020. Method 537.1 Determination of Selected Per-and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) Revision 2.0. EPA Document #: EPA/600/R-20/006.

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Appendix A

Quality Assurance Project Plan

APPENDIX A

Quality Assurance Project Plan

PFAS Groundwater and Surface Water Sampling Work Plan – Nantucket Landfill

Nantucket, Massachusetts

Prepared on behalf of:

Town of Nantucket

November 30, 2021

CDM Smith

Table of Contents

List of Tables

Attachments

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Acronyms

ASTM	American Society of Testing Materials
BGS	below ground surface
CDM Smith	CDM Smith, Inc.
CFR	Code of Federal Regulations
COC	chain of custody
DO	dissolved oxygen
EPA	Environmental Protection Agency
EMP	Environmental Monitoring Plan
ft	feet
HASP	Health and Safety Plan
HDPE	high density polyethylene
ID	identification
IDW	investigative derived waste
L	liter
LDPE	low density polyethylene
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
NA	not applicable
Ng/L	nanograms per liter
NTU	nephelometric turbidity unit
ORP	oxidation reduction potential
OSHA	Occupational Safety and Health Administration
PFAS	per- and polyfluoroalkyl substances
PID	photoionization detector
PPE	personal protection equipment
PTFE	polytetrafluoroethylene

PTL	project technical leader
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
%R	percent recovery
RL	reporting limit
RPD	relative percent difference
SOP	standard operating procedure
TBD	to be determined
TOC	total organic carbon
UCMR	Unregulated Contaminant Monitoring Rule
U.S. DOT	United States Department of Transportation
WON	Waste Options Nantucket, LLC

Section 1
Introduction

This Quality Assurance Project Plan (QAPP), an appendix to the per- and poly-fluoroalkyl substances (PFAS) Groundwater and Surface Water Assessment Work Plan (the Work Plan) for the Nantucket Landfill Site (the Site), has been prepared by CDM Smith, Inc. (CDM Smith) for the Town of Nantucket (the Town). The QAPP details the PFAS groundwater and surface water sampling investigation procedures, including quality control (QC) procedures, and quality assurance (QA) measures that will be used to provide reliable data for decision making purposes. The QAPP presents field data collection methods, analytical methods, and QA/QC procedures that will be used to analyze project samples. This QAPP was prepared in accordance with CDM Smith's standard operating procedures (SOPs). The QAPP will ensure project data are of known and acceptable quality.

The Work Plan for this investigation is being prepared and submitted at the request of the Massachusetts Department of Environmental Protection (MassDEP).

1.1 Purpose

The purpose of this document is to establish QA measures and QC procedures to be applied to the collection of environmental data; these data will in turn be used to support conclusions as to the nature and extent of environmental contamination and plans for future investigation and/or remedial activities. Every reasonable attempt will be made to obtain a complete set of reliable and usable field measurements and analytical data. If a measurement cannot be obtained or is unusable for any reason, the effect of the missing data will be evaluated and reported with a proposed corrective action, where required.

Sample representativeness will be achieved through:

- Careful, informed selection of sampling locations
- Selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter reporting limits (RLs)
- Proper gathering and handling of samples to avoid interferences and prevent contamination and loss
- Collection of a sufficient number of samples to allow characterization

Consistency in the acquisition, handling, and analysis of samples is necessary for comparison of results to other similar data sets. Data developed under this investigation will be collected and analyzed using MassDEP approved and certified analytical methods and QA/QC procedures.

1.2 Objectives

This QAPP provides information and procedures applicable to the field activities and analytical program detailed in the Work Plan. This information includes definitions and goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, chain of custody, and shipping; instrument calibration and maintenance; auditing; data deliverable and reduction, verification/evaluation of data, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratories subcontracted by CDM Smith.

Overall, the purpose of this sampling program is to assess Site groundwater and surface water for the presence of PFAS. Groundwater and surface water sampling will initially focus on existing MassDEP approved groundwater and surface water monitoring locations at the Site.

The primary data quality objectives (DQOs) will be satisfied by the sampling and analysis program outlined in the PFAS Groundwater and Surface Water Sampling Work Plan. The Work Plan and this QAPP outline the data needs including types of samples, quantity of samples, and QA/QC needs to ensure sufficient quantity, and quality. The type of data needed to meet the project DQOs includes the required chemicals of concern, concentration levels, media to be sampled, analysis type, and appropriate sampling techniques in order to obtain sufficient data to assess whether PFAS impacts are present in Site groundwater and surface water.

Section 2

Project Organization and Responsibility

2.1 Overview

The project management organization for this QAPP provides a clear delineation of functional responsibility and authority. The Town is the primary point of contact with MassDEP. He/she is responsible for development and completion of the investigation, project team organization and supervision of all project tasks. In this role, he/she will communicate directly with the MassDEP.

For the sampling program, a field team consisting of CDM Smith personnel and subcontractors will be assembled and will be responsible for implementing all aspects of the fieldwork. Several key activities will be performed as part of the field and analytical work. These activities include:

- Ensuring that sample collection, sample analysis, laboratory data packages, and data deliverable procedures are performed in accordance with the Work Plan.
- Ensuring that health and safety procedures, as outlined in the Health and Safety Plan (HASP) (Appendix B of the Work Plan), are adhered to.
- Ensuring that field QA/QC procedures are implemented.
- Ensuring that laboratory analysis, data verification/evaluation, and data processing are performed in accordance with MassDEP requirements.

2.2 Assessment Team Responsibility

Field Manager

The Field Manager will be directly responsible for coordinating all on-site field activities outlined in the Work Plan and QAPP. The Field Manager will be in contact with the Field Scientist/Engineer on a frequent basis to ensure that execution of the field activities are in compliance with the Work Plan and QAPP. She/he will also have the responsibility of ensuring that the subcontractors adhere to their subcontracts.

Field Scientist/Engineer

Responsible for executing sampling program in the field, under the direction for the Field Manager, in compliance with the Work Plan and QAPP.

Quality Assurance Officer

The Program Quality Assurance Officer will monitor QC activities of program management and technical staff, as well as identify and report the needs for corrective action to the Field Manager and project manager. He/she will also conduct an internal review of all project deliverables prepared by CDM Smith staff and sign off on the final investigation reports.

Health and Safety Site Supervisor/Coordinator
The Health and Safety Site Supervisor/Coordinator will be responsible for ensuring that the HASP is implemented during field activities and that a copy of the HASP is maintained at the Site at all times. He/she will also be responsible for upgrading or downgrading personnel protection based on actual conditions at the time of the investigation. She/he must also present an overview of the HASP to field personnel prior to initiating any field activities and is responsible for ensuring that field personnel sign off the HASP.

2.3 Subcontractors

The following subcontractor services will be required as part of the Work Plan:

- Analytical laboratory services;
- Investigation derived waste (IDW) hauler; and
- In addition, drilling (monitoring well installation, and well development) may be required if additional monitoring wells need to be installed.

Laboratory analysis will be performed by a MassDEP certified analytical laboratory.

Drilling activities, if required, will be performed by a Massachusetts licensed driller.

IDW hauling and disposal will be performed by a MassDEP approved waste management subcontractor.

The Field Manager and project manager has the responsibility of ensuring that the subcontractors follow the subcontracts and perform the work outlined therein. Subcontractors will be selected based upon qualifications and competitive bids solicited from firms judged to be capable of successfully carrying out the required work, and based on a review of their expertise

2.4 Special Training Needs/Certification

All field personnel will have necessary hazardous operations training and medical certification as described in the HASP. A field planning meeting will be conducted at the start of field activities. No other special training or certification is necessary for this field investigation.

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Section 3
Field Procedures

CDM Smith's point of contact for any field investigation activities is the Town, with additional coordination required with Waste Options Nantucket, LLC (WON) the operator of the Site. Any minor changes in sampling activities that are within the proposed scope of the project will be documented each day in the field logbook and signed by the CDM Smith representative on-site. Major modifications that are inconsistent with the approved Work Plan and/or QAPP are to be submitted and approved by the Town and MassDEP prior to implementation. If any significant changes or varied approach are required, MassDEP will be informed and consulted via phone and e-mail.

3.1 Documentation (Field Logbook)

Information recorded in field logbooks will include at a minimum: field observations, list of personnel on-site, data, calculations, time, weather, description of the data collection activity, methods, approved deviations, field instruments and calibrations, field screening results, and sample identification. Additionally, the logbook may contain descriptions of wastes, geologic material, and site features including sketches, maps, or drawings as appropriate.

Field sheets for specific activities are included in **Attachment A** and are further discussed in **Section 3.1.4.**

3.1.1 Preparation

Site personnel responsible for maintaining logbooks must be familiar with this QAPP, the Work Plan, and other site-specific information. These documents should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation.

Prior to field use, each logbook should be marked with the site name and location listed below. The logbook will then be assigned to an individual responsible for its care and maintenance.

Site Name: Nantucket Landfill

Location: 188 Madaket Rd, Nantucket, MA 02554

Field logbooks will be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The following information will be recorded inside the front cover of the logbook:

- Site Name, number, and location
- Contact details of person and organization to whom the book is assigned, including office address, and phone number(s)

3.1.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantity of materials, calculations, drawings, and related information directly in the logbook. Any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Before an entry has been signed and dated, any changes may be made but care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted.
- Do not remove any pages from the book.
- Record as much information as possible.
- Specific requirements for field logbook entries include:
  - Initial and date each page.
  - Initial and date all changes.
  - Multiple authors must sign out the logbook by inserting the following:
- Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time.
  - Description of activity being conducted, including station (i.e., well, boring, sampling location number) if appropriate.
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data.
  - Level of personnel protection to be used.

Entries into the field logbook require the time (written in military units) of the observation. The time should be recorded at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form. In these cases, the logbook must reference the automatic data record or form.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations, and reason for deviation, from Work Plan or QAPP procedures.
- Problems, downtime, or delays.
- Upgrade or downgrade of personnel protection equipment.
- Visitors to the Site.

3.1.3 Post-Operation

To guard against loss of data due to damage or loss of logbooks, completed pages will be scanned periodically (weekly, at a minimum) and submitted to the Field Manager. Documents that are separate from the logbook will be scanned and submitted regularly to the Field Manager. This includes all automatic data recording media (printouts, logs, disks, or tapes) and activity-specific data collection forms.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook will be submitted to the records file.

3.1.4 Field Sheets

Field sheets for specific activities are included in **Attachment A** and include:

- Lithologic log for drilling operations
- Groundwater monitoring well construction log
- Low-flow groundwater sampling purging data sheet
- Sample screening tracking log
- Drum tracking log

Field sheets are to be referenced in the logbook, scanned daily if possible, and provided to the Field Manager on a weekly basis.

3.2 Sample Collection, Documentation, and Identification

The following procedures describe proper sample collection and documentation to be included in field notebooks. Documentation includes describing data collection activities, logging sample locations, sample identifications (IDs), container labeling, and chain of custody (COC) forms.

3.2.1 Responsibilities

The field task manager or field scientist/engineer is responsible for overseeing field operations such as, monitoring well drilling and development, sample collection of groundwater or surface water, field book logs, sample documentation, COC forms, and labeling of any IDW drums, if required. The field manager and/or field engineer is also responsible for ensuring that all field activities adhere to the HASP. The field manager is responsible for ensuring that samples are sent to the laboratory as soon as practicable. Generally, samples should be received by the laboratory within 48 hours of sampling.

3.2.2 Field Documentation

Detailed and thorough notes of all field events are essential for timely and accurate project completion. For each workday, the field logbook should contain the following:

- Field personnel name, subcontractors name (if any), number of persons in crew, equipment used, calibrations completed, weather, date, time, and location at the start of day (e.g., boring number).
- Sample ID, field readings, depth of sample collection, amount of sample recovery, photoionization detector (PID) readings, odors, and visual descriptions.
- Description of any unusual conditions
- Record of Health and Safety monitoring; time, equipment, and results
- Record of site accidents or incidents
- Record of any visitors
- Any field work delays and the cause of the delay, i.e., subcontractor equipment breakdown
- Materials and equipment used during borehole installation
- Final daily summary of work completed, including a list of samples obtained
- Completion of any required field sheets e.g., sample log, drum log
- Contractor downtime, decontamination time, equipment breakdowns, movement tracking throughout the day, etc.
- Any other data that may be construed as relevant information later.

Field documentation (logbook notes or field sheets) should be scanned weekly and submitted to the Field Manager.

3.2.3 PFAS Sample Collection

Specific details for collecting groundwater and surface water samples are discussed in **Sections 3.9, 3.10** and **3.11**. The PFAS Checklist (**Attachment B**) should be consulted during field work preparation and planning phases to identify approved and non-approved field items for PFAS investigation programs. Field staff must ensure that no PFAS containing materials come into contact with samples or sample collection equipment. Care should also be taken when deciding on other equipment or products that are used during PFAS sampling programs.

3.2.3.1 Water Samples for PFAS Analysis

The following requirements are to be followed when collecting PFAS samples for water analysis:

- Sampler must wear powderless nitrile gloves while filling and sealing the sample bottles.
- Bottles should be filled slowly so that aeration is prevented and the preservation reagent is not flushed from sample. Pour water slowly into the bottle, tipping the bottle and allowing water to run down the side to prevent aeration. Headspace is not required in samples.
- After the sample is collected and bottle capped securely, agitate until the preservative is dissolved.
- Label bottles with sample ID, project, date, time, preservative and required analysis.
- Place sample in a cooler with ice to maintain temperature between 0 and 4 degrees Celsius (°C). Method EPA 537.1 Version 2.0 Modified requires samples to be stored between 0 and 10 °C. The proposed analytical laboratory for this sampling program, Alpha Analytical, advises the more stringent temperature range of 0 to 4 °C. Samples will be maintained at this temperature throughout the sampling and transportation period. A temperature blank (provided by the laboratory) is to be included in each cooler.
- Per method EPA 537.1 Version 2.0 Modified a field reagent blank (or field blank) is also required. This is further discussed in **Section 3.4**.
- COC and shipping procedures are discussed in **Section 3.3** and field logbook procedures in **Section 3.1**.

3.2.3.2 Sample Containers, Preservation, and Holding Times

Table 3-1 summarizes the relevant sampling procedures, including preservation and holding time requirements. Procedures are based on Alpha Analytical of Westborough, Massachusetts. CDM Smith will confirm information in Table 3-1 with the laboratory once selected.

Table 3-1 Sample Containers, Preservation and Holding Times

Analyte/Analyte Group	Analytical and Preparation Method/SOP	Container(s) (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time
PFAS (21 compounds) - See **Table 3-5**	EPA Method 537.1 Version 2.0 Modified[1]	(2) 250 mL polypropylene bottle fitted with a polypropylene screwcap	Cool 0 to 10°C for the first 48 hours after collection. 6°C after receipt at the laboratory. Laboratory to add Trizma (as a solid) to each sample bottle prior to shipment to the field	14 days	28 days after extraction (aqueous)

Note:
1. Modified method is for groundwater and surface water samples
EPA = U.S. Environmental Protection Agency, HDPE = high density polyethylene, L = liter, PFAS = per- and polyfluoroalkyl substance, SOP= Standard Operating Procedure

3.2.4 Sample Identification

Sample identification will follow the procedures outlined in the Work Plan. Each sample collected will be designated by an alphanumeric code that will identify the type of sampling location, matrix sampled, and the specific sample designation (identifier). The following terminology shall be used for the samples collected during this investigation:

Groundwater:	MW-ID
Surface Water:	SW-ID
Field Blanks:	FB-sequential # DATE (e.g., FB-1 1-1-22)
Field Reagent Blanks:	FRB-sequential # DATE (e.g., FRB-1 1-1-22)
Pre-Investigation Equipment Blanks:	PEB-Media-sequential # DATE (e.g., PEB-SW-1 1-1-22)
Equipment Blanks:	EB-Media-sequential # DATE (e.g., EB-SW-1 1-1-22)
Field Duplicates:	MW/SW-sequential # (e.g., MW-9 and SW-4)

3.2.5 Drum Labeling

Drum storage may be required for wastes generated during field investigations, including soil, drilling muds, cuttings, or purge water.

Labeling of drums is essential for tracking waste and/or hazardous materials. CDM Smith field personnel and their subcontractor are responsible for collecting, handling, labeling, and storing of drums. There are cost implications if drums are not properly labeled, including, but not limited to re-sampling costs.

The following drum labeling procedures are to be adhered to:

- Field staff shall secure packing list envelopes to the side of the drum(s) at the completion of a boring.
- Field staff shall print with an indelible marker on information cards all information pertaining to the contents of the drum(s). If more than one drum is collected from the same borehole, each information card shall be numbered sequentially in parenthesis starting with the number one after the boring number. The information shall include:
  - Program Area
  - Boring numbers
  - Date collected
  - Description of contents (i.e., soil cuttings, well water, etc.)
  - Amount of contents (specify in inches)
  - Fullness of drum (not including free liquid, specify in fractional form)
- Field staff shall insert an information card into a packing list envelope. The packing list envelope shall be sealed at this time.
- Field staff shall record in field book all information pertaining to the contents of the drum that was printed on the information card.
- CDM Smith Field Manager, upon receipt of the analytical data for the drums, shall prepare a summary table of the analytical results on a weekly basis, and provide to the designated coordinator.
- Based on the tabulated information, the designated coordinator will determine and prepare the appropriate storage labels required:
  - Hazardous waste label
  - Non-hazardous label
- The designated coordinator will fill out these labels.
- Field staff shall attach these labels to the appropriate drums. If the information cards inside the packing list envelopes are damaged, they shall be reprinted at this time.

3.3 Chain of Custody Procedures

This section describes the procedures used to ensure that sample integrity and COC procedures are maintained throughout the sampling and analysis program. COC procedures provide documentation of sample handling from the time of collection until its disposal by a licensed waste hauler. This documentation is essential in assuring that each sample collected is of known and ascertainable quality.

The COC begins at the time of sample collection. Sample collection is documented in the field notebooks. At the same time, the sampler fills out the label on the sample container with the following information:

- Project Code
- Sample ID code
- Required analyses
- Sampler initials
- Date and time of sample collection
- Preservation details
- Composite or grab
- Sample location

3.3.1 Chain of Custody Forms

COC forms are a paper trail system that follows the samples collected and indicates which laboratory analyses are to be performed on which samples. Each sample should be clearly labeled (using a ball point pen) and listed on the COC. Duplicate and blank samples will be submitted blindly e.g., no indication on the COC that they are duplicate or blank samples.

It is the responsibility of the field manager to coordinate COC forms and supply copies of all COC forms to the Field Manager for data management. COC forms will be provided by the analytical laboratory.

A COC form is filled out with details of all samples collected in the given time period (e.g., each day) or location. The COC 'travels' with the samples. Each time the samples are transferred to another custodian or to the laboratory, the signatures of the people relinquishing the sample and receiving the sample, as well as the time and date, are documented.

3.3.2 Chain of Custody Records

The COC record is a three-part form. The laboratory retains the original form and the person relinquishing the samples keeps a copy of the form at the time of sample submittal. This form is then returned to the Field Manager or person in charge of data coordination.

The COC record will be placed in a Ziplock bag and placed inside of all shipping and transport containers. Sample packaging and shipping is discussed in Section 3.14.

3.4 Field Quality Control Samples

In order to maintain QA/QC in both the field and the laboratory, additional samples such as field duplicates, pre-investigation equipment blanks, equipment rinsate blanks, and field/field reagent blanks will be collected. Each type of QA/QC sample is described below.

3.4.2 Quality Control for Groundwater and Surface Water Sampling

Approximately ten percent of all aqueous samples analyzed per media should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form as a QA/QC sample. All QA/QC samples should be numbered sequentially with other field samples. Matrix spike/matrix spike duplicate (MS/MSD) shall be collected at a frequency of ten percent of all samples per media. The following is a breakdown of types of QA/QC samples that are to be taken.

3.4.2.1 Field Duplicate Samples

Approximately ten percent of all aqueous samples analyzed per media should be field duplicate samples. To ensure laboratory "blind" analysis, duplicate samples will be recorded with the well ID number and the next sequential sample number on sample containers and the COC forms. Duplicate samples are collected from the same sampling device, such as a bailer, and analyzed for the same compounds.

3.4.2.2 Pre-Investigation Equipment Blanks

Pre-investigation equipment blanks should be collected of water to be used for decontamination, new equipment, plastic bags as sample containers, and any other equipment in which the presence of PFAS is uncertain. A pre-investigation equipment blank should be collected prior to using equipment and materials.

3.4.2.3 Equipment Rinsate Blanks

Equipment rinsate blanks are performed to assess adequacy of decontamination process and evaluate potential cross-contamination from equipment. This QA/QC blank sample should be collected at a frequency of either one blank per week per matrix or one blank per 20 samples per matrix, whichever is more frequent. Dedicated equipment and single use material will be used whenever possible to minimize the amount of decontamination required and potential for cross-contamination.

3.4.2.4 Field /Field Reagent Blanks

Field blanks are performed to assess contamination from field conditions. One field blank sample will be collected per week of sampling per matrix. Certified PFAS-free water is poured into designated bottleware in the field. The water should not come into contact with equipment or other field supplies. It should be documented in the field book which sample preceded the field blank and which sample followed the field blank for the equipment used.

3.4.3 QA/QC Sampling Summary

A summary of the proposed QA/QC measures for on-site sampling and the estimated quantities of QA/QC samples, based on the number of samples for each media, and the anticipated sampling duration of 1 week, is presented in **Table 3-2**.

Table 3-2 QA/QC Sampling Summary

Media	Total Number of Samples	Field Duplicates	MS/MSD	Field Blanks	Equipment Blanks	Pre-investigation Equipment Blanks	TOTAL
Surface Water	3	1	1 MS / 1 MSD	1	1	No ratio basis, assume flat number	
Groundwater	14	2	2 MS / 2 MSD	1	1		
Total	17	3	3 MS / 3 MSD	2	2	TBD	30

Note: TBD – to be determined, pre-investigation equipment blanks will include at a minimum sampling gloves and disposable sampling equipment.

If additional sampling is required QA/QC samples will be collected at the same rate as the above on-site sampling program.

3.5 Pre-Mobilization

Prior to initiating fieldwork, the following preparatory activities will be completed:

- Final Work Plan, QAPP and HASP completed and approved.
- Utility clearance and permitting if drilling required. CDM Smith (or the designated drilling subcontractor) is responsible for contacting the appropriate local utility or "dig-safe" service to locate subsurface and aboveground utilities in the vicinity of the site characterization area, as necessary.
- Coordination with the Town and WON regarding access to the Site and groundwater monitoring wells.
- Sample analysis scheduled with the laboratory.
- Appropriate sample containers and preservatives for the various sample parameters will be obtained. Extra containers will be obtained to account for possible breakage.
- Field blank water will be obtained from the laboratory performing the analysis. This water shall be specified as PFAS-free water.
- Necessary field sampling and monitoring equipment will be obtained. Prior to use, the equipment will be checked to confirm that it is in good working condition, properly calibrated, decontaminated, and determined to be PFAS-free.
- Materials necessary for personal protection and decontamination will be obtained.
- Coordinate with subcontractors and all Task Orders completed and signed.

3.6 Decontamination

It is recommended to use PFAS-free disposable equipment rather than re-useable decontaminated equipment. If equipment re-use is required, decontaminate field sampling equipment between uses and collect an equipment blank.

All non-dedicated, non-disposal sampling equipment and tools used to collect samples for chemical analysis will be decontaminated prior to and between each sample interval using a laboratory-certified PFAS-free water rinse prior to reuse. Unless disposable sampling equipment is used, the equipment will be decontaminated by the following procedure:

- Wash with the non-phosphate detergent
- Tap water rinse
- Triple rinse with a laboratory-supplied or a laboratory-confirmed PFAS-free water
- Air dry

Additional cleaning of the drilling equipment with steam may be needed under some circumstances if elevated levels of contamination appear to be present using field monitoring equipment or if there are visibly stained soils. Decontamination fluids are assumed to contain PFAS and, therefore, will be contained in a 55-gallon drum, staged and properly disposed of. If it is determined by the project team and MassDEP that decontamination fluids are PFAS-free, fluids may be discharged to the ground surface unless visible sheen or odor is detected either on the equipment or the fluids, at which point the decontamination water will be contained in a 55-gallon drum, staged, and properly disposed of.

3.7 Groundwater Monitoring Well Installation

Groundwater monitoring wells may be required to be installed off-site if PFAS detections are encountered in on-site monitoring wells. This section provides details on the design and installation of groundwater monitoring wells.

Prior to monitoring well installation, CDM Smith will coordinate with the Town and/or applicable property owners to get approval for proposed well locations, request utility plans, and discuss any permit requirements. CDM Smith will also correspond with the Nantucket Conservation Commission regarding proposed work approvals and the nearby wetlands areas.

Drilling locations will be flagged by CDM Smith. A DigSafe call-in will be done by CDM Smith's subcontractor, prior to drilling.

The drilling method to be used may vary depending on site conditions. Typical drilling methods include air rotary or hammer, mud/fluid rotary, rotosonic, and hollow-stem auger. The outer casing should be set and secured by grouting. The inner well borehole can then be drilled through the center of the outside casing. The monitoring wells should be drilled vertical, and to a depth specified in the site-specific plans and may vary based on actual lithologic conditions. The depth to completion should be approved by the Field Manager before monitoring well construction.

Drillers must prevent grease, oil, and other fluids from the drill rig from coming in contact with the ground around the area of well installation.

Monitoring wells are expected to be 2 inch diameter PVC, with 10 feet PVC well screens. Well screens should be flush threaded per American Society for Testing and Materials (ASTM) standards. Glue or solvent-welded joints may not be used, as these may alter the chemistry of water samples. No PFAS containing materials, or procedures that may introduce PFAS into the monitoring wells will be permitted. Fluoropolymer materials (e.g., Teflon ® should never be used for wells where PFAS will be an analyte. Refer to the PFAS Checklist (**Attachment B**) for approved and non-approved field items for PFAS investigation programs.

Deviations from the methods prescribed in these plans will be approved by the Field Manager and project manager.

CDM Smith's geologist will direct the drilling subcontractor, observe soil and groundwater conditions, determine the depths of the screens and monitoring wells, and screen the borings using field instruments, including a PID, ensure excess drill cuttings are drummed for disposal by a waste disposal subcontractor, and keep detailed field notes per **Sections 3.1** and **3.2.2**.

CDM Smith and/or the drilling subcontractor will develop new monitoring wells using a submersible pump. Development water will be drummed and disposed of appropriately by a subcontracted waste disposal firm.

Daily logs will be provided to the Field Manager. Field notes will be scanned and provided to the Field Manager on a weekly basis. Completed groundwater monitoring well construction forms will be provided to the Field Manager following completion of the monitoring well installation program.

New monitoring well locations and elevations will be surveyed by CDM Smith's surveying subcontractor.

3.8 Geological Boring Logs/Geoprobe

Geological logging includes keeping a detailed record of drilling (or excavating) and a geological description of materials on a prepared form.

Geological logs are used for all types of drilling and exploratory excavations and include descriptions of both soil and rock. Accurate and consistent descriptions are imperative.

3.8.1 Log Form

When drilling in soils or unconsolidated deposits, the log should be kept on a standard Geological Boring Log Form (**Attachment A**). The following basic information should be entered on the heading of each log sheet:

- Project name and number
- Boring or well number
- Locations (approximate in relation to an identifiable landmark; will be surveyed)

- Elevations (approximate at the time; will be surveyed)
- Name of the drilling contractor
- Drilling method and equipment
- Water level
- Start and finish (times and date)

The following technical information is recorded on the logs:

- Depth of sample below surface
- Sample interval
- Sample type and number
- Length of sample recovered
- Standard penetration test (American Society of Testing Materials (ASTM-D1586)) results, if applicable
- Soil description and classification
- Graphic soil symbols
- PID readings

In addition to the items listed above, all pertinent observations about drilling rate, equipment operation, or unusual conditions should be noted. Such information might include the following:

- Size of casing used and method of installation
- Rig reactions such as chatter, rod drops, and bouncing
- Drilling rate changes
- Material changes
- Zones of caving or heaving

3.8.2 Soil Classification

The soil description should be concise and should stress major constituents and characteristics. Soil descriptions should be given in a consistent order and format. The following order is as given in ASTM D2488:

- Soil name. The basic name of the predominant constituent and a single-word modifier indicating the major subordinate constituent.

- Gradation or plasticity. For granular soil (sand or gravel) that should be described as well graded, poorly graded, uniform, or gap graded, depending on the gradation of the minus 3 inch fraction. Cohesive soil (silts or clays) should be described as non-plastic, slightly plastic, moderately plastic, or highly plastic, depending on the results of the manual evaluation for plasticity as described in ASTM D2488.
- Particle size distribution. An estimate of the percentage and grainsize range of each of the soil's subordinate constituents with emphasis on clay particle constituents. This description may also include a description of angularity. This parameter is critical for assessing hydrogeology of the site and should be carefully and fully documented.
- Color. The color of the soil using Munsell notation.
- Moisture content. The amount of soil moisture, described as dry, moist, or wet.
- Relative density or consistency. An estimate of density of a granular soil or consistency of a cohesive soil, usually based on standard penetration test results (see **Table 3-3** and **3-4**).
- Local geologic name. Any specific local name or a generic name (i.e., alluvium, loess). Also use of Unified Soil Classification System of symbols.

The soil logs should also include a complete description of any tests run in the borehole; placement and construction details of piezometers, wells, and other monitoring equipment; abandonment records; geophysical logging techniques used; and notes on readings obtained by air monitoring instruments.

- Additional data in sedimentary rocks includes:
  - Sorting
  - Cementation
  - Density or compaction
  - Rounding

The core should be logged as quickly as possible after removal from the hole. Some materials may degrade rapidly upon exposure.

Check each core end carefully and try to determine if the fracture is natural or mechanical in origin. Mechanical fractures often can be identified by their orientation, the absence of secondary coatings or filling and slicken sides, and its fit with the adjacent core piece. If doubt exists, consider it a natural fracture. If it is determined that the fracture is mechanical, ignore it and consider the two pieces of core as a single piece.

Table 3-3 Relative Density of Non-Cohesive Soil

Blows/Ft	Relative Density	Field Test
0-4	Very Loose	Easily penetrated with ½ inch steel rod pushed by hand
5-10	Loose	Easily penetrated with ½ inch steel rod pushed by hand
11-30	Medium	Easily penetrated with ½ inch steel driven with a 5 lb hammer
31-50	Dense	Penetrated one foot with a ½ inch steel road driven with 5 lb hammer
>50	Very Dense	Penetrated only a few inches with a ½ inch steel rod driven with a 5 lb hammer

Note Blows/Ft= Blows per foot, lb = pound

Table 3-4 Relative Consistency of Cohesive Soil

Blows/Ft	Consistency	Pocket Penetrometer (TSF)	Torvance (TSF)	Field Test
<2	Very Soft	<0.25	<0.12	Easily penetrated several inches by fist
2-4	Soft	0.25-0.8	0.12-0.25	Easily penetrated several inches by thumb
5-8	Firm	0.50-1.0	0.25-0.5	Can be penetrated several inches by thumb with moderate effort
9-15	Stiff	1.0-2.0	0.5-1.0	Readily indented by thumb but penetrated only with great effort
16-30	Very Stiff	2.0-4.0	1.0-2.0	Readily indented by thumbnail
>30	Hard	>4.0	>2.0	Indented with difficulty by thumbnail

TSF= Tons per square foot

3.9 Preparation of Existing Monitoring Wells for PFAS Sampling

Prior to sampling the existing on-site monitoring wells, any installed tubing will need to be removed (to prevent potential PFAS cross-contamination). New high-density polyethylene (HDPE) or other suitable PFAS-free tubing will be installed in each well. Refer to the PFAS Checklist (**Attachment B**) for approved and non-approved tubing materials. Care should be taken to use unopened rolls of HDPE tubing and ensure contact with other surfaces is avoided. Field staff must wear powderless nitrile gloves while installing new HDPE tubing.

Once new tubing is installed monitoring wells will be purged at least one well volume following the procedure outlined below in **Section 3.10**. Monitoring wells will be allowed to stabilize for a minimum of 12 hours before sampling. Water purged from on-site wells will be allowed to infiltrate per the existing Environmental Monitoring Plan (EMP) for the site.

3.10 Low Flow Groundwater Sampling

Low-flow purge and sampling is appropriate at locations where disturbance of the media around the well screen needs to be minimized. A common concern is potential turbidity in the monitoring wells and the consequent undesirable effects on metals sampling results.

The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (oxidation reduction potential (ORP), pH, temperature, specific conductivity, and dissolved oxygen (DO)), and a sample more representative of conditions in the formation is collected.

The low flow purge and sample method consists of using a submersible or peristaltic pump to purge the well at a very low flow rate (0.5 to 1.5 liters/minute). Refer to **Section 3.12** for additional groundwater and surface water PFAS sampling requirements, including the list of acceptable materials for sampling. Bladder pumps are made up of PFAS-containing materials such as Teflon and cannot be used for PFAS sampling.

Tubing should be made of HDPE instead of Teflon or Teflon-lined material, and new tubing will be used for each well. The pump intake is set approximately in the middle of the well screen, with a stagnant water column over the top of the pump. The well is purged at the low rate until the field parameters have stabilized. The sample is then collected directly from the pump discharge at a low flow rate.

- Check and record the condition of the well for any damage or evidence of tampering.
- Remove the well cap.
- Measure well headspace with a PID and record the reading in the field logbook.
- Measure and record the depth to water with an electronic water level device and record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or drilling logs. Calculate volume of the water column by depth of water column times the cross-sectional area of the well.
- Lower pump to desired sampling depth. Set at a very low flow rate (0.5 to 1.5 liters/minute). During low flow purging, use a YSI flow through cell to monitor field parameters (ORP, temperature, pH, turbidity, specific conductance, and DO). Continue monitoring until the water level stabilizes and field parameters have stabilized to within 10 percent (plus or minus 5%) over a minimum of three readings. Turbidity and DO are typically the last parameters to stabilize. Note: once turbidity readings get below 10 nepholometric turbidity units (NTUs), then the stabilization range can be amended to 20 percent (plus or minus 10 percent) over a minimum of three readings.
- Record water quality readings during low-flow purging on the log sheet provided in **Attachment A**.

- Once the water level and field parameters have stabilized, collect the samples from the pump. Collect samples per **Section 3.2.3**.
- Decontaminate equipment in accordance with **Section 3.6**.

Volumes of groundwater purged during low flow sampling are usually very low. Groundwater purged from on-site wells will be allowed to infiltrate per the existing EMP for the site. Groundwater purged at off-site locations will be drummed and handled as investigation derived waste per **Section 3.15**.

3.11 Groundwater Sampling by Bailer

Groundwater may also be sampled by bailer after purging. Refer to **Section 3.13** for additional groundwater and surface water PFAS sampling requirements.

- Don personal protective clothing as specified in the HASP.
- Prepare the area for sample acquisition. If required, cover ground surface around well head with plastic sheeting.
- Open well head and immediately check for organic vapors with PID or flame ionization detector as appropriate.
- Determine static water level and calculate water volume in well.
- Purge well in accordance with **Section 3.9**.
- Allow water level to recover to a depth at least sufficient for complete submergence of the bailer without contacting well bottom. Ideally, water level should recharge to 75 percent of static level. Samples shall be collected within 3 hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging.
- Securely attach the bailer to the line and test the knot. The opposite end of the line should be secured to prevent loss of bailer into well.
- Lower bailer slowly into the water to prevent aeration.
- Retrieve filled bailer and fill sample bottles in accordance with **Section 3.2.3**.
- Collect required field parameters and depth to water.
- Decontaminate non-disposable sampling equipment in accordance with **Section 3.6**.
- Secure well, clean up area.

3.12 Surface Water Sampling

Surface water sampling guidance is presented below. Refer to **Section 3.13** for additional groundwater and surface water PFAS sampling requirements. The following steps should be taken when preparing for sampling surface water:

- Don the appropriate personal protective clothing as dictated by the HASP.
- Locate sampling point locations as directed in Work Plan.
- Prepare sampling site by laying out clean plastic sheeting on the ground or any flat, level surfaces near the sampling area and place equipment to be used on the plastic.
- Take field measurements of DO, ORP, pH, temperature, and conductivity
- If surface water samples are to be collected in the same day, collect from downstream to upstream locations.
- The sampler should be facing upstream when sampling.
- Document the sampling events, recording all information in the designated field logbook and take photographs if required or if possible. Document any and all deviations from this QAPP and include rationale for changes.

3.12.1 Collecting Shallow Surface Water Samples

The following steps must be taken when collecting shallow surface water samples:

- Approach the sample location from downstream; do not enter the sample area. Slowly submerge bottles completely into an area of gently flowing water and fill. Do not disturb bottom sediments. The sampler and open end of the bottles should be pointed upstream. If wading is necessary, approach the sample location from downstream; do not enter the actual sample area.
- Collect samples per **Section 3.2**; if preserved bottles are used, collect sample in a dedicated non-preserved bottle and transfer to the preserved bottle.

3.13 Groundwater and Surface Water PFAS Sampling

In addition to the groundwater and surface water sampling protocols described above, all aqueous sampling will comply with the following protocol. Additional information regarding PFAS sampling protocol can be found in **Attachment B**. Samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537.1 Version 2.0 Modified. Any changes will be submitted as an amendment for approval by MassDEP.

The list of PFAS compounds are shown on **Table 3-5**. The EPA Method 537.1 Version 2.0 Modified provides PFAS results with reporting limits of approximately 2 nanograms per liter (ng/L). However, reporting limits vary based on the specific laboratory. Reporting limits for this QAPP will be confirmed with the laboratory and updated if necessary once CDM Smith has officially subcontracted a laboratory.

Table 3-5 Full PFAS Target Analyte List

Class	PFAS Name	Abbreviation	Cas No.
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Footnote: Bold entries depict the six original Third Unregulated Contaminant Monitoring Rule (UCMR 3) chemicals

At this time, acceptable materials for sampling include: stainless steel, HDPE, and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. Note that Grundfos pumps and bladder pumps are known to contain PFAS materials (e.g., Teflon™ washers for Grundfos pumps and low density polyethylene [LDPE] bladders for bladder pumps). Selection of sampling devices must be carefully researched. All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or PTFE or Teflon™ materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with polyfluorinated materials.

Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with polyfluorinated materials must be avoided. All clothing worn by sampling personnel must have been laundered multiple times and dried without using dryer sheets of any type.

The sampler must wear powderless nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory. The following sampling procedures will be followed:

1. Fill two laboratory provided 250 milliliter (mL) polypropylene bottles with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained between 0 and 10 º C per Method EPA 537.1 Version 2.0.

Refer to **Section 3.2.3** for full PFAS sample collection guidelines, including sample containers, preservation, and holding times.

3.13.1 Prohibited Materials and Equipment

- Teflon®-containing materials, when possible, should be avoided (e.g., tubing, bailers, tape, and plumbing paste). In cases where Teflon®-containing materials are unavoidable, ensure adequate purging is performed prior to sampling (e.g., in-well pumps) and/or rinse blanks are collected prior to sampling.
- LDPE containing materials (e.g., bags or containers used to transport samples)
- Paper products such as waterproof field books, plastic clipboards, binders, spiral hard cover notebooks, sticky notes, or glue materials
- Markers
- Chemical (blue) ice packs
- Decontamination soaps containing fluoro-surfactants such as Decon 90
- Water that is not verified to be "PFAS-free" to be used for trip and decontamination blanks and decontamination processes
- Water resistant, waterproof, stain-treated clothing or shoes including Gore-Tex™ and Tyvek® materials

3.13.2 Recommended Materials and Equipment

- HDPE and silicon
- Materials include: tubing, bailers, tape, plumbing paste, verified PFAS-free nylon or cotton twine
- Acetate liners for direct push technologies
- Powderless nitrile gloves – change often
- Loose paper with Masonite or aluminum clipboards

- Ball Point Pens
- Bags of ice
- Alconox® or Liquinox®
- Laboratory supplied and verified "PFAS-free" water to be used for trip and decontamination blanks and decontamination processes
- Cotton construction is recommended for field clothing and should be laundered a minimum of 6 times from time of purchase due to possible PFAS related treatments. Fabric softener and dryer sheets must be avoided. Rain gear, if necessary, should be made from polyurethane and wax-coated materials.

3.14 Sample Handling, Packaging, and Shipping

The shipping containers (coolers or shuttles) will be provided by the laboratory providing the analysis. These containers, once filled, will be secured with fiber tape, wrapped entirely around the container and will either be shipped or delivered directly to the laboratory by the field crew or picked up by a laboratory provided courier. Consequently, the strict packaging, labeling and shipping of hazardous wastes and substances requirements set forth by the United States Department of Transportation (U.S. DOT) under Code of Federal Regulations (CFR) 49 will not be necessary. However, the following sample packaging procedures will be followed to guard against sample breakage and to maintain COC. All plastic materials should be polyethylene.

- Check to ensure that the sample is properly filled; tighten cap securely.
- Enclose and seal sample containers in a clear plastic bag (polyethylene).
- Place freezer packages or ice in two large Ziplock plastic bags and place the bags in a sample cooler so that ice is not in direct contact with sample bottles. Sufficient ice will be added to cool the samples to between 0-10°C per EPA method 537.1 Version 2.0.
- Ensure temperature blank (provided by the laboratory) is included in each cooler.
- Use appropriate packing material such as bubble wrap to protect sample bottles from breaking during shipping.
- Complete COC records and other shipping/sample documentation including air bill numbers for each shipment of samples using a ballpoint pen. Seal documentation in a waterproof plastic bag and tape the bag inside the shipping container under the container lid. Include a return address for the cooler.
- Close the container and seal it with fiber tape and custody seals in such a manner that the custody seals would be broken if the cooler were opened.

3.15 Investigative Derived Waste

Existing tubing installed in existing groundwater monitoring wells will be removed (to prevent potential PFAS cross-contamination). Removed tubing will be bagged and disposed of within the

lined cell at the Nantucket Landfill. Once tubing is removed, PFAS free tubing will be installed, and monitoring wells will be purged following the procedure outlined in the **Section 3.10**.

It is assumed that purge water generated on-site will be handled in a manner consistent with the current EMP sampling program practices. This consists of collection of the purge water in a 5-gallon bucket during purging, and then discharge to the pervious ground surface at the point of extraction to allow the water to infiltrate.

Potential scenarios that may result in IDW being generated from the existing wells are if field staff observe any unusual observations of visual or olfactory signs of contamination (i.e., sheen or odor etc.). Additionally, if on-site sampling discovers elevated PFAS concentrations, future on-site sampling of existing wells may require purge water to be drummed (depending on the PFAS concentration).

It is assumed that purge water and other potential IDW generated off-site will require drumming. All IDW such as drill cuttings and purge water generated during investigation activities, shall be handled appropriately in accordance with MassDEP regulations. Transport, storage, and disposal of IDW are generally subject to one or more solid or hazardous waste regulations (MassDEP). A drum tracking form is provided in **Attachment A**, to maintain a record of drums stored on-site and their contents.

Investigation derived water/fluid resulting from well development, must be collected, handled, and discharged/disposed of pursuant to applicable guidance and regulations. It shall be properly labeled and stored on-site. Additional detail on IDW handling and disposal procedures for the site characterization will be provided by CDM Smith if required, once subcontracting of an IDW hauler is completed.

3.15.1 Waste Sampling

Waste classification sampling will occur before the completion of site investigation activities. Representative soil samples will be collected from waste containers. Grab samples will be collected from each container containing aqueous wastes.

The requirements for waste characterization will be determined by the disposal facility. The containers of waste will be stored in a secure designated area until the analytical results are received and the waste can be characterized for disposal.

3.15.2 Waste Sampling Procedure

3.15.2.1 Soil Waste

- Scan the sample with the PID and record readings.
- Collect a sample of the soil from the container using a decontaminated stainless steel or disposable trowel and place the sample in a stainless steel bowl. Homogenize the soil using the trowel. Several samples will be collected and homogenized in the steel bowl to represent each drum.

- Fill the sample container as completely as possible with a stainless steel trowel by transferring the sample to the container immediately after collection. Screen the sample with the PID.
- Close the sample container tightly.
- Label the container and place it in a cooler with bagged ice sufficient to cool the samples to 4°C.
- Maintain COC forms for samples.
- Log the description of IDW sampled in the field book, i.e., number of drums and locations from which IDW originated.

3.15.2.2 Aqueous Waste

- Fill a sample container(s) as completely as possible by transferring liquid sample from the waste container to the sample container and screening the sample with a PID.
- Close the sample container(s) tightly.
- Place sample container(s) in cooler with bagged ice sufficient to cool the samples to 4°C.
- Maintain COC forms and log the description of IDW sampled in the field book.

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Section 4

Field Instrument/Equipment Calibration and Frequency

Each piece of field equipment used for measuring, monitoring, or analytical purposes will be calibrated and maintained periodically to assure accuracy within specified limits. Calibration and maintenance procedures, and frequency for most field equipment will follow both manufacturer's recommendations and those stipulated in the reference analytical methods used.

Instrument	Reference Method
Multi-RAE PID or similar	Manufacturer's Recommendations
Hach Turbidity Meter	Manufacturer's Recommendations
YSI 600 XL Water Quality Meter or similar	Manufacturer's Recommendations

Field staff will be responsible for calibrating equipment prior to starting work on-site by following the calibration procedures outlined in the equipment manual included with the equipment. Proper calibration tools, including specific gases, will be included with the rental equipment request. Equipment will be calibrated daily prior to the start of work, and calibration data will be recorded.

PIDs come with field calibration kits when requested. A field calibration kit will be used if the instrument is to be kept at the Site for an extended period, or if the instrument endures prolonged environmental extremes. In either case, a calibration check standard will be introduced in the instrument to verify its accuracy. If an instrument will not calibrate or shows improper field operation, it will be sent back to the rental company, and another instrument will be obtained.

Field personnel will generally not perform equipment maintenance in the field. Backup equipment or rental replacement will be utilized in case of instrument failure. A Field Equipment Status Report sheet, as well as calibration worksheets, will be maintained for each measuring, monitoring, and analytical piece of field equipment. Sheets will contain the following information:

- Date of calibration and/or maintenance
- All data pertaining to the calibration and/or maintenance procedure (not contained in specific equipment worksheets)
- Due date of next calibration and/or maintenance
- Initials of person performing the calibration and/or maintenance

- Adjustments made and the accuracy of the equipment prior to and following calibration (where applicable)
- Record of equipment failure or inability to meet specifications (where applicable)

If the calibration schedule is not adequately maintained or the calibration specifications cannot be attained, that instrument will be labeled "HOLD" and will be unavailable for use until the specifications are attained.

Additional equipment required for site activities include:

- Field Logbook
- 100 foot measuring tape
- Polyethylene sheeting
- Camera and film
- Zip-top freezer bags
- Water level meter
- Pressure transducer and data recorder

Section 5
Analytical Laboratory Requirements

5.1 Introduction

Laboratory analysis must be conducted by a laboratory that is certified by MassDEP for the category of parameters analyzed. PFAS samples shall be analyzed using the analytical method U.S. Environmental Protection Agency (EPA) Method 537.1.

The term "data quality" refers to the level of uncertainty associated with a particular data set. The data quality associated with environmental measurement data is a function of the sampling plan rationale and procedures used to collect the samples as well as the analytical methods and instrumentation used in making the measurements. Each component has its own potential sources of error and biases that can affect the overall measurement process.

Sources of error that can be traced to the sampling component of environmental data collection are:

- Poor sampling plan design,
- Inconsistent use of standard operating procedures,
- Sample handling and transportation.

The most common sources of error that can be traced to the analytical component of the total measurement system are calibration and contamination problems. It is recognized that, by far, the largest component of the total uncertainty associated with environmental data collection originates from the sampling process. All sampling programs initiated in support of this project will stress forward planning and be well conceived and reviewed prior to the collection of any samples as a way to minimize this major source of potential error.

Uncertainty cannot be eliminated from environmental measurement data. The amount of uncertainty that can be tolerated depends on the objective of the sampling program and the intended use of the data collected. The purpose of the project's quality assurance program is to assure that the quality of all data collected be of known and ascertainable value.

5.2 Data Quality Criteria

Data quality can be assessed in terms of its precision, accuracy, representativeness, completeness, comparability and sensitivity.

5.2.1 Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. The overall precision of a sampling event is a mixture of sampling and analytical factors. The precision of data collected in support of this project will be assessed on two different levels:

- By calculating the relative percent difference (RPD) of laboratory matrix spike duplicates and/or laboratory replicate samples (a measure of analytical precision).
- By calculating the RPD of field duplicate samples submitted to laboratory "blind" (a measure of the precision of the entire measurement system, including sampling).

Relative percent difference will be calculated according to the following equation:

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100$$

Where: A = Sample Result
B = Replicate Sample Result

All RPD acceptance criteria will follow the method requirements.

5.2.2 Accuracy

Accuracy is a measurement of the amount of bias that exists in a measurement system. This can be thought of as the degree to which the reported value agrees with the supposed "true value". The accuracy of data collected in support of this project will be assessed in the following ways:

- By calculating the percent recovery (%R) of laboratory matrix spikes and/or laboratory control standards (e.g., laboratory fortified blanks, internal standards, surrogates, etc.).
- By documenting the level of contamination that exists (if any) in laboratory method blanks.
- By documenting the level of contamination that exists (if any) in field blanks submitted to the laboratory "blind" for analysis.
- Percent recovery will be calculated according to the following equation:

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

Where: SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Concentration

All %R acceptance criteria will follow the method requirements.

5.2.3 Representativeness

Unlike the previous two criteria which can be expressed in quantitative terms, representativeness is a qualitative parameter. However, in terms of overall data quality, representativeness may be the most important parameter of all.

The representativeness criterion is concerned with the degree to which a sample reflects (represents) a characteristic of a population, parameter variations at a specific location, or an environmental condition. Sample representativeness will be addressed in support of this project

through the proper use of the appropriate sampling procedures, depending on sample matrix and the parameters to be analyzed.

Composite samples will be collected in situations conducive to compositing techniques (particularly samples collected along the vertical extent of a borehole). The use of composite samples tends to maximize the representativeness of a sampling round because more information is provided about a much broader area than a single grab sample. This is especially true in situations where the objective of sampling is to determine where gross contamination exists on-site and the location of any "hot spots". In these cases, broad coverage of the area to be sampled is more important than obtaining the lowest possible detection limits.

5.2.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the precision, accuracy, representativeness, comparability and sensitivity parameters. The data that is verified/evaluated as correct, or are qualified as estimated or non-detect by the laboratory are considered usable. If there are significant QA/QC issues identified during the verification/evaluation process some data may not be considered usable. A completeness goal of 90% is projected. If this goal is not met, the effect of not meeting this goal will be discussed by the CDM Smith project manager and the Town. MassDEP will be informed accordingly. Completeness is calculated using the following equations:

% Completeness = V/n x 100

Where: V = number of measurements judged valid

n = total number of measurements made

% Completeness = C/P x 100

Where: C = number of samples collected

P = total number of measurements planned

$$Percent\ Completeness = \frac{DO}{DP} \times 100$$

Where: DO = Data obtained and usable
DP = Data planned to be obtained

There also may be incomplete data while still meeting the 90% goal if a critical sample location cannot be sampled.

5.2.5 Comparability

The comparability criterion is a quality characteristic which is an expression of the confidence with which one data set can be compared with another. Comparability issues are of importance at two different levels of a sampling program. The primary comparability issues are concerned with whether the field sampling techniques, analytical procedures, and concentration units of one data set can be compared with another.

The comparability criterion also applies to the environmental conditions/considerations present at the time of the sampling. Temporal and/or seasonal variations may make data collected from the same location at different times of the year incomparable, or comparable in a relative sense only.

Comparability is judged by comparing results to similar data sets. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results.

5.2.6 Sensitivity

Whenever environmental measurement data is to be used in comparison with predetermined "action levels" or other regulatory requirements, the reported method detection limits of the analytical data are of prime importance. Analytical methods specified in support of this project should have a reported detection limit at least 50% below the required action level to assure that measurements made in the vicinity of the action level are of high quality. In circumstances concerning extremely low action levels or regulatory requirements where analytical techniques will have to be pushed to their limits, every effort will be made to select the most appropriate analytical procedures. It is recognized that analytical detection limits are sample specific and are affected by sample volumes as well as the need for sample concentration or dilution. These circumstances will be accounted for in the review and interpretation of the analytical results.

5.3 Quality Control

Two separate levels of quality control (QC) exist for all samples collected in support of this project, internal laboratory QC and program generated QC.

5.3.1 Internal Laboratory Quality Control

Internal laboratory QC is a function of the individual laboratory's QA/QC plan. A laboratory's QA/QC plan contains specific criteria governing the manner in which analyses are conducted and provides information on the laboratory's performance and control of the sources of error that exist within the lab. Included in the plan are requirements for the type and frequency of QC check samples that are to be analyzed on a routine basis.

All laboratory analysis conducted for this project must include the following QC check samples:

- Surrogate spikes (where appropriate)
- MS/MSD or laboratory duplicates and laboratory control samples (where appropriate)
- Laboratory blanks (Field Reagent Blanks, Laboratory Reagent Blanks, Laboratory Fortified Blanks)

- Calibration confirmation (Continuing Calibration Checks)
- Internal Standards
- Peak Asymmetry Factor
- Quality Control Samples

The laboratory may adhere to the analysis frequency specified in their QA/QC plan for these check samples, provided that the specified frequency is equal-to or greater-than the frequency specified in **Table 5-1**.

Table 5-1 Laboratory Sample Frequency

QC Check Sample	Frequency of Analysis
Method Blanks	One per analytical batch or one per every twenty samples
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per analytical batch or one per every twenty samples
Surrogate Spikes	One per every trace organic analysis

The combination of laboratory duplicates and laboratory control samples may be substituted for MS/MSD analysis for parameters where they are more appropriate.

5.3.2 Program Generated Quality Control

Program generated QC consists of QC check samples that are submitted to the laboratory for analysis "blind" along with actual environmental samples. These samples provide QC information for the entire sampling event, from the actual sampling and handling through laboratory analysis. As such, they can provide the best overall estimate of the total uncertainty associated with the sampling round.

Program generated quality control samples collected in support of this project are:

- Duplicate samples
- MS/MSD samples
- Pre-investigation equipment blanks
- Equipment blanks
- Field blanks

Each report should have a cover page that references the appropriate task number. The cover page also provides an opportunity to describe, in a narrative format, any unusual problems or interferences encountered during analysis. In addition, all results should be reported on a dry weight basis for soils and at dilution-corrected concentrations for all samples.

5.3.3 Laboratory Quality Control Deliverables Package

A standard EPA CLP-Like (Level 4) is required for laboratory deliverables. The following QC data is required to be reported in laboratory data packages at a minimum.

- Case narrative
- Chain of Custody Forms
- Sample Log-In Form
- Sample Receipt Information
- Sample Results
- All applicable method QC information and raw data (e.g., laboratory blanks, calibrations, ion ratios, internal standards, surrogates, etc.)
- MS/MSDs for all priority pollutant parameters. One MS/MSD should be run for every 10 samples per the assumptions detailed in **Section 3.4**.

No specific acceptance criteria for blanks and spike recoveries will be set forth here; however, all laboratories are expected to conform to the laboratory SOP, and specifications outlined in EPA Method 537.1 Version 2.0 Modified.

5.4 Data Quality Requirements

PFAS analyses of water samples are to be conducted in accordance with EPA method 537.1 Version 2.0 Modified.

5.5 Analytical Data Verification/Evaluation

The laboratory will apply laboratory qualifiers if QA/QC parameters are outside of method criteria and/or laboratory SOP criteria. The laboratory data packages will be verified/evaluated by CDM Smith to ensure the data is usable and defensible for project purposes. If serious data quality issues are identified the Town will be notified to discuss potential data gaps of the sampling programs and the plan moving forward. The laboratory may also be contacted to discuss the deficiencies. Laboratory results shall be supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data (EPA CLP-Like Level 4 data package). The laboratory will review data prior to its release from the laboratory. Objectives for review are in accordance with the QA/QC objectives stated in the Work Plan. The laboratory is required to evaluate their ability to meet these objectives. Outlying data will be flagged in accordance with laboratory standard operating procedures, and corrective action will be taken to rectify the problem.

5.6 Data Assessment Report

A data deliverable will be provided for the above analyses and will be submitted with/or as part of the Data Assessment Report submittal.

A Data Assessment Report will be prepared that documents the work conducted; presents the results of the sample analysis, including field notes and laboratory reports; details data evaluation/verification; and provides recommendations for further investigation, if warranted.

A data usability summary included in the Data Assessment Report provides an evaluation of analytical data. The primary objective of a data usability summary is to determine whether or not the data, as presented, meet the Site/project specific criteria for data quality and data use.

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Attachment A

Field Forms

Attachment A

Lithologic Logs (cont.)

DRILLING LOG			Client		Boring Number
Company Name CDM Smith			Drilling Subcontractor		Sheet 1 of Sheets
Project			Location		
Name of Driller			Drill Rig(s)		
Sizes and Types of Drilling and Sampling Equipment			Northing	Easting	ORNL Grid
			Surface Elevation		
			Date Started	Date Completed	
Overburden Thickness			Depth Groundwater Encountered		
Depth Drilled into Rock			Depth to Water and Elapsed Time After Drilling Completed		
Total Depth of Hole			Other Water Level Measurements (Specify)		
Drilling Method	Borehole Diameter(s)	Depth of Surface Casing	Signature of Geologist		
Location Map					
Project					Boring Number

Attachment A

Lithologic Logs (cont.)

DRILLING LOG
(continuation sheet)

Boring Number:

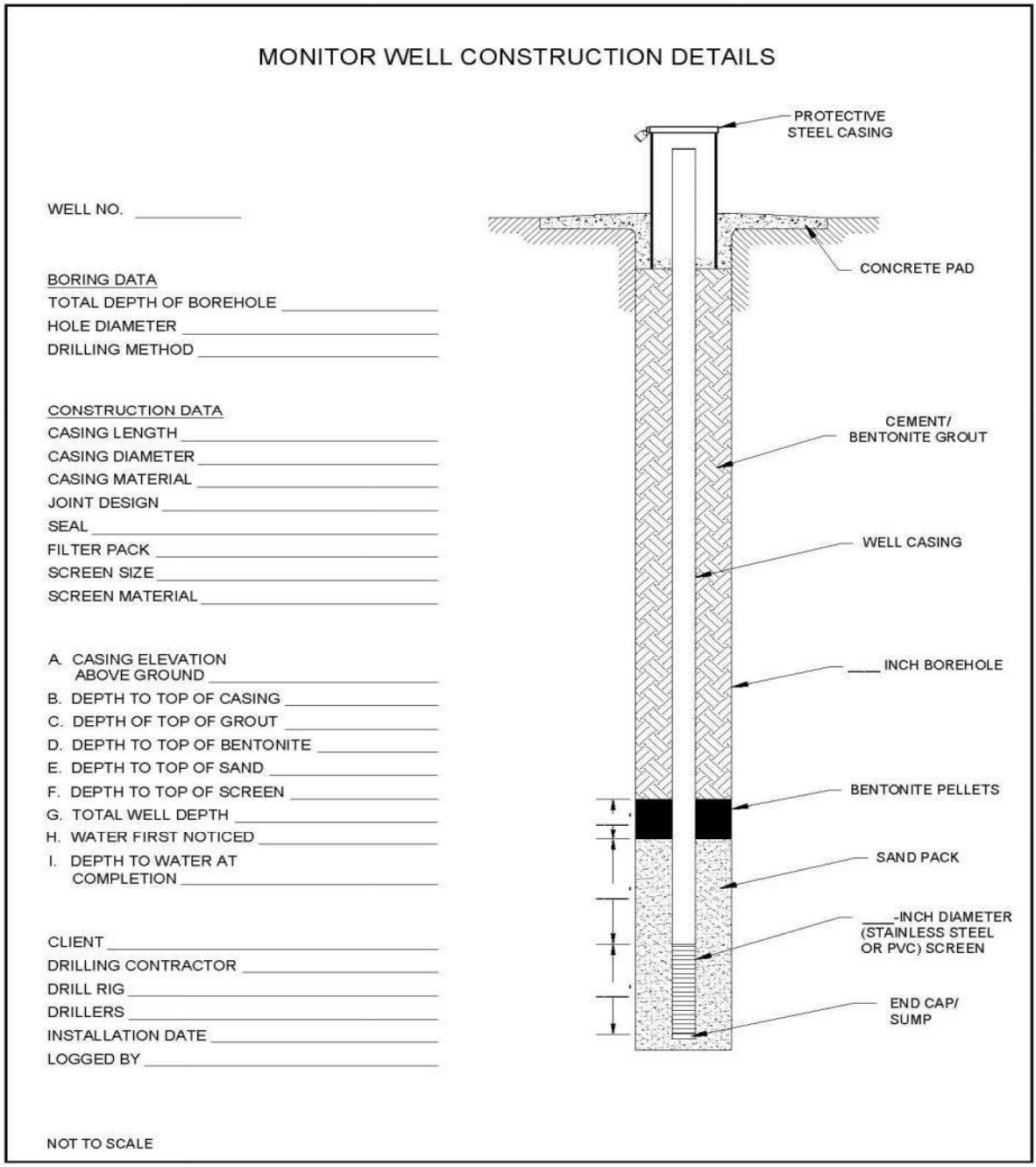
Project: | Geologist: | Sheet of Sheets

Elev (ft)	Depth (ft) bgs	Description of Materials	USCS/ Litho	Field Screening Results (ppm)	Sample No.	Blow Counts	Recovery (ft)	Remarks

Project: Boring Number:

Figure 1

Typical Construction Detail of Above-Grade Single-Cased Monitor Well (Not to Scale - Shown as an Example Only)



Attachment 1
EXAMPLE LOW-FLOW GROUNDWATER SAMPLING PURGING DATA SHEET

Site Name: _____ **Date:** _____ **OVM:** **FID** ☐ **PID** ☐ **In Casing (ppm): (Initial)** _____ **(Vented to)** _____

Well ID: _____ **Purging/Sampling Device:** _____

Initial Static Water Level (feet btoc): _____ **Analytical Parameters:** _____

Final Water Level (feet btoc): _____ **QC Samples Collected:** _____

Purge Start Time: _____ **Sample Number:** _____

Sample Time: _____ **Samplers' Signatures:** _____

Time	Water Level (ft btoc)	Temperature (ºC)	pH (SU)	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (mL/min)	Comments (e.g., depth of pump intake, screened interval)

Parameter	Units	Stabilization Criterion
Water Level	Feet/meters	< 0.3 foot (< 0.1 meter)
Temperature	°F/°C	± 3 percent, or ±1.8 degrees Fahrenheit (°F) /±1 degree Celsius (°C)
pH	(n/a)	± 10 percent, or ±0.1 standards units (SU)
Specific Conductivity	µm/cm	±3 percent (microsiemens per centimeter, or µm/cm)
ORP	mV	±10 millivolts (mV)
Dissolved Oxygen	mg/L	±10 percent, or 0.2 milligram per liter (mg/L) - whichever is greater If three DO values values are less than 0.5 mg/L, consider the values as stabilized.
Turbidity	NTU	± 1 Nephelometric Turbidity Unit (NTU) (±10 percent for turbidity if greater than 5 NTU), If three turbidity values are less than 5 NTU, consider the values as stabilized.
Flow Rate	L/min	0.1 to 0.5 Liters per minute (L/min) (< 1 L/min)

SAMPLE SCREENING TRACKING LOG

SITE NAME: ____

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DUPLICATE (Y/N)	OFFSITE (Y/N)	COMMENTS

DRUM TRACKING LOG

SITE NAME: _____

Drum #	Boring/MW#	Date Drilled/ Sampled	Related Sample #	Description of Drum Contents	Signature

Attachment B

CDM Smith PFAS Sampling Checklist

PFAS Sampling Checklist

This per- and polyfluoroalkyl substance (PFAS) sampling checklist provides a quick guidance on what field items can and cannot be used in the proximity of PFAS investigation area. This checklist does not replace the PFAS sampling guidance developed by federal, state or CDM Smith. All PFAS sampling staff should read project specific PFAS sampling guidance before conducting PFAS investigation. Development of a PFAS guidance is necessary because cross-contamination is a prominent concern for data quality, particularly with action levels in the parts per trillion (ppt) range.

The levels of awareness for PFAS cross contamination vary by the opportunities of introducing PFAS into the environment media under investigation.

1. Most important: Items in direct contact of environmental media under investigation. These can include, but not limited to, sample containers, sampling parts and equipment, drilling equipment, well construction items and materials, parts and equipment for hydrogeological testing, in-situ treatment parts and equipment.
2. Important: PPE, personal hygiene that are used by sampling personnel.
3. Important: Items used in coolers for shipping and transporting PFAS samples.
4. Less important: Activities in the staging area away from immediate PFAS investigation area.

Because of the evolving nature of PFAS regulation and guidance, the information provided here is based on our current knowledge. Some of the recommendations made here may reflect an overly cautious approach to avoid cross-contamination by removing items from the immediate sampling environment. As additional information about PFAS is confirmed this checklist will be revised to reflect the recommended practices for PFAS sampling.

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Field Clothing or PPE				
Clothing or boots containing “water resistance” or “stain-treated” fabrics				
Cloths washed with fabric softeners				Fabric softeners may contain PFAS
New and unwashed clothing				fabric treatment may contain PFAS
Uncoated Tyvek				USEPA PFAS sampling guidance from Region 2 prohibits use of Tyvek
Coated Tyvek				
PVC or wax-coated fabrics				
Neoprene				
Synthetic and natural fibers (preferably cotton)				

PFAS Sampling Checklist

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Steel-toed boots made with polyurethane and PVC				If it is not possible to find PFAS free steel-toed footwear, PFAS-free over boots may be worn. The over boots must be put on and the hands washed after putting the over boots on prior to the beginning of the sampling activities. Over boots may only be removed in the staging area and after the sampling activities have been completed
Well laundered clothes				several times from time of purchase
Well washed cotton coveralls				washed several times
Personnel Hygiene and Protective Skin Products				
Sunscreens				Good to use: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, and baby sunscreens that are “free” or “natural
Insect Repellents				Good to use: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics
International Brands of sunscreens and insect repellents				Must be evaluated on a case-by-case basis
Field Sampling Items				
Water proof field paper or books				Use loose plain paper
Post-it notes				
Aluminum foil				
Brand-name markers				Sharpie may be used to label sample bottles in the staging area, but markers should not be used in the immediate sampling environment
Off-brand markers				
Ball point pens				

PFAS Sampling Checklist

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
plastic clipboards				NJ DEP sampling guidance, use metal clipboard
Plastic table cover				
Sampling Equipment				
Item containing high-density polyethylene (HDPE)				
Item containing polypropylene				PP sample bottles must be used for drinking-water samples in accordance with USEPA method 537.1.1
Item containing polyurethane				
Item containing Polyvinyl chloride (PVC)				
Item containing silicon				
Item made of stainless steel				
Alconox®				
Citronex®				
Liquinox®				
Powderless nitrile gloves				
HDPE Hydrasleeves or sonic core bags				
Neoprene				
Crisco® or other vegetable-based greases for lubricating parts				
Item containing PTFE				Items or equipment that contains PTFE parts that will be in direct contact with sampling media
Item containing Teflon®				Field sampling items or equipment that contains Teflon® and that will be in direct contact with the sampling media
Item containing fluoropolymer				

PFAS Sampling Checklist

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Low-density polyethylene (LDPE)				Items or equipment that contains LDPE parts and that will be in direct contact with the sampling media
Viton® O-rings				Viton® O-rings used in pressure washers used for sampling equipment decontamination
Glass sample containers				
Field filter				Field filtration should be avoided regardless of filter types
Decon 90				
Items containing fluorosurfactants				
Teflon-bearing plumber's tape				
Blue (or chemical) ice				Later data (unpublished) suggest no cross contamination from blue ice. The category may be changed after data are published
Water ice				Double bag in polyethylene bags
Internal valves and equipment parts for sampling or decon				
Methanol or other solvents				
LDPE plastic bags (e.g., Ziploc® bags)				For larger biota sampling, Ziploc bags may be used, but collecting an equipment blank is recommended because these bags may be made of LDPE
Drilling fluids				
LDPE sonic core sample bags				Manufactured by Boart Longyear and Hole Products
Equipment with moving parts that may be lubricated with PFAS containing lubricants or greases				

PFAS Sampling Checklist

Item	Good to Use	Need Verification (2)(3)	Should Avoid (1)(2)	Comments
Rental equipment				Must be verified to have no PFAS-bearing parts prior to use
Others				
Food wrappers				Field personnel must wash hands after having food wrapped with grease repelling paper

(1) If an item which may contain PFAS but alternative is not available, the item should be tested for PFAS before use

(2) This mostly refers to the immediate sampling environment, particularly, the item is in contact with environmental media to be sampled

(3) There are no standard operation procedures on how an item can be verified, please contact PFAS experts for advices on the best practice of testing a potential PFAS containing item.

Version: November, 2018

Revised: September, 2020

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Appendix B

Health and Safety Plan

General Information

This task-specific health and safety plan (HASP) provides safety-related information and requirements specific to the task and work location(s) described. General requirements contained in the CDM Smith Health and Safety Program along with those described in this task-specific HASP will be implemented except where noted. Significant changes to this HASP shall be documented by resubmittal of a revised task-specific HASP.

Project Name:	Nantucket LF FY21	Client:	Town of Nantucket
Project No.:	230925	Date:	9/1/2020
Performing Organization(s):	TSU		
Planned Duration of Field Activities:	2020-2021		
Project Location:	Nantucket, Massachusetts		

Key Personnel

Project Manager:	Nick Castonguay	Telephone:	617-301-1763
Project Health and Safety Contact:	Jim Skrabak	Telephone:	617-452-6069

Project Field Personnel	Responsibilities	Telephone
Fred Santoro	Health & Safety Site Coordinator, Landfill Monitoring	617-593-8537
Mike Dolan	Landfill Monitoring	617-593-8538
Patrick Journeay	Landfill Monitoring	603-686-9448

Project Site Description	Project field personnel will perform landfill site inspections and landfill gas sampling. Potential hazards include slips, trips, falls, pinch points. Biological hazards including ticks, mosquitos, hornets.

CDM Smith Activity Hazard Analysis

Project Name:	Nantucket Landfill			**Project No.:**	230925		
Analyzed by:	Nick Castonguay	**Date:**	09/01/20	**Reviewed by:**	Jim Skrabak	**Date:**	

Description of Work Activity

Semi-annual groundwater and surface water monitoring, quarterly landfill gas monitoring, well repairs.

Potential Hazards	Hazard Controls (Examples provided at this link)
Traffic hazards while on site	Wear hi-visibility vests, remain aware of surroundings, stay on sidewalk or shoulder as much as possible, face oncoming traffic.
Slips, trips and falls	Remain aware of walking surface, wear good sturdy outdoor walking/work footware.
Severe weather	Cease work until conditions are safe; no work during inclement weather
Driving	Inspect vehicle before each use, use seatbelts, avoid use of cell phones while driving. Vehicles will be parked off-street.
General Public, Pets etc.	Avoid contact with stray dogs/pets, etc. Have cell phone charged to contact local police if needed.
Stinging Insects and Ticks	Observe for insects. Use insect repellent and insect killer if required. Tape pant legs and apply permanone on shoes and pant legs to protect against ticks. Visually inspect clothing. Employees allergic to insect stings shall be identified and necessary actions taken to treat in the event of a sting.
Poisonous Plants	Observe and avoid contact with poisonous planst such as poison ivy.
Tripping Hazards	Visually inspect site for objects that could cause employees to stumble or fall. Use care when walking.
Eye Injury Due to striking Against Branches	Safety glasses with side shields are required in wooded conditions.
Hazardous Materials	None anticipated, no earth will be disrupted as part of this project.
Heat Stress	Drink plenty of water, sit or lie down in a cool/shaded area if feeling nauseas or dizzy
Summoning Emergency Aid	Cell phone required. Check in w/ PM or designee at the beginning of the day, and then have the PM or designee contact the person periodically while the work is in progress to be sure that things are going as planned. Notify PM or designee when the work is complete to be sure that the person is safely out of the project site.
COVID-19 Exposure	Wear surgical face masks, use hand sanitizer regulary, drive separate vechicles. See attache COVID guidance for additional information.

Training Required	Equipment Required
Pre-project safety briefing	Hi- Visibility vests, steel toed boots, safety glasses

Emergency Plan and Information		
Basic Approach:	If an emergency happens, the CDM Smith team will rapidly, but without haste, withdraw to a safe location and notify the appropriate emergency agencies listed below.	
Police:	911	
Fire:	911	
CDM Smith H & S Manager	**Jim Skrabak**	**617 / 452 - 6069**
Poison Control Center	Nationwide	1 800 / 222 - 1222
State Spill Number:	**Massachusetts**	**(888) 304 - 1133**
24-Hr. First Aid/Non-Emergency Medical Services:	**1-800-350-4511, Press 1**	
	For non-emergency medical services: 1. Call AllOne Health at 1.800.350.4511, PRESS 1, and tell them you are reporting an injury for CDM Smith. Supply requested information. 2. Follow AllOne Health instructions (e.g., first aid, go to clinic, etc.). 3. After care, follow-up with AllOne at the 1-800 #.	
Ambulance:	Nantucket Cottage Hospital (contact information below)	
Client's Emergency Number:	508-228-7244 (Rob McNeil)	
Nearest Medical Facility:	Nantucket Cottage Hospital	
Address:	57 Prospect Street, Nantucket, MA	
Telephone:	(508) 825-8100	
Driving Directions: (Attach Map)	See Attached	

Reviews			
Project Manager:	Nick Castonguay	Date:	3/9/2021
Health and Safety Manager:	James W. Skrabak		3/11/2021

Health & Safety Plan Signature Form

CDM Smith Health and Safety Plan

All site personnel must sign this form indicating receipt or review of the H&SP. Keep this original on site. It becomes part of the permanent project files. Send a copy to the health and safety manager (HSM).

SITE NAME/NUMBER: Nantucket Landfill

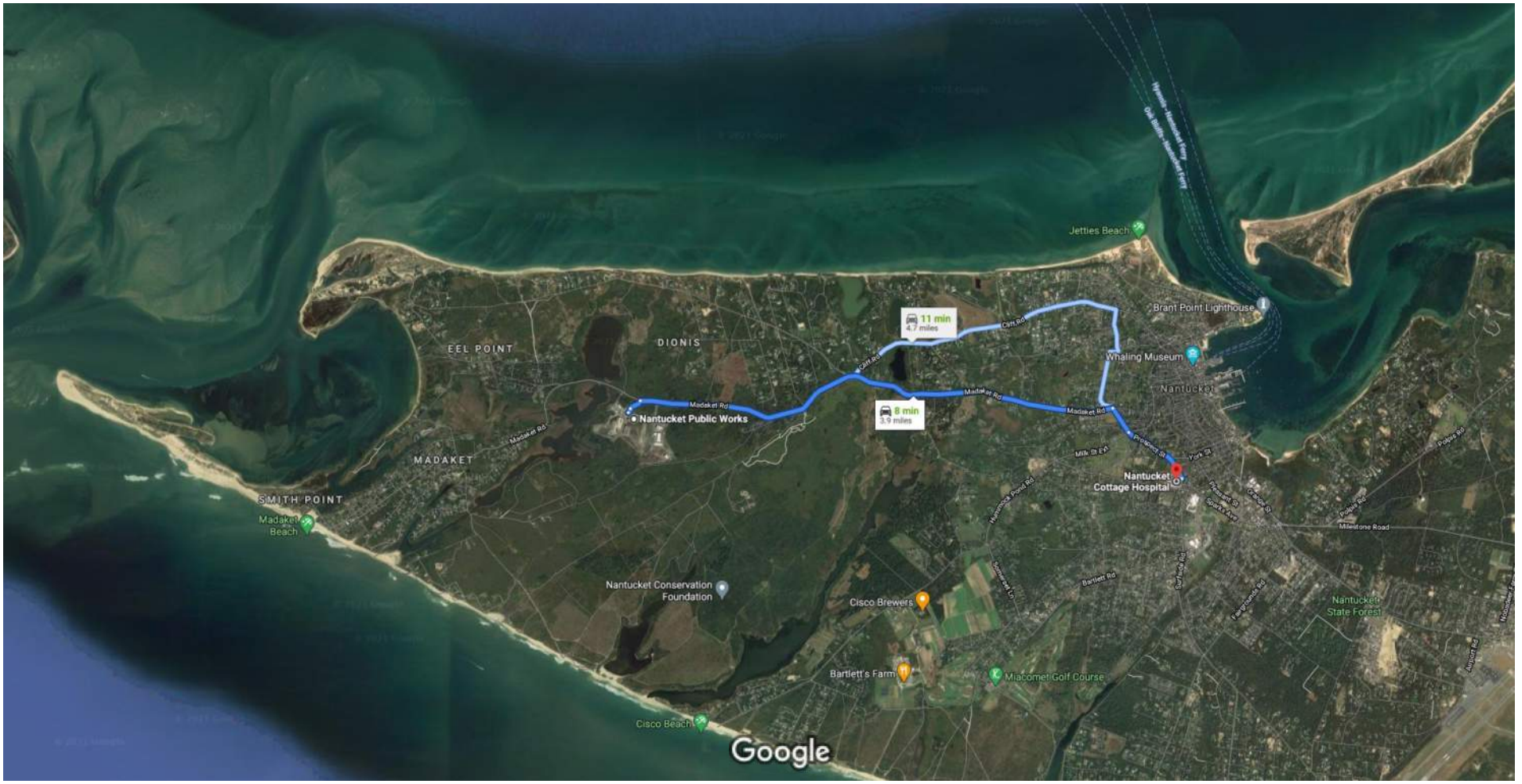
DIVISION/LOCATION: TSU

CERTIFICATION:

I understand, and agree to comply with, the provisions of the above referenced H&SP for work activities on this project. I agree to report any injuries, illnesses or exposure incidents to the site health and safety coordinator (SHSC). I agree to inform the SHSC about any prescription drugs or over-the-counter medication that may cause impairment that I take within 24 hours of site work.

PRINTED NAME	SIGNATURE	DATE

Google Maps Nantucket Public Works to Nantucket Cottage Hospital Drive 3.9 miles, 8 min



Imagery ©2021 CNES / Airbus, Landsat / Copernicus, MassGIS, Commonwealth of Massachusetts EOEA, Maxar Technologies, USDA Farm Service Agency, Map data ©2021 2000 ft

via Madaket Rd		8 min
Fastest route, the usual traffic		3.9 miles
via Madaket Rd and Cliff Rd		11 min

CDM Smith

Memorandum

Date: *January 5, 2021*
Subject: *Updated Field Guidance*

COVID-19 Prevention Guidance for Field Activities

This document is intended to provide basic guidance to field and project teams that have operations outside of a CDM Smith office, other than CCI construction sites. Included are measures on how to best protect employees and minimize potential exposure to COVID-19.

Planning

All projects involving field work should have an H&S plan to address specific hazards associated with that project. Since potential exposure to this virus is a universal hazard, H&S plans will need to address COVID-19 protocol at the project level. This includes both new plans and any existing plans that have not yet been revised. This information will need to be communicated to personnel ASAP.

The practices below must be evaluated and included in any greater planning activities and project-specific H&S plans. For non-routine exposure scenarios contact your H&S Manager for assistance in working out appropriate precautions.

COVID-19 Practices to Minimize Exposure

COVID-19 exposure is most directly associated with close contact with an infected individual. Close personal contact generally means one of the following:

- Within 6 feet of an infected person for a cumulative total of 15 minutes or more over a 24-hour period starting from 2 days before illness onset (or, for asymptomatic patients, 2 days prior to test specimen collection) until the time the patient is isolated. (Employees in countries outside the U.S., should follow the definition of measurement that defines close personal contact based on their country's requirements.
- In direct contact with infectious secretions (been coughed/sneezed upon, etc.).
- Live in the same household.

There are also less direct means of exposure such as contact with contaminated surfaces, droplets, and residues. To minimize exposure, it is imperative that field staff exercise the precautions below.

When not to report for Site Work

Employees should refer to the firm's COVID-19 Employee Notification and Return to Work Requirements policy for current details. There are 3 general categories of employees that will need to take action:

1. Employees who have been diagnosed with COVID-19 or suspect they have COVID-19 and are symptomatic.

2. Employees who have been diagnosed with COVID-19 and are asymptomatic.

3. Employees who have been exposed to an individual who has been diagnosed with COVID-19.

Symptoms of COVID-19 may include: fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, and diarrhea.

What to do if you or someone gets sick or exposed while on site:

- If you become ill while at work, you should immediately self-isolate in your home or lodging and contact AllOne Health (1-800-350-4511, Press 1) or your medical provider to determine if you should visit a medical facility or local medical provider. From there, notify your human resources business partner (HRBP) and manager of your situation and any medical recommendations. It is important that you receive guidance from your HRBP. Medical providers are requesting that you call first before seeking treatment.
- In general, an employee that has been sick or exposed can return to the site once they meet the criteria outlined in the COVID-19 Employee Notification and Return to Work Requirements policy.

Best Practices

- Maintain social distancing. Stay a minimum of 6 feet away from other people. **This is the most important action to limitexposure.**
- Minimize contact withothers. Do not shake hands (use non-contact greetings).
- Increase the frequency of hand washing with soap and water, for a minimum of 20 seconds. Use hand sanitizer as you can.
- Use of a face covering or mask is required when social distancing of 6 feet or more is not possible or when indoors. Face coverings or masks may also be required by certain local governments and/or clients.
    - CDM Smith's Equipment Center has a limited supply of work gloves, hand sanitizer, and face masks that meet CDC, local government and client requirements. Limited amounts are available for staff involved with field work. Contact the Equipment Center to request any PPE.
    - Staff may wear their own face covering or mask; they may also make face coverings or masks themselves. See https://www.ecommunity.com/giveppe/homemade-mask-instructions.
    - Please note that use of a cloth face covering or surgical style face mask is not adequate protection alone - physical distancing, hand washing, and disinfection of common surfaces needs to be incorporated into your daily activities. Face coverings or masks should not be used in place of N95 masks or any respirators that have been approved for protection from contaminants.
    - Face coverings or masks with exhalation valves do not limit the user's exhalation of respiratory droplets, and should never be used in place of standard coverings or masks.
    - Face coverings or masks must cover both the mouth and nose; those that fit the face without gaps and have molded nosepieces have been shown to be more effective at limiting exposure.

- Do not share of PPE without first disinfecting the equipment.
- Do not use common coffee pots or water coolers. Bring your own and use individual water bottles.
- Do not share food or meals with others. Prepare your own or have individually-wrapped meals ordered.
- Minimize time in shared office spaces, trailers etc. Maximize physical distancing.
- Avoid touching your face, in particular your mouth, eyes, and nose.
- Disinfect common surfaces regularly; several times per day if possible. If disinfectant is not available, the surface can be cleaned with soap and water or a diluted solution of bleach (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/disinfecting-your-home.html).
- Plan work and meetings to minimize the density of people in one area.
- Organize virtual meetings as opposed to in-person meetings where possible.
- Start your workday by discussing COVID-19 precautions with any CDM Smith, subcontractor, or Client team members.

- Use recommended disinfectants such as those here (https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2)or the following alternatives:
    - isopropyl alcohol (aka isopropanol aka IPA) min. 70%-recommended sit time 5 minutes,
    - household hydrogen peroxide, min. 3% (Note: opened/expired H_20_2 will likely be less than 3%, start with unopened/unexpired bottle) – recommended sit time 2 minutes (test as it may bleach fabrics),
    - quaternary ammonium, recommended sit time 5-10 minutes dependent on the mixture. (via spray bottle) *,
    - 10% bleach (1 part 5% household bleach to 9 parts water); recommended sit time up to 10 minutes depending on the label (spray bottle) *

The physical distancing, personal hygiene, and PPE guidance above are the most effective means to minimize exposures to COVID-19.

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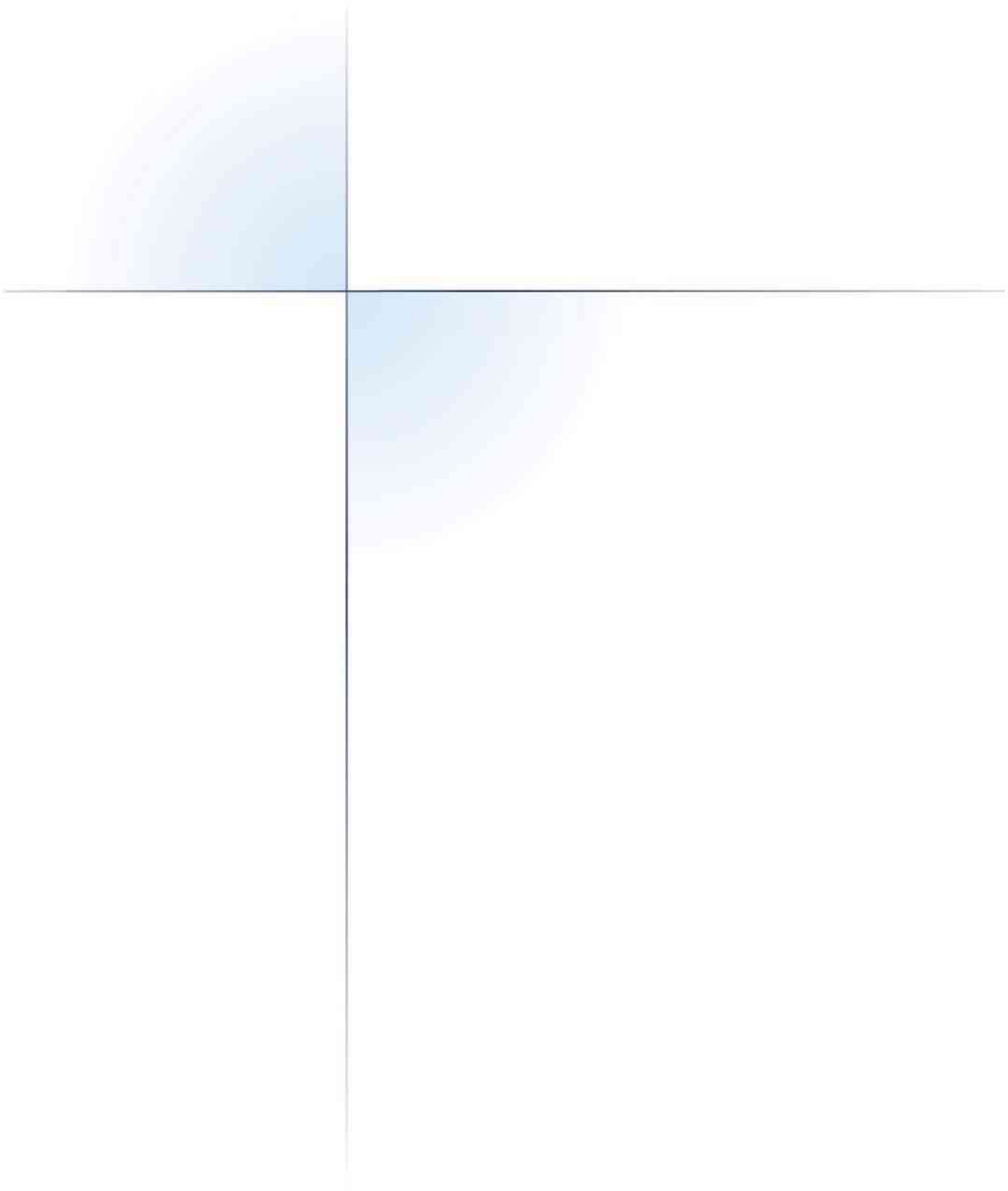

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