DES Waste Management Division
29 Hazen Drive; PO Box 95
Concord, NH 03302-0095

On-Property Site Investigation Work Plan
Saint-Gobain Performance Plastics Facility
701 Daniel Webster Highway
Merrimack, New Hampshire 03054
NHDES Site No.: 199712055
Project Number: 36430

Prepared For:
Saint-Gobain Performance Plastics Corp.
14 McCaffrey Street
Hoosick Falls, New York 12090
Phone Number (518) 686-6268
RP Contact Name: Chris Angier
RP Contact Email:
Christopher.Angier@saint-gobain.com

ross_bennett@golder.com

Digitally signed by ross_bennett@golder.com
DN: cn=ross_bennett@golder.com
Date: 2018.06.08 17:54:35 -04'00'

Prepared By:
Golder Associates Inc.
670 North Commercial Street
Manchester, New Hampshire 03101
Phone Number: (603) 688-0880
Contact Name: Ross Bennett
Contact Email: rbennett@golder.com

STATE OF NEW HAMPSHIRE – ROSS W. BENNETT No. 12373 LICENSED – PROFESSIONAL ENGINEER –

Date of Report: June 8, 2018

REPORT

ON-PROPERTY SITE INVESTIGATION WORK PLAN

Saint-Gobain Performance Plastics Facility
701 Daniel Webster Highway in Merrimack, New Hampshire

Submitted to:

New Hampshire Department of Environmental Services

Hazardous Waste Remediation Bureau

29 Hazen Drive, PO Box 95

Concord, New Hampshire 03302

Submitted by:

Saint-Gobain Performance Plastics Corp.

14 McCaffrey Street

Hoosick Falls, New York 12090

Submitted by:

Golder Associates Inc.

670 North Commercial Street, Suite 103

Manchester, New Hampshire, USA 03101

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APPENDICES

1.0 INTRODUCTION

On behalf of Saint-Gobain Performance Plastics (SGPP), Golder Associates Inc. (Golder) prepared this On-property Site Investigation Work Plan (Work Plan) for the SGPP Facility located at 701 Daniel Webster Highway in Merrimack, New Hampshire (the Facility; as shown in Figure 1). The New Hampshire Department of Environmental Services (NHDES) has designated the property a Remediation Site (Facility ID #199712055, Project Number 36430) due to the presence of perfluoroalkyl substances (PFAS) in soil and groundwater.

This Work Plan presents the objectives, proposed scope-of-work and methods for assessing “on-property” (i.e., Tax Lot 6E-3-2) soil and groundwater to satisfy the Site Investigation requirements outlined in ENV-Or 606. In addition to the scope-of-work described herein, SGPP is performing on-property quarterly groundwater monitoring, off-property investigation of surface water, stormwater and garden soils, and sampling of off-property residential wells under separate work plans.

The remainder of this Work Plan is organized as follows:

- Section 2 – Background
- Section 3 – Preliminary Conceptual Site Model
- Section 4 – Investigation Objectives and Scope-of-Work
- Section 5 – Methods and Procedures
- Section 6 – Schedule and Project Organization
- Section 7 – Acronyms and Abbreviations
- Section 8 – References Cited

2.0 BACKGROUND

Following Initial Site Characterization (ISC) field investigation activities, C. T. Male Associates (C.T. Male) submitted a Draft Site Investigation Work Plan (Draft SI Work Plan) to NHDES in May 2016 (C.T. Male, 2016). C.T. Male subsequently submitted a Draft Initial Site Characterization Report in March 2017 (C.T. Male, 2017a). NHDES provided comments on the Draft SI Work Plan and Draft ISC Report on April 13, 2018 (NHDES, 2018). C.T. Male submitted a Revised Initial Site Characterization Summary Report in April 2018 (C.T. Male, 2018). SGPP is submitting this Work Plan in response to the April 2018 NHDES comments on the Draft SI Work Plan, included as Appendix A-1. A detailed response to comments is presented in Appendix A-2.

2.1 Property and Facility History

This section summarizes the history of the SGPP Facility, the current Facility property (Tax Lot 6E-3-2) and adjacent properties (Tax Lots 6E-3-1, 6E-3-3, 6E-3-4, 6E-3-5, and 6E-3-6), which historically were one contiguous property (see Figure 2). The property and Facility history presented herein is based on a review of historical aerial photographs, property information, environmental records, physical setting information, and other historical records pertaining to site ownership, development, and operations.

Aerial photographs from 1947, 1952, and 1965 indicate that prior to development the properties were a mixture of forested and cleared land. Two structures, which appear to be residential, were located near the current SGPP Facility driveway. Merrimack Historical Society records and aerial photographs indicate that a state fish hatchery was operated from the late 1940s to the early 1970s on the property now owned by the John C. Flatley Company (Flatley), adjacent to Dumpling Brook.

Circa 1971, General Electric (GE) purchased approximately 170 acres of land (i.e., current Tax Lots 6E-3-1, 6E-3-2, 6E-3-3, 6E-3-4, 6E-3-5, and 6E-3-6) between Daniel Webster Highway and the Merrimack River and began development of approximately 20 acres in the center of the parcel. GE's development included:

- A 90,000-square-foot manufacturing building (now referred to as the "Main Building")
- Several outbuildings, including the Water Tank and Pump House, the Hydro-Test Building, and what is currently referred to as the Hazardous Waste Storage Building (formerly referred to as the Oil Drum Storage Building [GE] or pressure-sensitive adhesive (PSA) Coater Building [Chemical Fabrics Corporation (ChemFab)/SGPP])
- A railway spur linking the Facility to the nearby Boston and Maine rail line
- The sanitary sewer system[1]
- The stormwater conveyance system which collects runoff from the developed portion of the property and discharges to the Merrimack River southeast of the facility

GE manufactured turbine-based electrical generating components as part of their Large Steam Turbine Generator Division. Air permits obtained by GE for their furnaces/boilers indicate that manufacturing operations included machining of large (80-ton to 110-ton) steel generator casings and machining and installation of magnetic coils/supports (Air Pollution Control Agency, NH Department of Health and Welfare, 1974). NHDES On-Site Partial Multimedia Compliance Evaluation documents (NHDES, 2016) indicate that heat-treating and fluid degreasing equipment was also used in the facility. GE continued to operate at the property until 1982.

In 1984, ChemFab purchased the entire approximately 170-acre property from GE. ChemFab retro-fitted the Main Building to accommodate corporate functions, weaving operations, and a research and development department during their initial occupation of the Facility. Additional operations were relocated from other facilities to the Merrimack facility over the next 15 years, including polytetrafluoroethylene (PTFE) film casting and fabric-coating operations.

In 1987, ChemFab sub-divided the property and sold approximately 150 acres of predominantly wooded/undeveloped land (current Tax Lots 6E-3-1, 6E-3-3, 6E-3-4, 6E-3-5, and 6E-3-6). ChemFab retained ownership of the developed portion of the property (approximately 21.183 acres, current Tax Lot 6E-3-2). As part of the subdivision, easements were established for the portions of the railway spur, sanitary sewer system, and stormwater conveyance system located between the eastern facility boundary and the Merrimack River. Although the Water Tank and Pump House were part of the property sale, ChemFab retained access to and use of equipment in the building that supported the Facility's fire safety infrastructure (fire engine pumps).

By the early 1990s, the current Hazardous Waste Storage Building had been modified to house ChemFab's PSA coating operations. PSA coating equipment included an incinerator which, per the permit to operate, had to be operated during use of the coater to destroy volatile organic compounds (VOCs). Records indicated that PSA

[1] The Site sanitary sewer system joins with the Town of Merrimack's sanitary sewer main southeast of the facility, where the Town's sanitary line runs parallel to the Merrimack River.

coating in the current Hazardous Waste Storage Building was discontinued in 2001 (SGPP, 2001). The Hazardous Waste Storage Building is currently used for temporary storage of hazardous wastes prior to offsite disposal.

In the mid- to late-1990s ChemFab constructed a 55,000-square foot addition east of the facility's Main Building (referred to as the "New Manufacturing Building" – see Figure 3) to house additional manufacturing, offices, and warehouse space. A portion of the stormwater conveyance system near the New Manufacturing Building was reconfigured to accommodate the new construction.

ChemFab and its associated property were acquired by SGPP in 2000. Current operations consist of the manufacture of coated fabrics and cast extruded plastic films, and research and development related to these products. Unit processes related to these operations include industrial fabric weaving, mixing and application of coating formulations, curing and/or fusing formulation coatings to fabrics and other substrates, conversion of products to required size specifications and/or fabrication into specific assemblies, and research and development (NHDES, 2016).

SGPP built a new Fire Pump Building in 2015 immediately south of the Main Building and ceased use of the former Water Tank and Pump House. SGPP installed a gate valve in the water line that runs from the Water Tank and Pump House to the Main Building to prevent flow in either direction and cut and capped the water line supplying the Water Tank and Pump House from the Town of Merrimack water line at the Daniel Webster Highway connection point.

2.2 Summary of Previous Investigations

SGPP submitted an ISC Summary Report (C.T. Male, 2018) which documented on-Property investigations completed by SGPP in 2016 and 2017; including:

- Advancement and sampling of 6 soil borings for analysis of PFAS and other parameters
- Installation, development and sampling of 11 groundwater monitoring wells for analysis of PFAS and other parameters
- Collection of wipe samples from the roof of the main facility for analysis of PFAS

A summary of the findings from these investigations is presented in Section 3.0. Other on-property and related investigations completed by SGPP include:

- Ongoing quarterly sampling and analysis of on-property groundwater (latest annual report is Golder, 2018b)
- On-property stormwater and off-property surface water sample collection and analysis (Golder, 2018a; Golder, 2018c; and Golder 2018d)

3.0 PRELIMINARY CONCEPTUAL SITE MODEL

This section presents the preliminary conceptual site model (CSM) based on findings from previous investigations completed at the property as described in Section 2.0. The preliminary CSM is presented as the basis for developing a scope of work for further investigation. Data generated during implementation of the Work Plan and other on-going investigations will be used to further inform and modify the CSM.

3.1 Geologic and Hydrogeologic Setting

The following description of the geologic and hydrogeologic setting is based primarily on information presented in the ISC Summary Report (C.T. Male, 2018).

Merrimack, New Hampshire is located within the Northeastern Appalachians groundwater region. This region is characterized by rolling topography that primarily reflects the weathered bedrock surface with glacial and fluvial landforms mantling the bedrock. The bedrock consists of folded and faulted metamorphosed sedimentary rocks, which, when unweathered, has a low primary porosity. Groundwater in bedrock is conducted primarily through secondary porosity that results from fracturing, jointing and weathering. Bedrock groundwater recharge occurs primarily through infiltrating precipitation and typically discharges to surface water.

Glacial erosion and deposition produced changes in drainage and topography and deposited a nearly continuous layer of unconsolidated till over the bedrock. Stratified drift units, chiefly sand and gravel, follow the larger valleys such as those of the Merrimack River. These stratified drift units are referred to as valley-fill aquifers (Kontis, et al, 2004). Surficial unconsolidated deposits in the vicinity of the Facility consist mainly of stream terrace deposits that cut into glacial lake and till deposits and recent alluvial deposits. The stream terraces are composed mainly of sand to gravel with minor amounts of silt. The Merrimack River is incised through terrace deposits. Narrow alluvial deposits are present on the western river bank.

Borings advanced on the property as part of ISC activities encountered drilling refusal on what was assumed to be till, boulders and/or bedrock at depths ranging from 23.8 to 50 feet below ground surface (bgs). The dominant subsurface soil type generally consists of fine to medium sand with minor percentages of silt underlain by sand and gravel. Soils were observed to be wet (saturated) at depths ranging from 8 to 15 feet bgs. Monitoring wells have not been installed in bedrock at the property.

The direction of groundwater flow in overburden, based on groundwater elevations measured in on-property overburden monitoring wells, is generally from north to the south. Regional bedrock groundwater flow direction on the western side of the Merrimack River is assumed to be to the east, towards the Merrimack River.

Geometric mean hydraulic conductivity values calculated by C.T. Male (2018) for shallow overburden (i.e., wells screened across the water table) range from approximately 5.1×10^{-3} centimeters per second (cm/sec) to 2.6×10^{-2} cm/sec. Hydraulic conductivity values for deeper overburden wells ranged from approximately 6.4×10^{-5} cm/sec to 3.4×10^{-4} cm/sec.

Information required to refine the geologic and hydrogeologic CSM includes:

- Confirming the lithologic profile of overburden deposits to the top of bedrock
- Confirming the depth to bedrock at multiple locations to define the overburden thickness and top of bedrock surface
- Collection of bedrock cores to characterize the bedrock lithology
- Installation of additional wells in the shallow and deep overburden to further characterize the potentiometric conditions in the overburden
- Installation of monitoring wells in the bedrock to define the potentiometric surface in bedrock
- Collection of hydraulic conductivity information in overburden bedrock

3.2 Potential Releases and Transport Mechanisms

SGPP and ChemFab historically used dispersions at the facility that contained PFAS in the manufacture of films and coated cloths for a variety of industries. Perfluorooctanoic acid (PFOA) was an additive in dispersions used during production. During drying and curing of the product, some PFOA was driven off the fabric and may have been emitted from the Facility's stacks. The Draft Model Memo (Barr, 2017) evaluated an aerial deposition pathway for transport of PFOA via stack emissions as follows:

- **Air Transport and Deposition:** Particulates of PFOA released in stack emissions are transported by wind and are deposited at the ground surface.
- **Dissolution in Water and Infiltration:** PFOA deposited at the ground surface dissolves in water from precipitation or melting snow and is transported into the subsurface as the water infiltrates.
- **Unsaturated Zone and Groundwater Transport:** Once precipitation with dissolved phase PFOA infiltrates below the ground surface, it leaches vertically through, and is temporarily retained in, the unsaturated zone – the subsurface area above the water table. The water and PFOA mass eventually reaches the saturated zone (i.e., the groundwater).

The available data indicate that on-property soil and groundwater has been impacted by PFAS, primarily consisting of PFOA, from aerial deposition.

In addition to aerial deposition, soil and groundwater may have been impacted by PFAS and other constituents potentially released from one or more Potential Release Areas (PRAs) defined as areas where a release is either known to have occurred or may have occurred. Examples of PRAs include formulation and waste formulation handling and storage areas, tanks, and stormwater and process water conveyance lines.

Golder reviewed available historical site records to identify PRAs, which include all known or suspected on-property releases as identified in the ISC Summary Report (see Appendix B) and areas identified by NHDES in their comments on the Draft SI Work Plan (NHDES, 2018; Appendix A-1). A complete listing of identified PRAs in presented in Section 4.2.1, along with the proposed scope-of-work to evaluate each PRA. Identification of a PRA is not confirmation that the release occurred or that if a release did occur, that the release resulted in a measurable impact to environmental media.

If a release occurred and reached the water table, transport in groundwater would generally follow groundwater flow gradients, which appear to be to the south in the overburden.

Uncertainties associated with identified PRAs include:

- The exact location of some PRAs. For example, site records indicate a floor drain was decommissioned in 2003 (PRA-20, see Section 4.2.1), but the exact location of the floor drain is unknown. In other cases, PRAs include potential isolated releases along a long linear feature (e.g., PRA-13, Sub-slab Sewer Line) or a potential isolated release within a feature with a large footprint (e.g., PRA-21– Stormwater Runoff and Snow Management Areas). Where the exact location of a PRA cannot be identified, Golder is proposing to collect groundwater samples downgradient of the PRA to evaluate whether the PRA has had a measurable impact on groundwater quality.
- The degree to which individual PRAs have impacted soil and or groundwater in the context of air deposition impacts. The proposed scope-of-work includes sufficient soil and groundwater sampling to allow for an evaluation of the overall variation of PFAS in soil and groundwater to identify areas of impact, if any, that suggest the presence of a release or releases other than air deposition.

- NHDES notes that in contrast to groundwater samples, almost half of the soil samples collected during the ISC had had detections of perfluorooctanesulfonic acid (PFOS) at concentrations higher than PFOA (NHDES, 2018). NHDES suggested that additional soil sampling is required to allow for further evaluation of the relative differences in PFOA and PFOS concentrations in soil and groundwater.

3.3 Nature and Extent of PFAS

As described in Section 2.2, SGPP collected soil, groundwater, and roof wipe samples for analysis of PFAS and other parameters as part of the ISC (C.T. Male, 2018).

Soil samples were collected for PFAS analysis at six boring locations from select depth intervals from grade to depths above the water table. PFOA concentrations in soil ranged from non-detect to 30 parts per billion (ppb). PFOS concentrations in soil ranged from non-detect to 31 ppb. All detected PFOA and PFOS concentrations are below residential direct contact soil standards (500 ppb).

The ISC included two rounds of groundwater sampling (March 2016 and April 2016) from the eleven on-property monitoring wells. During the March 2016 monitoring event, PFOA was detected in each of the monitoring wells at concentrations ranging from 280 parts per trillion (ppt) at MW03 (see Figure 3 for well locations) to 7,300 ppt in the duplicate sample collected from MW04S. The highest PFOA concentrations were detected in the shallow wells (i.e., the wells screened across the water table), except for the MW06/06S well couplet, where the highest concentration was detected in the deeper well (MW-06).

During the April 2016 monitoring event, PFOA was detected in each of the monitoring wells at concentrations ranging from 270 ppt at MW03 to 5,500 ppt at MW05. Similar to the March 2016 monitoring event, the highest PFOA concentrations were detected in the shallow wells, except for the MW06/06S well couplet.

The lowest PFAS concentrations were generally detected in samples collected from monitoring well MW03; located in the presumed upgradient direction of the facility. Higher concentrations were generally detected at locations (MW-04/4S, MW-05/5S and MW06/6S) in the presumed downgradient direction of the facility.

Results of quarterly groundwater sampling conducted since the ISC were submitted to NHDES in the 2017 Annual Groundwater Summary Report (Golder, 2018b) and the April 2018 Unvalidated Groundwater Data Submittal (Golder, 2018e); and are generally consistent with the groundwater results described in the ISC Summary Report[2].

The June 2017 groundwater samples were analyzed for a larger suite of analytical parameters, as reported in Golder, 2018b. NHDES reviewed this data and commented that:

> *June 2017 groundwater sample results indicate that volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs) were not detected, and that metals, semi-volatile organic compounds (SVOCs), and pesticides, where detected, were detected at levels generally an order of magnitude less than Ambient Groundwater Quality Standards (AGQS).*

[2] The concentrations of PFOA in the samples collected since April 2016 are generally slightly higher than those reported for March 2016 and April 2016 in the ISC Summary Report because Eurofins Eaton was not quantifying the separate branched isomer peak for PFOA and was only reporting concentrations based on the peak for the linear isomer of PFOA.

> *Based on these results, additional analysis for ethylene glycol, VOCs, PCBs, metals, SVOCs, and low-level 1,4-dioxane as part of routine groundwater sampling of these existing monitoring wells is not required at this time. Please note, however, that analysis for these compounds will be required for groundwater samples collected from new monitoring wells installed as part of the upcoming site investigations.* (NHDES, 2017)

PFAS, including PFOA and PFOS were detected in roof wipe samples.[3]

General information required to refine the understanding of the nature and extent of PFAS at the property includes:

- Additional soil sampling to refine the understanding of the areal and vertical distribution of PFAS in on-property soil
- Additional well installation and groundwater sampling to refine the understanding of the areal and vertical distribution of PFAS in on-property overburden groundwater
- Well installation and groundwater sampling to refine the understanding of the areal distribution of PFAS in on-property bedrock groundwater

As described in Section 3.2, additional soil and groundwater sampling is needed to evaluate the degree to which individual PRAs have impacted soil or groundwater in the context of air deposition impacts.

4.0 INVESTIGATION OBJECTIVES AND SCOPE OF WORK

This section outlines the site investigation objectives and proposed scope-of-work to meet the objectives. The site investigation objectives are based on the information needs identified in Section 3.0 to refine the preliminary CSM and information needed to evaluate the degree to which individual PRAs have impacted soil and or groundwater in the context of air deposition impacts. The scope-of-work has been developed to fill the identified information needs.

4.1 Investigation Objectives

The following information needs were identified in Section 3.0:

<u>Geologic and Hydrogeologic CSM (Section 3.1):</u>

- Advance additional soil borings to confirm/refine the understanding of the overburden lithology
- Advance additional soil borings to confirm/identify the depth to bedrock at multiple locations to define the overburden thickness and top of bedrock surface
- Collect core samples of the bedrock to characterize the bedrock lithology
- Install additional shallow and deep overburden wells to further characterize the potentiometric conditions (i.e., groundwater flow directions) in the overburden
- Install bedrock wells to characterize potentiometric conditions in bedrock

[3] The degree to which PFAS detections on the roof have potential to impact the environment is being evaluated as part of ongoing stormwater and surface water investigations (Golder, 2018a; Golder, 2018c; and Golder, 2018d).

- Complete additional hydraulic conductivity testing of overburden materials and bedrock

<u>Potential Releases and Transport Mechanisms (Section 3.2)</u>

- Collect groundwater samples downgradient of the PRAs where the exact location of the PRA is uncertain to evaluate whether the PRA has had a measurable impact on groundwater quality
- Collect sufficient soil and groundwater data to allow for an evaluation of the overall variation of PFAS in soil and groundwater to identify areas of impact, if any, that suggest the presence of a release or releases other than air deposition

<u>Nature and Extent of PFAS (Section 3.3)</u>

- Collect additional soil samples to refine the understanding of the areal and vertical distribution of PFAS in on-property soil
- Install and sample additional monitoring wells to refine the understanding of the areal and vertical distribution of PFAS in on-property overburden groundwater
- Install and sample monitoring wells to refine the understanding of the areal distribution of PFAS in on-property bedrock groundwater

In addition, NHDES requested the scope-of-work include sufficient data collection to (NHDES, 2018):

- Evaluate potential differences in water quality between shallow and deep overburden groundwater
- Evaluate the distribution of PFOS in soil as well as the differences in concentrations between PFOS and PFOA in soil versus groundwater
- Evaluate the potential for continued leaching of PFAS from soil to groundwater

4.2 Scope-of-Work

The following sections describe the scope of work to meet the objectives outlined in Section 4.1. The investigation activities will comprise:

- Advancement of 29 soil borings
- Installation of 5 shallow and 2 deep overburden monitoring wells to:
  - further characterize the overburden lithology
  - obtain samples of overburden groundwater for laboratory analysis
  - obtain depth to water (potentiometric) measurements to allow for a refined analysis of groundwater flow directions in overburden
  - complete slug testing to further characterize the hydraulic conductivity of overburden
- Installation of 7 temporary shallow groundwater monitoring wells to obtain samples of shallow overburden groundwater downgradient of specific PRAs for laboratory analysis
- Installation of 5 bedrock monitoring wells to:

- characterize bedrock lithology
- obtain samples of bedrock groundwater for laboratory analysis
- obtain depth to water (potentiometric) measurements to evaluate groundwater flow directions in bedrock
- complete slug testing to characterize the hydraulic conductivity of bedrock

Section 4.2.1 describes the PRAs and the specific scope-of-work associated with the identified PRAs. Sections 4.2.2 and 4.2.3 describe the soil and groundwater analytical programs, respectively. Section 4.2.4 describes hydrogeologic data to be collected. Field investigation methods are described in Section 5.0.

4.2.1 PRA-Specific Investigations

Golder reviewed available historical site records to identify PRAs. In addition, NHDES identified several areas for investigation in the comment letter on the Draft SI Work Plan (NHDES, 2018) and these areas have been included as PRAs. PRAs represent areas where a release is either known to have occurred or may have occurred. Identification of a PRA is not confirmation that the release occurred or that the release resulted in a measurable impact to environmental media. Some of the identified PRAs are located within the building footprint where the building foundation is intact and several feet thick. It is unlikely that a release in these areas would have migrated through the building foundation in the absence of infrastructure (e.g. drain lines) that penetrate the foundation. Identified PRAs are listed below and illustrated on Figure 4. Proposed investigation activities associated with the PRAs are illustrated on Figure 5 and summarized on Table 1. The soil and groundwater samples will be analyzed for the parameters listed on Tables 2 through 6, and the analytical methods are discussed in detail in Sections 4.2.2 and 4.2.3.

The proposed scope of work for each PRA is discussed below. With a few exceptions, most PRAs are proposed to be investigated through downgradient monitoring wells as an initial phase of investigation. Data generated from these downgradient monitoring wells will be evaluated to determine whether discrete PRAs have impacted soil and or groundwater in the context of air deposition impacts. SGPP will propose follow-up investigation if sampling results suggest that one or more PRAs have significantly impacted soil and/or groundwater in the context of air deposition impacts.

PRA-1: Aerial Deposition Area

- Description: The aerial deposition pathway is described in Section 3.2. All current and former undeveloped/unpaved areas of the property where particulates of PFOA released in stack emissions could have been deposited at the ground surface and serve as a potential source to soil and/or groundwater are considered part of PRA-1. Because of the broad nature of this PRA, it is not depicted on Figures 4 or 5.
- Proposed Investigations: The proposed scope-of-work includes borings and wells across the entire SGPP Facility property. It is anticipated that aerial deposition of PFAS will be manifested as a relatively consistent level of PFAS concentration in soil and groundwater, with potential for higher concentrations in proximity to the stacks. Golder will undertake an evaluation of all soil and groundwater analytical results to assess the variability of PFAS concentrations. If appropriate, Golder will identify a range of PFAS concentrations for soil and groundwater that are considered representative of on-property aerial deposition. Results of this evaluation will be used to distinguish PFAS detections associated with aerial deposition from potential PFAS detections related to one or more of the following PRAs.

PRA-2: Current and Former Loading Dock Areas

- Description: Potential releases associated with the loading/unloading of formulations and the storage of empty totes in the current and former loading dock areas represent a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of three soil borings (SG-SB-D, SG-SB-E, and SG-SB-F) and installation and sampling of groundwater from downgradient monitoring well MW-11S.

PRA-3: Former Railroad Tracks

- Description: At the request of NHDES, the former railroad tracks are identified as a PRA. To Golder's knowledge, neither SGPP nor its predecessors used the railroad tracks for storage of chemicals, or that a release occurred along tracks.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil and groundwater from temporary monitoring well TMW-G.

PRA-4: June 2015 Formulation Spill Area

- Description: SGPP reported a material spill that migrated to pavement outside of the building through the north and east walls at slab level.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of one soil boring (SG-SB-D) and installation and sampling of groundwater from downgradient monitoring well MW-11S.

PRA-5: Former Outdoor Chip Storage Area

- Description: At the request of NHDES, the area identified as the "former outdoor chip storage area" in a 1987 Spill Prevention and Pollution Control Plan (ChemFab, 1987) is identified as a PRA. To Golder's knowledge, neither SGPP nor ChemFab used this area for chip storage. If any releases from the chip storage occurred, such releases would likely have been related to GE's operations.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of one nearby soil boring (SG-SB-B) and installation and sampling of groundwater from downgradient temporary monitoring well TMW-E. Due to the historical use of this area by GE, the groundwater samples will be analyzed for VOCs, SVOCs, metals and total petroleum hydrocarbons (TPH) in addition to PFAS, as listed on Table 4.

PRA-6: Hazardous Waste Storage Building and Former PSA Coater Area

- Description: This PRA includes the Hazardous Waste Storage Building located to the east of the main building, and the area north of the Hazardous Waste Storage Building where materials may have been stored in temporary units. From approximately 1991 to 2001, the building housed the PSA coater which applied silicone and acrylic adhesives.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of three soil borings (SG-SB-C, SG-SB-I, and TMW-F) and installation and sampling of groundwater from downgradient temporary monitoring well TMW-F. Due to the historical use of this area, the soil samples and groundwater samples will be analyzed for VOCs, SVOCs and metals in addition to PFAS, as listed on Table 3.

PRA-7: 2011 Loom Spill Area

- Description: In May 2011, SGPP reported that an oil sheen was observed entering a storm drain catch basin from unprotected equipment stored outside. Based on a review of the photographs included in the 2011 report, it appears that the oil sheen originated in the area between the hazardous waste storage building and the nearest catch basin.
- Proposed Investigations: SGPP will investigate this PRA through installation and sampling of groundwater from downgradient temporary monitoring well TMW-E.

PRA-8: New Manufacturing Building Roof Drain Downspouts

- Description: Stormwater from the eastern half of the new manufacturing building flows to the paved ground surface via roof drain down spouts located along the eastern edge of the new manufacturing building. Surface water in this area flows to the north to a catch basin located at the northeastern corner of the new manufacturing building. PFAS potentially present in the stormwater could impact soil and groundwater through areas of compromised pavement integrity.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of one soil boring (SG-SB-B) located in an area of potentially compromised pavement integrity and installation and sampling of groundwater from downgradient temporary monitoring well TMW-E.

PRA-9: Current and Former Interior Chemical Storage Areas

- Description: NHDES requested assessment of the potential for releases from current and former chemical storage areas. This PRA identifies interior areas where formulations are currently, or were formerly, stored or used.
- Proposed Investigations: SGPP will investigate this PRA through installation and sampling of groundwater from downgradient temporary monitoring well TMW-D.

PRA-10: QX Settling Tank Area

- Description: Wash water from sinks, a sump, and cleaning areas near the QX tower is collected in the QX settling tanks, which discharge to the sub-slab sewer line. Potential releases of wash water in the area of the settling tank represent a PRA.
- Proposed Investigations: SGPP will investigate this PRA through installation and sampling of groundwater from downgradient temporary monitoring well TMW-D and downgradient monitoring wells MW-04S, MW-04, MW-04B, MW-09S, and MW-09.

PRA-11: Formulation Area

- Description: This PRA includes the first floor footprint of the formulation area, including the tote cleaning operations area, where releases of formulation potentially occurred.
- Proposed Investigations: SGPP will investigate this PRA through installation and sampling of groundwater from downgradient temporary monitoring well TMW-B and permanent monitoring wells MW-08S, MW-09S, and MW-09.

PRA-12: Weaving Room Settling Tank Area

- Description: The Weaving Room settling tanks receive wash water from sinks, a sump, and cleaning areas in the formulation area and the second floor Research and Development (R&D) area. The R&D settling tank included a limestone media to neutralize potential acid discharges. A 1987 NHDES inspection report indicated that some facility wastes were discharged to a “limestone tank” which discharged to the “ground surface”. Golder assumes that the “limestone tank” is the R&D settling tank. SGPP is not aware of any other information suggesting the R&D settling tank discharged to the ground surface. Potential releases of wash water in the area of the R&D settling tank represent a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil from the boring for TMW-C and installation and sampling of groundwater from temporary monitoring well TMW-C and downgradient monitoring well MW-08S.

PRA-13: Sewer Lines

- Description: The sewer lines were installed by GE in 1971. SGPP performed a camera survey of the sewer lines in 2017 and observed that the on-property portions of the sewer conveyance system were generally in good condition (Attachment F in Golder, 2018d). The potential release of wash water from the sewer line is identified as a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil from the boring (MW-10S) and installation and sampling of groundwater from downgradient temporary monitoring wells TMW-B and TMW-D and downgradient monitoring wells MW-04S, MW-04, MW-04B, MW-09S, and MW-09 and MW-10S.

PRA-14: Former UST

- Description: This PRA represents the location of a former “scavenger tank” UST installed by GE (Chas. T. Main, 1971) previously located approximately 20 feet south of the main building. GE used the UST to store oil-containing condensate water. The UST was decommissioned in 1992 (GZA, 1992). To Golder’s knowledge, neither SGPP nor ChemFab used this UST. If any releases occurred in this area they would likely have been related to GE’s operations. Potential releases from the UST represent a PRA.
- Proposed Investigations: SGPP will investigate this PRA through installation and sampling of groundwater from downgradient monitoring well MW-08S. Due to the historical use of this area, the groundwater samples will be analyzed for VOCs, SVOCs, metals and TPH in addition to PFAS, as listed on Table 4.

PRA-15: Stormwater Infiltration Catch Basin

- Description: During the 2017 stormwater conveyance system investigation, Golder identified a stormwater infiltration catch basin south of the Main Building near manhole MH-16 that is not connected to the stormwater conveyance system. According to Facility personnel this stormwater infiltration catch basin was installed in October 2015 to mitigate flooding during storm events around a pedestrian walkway. Infiltration of potentially impacted stormwater to the subsurface at this location represents a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil from the boring for temporary monitoring well TMW-A and installation and sampling of groundwater from temporary monitoring well TMW-A and downgradient monitoring well MW-07 and MW-07S.

PRA-16: Existing Sub-surface Stormwater Conveyance System

- Description: During the 2017 stormwater conveyance system investigation, Golder observed conditions in the conveyance system that may allow stormwater to exfiltrate from the conveyance system. The potential for exfiltration of stormwater to the subsurface represents a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil from the boring SG-SB-E and installation and sampling of downgradient bedrock monitoring wells MW-3B and sampling of existing monitoring wells MW-03 and MW-03S.

PRA-17: Connex Storage Container Area

- Description: Empty totes have occasionally been stored in the Connex Storage Container Area located to the south of the Hazardous Waste Storage Building. The potential release of formulation from totes stored in this area represents a PRA.
- Proposed Investigations: SGPP will investigate this PRA through advancement and sampling of soil from the boring for MW-10S and installation and sampling of downgradient monitoring wells MW-04S, MW-04, MW-04B and MW-10S.

PRA-18: Ground Surface East of Stacks

- Description: NHDES has questioned whether stack char materials may be discharged onto the ground surface near the stacks. Based on Golder's observations, the discharge of stack char materials is generally limited to the roof top. SGPP is not aware of discharge of stack char materials to the ground surface, besides the aerial deposition of particulates already being investigated. Regardless, SGPP has added this PRA for the ground surface in the immediate vicinity of the stacks along the eastern edge of the main building.
- Proposed Investigations: SGPP will investigate this PRA through sampling of soil from soil boring SG-SB-A.

PRA-19: Ground Surface West of Stacks

- Description: See discussion under PRA-18. SGPP has added this PRA for the ground surface in the immediate vicinity of the stacks along the western edge of the main building.
- Proposed Investigations: SGPP will investigate this PRA through sampling of soil from soil borings SG-SB-G and SG-SB-H.

PRA-20: Former Floor Drain

- Description: NHDES observed a floor drain within the Facility building during an inspection on March 6, 2003 and sent a letter to SGPP on April 3, 2003 requesting that the floor drain be decommissioned, rerouted to the municipal sanitary sewer, or re-routed to a registered holding tank. SGPP decommissioned the floor drain and notified NHDES of the closure on May 6, 2003. Recently, SGPP interviewed facility personnel and reviewed state and local records and was unable to determine the location of this former floor drain. The uncertainty in the location of this PRA will be carried forward in the conceptual site model.
- Proposed Investigations: Due to the uncertainty in the location of this PRA, no investigations specific to this PRA are proposed in this Work Plan. Should new information become available, and/or sampling associated

with other PRAs indicates potential significant impact beneath the Facility building, additional investigations may be proposed.

PRA-21: Stormwater Runoff and Snow Management Areas

- Description: NHDES requested investigation of areas where stormwater might runoff to pervious areas, and snow stockpile areas. SGPP personnel indicated that snow is usually managed in areas adjacent to roads and parking lots but did not identify areas of significant snow "stockpiling". At the request of NHDES, the potential release associated with stormwater or snow melt infiltration is identified as a PRA. This PRA would include most pervious areas adjacent to paved areas not already identified above. Due to the broad nature of this PRA, it is not depicted on Figure 4.
- Proposed Investigations: Several borings installed by C.T. Male as part of ISC investigation activities are located in areas of stormwater runoff (MW-01/MW-01S) or snow management (MW-01/MW-01S, MW-03/MW-03S, MW-04/MW-04S). Soil and groundwater results from these investigations will be compared to the results generated from investigations in other areas to determine if stormwater runoff or snow management are potential significant sources of PFAS. In addition, the proposed investigations under PRA-15: Stormwater Infiltration Catch Basin will evaluate the potential influence of stormwater on soil and groundwater quality.

4.2.2 Soil Sampling and Analysis

Soil samples will be collected according to the procedures described in Section 5.2 from the borings listed on Tables 2 and 3. Soil samples will be collected for analysis at the approximate intervals listed on Table 2, and submitted to Eurofins Lancaster Laboratory Environmental (ELLE) of Lancaster, Pennsylvania for analysis of:

- The PFAS analytes by Modified Method 537.1 (see list of analytes in Table 7).
- Total organic carbon by Method SW-846 9060.
- Moisture content by Method SM 2540 G-1997.

The following additional analytes will be analyzed in a subset of samples as identified on Table 3:

- Expanded PFAS list (see Table 7) by Method EPA 537 Version 1.1 Modified.
- Perfluoro(2-methyl-3-oxahexanoic) acid (HFPODA, "GenX") by Method SW-846 8321B.
- Total oxidizable precursor (TOP) assay – at the request of NHDES, SGPP will submit a split sample from the soil samples identified on Table 2 to SGS AXYS Analytical Services Ltd. of Sidney, British Columbia, Canada for analysis of PFAS before and after the TOP assay (SGS AXYS Method MLA-111 Rev 01 Ver 01).
- Principal ions (i.e., calcium, magnesium, potassium, sodium, chloride, sulfate, and carbonate/bicarbonate), pH and grain size analysis.

Soil borings advanced for collection of analytical samples will be logged according to the procedures described in Section 5.2. In addition, a sonic boring for geologic logging purposes has been proposed for the vicinity of current monitoring well MW-05.

4.2.3 Groundwater Sampling and Analysis

Groundwater samples will be collected according to the procedures described in Section 5.4 from the wells listed on Tables 4 through 6 which will be installed according to the procedures described in Section 5.3. The permanent monitoring wells installed under this work plan will be sampled twice, with one event coinciding with routine quarterly groundwater monitoring. Groundwater samples will be submitted to ELLE of Lancaster, Pennsylvania for analysis of:

- The PFAS analytes by Modified Method 537.1 (see list of analytes in Table 7)

The following additional analytes will be analyzed in a subset of samples as identified on Table 5:

- Expanded PFAS list by Method EPA 537 Version 1.1 Modified (see Table 7)
- Perfluoro(2-methyl-3-oxahexanoic) acid (HFPODA, “GenX”) by Method SW-846 8321B
- TPH by method 413.1 SGT-HEM
- VOCs by method 8260B
- SVOCs by method 8270C
- Target Analyte List (TAL) Metals ((aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) by Methods 6010C and/or 6020A)
- Wet chemistry parameters including total suspended solids and principal ions (alkalinity as bicarbonate, ammonium, calcium, chloride, iron, magnesium, manganese, nitrate, nitrite, potassium, sodium, sulfate, and sulfite)

4.2.4 Hydraulic Testing and Water Level Elevation Monitoring

Slug tests will be completed at newly installed monitoring wells using the methods described in Section 5.10. Golder will collect at least two full rounds of water levels for all new and existing monitoring wells.

5.0 METHODS AND PROCEDURES

The following sections describe the methods and procedures to complete the scope of work described in Section 4. These sections also describe necessary preventive measures to reduce the potential for sample cross-contamination and false positive sample results.

5.1 General

Due to the very low method detection limits associated with PFAS analysis and the many potential sources of trace concentrations of PFAS, sampling programs require the implementation of detailed operation procedures to reduce the potential for cross contamination and false positive sample results. Appendix C describes the precautions and measures required of field personnel to reduce the potential for cross contamination and false positive sample results. All contractors shall be notified in advance of the required precautions and measures to allow Site personnel to make necessary arrangements to fully comply.

5.2 Soil Boring Advancement and Soil Sampling

Prior to mobilization, at a minimum, at least 72 hours prior to conducting intrusive work, personnel will perform a subsurface utility clearance by coordinating with facility personnel, contacting DigSafe and any utility companies not included in the DigSafe notification.

Upon arrival on-Site, the driller will set up a decontamination area and decontaminate all tools and equipment that may come in contact with Site materials following the procedure outlined in Section 5.7. Field personnel shall decontaminate non-dedicated tools and sampling equipment as indicated in Section 5.7. Decontamination and drilling water will be treated and a sample will be analyzed for PFAS prior to use.

Soil borings will be advanced at pre-determined locations using direct push technology with Macro-Core samplers or sonic drilling methods, depending on location and total boring depth. Shallow soil borings (less than 15 feet) will be advanced with direct push technology unless refusal is encountered. Deep soil borings and bedrock borings will be advanced with sonic drilling methods. During drilling, field personnel will collect continuous soil samples, log the soil and/or rock cuttings and describe the soil lithology according to the Unified Soil Classification System (USCS) including identification of any visual or olfactory indications, and observe encountered groundwater depths (if any). New nitrile gloves shall be worn by the drilling contractor prior to the handling and recovery of the sampling equipment (e.g. drill rods, etc.). A new pair of clean nitrile gloves shall be worn by field staff prior to the collection of each soil sample.

The sonic and direct push drilling methods produce continuous sleeves of subsurface materials extracted during drilling. Samples will be labeled according to boring number, depth, and date. A photoionization detector will be used to conduct field screening of the drill cuttings in accordance with Site health and safety protocols. Following drilling, geologic logs of each borehole will be produced.

For Quality Assurance/Quality Control (QA/QC) purposes, duplicate soil samples, field blanks, and equipment blanks will be collected and analyzed in accordance with Section 5.6. Equipment blanks must be collected using PFAS-free water poured over appropriate equipment per Section 5.6.3.

5.3 Monitoring Well Installation

This section presents the protocols for installation of monitoring wells.

5.3.1 Installation of Monitoring Wells

Only PFAS- and Teflon®-free equipment (well materials, O-ring seals, glue, tape, etc.) shall be permitted on-Site and used in well construction. Written details on the equipment construction materials and/or Safety Data Sheets (SDS) shall be requested and reviewed in advance, as applicable. New nitrile gloves shall be worn by the drilling contractor prior to the handling of monitoring well components at each location.

New monitoring wells will be installed at the approximate locations shown on Figure 5. SGPP may adjust well locations based on identification of underground or overhead utilities and/or access to the drilling locations. Three types of monitoring wells are proposed:

- Shallow overburden monitoring wells will be installed in boreholes advanced using direct push or roto-sonic drilling techniques with a screen interval intersecting the water table
- Deep overburden monitoring wells will be installed in boreholes advanced using roto-sonic drilling techniques. The bottom of the well screen will be installed at the top of bedrock.

- Bedrock monitoring wells will be installed in boreholes advanced using roto-sonic drilling techniques. The well screen will be installed in the top approximately 10 feet of bedrock.

The drilling contractor will collect continuous soil/rock samples for geologic logging from the ground surface to the bottom of the boring using a roto-sonic core sampler. After removal of the roto-sonic sampler from the ground, the driller will extract the soil/rock core from the sampler for logging. Collected samples will be logged using the USCS ASTM D2487, modified to account for man-made materials. Rock will be logged using International Society of Rock Mechanics (ISRM) protocols. Full ISRM descriptions may not be possible due to disturbance caused by roto-sonic drilling methods. Well screen interval selection will consider material textures and gradations that appear more conducive to groundwater movement, and in hard, fractured rock zones.

Overburden monitoring wells will be constructed of 2-inch diameter, schedule 40 PVC with approximately 5 feet of 0.010-inch slotted well screen below a PVC below a PVC riser. The PVC riser will extend to ground surface or appropriate height, depending on well completion method (flush-mount road box or stick-up protective cover). Bedrock monitoring wells will be installed with a similar construction, but with approximately 10 feet of 0.010-inch slotted well screen below a PVC.

The overburden wells will be constructed as follows:

- Place at least 1 foot of clean filter sand below the well screen (shallow overburden and bedrock wells only)
- Place clean sand in the borehole annulus adjacent to the well screen to approximately 2 feet above the well screen
- Place a 3-foot bentonite seal (hydrated chips or pellets) above the sand (a 1-2 foot bentonite seal may be required if the top of the well screen is less than 5 feet bgs)
- Fill the remaining borehole annulus with a neat cement grout and/or hydrated bentonite chips/pellets to the ground surface; and
- Complete the well with a cement pad and locking well cover.

The bedrock monitoring wells will be installed using similar construction, plus a steel isolation casing installed 3 feet into bedrock. The well screen interval for bedrock wells will be 10 feet long.

The final well ID will be based on the installed bottom of well screen, in feet below ground surface (e.g., if MW-09S is installed to a depth of 15 feet bgs, the final well ID will be MW-09S-15.

5.3.2 Installation of Temporary Monitoring Wells

Groundwater grab samples will be collected from temporary monitoring wells (TMWs) at the approximate locations shown on Figure 5. The TMWs will be installed and abandoned using the geoprobe well point, procedures outlined in Appendix D. The TMWs will be purged and sampled according to the protocols in Section 5.4. SGPP will not develop the TMWs or wait two weeks after installation to sample.

5.3.3 Development

Following installation, each well will be developed using a submersible pump or inertial pumps equipped with a surge block, and high-density polyethylene (HDPE) tubing. Other pumping methods may be preferred or required for deep and/or high-yield monitoring wells (e.g., air-lift pumping using either compressed air or nitrogen). The Project Manager and field personnel shall inquire of the manufacturer and subcontractors with sufficient notice prior to performing this task, and identify down-the-well equipment (pumps, tubing, tape, lubricants, etc.) whose construction does not include any PFAS or Teflon® components (e.g., check balls, O-rings, compression fittings, etc.).

Written details on the equipment construction materials and/or SDS shall be requested and reviewed as applicable. Field personnel shall determine and cut the appropriate length of new HDPE tubing to be used in each well to avoid contact with any materials other than the well and pump. Field personnel shall decontaminate non-dedicated components and sampling equipment (including pumps, tubing shears, etc.) in accordance with Section 5.7. Well development will continue until relatively clear water is produced, and field parameters (pH, ORP, specific conductance, and turbidity) stabilize indicating good hydraulic communication with the surrounding water bearing zone. Wells will be developed to a target turbidity of less than 50 NTU, although higher turbidities may be accepted if the readings have stabilized after purging more than 5 well volumes.

Field personnel shall not use Teflon® tubing, other equipment made of Teflon® or other PFAS-containing materials for well development. Field personnel shall not re-use materials between well sample locations whenever possible. Following completion of monitoring well development, field personnel shall place all disposable materials in heavy-duty (i.e., lawn waste) garbage bags for disposal.

Development water shall be containerized and disposed of in accordance with Section 5.8.

5.3.4 Surveying

SGPP will contract a certified surveyor to survey the northing, easting, ground surface and top of casing (top of outer casing and PVC casing, if present) elevations of each monitoring well upon completion. The survey measurements will adhere to the North American Vertical Datum of 1988 (NAVD 88) for vertical control to an accuracy of within 0.01-foot. Horizontal control will be surveyed to the New Hampshire State Plane Coordinate System (North American Datum of 1983 (NAD 83)) to an accuracy of 0.1-foot.

5.4 Groundwater Sampling

This section presents the protocols for sampling of monitoring wells.

5.4.1 Sample Purging and Stabilization

Following well installation and development, the wells will be allowed to stabilize for a minimum two-week period prior to sampling. Following the two-week stabilization period, field personnel shall adhere to the procedures described in the following sections during groundwater sampling activities.

Field personnel shall purge monitoring wells using a peristaltic pump or submersible pump and HDPE tubing because of its’ lower tendency to sorb PFAS. Low-flow purging and sampling techniques shall be used whenever possible. Field personnel shall not use Teflon® tubing or other equipment containing PFAS (e.g., check balls, O-rings, compression fittings, etc.) for purging or sample collection. Field personnel shall wear nitrile gloves at all times.

The sampler shall determine and cut the appropriate length of HDPE tubing to be used in each well using their previously-measured arm span to avoid contact with any materials other than the well and the pump. Field personnel shall decontaminate non-dedicated components and sampling equipment (including pumps, tubing shears, etc.) in accordance with Section 5.7 between well locations. Field personnel shall not re-use disposable materials between well sample locations.

Purging rates shall not exceed 300 ml/min. All purge water shall be captured and containerized, and transported to temporary holding tanks or drums staged on site, as appropriate, for off-site disposal. Following completion of purging at each location, field personnel shall place all disposable materials in heavy-duty (i.e., lawn waste) garbage bags for off-site disposal. Dedicated stainless steel tubing weights may be used, if needed, to assist with placement of tubing intakes within the screened interval.

As previously noted, depth to water will not be monitored prior to or during groundwater sampling. All other parameters will be monitored as described in the USEPA Region 1 SOP for low-flow sampling, as summarized in the following table:

Parameter	Stabilization Criteria
Turbidity	± 10% for values greater than 5 NTU; if three consecutive turbidity values are less than 5 NTU, consider values stabilized To limit potential contamination, turbidity readings shall be collected after the YSI flow-through cell, not before.
Dissolved Oxygen	± 10% for values greater than 0.5 mg/L; if three consecutive dissolved oxygen values are less than 0.5 mg/L, consider values stabilized
Specific Conductance	± 3%
Temperature	± 3%
pH	± 0.1 S.U.
Oxidation/Reduction Potential	± 10 millivolts

5.4.2 Sample Collection

Following stabilization of field parameters, field personnel shall wash their hands and put on a new pair of nitrile gloves prior to sample collection. If all of the above parameters have not stabilized after 2 hours of purging, field personnel shall will note this on the field form and collect samples.

PFAS sample bottles should be filled first prior to other analytes to limit the potential for cross-contamination. Once the nitrile gloves are put on, field personnel shall not handle papers, pens, clothes, etc. prior to the collection of groundwater samples. If field personnel need to take notes or handle anything other than the sample container prior to collecting the sample, the old nitrile gloves with which contact was made shall be removed and new nitrile gloves put on. Groundwater samples for PFAS shall be collected in HDPE or polypropylene sample containers provided by the laboratory specifically for use in the collection samples for analysis of PFAS (no Teflon® liner). Glass containers shall not be used due to the potential for loss of PFAS through sorption. Sample container lids shall remain on the sample container until immediately prior to sample collection and lids shall be resealed immediately following sample collection. Field personnel shall hold the sample container lid in their hand until the lid is replaced on the sample container. Field personnel shall not rinse sample bottles during groundwater sample collection. Sample container labels shall be completed using a non-gel pen or a pencil after the lid has been re-secured on the sample container. If a marker must be used, nitrile gloves shall be removed after use of the marker and replaced with new ones.

Field personnel shall hold the sample container in such a manner that the sample container does not come in direct contact with the HDPE tubing or pump equipment. The sampling container shall be filled completely to minimize surface-to-volume ratio and therefore the likelihood of PFAS loss via sorption. If field personnel observe suspended solids in the collected groundwater sample, a new sample shall be collected, if possible. No subsampling, sample transfer or sample filtering shall occur in the field. If it is not possible to collect a sample with minimal suspended solids, field personnel shall contact the Project Manager and, if the sample is submitted for analysis, indicate the presence of suspended solids as a note on the chain-of-custody.

Groundwater samples shall be placed directly into the laboratory-supplied containers. Once the lid has been resealed, sample containers will be placed into individual new Ziploc® storage bags and placed on ice in the laboratory- provided sample cooler. Field personnel shall minimize sample exposure to sunlight during sample handling and storage. Sampling materials shall be treated as single use and disposed of following completion of groundwater sampling at each monitoring well location.

If a duplicate or matrix spike/matrix spike duplicate (MS/MSD) will being collected, PFAS sample bottles for the duplicate and MS/MSD should be filled immediately after the primary PFAS sample (i.e., before any additional other analyte sample bottles are filled). The remaining sample bottles shall be filled in order of volatility (i.e., VOCs, SVOCs, etc.).

5.5 Groundwater Elevation Measurement

Golder will collect two rounds of groundwater elevation measurements after each round of groundwater sampling. The water level measuring probe will be decontaminated between monitoring well locations in accordance with Section 5.7. If possible, Golder will coordinate groundwater elevation measurements to be concurrent with surface water elevation measurements collected as part of stormwater and surface water investigation activities.

5.6 Quality Control

This section describes the QA/QC samples that shall be collected during the sampling program.

This SOP includes protocols for the collection of the following QA/QC samples during PFAS sampling:

- Equipment Blanks
- Field Duplicates
- Field Blanks
- Trip Blanks
- Analytical QA/QC

5.6.1 Field Duplicates

Field personnel shall collect one blind field duplicate for every 20 primary field samples collected. Field duplicates will be collected for analysis of PFAS, VOCs, SVOCs, metals, and wet chemistry. Field personnel shall collect field duplicates immediately after collection of the primary field samples. Field duplicates shall be collected in the laboratory-supplied sample containers. Field duplicate container lids shall remain in the hand of field personnel until replaced on the sample container. Sample container labels shall be completed as described above.

5.6.2 Trip Blanks

Field personnel shall submit one laboratory-supplied trip blank per day of sampling or per cooler, whichever is more frequent. Trip blanks will be submitted for analysis of PFAS and VOCs. Trip blanks shall consist of PFAS- or VOC- free water containerized in a container filled at the laboratory prior to the beginning of the field program. Field personnel shall place one trip blank container in the sample cooler at the beginning of the day and the trip blank shall remain in the cooler for the duration of sampling activities conducted on that day. Trip blank containers shall be submitted to the laboratory with the daily field sample shipment.

5.6.3 Equipment Blanks

Equipment blanks shall be collected at a rate of one per setup per event for non-dedicated sampling equipment. Equipment blanks will be collected for analysis of PFAS. Equipment blanks shall be collected using laboratory-supplied PFAS-free water and shall be collected in laboratory-supplied containers.

Equipment blanks for soil sampling will be collected by pouring the laboratory supplied PFAS-free water over the soil sampling equipment (e.g., drill rod or stainless-steel scoop) and collecting that water directly into a sample container. Equipment blanks for groundwater sampling will be collected by pouring the laboratory supplied PFAS-free water into a new and unused sample bottle and then pumping the PFAS-free water through new HDPE tubing and new silicon tubing into the sample container. When the sample container is full, replace the sample container lid and re-seal.

5.6.4 Field Blanks

Field personnel shall submit one field blank per day of sampling for analysis of PFAS. Field blanks shall consist of PFAS-free water containerized in an HDPE sample container filled at the laboratory prior to beginning the field program. Field blank sample containers shall be opened during the collection of a sample and the laboratory-supplied PFAS-free water contained therein shall be poured directly into a laboratory-supplied HDPE sample container and then resealed.

5.6.5 Analytical QA/QC

Laboratory QA/QC shall consist of one laboratory blank and one MS/MSD for every 20 primary field samples collected for analysis. MS/MSDs will be submitted for analysis of PFAS and metals. Field personnel shall collect MS/MSDs immediately after collection of the primary field samples as described above for field duplicates.

As part of the internal QA/QC, relative percent difference (RPD) shall be calculated between samples and corresponding field or laboratory duplicates. The laboratory quality assurance portion of the laboratory certificates shall be reviewed to verify that all calculations/recoveries were within acceptable limits as established by the laboratory method.

5.7 Decontamination

Field personnel shall use the procedures in this section to decontaminate all non-dedicated sampling equipment (e.g., submersible pumps, bladder pump components, tubing shears, water level meter, etc.) used to collect samples:

- Rinse thoroughly with Alconox, Liquinox, or Citranox solution

- Rinse thoroughly with PFAS-free water
- Rinse with methanol
- Rinse with PFAS-free water
- Allow to air dry
- Store equipment in clean Ziploc® storage bag until needed for sampling

Decontamination fluids used to clean equipment including Alconox/Liquinox/Citranox, PFAS-free water, and methanol shall not be reused during field decontamination and shall be collected and stored for off-property disposal.

5.8 Investigation-Derived Waste

Soil cuttings generated during drilling shall be containerized in drums or covered roll-off containers for disposal. Return fluid from drilling operations, if any, shall be containerized for disposal. Solid (non-soil) materials generated during drilling (plastic sheeting, nitrile gloves, paper towels, empty water jugs, etc.) will be disposed of in the Facility refuse dumpster.

Purge water and decontamination water will be containerized in 55-gallon drums or larger storage containers and stored at a location designated by SGPP.

The drums or storage containers will be closed/covered and labeled prior to staging on-Site. SGPP will be responsible for disposal of the waste materials in accordance with requirements applicable to the receiving Site.

5.9 Equipment Calibration

The calibration and maintenance of field equipment will be the responsibility of the field sampling team. Field instruments, such as meters for measuring field parameters, will be standardized/calibrated in accordance with the manufacturers' recommendations against National Institute of Standards and Technology (NIST) traceable standards, where appropriate. During sampling, calibration will occur at the start of each day, and calibration checks will occur at a minimum of two times a day (once every four hours of operation including at the end of the day). Appropriate calibration records will be maintained in project field log books, groundwater sample field information forms, or on calibration forms. A minimum of a two-point calibration will be performed for each parameter being calibrated. The field team leader is responsible for ensuring that calibrations are properly performed and documented at the appropriate frequency.

5.10 Slug Testing

Rising and falling head slug tests will be completed in the newly installed monitoring wells following well installation and development to estimate hydraulic conductivity of the screened hydrogeologic materials. The slug will consist of a solid steel pipe, about 5-feet long and 0.75 inches in diameter. A programmable pressure transducer capable of recording logarithmic changes in groundwater level (such as In-Situ's Level TROLL 700® Data Logger or equivalent) will be placed near the bottom of each well prior to starting each slug test. Groundwater level measurements will be collected logarithmically, starting at intervals as short as 0.25 seconds and up to 5 minutes at the end of the tests.

Falling head tests will be conducted first by lowering the slug into a well and recording the changes in head over time. Once groundwater level has returned to the static (pre-slug) conditions, the rising head test will begin by removing the slug, and logarithmically recording changes in head as the well recovers. Throughout both tests, manual groundwater level measurements will be obtained to verify transducer measurements. Manual measurements will be collected at approximately 30-second intervals for the first five minutes, at one-minute intervals for the next five minutes, and five-minute intervals until the groundwater level stabilizes (or attains 70% of recovery).

Slug test data will be evaluated using Hvorslev, Bouwer-Rice, or other methods, as appropriate. Inefficiencies in the communication between the well and the aquifer will be considered during the evaluation of the conductivity estimates.

5.11 Data Management

Data collection during this project will be retained in an electronic format. Specific data management activities are as follows:

Field Sample Collection Forms:

- Data will be transcribed from field forms or notebooks and tabulated, as appropriate, using a spreadsheet or database program.
- Data entry will be checked to ensure no transcription errors occurred.

Chain of custody (COC) forms:

- COC forms will be reviewed by the field staff prior to sample submission to ELLE to verify that the COC matches the cooler contents.
- COC forms will also be reviewed after sample submission to ELLE by the QA manager or designee to verify that the sampling plan is being followed.

Laboratory sample receipt documentation:

- Golder will review the laboratory sample receipt documentation and compare to the COC. If discrepancies are found, Golder will contact the field staff and laboratory to resolve any inconsistencies.
- Communications concerning changes to the sample identifications and required analysis, including telephone memoranda and emails, will be saved to project files by the project manager.

Final Chemistry Analytical Data documentation:

- Analytical data packages will be verified internally by ELLE for completeness prior to submittal to SGPP.
- Golder will verify that the analytical data packages contain the information required for data validation upon receipt.

An electronic database, as well as validated qualifiers, will be maintained by SGPP. Database entries will be checked for correctness and completeness.

5.12 Data Validation

For field samples associated with this project that are sent to a laboratory, the laboratory will produce data packages that will contain the information needed for formal validation of the data. Data will undergo a data evaluation process by which accuracy, precision and completeness are assessed.

Data validation techniques include screening, accepting, rejecting or qualifying data on the basis of specific quality control criteria for holding times, blank results, spike results, surrogates, and field duplicates. Upon receipt from ELLE, PFAS analytical results will be validated using Level 4 protocols[4]. Other analytical parameters will be validated using Level 2 protocols.

6.0 SCHEDULE AND PROJECT ORGANIZATION

6.1 Schedule

SGPP anticipates the following schedule, pending weather conditions and NHDES' approval of the work plan by July 9, 2018 (one month after work plan submission):

Start Date	End Date	Duration	Activity
7/9/2018	NA	NA	NHDES Work Plan Approval
7/9/2018	8/6/2018	4 weeks	Utility clearance and subcontractor coordination
8/6/2018	9/17/2018	6 weeks	Soil boring advancement and monitoring well installation
9/17/2018	10/15/2018	4 weeks	Lab analysis of soil and temporary monitoring well groundwater samples
9/17/2018	10/8/2018	3 weeks	2-week well stabilization and well development
10/8/2018	10/15/2018	1 weeks	First round monitoring well sampling
10/15/2018	10/22/2018	1 weeks	Slug testing of newly installed monitoring wells
10/15/2018	11/12/2018	4 weeks	Lab analysis of first round groundwater samples
11/1/2018	11/8/2018	1 weeks	Second round monitoring well sampling
11/8/2018	12/6/2018	4 weeks	Lab analysis of second round groundwater samples
12/6/2018	1/31/2019	8 weeks	SI Report[5] preparation

SGPP will meet with NHDES to discuss the results of the soil and first round groundwater sampling event within one month of receipt of laboratory analytical data. If sampling results indicate a specific PRA requires further

[4] Validation levels are described in accordance with Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 540-R-08-005; January, 2009)

[5] The SI Report will meet the requirements of Env-Or 606.03.

evaluation, SGPP will consider submitting a supplemental work plan for additional investigation. If additional investigation is warranted, the schedule for preparation of the SI Report may be adjusted, as appropriate.

Data validation reports will be included in the SI Report, if available. The validated data from the SI Report will be uploaded to the NHDES Environmental Monitoring Database (EMD) within 30 days of submittal of the SI Report. If data validation is not complete in time for inclusion in the SI Report, SGPP will include unvalidated data in the SI Report and transmit/upload the validated data to NHDES within 60 days after receipt of analytical data[6].

6.2 Project Organization

The following presents the primary contacts for representatives of each organization involved in this project:

Organization	Contact	Role
NH Department of Environmental Services	Lea Ann Atwell	NHDES Project Manager
Saint-Gobain Performance Plastics	Chris Angier	Site Manager
Golder Associates Inc.	Alistair Macdonald	Golder Project Director
Golder Associates Inc.	Ross Bennett	Golder Technical Lead

[6] "Receipt of analytical data" is defined as receipt of data for all SDGs associated with a contemporaneous data set in all formats necessary for the validation process (e.g., lab reports with chromatograms and electronic data deliverable files)

7.0 ACRONYMNS AND ABBREVIATIONS

AGQS	Ambient Groundwater Quality Standards
BGS	Below ground surface
ChemFab	Chemical Fabrics Corporation
COC	Chain of custody
CSM	Conceptual site model
C.T. Male	C.T. Male Associates
Draft SI Work Plan	Draft Site Investigation Work Plan
ELLE	Eurofins Lancaster Laboratory Environmental
Facility	SGPP Facility located at 701 Daniel Webster Highway, Merrimack, New Hampshire
Flatley	John C. Flatley Company
GE	General Electric
Golder	Golder Associates Inc.
HFPODA	Perfluoro(2-methyl-3-oxahexanoic) acid
HDPE	High-density polyethylene
ISC	Initial site characterization
ISRM	International Society of Rock Mechanics
MS/MSD	Matrix spike/matrix spike duplicate
NAD 83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NHDES	New Hampshire Department of Environmental Services
NIST	National Institute of Standards and Technology
NRC	National Response Center
PCBs	Polychlorinated biphenyls
PFAS	Per- and poly-fluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PPB	Parts per billion
PPT	Parts per trillion

PRA	Potential Release Areas
PSA	Pressure-sensitive adhesive
PTFE	Polytetrafluoroethylene
QA/QC	Quality Assurance/Quality Control
R&D	Research and development
RPD	Relative percent difference
SDS	Safety Data Sheets
SGPP	Saint-Gobain Performance Plastics
SVOCs	Semi-volatile organic compounds
TAL	Target Analyte List
TMWs	Temporary monitoring wells
TOP	Total oxidizable precursor
TOWN	Town of Merrimack
TPH	Total petroleum hydrocarbons
USCS	Unified Soil Classification System
VOCs	Volatile organic compounds
Work Plan	On-property Site Investigation Work Plan
WWTF	Waste Water Treatment Facility

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9.0 CLOSING

The undersigned are the principal authors of this work plan. Should you have any questions regarding this document, please contact Mr. Ross Bennett at (603) 668-0880.

GOLDER ASSOCIATES INC.

Ross W. Bennett, PE
Senior Engineer

Scott Drew, GIT
Staff Geologist

Alistair P.T. Macdonald, PG, LSP
Program Leader and Principal

TABLES

Table 1: Potential Release Areas

PRA	PRA Description	Soil Investigations	Groundwater Investigations
PRA-1	Aerial Deposition Area	*	*
PRA-2	Current and Former Loading Dock Areas	SG-SB-D, SG-SB-E, SG-SB-F	MW-11S
PRA-3	Former Railroad Tracks	TMW-G	TMW-G
PRA-4	June 2015 Formulation Spill Area	SG-SB-D	MW-11S
PRA-5	Former Outdoor Chip Storage Area	SG-SB-B	TMW-E
PRA-6	Hazardous Waste Storage Building and Former PSA Coater Area	SG-SB-C, SG-SB-I, TMW-F	TMW-F
PRA-7	2011 Loom Spill Area	--	TMW-E
PRA-8	New Manufacturing Building Roof Drain Downspouts	SG-SB-B	TMW-E
PRA-9	Current and Former Interior Chemical Storage Areas	--	TMW-D
PRA-10	QX Settling Tank Area	--	TMW-D, MW-04S, MW-04, MW-04B, MW-09S, MW-09
PRA-11	Formulation Area	--	TMW-B, MW-08S, MW-09S, MW-09
PRA-12	Weaving Room Settling Tank Area	TMW-C	TMW-C, MW-08S
PRA-13	Sewer Lines	MW-10S	TMW-B, TMW-D, MW-04S, MW-04, MW-04B, MW-09S, MW-09, MW-10S
PRA-14	Former UST	--	MW-8S
PRA-15	Stormwater Infiltration Catch Basin	TMW-A	TMW-A, MW-07S, MW-07
PRA-16	Existing Sub-surface Stormwater Conveyance System	SG-SB-E	MW-03S, MW-03, MW-03B
PRA-17	Connex Storage Container Area	MW-10S	MW-04S, MW-04, MW-04B, MW-10S
PRA-18	Ground Surface East of Stacks	SG-SB-A	--
PRA-19	Ground Surface West of Stacks	SG-SB-G, SG-SB-H	--
PRA-20	Former Floor Drain	--	--
PRA-21	Stormwater Runoff and Snow Management Areas	MW-01S, MW-01, MW-03S, MW-03, MW-04S, MW-04[1]	MW-01S, MW-01, MW-03S, MW-03, MW-04S, MW-04[1]

Notes:
PRA: Potential Release Area
* All soil and groundwater investigations will assess the areal deposition area
1: Soil and groundwater results from the installation and initial sampling of these wells will be compared to the results generated from investigations in other areas to determine if stormwater runoff or snow management are potential significant sources of PFAS

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

GOLDER

Table 2: Soil Investigation Locations - PFAS Analysis

Soil Boring	Anticipated Depth Intervals						PFAS - Short List[1]	PFAS - Expanded List[1]	HFPODA/ ADONA	PFAS - TOP	Principal Ions, pH, Grain Size
	0-2 Inches	2-12 Inches	3-4 feet	6-8 feet	10 feet below water table	Other					
SG-SB-A	X	X					X	--	--	--	X
SG-SB-B	X	X					X	--	--	--	--
SG-SB-C	X	X	X				X	--	--	--	--
SG-SB-D	X	X	X				X	--	--	--	--
SG-SB-E	X	X	X				X	--	--	--	--
SG-SB-F	X	X	X				X	--	--	--	--
SG-SB-G	X	X					X	--	--	--	X
SG-SB-H	X	X					X	--	--	--	X
SG-SB-I	X	X	X				X	--	--	--	--
TMW-A	X	X	X	X			X	--	--	--	--
TMW-B	X	X	X	X			X	--	--	--	--
TMW-C	X	X	X	X			--	X	X	--	--
TMW-F	X	X	X	X			X	--	--	--	--
TMW-G	X	X	X	X			X	--	--	--	X
MW-07	X	X	X	X	X		X	--	--	--	X
MW-09	X	X	X	X	X		--	X	X	--	X
MW-10S	X	X	X	X			--	X	X	--	--
MW-04B	See Note 2						X	--	--	X	X
MW-06B							X	--	--	X	X

Notes:

1: See Table 7 for PFAS short and expanded lists

2: SGPP will collect soil PFAS, TOP, and SPLP samples during boring advancement for bedrock wells MW-04B and MW-06B at the approximate depth interval with the highest PFOA concentration in the MW-04 or MW-06 borings

HFPODA - perfluoro(2-methyl-3-oxahexanoic) acid ("GenX")

ADONA - dodecafluoro-3H-4,8-dioxanonanoic acid

TOP - total oxidizable precurser assay

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

Table 3: Soil Investigation Locations - Non-PFAS Analysis

Soil Boring	Anticipated Depth Intervals					VOCs	SVOCs	TAL Metals
	0-2 feet	3-4 feet	6-8 feet	10 feet below water table	Other			
SG-SB-C	X					X	X	X
SG-SB-D	X					X	X	X
SG-SB-I	X					X	X	X
TMW-F	X					X	X	X
MW-10S	X					X	X	X

Notes:
VOCs - volatilte organic compounds
SVOCs - semi-volatile organic compounds
TAL Metals - target analyte list metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc)

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

Table 4: Overburden Groundwater Investigation Locations - First Sampling Event

Well	PFAS - Short List[1]	PFAS - Expanded List[1]	HFPODA/ADONA	TPH	VOCs	SVOCs	Metals	Wet Chemistry
TMW-A	X	--	--	--	--	--	--	--
TMW-B	X	--	--	--	--	--	--	--
TMW-C	--	X	X	--	--	--	--	--
TMW-D	--	X	X	--	--	--	--	X
TMW-E	X	--	--	--	X	X	X	--
TMW-F	X	--	--	--	X	X	X	--
TMW-G	X	--	--	--	--	--	--	--
MW-07S	X	--	--	--	--	--	--	X
MW-07	X	--	--	--	--	--	--	X
MW-08S	X	--	--	X	X	X	X	X
MW-09S	X	X	X	--	X	X	X	X
MW-09	X	--	--	--	--	--	--	X
MW-10S	--	X	X	--	X	X	X	X
MW-11S	X	--	--	--	X	X	X	X

Notes:

1: See Table 7 for PFAS short and expanded lists

TOP - total oxidizable precurser assay

HFPODA - perfluoro(2-methyl-3-oxahexanoic) acid ("GenX")

ADONA - dodecafluoro-3H-4,8-dioxanonanoic acid

TPH - total petroleum hydrocarbons

VOCs - volatilte organic compounds

SVOCs - semi-volatile organic compounds

TAL Metals - target analyte list metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc)

Wet chemistry parameters - total suspended solids and principal ions (alkalinity as bicarbonate, ammonium, calcium, chloride, iron, magnesium, manganese, nitrate, nitrite, potassium, sodium, sulfate, and sulfite)

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

Table 5: Overburden Groundwater Investigation Locations - Second Sampling Event

Well	PFAS - Short List[1]	PFAS - Expanded List[1]	HFPODA/ADONA
MW-01S	X	--	--
MW-01	X	--	--
MW-02S	--	X	X
MW-02	--	X	X
MW-03S	X	--	--
MW-03	X	--	--
MW-04S	X	--	--
MW-04	X	--	--
MW-05	X	--	--
MW-06S	--	X	X
MW-06	--	X	X
MW-07S	X	--	--
MW-07	X	--	--
MW-08S	X	--	--
MW-09S	X	--	--
MW-09	X	--	--
MW-10S	--	X	X
MW-11S	X	--	--

Notes:
1: See Table 7 for PFAS short and expanded lists
HFPODA - perfluoro(2-methyl-3-oxahexanoic) acid ("GenX")
ADONA - dodecafluoro-3H-4,8-dioxanonanoic acid

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

Table 6: Bedrock Groundwater Investigation Locations

	First Sampling Event				Second Sampling Event
Well	PFAS - Short List[1]	PFAS - Expanded List[1]	GenX/ADONA	Wet Chemistry	PFAS - Short List[1]
MW-01B	X	--	--	X	X
MW-02B	--	X	X	X	X
MW-03B	X	--	--	X	X
MW-04B	X	--	--	X	X
MW-06B	--	X	X	X	X

Notes:

1: See Table 7 for PFAS short and expanded lists

HFPODA - perfluoro(2-methyl-3-oxahexanoic) acid ("GenX")

ADONA - dodecafluoro-3H-4,8-dioxanonanoic acid

Wet chemistry parameters - total suspended solids and principal ions (alkalinity as bicarbonate, ammonium, calcium, chloride, iron, magnesium, manganese, nitrate, nitrite, potassium, sodium, sulfate, and sulfite)

Prepared by: STD
Checked by: RWB
Reviewed by: APTM

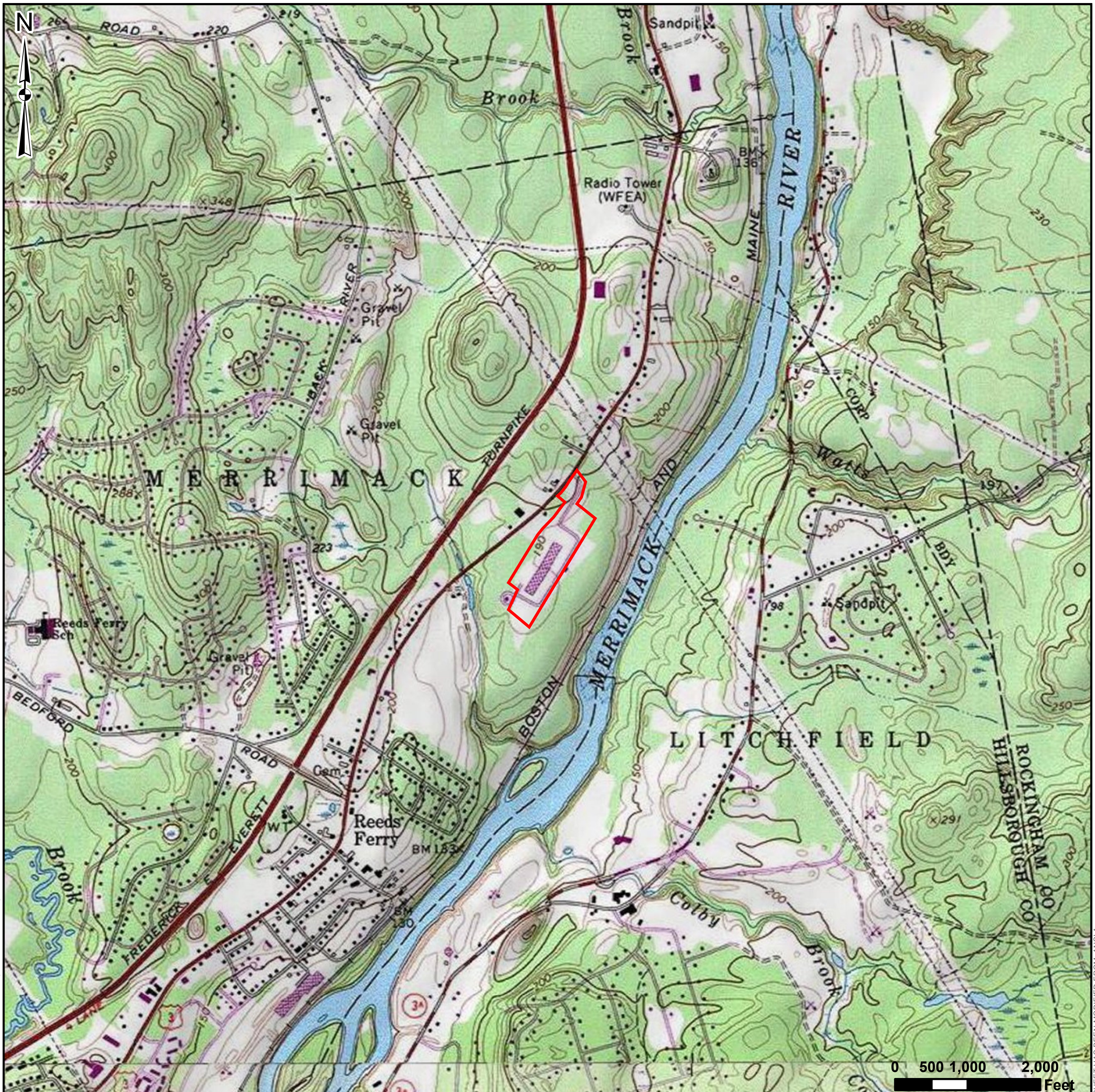
Table 7: PFAS Analyte List

PFAS Analytes	Abbreviation	CAS Id.	Target List	Expanded List*
10:2 Fluorotelomer sulfonic acid	10:2 FTSA	120226-60-0		x
4:2 Fluorotelomer sulfonic acid	4:2 FTSA	757124-72-4		x
6:2 Fluorotelomer sulfonic acid	6:2 FTSA	27619-97-2		x
8:2 Fluorotelomer sulfonic acid	8:2 FTSA	39108-34-4		x
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	x	
N-ethyl perfluorooctylsulfonamide	NEtPFOSA	4151-50-2		x
N-ethyl perfluorooctanesulfonamideoethanol	NEtPFOSAE	1691-99-2		x
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	x	
N-methyl perfluorooctanesulfonamide	NMePFOSA	31506-32-8		x
N-methyl perfluorooctanesulfonamidoethanol	NMePFOSAE	24448-09-7		x
Perfluorooctanesulfonic acid	PFOS	1763-23-1	x	
Perfluorobutanesulfonic acid	PFBS	375-73-5	x	
Perfluorobutanoic acid	PFBA	375-22-4	x	
Perfluorodecanesulfonic acid	PFDS	335-77-3		x
Perfluorodecanoic acid	PFDA	335-76-2	x	
Perfluorododecanesulfonic acid	PFDoS	79780-39-5		x
Perfluorododecanoic acid	PFDoA	307-55-1	x	
Perfluoroheptanesulfonic acid	PFHpS	375-92-8		x
Perfluoroheptanoic acid	PFHpA	375-85-9	x	
Perfluorohexadecanoic acid	PFHxdA	67905-19-5		x
Perfluorohexanesulfonic acid	PFHxS	355-46-4	x	
Perfluorohexanoic acid	PFHxA	307-24-4	x	
Perfluorononanesulfonic acid	PFNS	68259-12-1		x
Perfluorononanoic acid	PFNA	375-95-1	x	
Perfluorooctadecanoic acid	PFOdA	16517-11-6		x
Perfluorooctanesulfonamide	PFOSA	754-91-6		x
Perfluorooctanoic acid	PFOA	335-67-1	x	
Perfluoropentanesulfonic acid	PFPeS	2706-91-4		x
Perfluoropentanoic acid	PFPeA	2706-90-3	x	
Perfluorotetradecanoic acid	PFTA	376-06-7	x	
Perfluorotridecanoic acid	PFTrDA	72629-94-8	x	
Perfluoroundecanoic acid	PFUnA	2058-94-8	x	

*Analysis added at the request of NHDES.

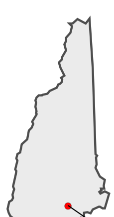
Prepared by: STD
Checked by: RWB
Reviewed by: APTM

FIGURES



LEGEND

Approximate SGPP Facility Property Boundary



REFERENCE

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CLIENT

SAINT-GOBAIN PERFORMANCE PLASTICS

PROJECT

SAINT-GOBAIN PERFORMANCE PLASTICS
701 DANIEL WEBSTER HIGHWAY
MERRIMACK, NH

TITLE

FACILITY LOCATION MAP

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-29
PREPARED	SHL
DESIGN	HDE
REVIEW	RWB
APPROVED	APTM

PROJECT No.	CONTROL	Rev.	FIGURE
166-8623	-	0	**1**

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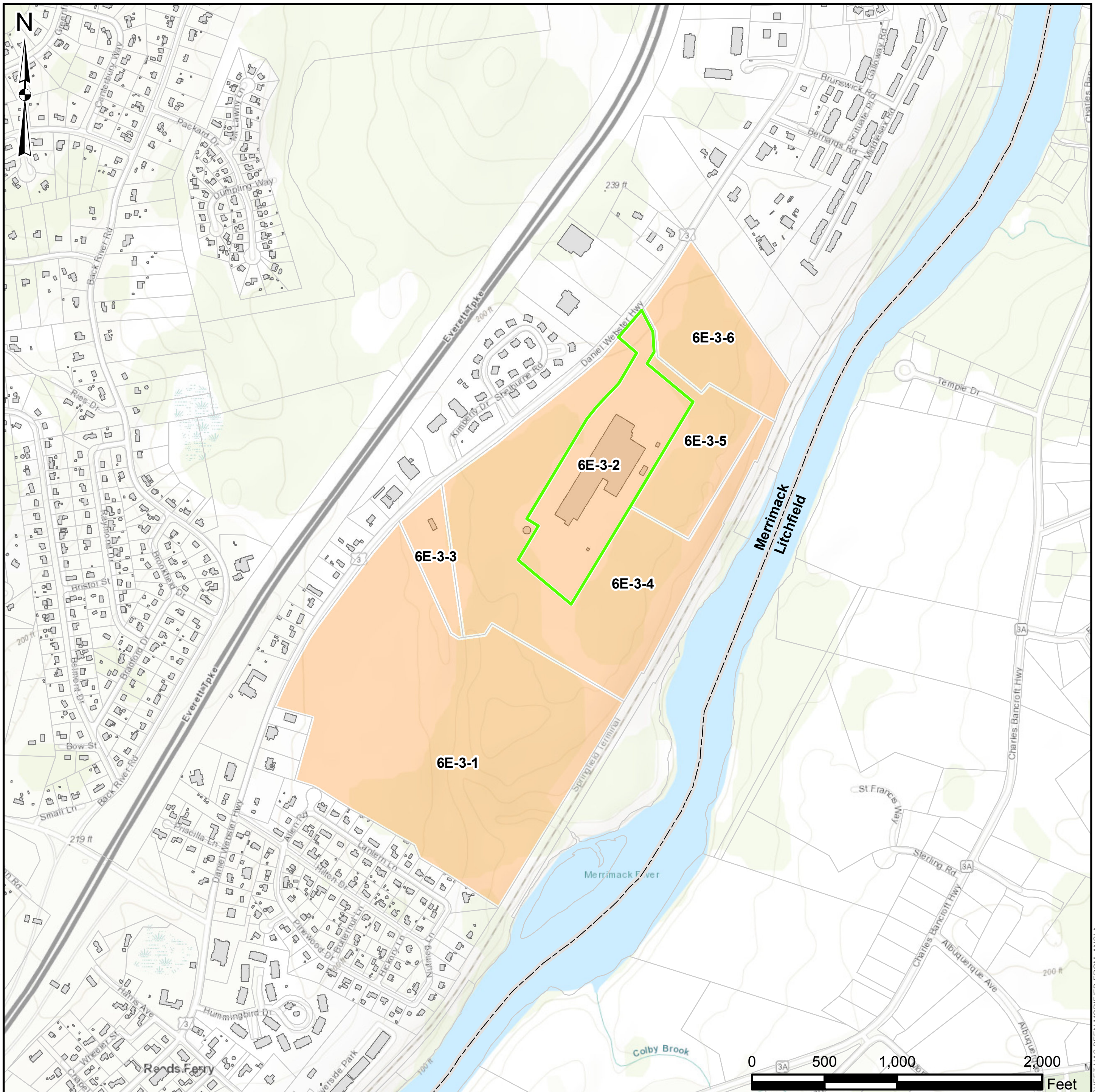

LEGEND

SGPP Property Boundary

Former GE or Chemfab Properties

Parcel Boundary

NOTES

1. PROPERTY BOUNDARIES ARE APPROXIMATE.

REFERENCE

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CLIENT

SAINT-GOBAIN PERFORMANCE PLASTICS

PROJECT

SAINT-GOBAIN PERFORMANCE PLASTICS
701 DANIEL WEBSTER HIGHWAY
MERRIMACK, NH

TITLE

FACILITY AND NEARBY PROPERTY LOCATIONS

CONSULTANT

GOLDER

YYYY-MM-DD	6/8/2018
PREPARED	SHL
DESIGN	RWB
REVIEW	RWB
APPROVED	APTM

PROJECT No.	CONTROL	Rev.	FIGURE
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5	Tower MB
6	Tower QX
7	Tower MC
	Tower MR
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	Tower MH
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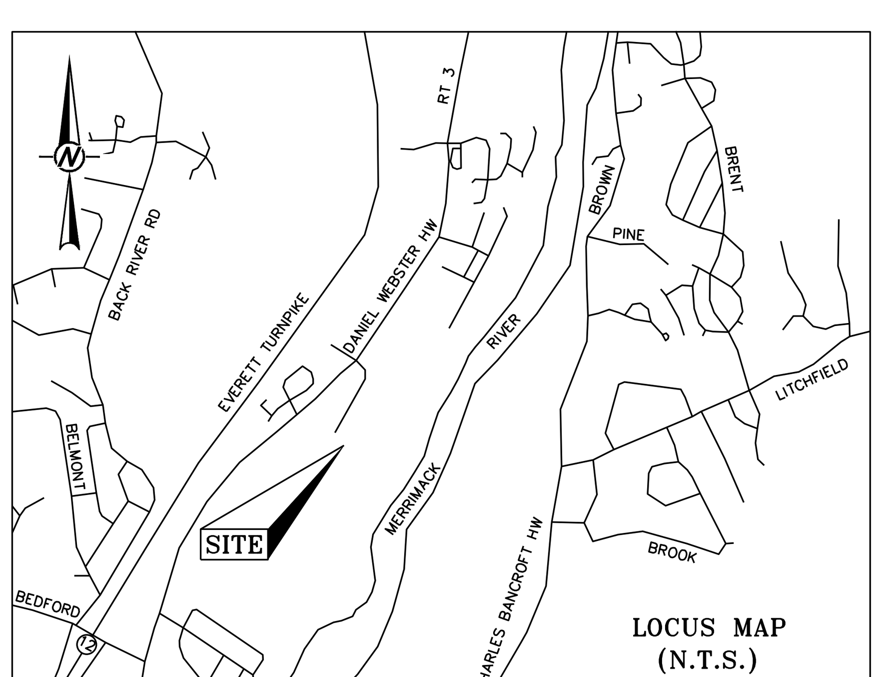
13	R&D Pilot Tower



LOCUS MAP
(N.T.S.)

LEGEND

IRF — IRON ROD FOUND	CATCH BASIN
CULVERT	ROUND CATCH BASIN
POST	UNKNOWN MANHOLE
TBM — TEMPORARY BENCHMARK	DRAIN MANHOLE
SB — STONE BOUND FOUND	EXTERIOR ROOF DRAIN DOWNSPOUT
STACK LOCATIONS	SEWER MANHOLE
MONITORING WELL	BOLLARD
OFF-PROPERTY MONITORING WELL	FIRE HYDRANT

CHAIN LINK FENCE
PROPERTY LINE
STORMWATER CONVEYANCE SYSTEM
ROOF DRAIN LINE (ABOVE GROUND)
SANITARY SEWER LINE

NOTES

1. THIS PLAN WAS PREPARED FROM FIELD SURVEY CONDUCTED BY WSP IN APRIL OF 2016, AUGUST OF 2017 AND OCTOBER OF 2017.

2. THE HORIZONTAL DATUM SHOWN HEREON REFERENCES THE NEW HAMPSHIRE STATE PLANE COORDINATE SYSTEM NAD83.

3. THE VERTICAL DATUM SHOWN HEREON REFERENCES NAVD88.

4. THIS PLAN ONLY REFERENCES THE BENCHMARK SET BY WSP AND IS LABELED AS 'TBM A'. ANY OTHER BENCHMARKS FOUND ON SITE WERE NOT SET OR VERIFIED BY WSP.

5. THE SURVEYED PROPERTY IS SUBJECT BUT NOT LIMITED TO THE INFORMATION SHOWN HEREON. ALL INFORMATION THAT MAY AFFECT THE QUALITY OF THE TITLE TO BOTH THE SUBJECT AND ADJOINING PARCELS SHOULD BE VERIFIED BY AN ACCURATE AND CURRENT TITLE REPORT. THIS SURVEY WAS PREPARED WITHOUT THE BENEFIT OF A CURRENT TITLE REPORT.

PLAN REFERENCES

1. PLAN ENTITLED "SUBDIVISION PLAN (MAP 6E, LOT 3-4), MERRIMACK COMMERCE PARK, DANIEL WEBSTER HIGHWAY, MERRIMACK, NEW HAMPSHIRE, PREPARED FOR JOHN J. FLATELY COMPANY." DATED NOVEMBER 3, 2012. PREPARED BY HAYNER/ SWANSON, INC. PLAN ON RECORD AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS AS PLAN No. 37652.

2. PLAN ENTITLED "LOT LINE RELOCATION PLAN (LOTS 3-2 & 3-4, MAP 6E), BALLYGOWAN PARK, D.W. HIGHWAY, MERRIMACK, NEW HAMPSHIRE. PREPARED FOR THE FLATLEY COMPANY." DATED APRIL 6, 1990. PREPARED BY ALLAN H. SWANSON, INC. PLAN ON RECORD AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS AS PLAN No. 24540.

3. PLAN ENTITLED "PLAN OF LOTS PREPARED FOR CHEMICAL FABRICS CORPORATION, DANIEL WEBSTER HIGHWAY, MERRIMACK, N.H." DATED MARCH 9, 1987. PREPARED BY T.F. MORAN, INC. PLAN ON RECORD AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS AS PLAN No. 20689.

4. PLAN ENTITLED "SUBDIVISION PLAN PREPARED FOR CHEMICAL FABRICS CORPORATION, DANIEL WEBSTER HIGHWAY, MERRIMACK, N.H." DATED MARCH 9, 1987. PREPARED BY T.F. MORAN, INC. PLAN ON RECORD AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS AS PLAN No. 20582.

5. PLAN ENTITLED "LOT LINE REVISION PLAN, LAND OF CHEMICAL FABRICS CORPORATION, DANIEL WEBSTER HIGHWAY, MERRIMACK, N.H." DATED AUGUST 7, 1986. PREPARED BY GEORGE F. KELLER, INC. PLAN ON RECORD AT THE HILLSBOROUGH COUNTY REGISTRY OF DEEDS AS PLAN No. 19804.

6. STACK LOCATIONS ARE BASED ON A LASER SCAN OF THE ROOFTOP AND STACKS COMPLETED BY C.T. MALE IN MARCH 2017.

CLIENT
SAINT-GOBAIN PERFORMANCE PLASTICS

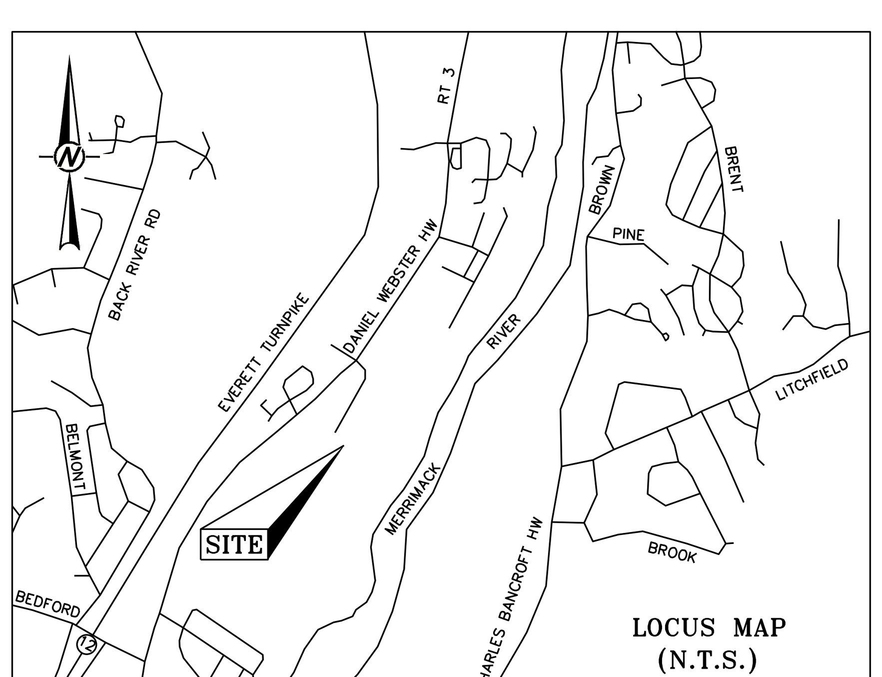
CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-22
DESIGNED	RWB
PREPARED	RWC
REVIEWED	RWB
APPROVED	APTM

PROJECT
SAINT-GOBAIN PERFORMANCE PLASTICS
701 DANIEL WEBSTER HIGHWAY
MERRIMACK, NEW HAMPSHIRE

TITLE
FACILITY PLAN

PROJECT NO.	SUBTITLE	REV.	FIGURE
166-8623	A	0	3



LEGEND

- IRF — IRON ROD FOUND
- CULVERT
- POST
- TBM — TEMPORARY BENCHMARK
- SB — STONE BOUND FOUND
- STACK LOCATIONS
- MONITORING WELL
- OFF-PROPERTY MONITORING WELL
- CATCH BASIN
- ROUND CATCH BASIN
- UNKNOWN MANHOLE
- DRAIN MANHOLE
- EXTERIOR ROOF DRAIN DOWNSPOUT
- SEWER MANHOLE
- BOLLARD
- FIRE HYDRANT
- CHAIN LINK FENCE
- PROPERTY LINE
- STORMWATER CONVEYANCE SYSTEM
- ROOF DRAIN LINE (ABOVE GROUND)
- SANITARY SEWER LINE
- POTENTIAL RELEASE AREAS
- POTENTIAL RELEASE AREAS - LOCATION APPROXIMATE

NOTES

1) SEE FIGURE 3 FOR PLAN NOTES AND REFERENCES.

2) POTENTIAL RELEASE AREAS (PRAS) REPRESENT AREAS WHERE A RELEASE IS EITHER KNOWN TO HAVE OCCURRED OR MAY HAVE OCCURRED. IDENTIFICATION OF A PRA IS NOT CONFIRMATION THAT THE RELEASE OCCURRED OR THAT THE RELEASE RESULTED IN A MEASURABLE IMPACT TO ENVIRONMENTAL MEDIA.

CLIENT
SAINT-GOBAIN PERFORMANCE PLASTICS

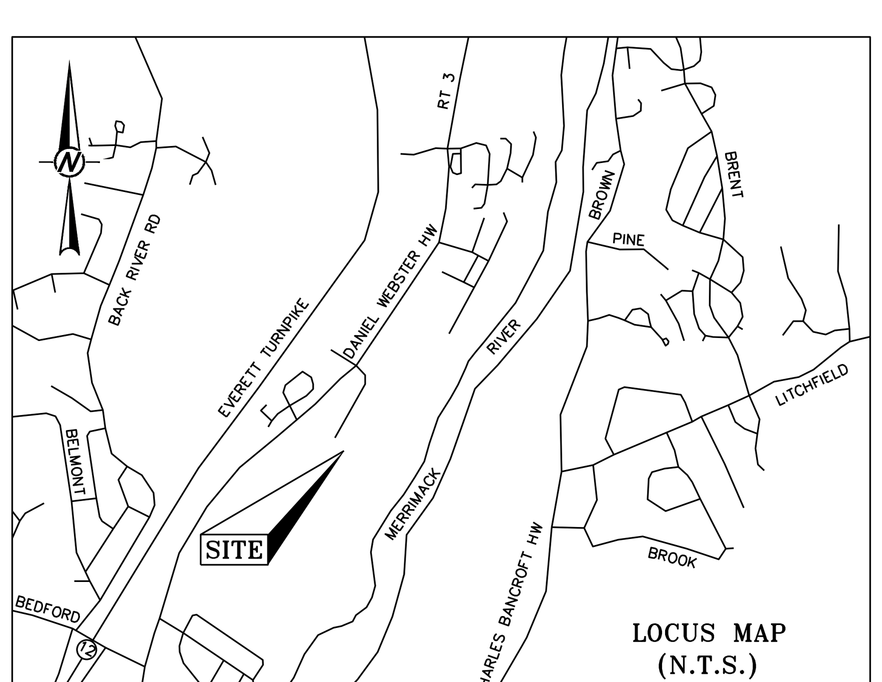
CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-22
DESIGNED	RWB
PREPARED	RWC
REVIEWED	RWB
APPROVED	APTM

PROJECT
SAINT-GOBAIN PERFORMANCE PLASTICS
701 DANIEL WEBSTER HIGHWAY
MERRIMACK, NEW HAMPSHIRE

TITLE
POTENTIAL RELEASE AREAS

PROJECT NO.	SUBTITLE	REV.	FIGURE
166-8623	A	0	4



LEGEND

- IRF — IRON ROD FOUND
- CULVERT
- POST
- TBM — TEMPORARY BENCHMARK
- SB — STONE BOUND FOUND
- STACK LOCATIONS
- OFF-PROPERTY MONITORING WELL
- CATCH BASIN
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- ROOF DRAIN LINE (ABOVE GROUND)
- SANITARY SEWER LINE
- POTENTIAL RELEASE AREAS
- POTENTIAL RELEASE AREAS - LOCATION APPROXIMATE

BORINGS AND MONITORING WELLS:

- SOIL BORING FOR SOIL SAMPLING
- SOIL BORING FOR GEOLOGIC OBSERVATION
- SHALLOW OVERBURDEN TEMPORARY MONITORING WELL
- SHALLOW OVERBURDEN MONITORING WELL
- DEEP OVERBURDEN MONITORING WELL
- BEDROCK MONITORING WELL
- EXISTING SHALLOW OVERBURDEN MONITORING WELL
- EXISTING DEEP OVERBURDEN MONITORING WELL

NOTES

1) SEE FIGURE 3 FOR PLAN NOTES AND REFERENCES.

2) POTENTIAL RELEASE AREAS (PRAS) REPRESENT AREAS WHERE A RELEASE IS EITHER KNOWN TO HAVE OCCURRED OR MAY HAVE OCCURRED. IDENTIFICATION OF A PRA IS NOT CONFIRMATION THAT THE RELEASE OCCURRED OR THAT THE RELEASE RESULTED IN A MEASURABLE IMPACT TO ENVIRONMENTAL MEDIA.

3) ALL PROPOSED BORING AND WELL LOCATIONS ARE APPROXIMATE AND MAY BE ADJUSTED TO ACCOMODATE ACCESS ONCE/OR TO AND/OR TO AVOID SITE INFRASTRUCTURE (e.g. UTILITIES)

CLIENT
SAINT-GOBAIN PERFORMANCE PLASTICS

CONSULTANT
GOLDER

YYYY-MM-DD	2018-05-22
DESIGNED	RWB
PREPARED	RWC
REVIEWED	RWB
APPROVED	APTM

PROJECT
SAINT-GOBAIN PERFORMANCE PLASTICS
701 DANIEL WEBSTER HIGHWAY
MERRIMACK, NEW HAMPSHIRE

TITLE
PROPOSED INVESTIGATIONS

PROJECT NO.	SUBTITLE	REV.	FIGURE
166-8623	A	0	5

APPENDIX A

NHDES SI WORK PLAN COMMENTS

APPENDIX A-1
NHDES COMMENT LETTER

EMAIL ONLY

April 13, 2018

Christopher S. Angier
Senior Environmental Project Manager
Saint-Gobain Performance Plastics
14 McCaffrey Street
Hoosick Falls, NY 12090

Subject: **Merrimack** – Saint-Gobain Performance Plastics, 701 Daniel Webster Highway
DES Site #**199712055**, Project #36430

Draft Site Investigation Work Plan, prepared by C.T. Male Associates, dated May 2016

Draft Initial Site Characterization Report, prepared by C.T. Male Associates, dated March 31, 2017

Updated Tables 3.5A and 3.5B, Draft Initial Site Investigation Report, prepared by Golder Associates, dated September 14, 2017

Dear Mr. Angier:

The New Hampshire Department of Environmental Services (NHDES) has reviewed the above-referenced submittals prepared on behalf of Saint-Gobain Performance Plastics (Saint-Gobain) for the Saint-Gobain facility located at 701 Daniel Webster Highway in Merrimack (facility). Comments based on NHDES' review of these documents are provided in the sections below.

NHDES notes that the extent of the "Site" as defined in Env-Or 600 has yet to be defined, but is anticipated to include the facility property, as well as properties around the facility that have been impacted by releases of per- and polyfluoroalkyl substances (PFAS) from the facility. Based on the detections of PFAS in samples collected by NHDES from private drinking water supply wells in the areas surrounding the facility, the "Site" will most likely include portions of the communities of Bedford, Litchfield, Manchester, and Merrimack. A preliminary Groundwater Management Zone (pre-GMZ) boundary was included in the March 2017 Consent Decree between NHDES and Saint-Gobain.

Site Investigation (SI) will be required to define the nature and extent of contamination and define the "Site," and investigation activities will be required both at the facility ("on-facility") and in the communities around the facility ("off-facility"). The pre-GMZ boundary is likely to be modified to some extent following completion of the off-facility SI.

The comments provided below relate to SI activities to be completed at the Saint-Gobain facility property (on-facility) only ("on-facility SI"). In our November 3, 2017 letter, NHDES requested that SI activities also be completed at off-facility properties in close proximity to the Saint-Gobain facility. Work plans for these separate efforts include the following:

- A scope of work for further investigation related to stormwater and surface water quality impacts was provided to NHDES on March 30, 2018.
- A scope of work for garden soil sampling at nearby residential properties was submitted on April 6, 2018.
- Based on information provided by Saint-Gobain, a proposed scope of work for SI activities at the immediately adjacent parcels owned by the John Flatley Company (Town of Merrimack Tax Parcel IDs 6E-3-4, 6E-3-1, 6E-3-3, and 6E-3-5) will be submitted by mid- to late-April.

Comments on these scopes of work will be provided separately. Additional comments on the off-facility SI activities will be provided by NHDES in conjunction with comments on the modeling report prepared by Barr Engineering Co. (Barr)[1], at a future date.

Draft Initial Site Characterization Report

The Draft Initial Site Characterization Report (ISC Report) prepared by C.T. Male Associates (CT Male) describes soil and groundwater sampling completed at the facility by Saint-Gobain as part of initial site characterization investigations. The work described in the ISC Report was completed in accordance with the proposed scope of work.[2]

As part of these efforts, on-facility monitoring wells (MW-1, MW-1S, MW-2, MW-2S, MW-3, MW-3S, MW-4, MW-4S, MW-5, MW-6, and MW-6S) were installed in March 2016 and subsequently sampled in March 2016 and April 2016. Additional sampling was completed in March, June, October, and December 2017; data for these sampling events were provided under separate cover and are summarized in the 2017 Annual Groundwater Monitoring Summary Report[3]. Monitoring wells were installed as shallow and deep couplets in overburden materials, with the exception of MW-5, which was installed as a single overburden well. In addition, soil samples were collected during monitoring well installation, wipe samples were collected from the rooftops of the facility buildings, and a sample was collected of the char material (designated as “stack tar”) inside one of the air emission stacks.

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[1] *Preliminary Air, Soil, and Water Modeling Technical Memorandum: Merrimack, New Hampshire*, prepared by Barr, dated June 2017.

[2] *Summary of Work Scope, Initial Site Characterization Investigation*, prepared by CT Male, dated March 13, 2016.

[3] *2017 Annual Groundwater Monitoring Summary, Volumes I and II*, prepared by Golder Associates (Golder), dated February 7, 2018. NHDES comments on this report will be provided under separate cover.

In summary, results presented in the ISC Report indicate the following key findings:

- PFAS are present in on-facility soil and groundwater. PFAS were also detected in samples collected from rooftops and stack tar.

- The detected concentrations of perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) in groundwater at the facility are greater than the NHDES Ambient Groundwater Quality Standards (AGQS) of 70 nanograms per liter (ng/L) for PFOA and PFOS, either individually or combined. Several other PFAS that are currently not regulated were also detected in groundwater.

- The detected concentrations of PFOA and PFOS in soil were less than the NHDES soil guidance levels of 500 parts per billion (ppb) for these compounds, which are based on a direct-contact exposure scenario.

- NHDES notes that the locations with the highest concentrations of PFOA in groundwater do not correlate to those locations with the highest concentrations of PFOA in soil. In addition, concentrations of PFOA detected in groundwater are greater on the eastern side of the facility than the western side of the facility. These patterns suggest that in addition to leaching of PFOA deposited from facility air emissions, other sources of groundwater contamination are likely present.

NHDES makes the following comments on the ISC Report, which should be addressed in a revised report:

1) Section 1.3 (Scope of Work) indicates that soil samples were collected at each soil boring location at depths up to 24"; however, we note that soils were sampled at deeper intervals at some locations, as noted on the soil boring logs in Appendix A and Table 2.2. *Please revise.*

2) Section 1.5 (Site History) indicates that Saint-Gobain acquired the facility from ChemFab in 2000; however, NHDES notes that the online tax parcel map maintained by the Town of Merrimack lists the owner of the property as CHEMFAB CORPORATION and the co-owner as C/O SAINT-GOBAIN PPL CORP/AP. *Please clarify who currently owns the facility property.*

3) Section 1.5 (Site History) does not mention that the abutting properties owned by John Flatley Company (Town of Merrimack Tax Parcel IDs 6E-3-4, 6E-3-1, 6E-3-3, and 6E-3-5) were previously owned by ChemFab. In addition, we note that Section 1.5 contains little information about the prior site operations under General Electric's (GE's) ownership of the property. *Please provide additional information about the property ownership and history and prior site operations.*

4) Section 1.8.3 (Environmental Orders, Decrees, and Violations Associated with the Site) indicates that the underground injection control (UIC) registration for the facility was likely associated with the used/waste oil underground storage tank (UST) that was removed from the facility in 1992. It is unclear based on the information provided in the report why this

association was assumed. UIC registrations are issued for wastewater discharges to the subsurface, and the May 2003 letter to NHDES referenced in the report indicates that a floor drain had been closed with concrete in 2003. Thus, it is unlikely that the 2003 registration and closure were associated with the UST. *Please provide additional information related to the UIC and the process(es) and location(s) with which it was associated.*

5) Section 1.8.3 describes a spill in the state spills database with NHDES Site Number 201103015 as being associated with the facility. We note that this Site Number pertains to a spill with an address of 70 Daniel Webster Highway and appears to be an error in the database report. *Please clarify.*

6) The database report provided in Appendix G includes several listings for the Saint-Gobain facility, with hyperlinks for additional information. The hyperlinks in the report provided are not active. *For completeness of the project record, please provide a full copy of the database report that includes these additional hyperlinked reports.*

7) Section 1.8.3 does not include descriptions of December 2003 and April 2004 spills of dispersions on the exterior of the building, or a June 2015 spill inside the facility building that seeped through the wall and leaked onto the ground on the outside of the building. These spills were described in previous correspondence to NHDES[4] and are documented in files maintained by NHDES and the Town of Merrimack. *Please provide a description of these incidents.*

8) Section 3.2 (Soil Borings and Monitoring Wells) indicates that drilling refusal, assumed to be till, boulders, and/or bedrock, was encountered in each of the borings at depths ranging from 23.8 to 28 feet below ground surface (ft bgs). However, the Geologic Cross Sections presented as Figures 8A-C and the Subsurface Logs and Monitoring Well Construction Logs provided in Appendix G do not indicate the presence of till in the exploration locations. *For clarity, lithological descriptions on the boring logs, cross-sections, and in the report text should be consistent.*

9) Section 3.4 (Hydraulic Conductivity Testing) indicates that the range of estimated hydraulic conductivity values for the deep wells is consistent with silty sand, silt, and glacial till, suggesting a greater component of fine-grained material than was observed in the samples. We note that the soil descriptions contained on the boring logs in Appendix A contain minimal information regarding the secondary components observed in the soil samples. *Please provide additional soil description information, if available.* Otherwise, going forward, please provide detailed soil descriptions for samples collected during future site investigation activities to better understand geological conditions.

10) Section 3.9 (Receptors and Potential Receptors) and the accompanying Figure 7 indicates that there are no known drinking water supply wells within the 500-foot radius of the facility. NHDES notes that were been connected to the Merrimack Village District (MVD) public water system by Saint-Gobain. *The revised report should acknowledge that drinking water*

[4] *Letter re Request for Information*, prepared by Archer & Greiner, PC, dated May 6, 2016.

supply wells were previously in use at these properties. In addition, please confirm if the wells are still active at these properties, or if these wells have been or will be decommissioned.

11) Figure 1 (Site Location Map) does not show the facility property boundary. *The property boundary should be noted on similar figures provided in reports.*

12) Wipe samples were collected from portions of the facility building rooftops and analyzed for PFAS. PFOA concentrations in these samples ranged from not detected to 530 nanograms per gram (ng/g, which are equivalent to ppb). PFOS was also detected in two samples. Shorter- and longer-chain perfluoroalkyl carboxylic acids (PFCAs) were also detected. The concentrations of each PFAS, including PFOA, varied from location-to-location. *Please indicate what may be the cause of the variations, and whether PFAS at these concentrations represent a potential source of impacts to the environment. In addition, please update Figure 5 to include the locations of the air emissions stacks.*

13) Groundwater elevations presented on Figures 8A, 8B, and 8C are inconsistent with those provided in Appendix C. For example, the approximate water table elevations depicted on Cross-Section B-B' (Figure 8B) appear to be higher than the elevations listed on the Water Level Record tables contained in Appendix C. *NHDES suggests posting the elevations on the cross-sections and noting the date of the measurement. It would also be helpful to show the groundwater elevations for the couplet wells to help understand vertical gradients.*

14) Groundwater samples collected during the March 2016 and April 2016 monitoring rounds were analyzed only for the six PFAS required by the USEPA Unregulated Contaminant Monitoring Rule 3 (UCMR 3) program. Reporting limits for these samples were elevated and ranged from 20 to 90 nanograms per liter (ng/L). NHDES understands that until USEPA issued its September 2016 clarification guidance, many laboratories were not quantifying the branched isomers of PFOA, and were reporting only the concentration of the linear isomer of PFOA. NHDES understands based on discussions with CT Male personnel that Eurofins Eaton, who completed the analyses described in the report, may have been such a laboratory. *Please clarify whether the concentrations provided in the report represent quantification of both linear and branched isomers of PFOA. If these concentrations are for linear isomers only, please inquire with the analytical laboratory as to whether revised concentrations can be reported that also include the branched isomers. If reported concentrations are for the linear isomers only, and revised concentrations cannot be reported, notation should be made on analytical data tables submitted with these results (as well as in future reports).*

15) Please clarify whether the groundwater samples were submitted for laboratory analysis of sulfonic acids or sulfonates. The analytical laboratory data reports indicate sulfonates, but the data validation reports indicate sulfonic acids, and the CAS numbers reported in both locations are the same. Note that the AGQS is for perfluorooctane sulfonic acid. *Please clarify which compounds were analyzed and reported.* In addition, please provide CAS numbers on tables, and order perfluoroalkyl acids in the tables by chain length.

16) *Please revise and submit the data tables to address the following*:

a) In Tables 3.5a and 3.5b, data should be compared to AGQS, not the EPA Lifetime Health Advisory (LHA), as New Hampshire has adopted the LHA levels of 70 ng/L as regulatory standards in the New Hampshire Code of Administrative Rules Chapter Env-Or 600.

b) Provide the primary sample locations associated with the duplicate samples.

c) Tables 3.4, 3.5a, and 3.5b contain results for the matrix spike / matrix spike duplicate (MS/MSD) samples. While these are important quality assurance / quality control samples, it is confusing to have them tabulated with the rest of the analytical data without any explanation where they are easily confused with primary soil samples. It is similarly confusing that these samples are listed in the analytical laboratory data reports along with the other soil samples without any explanation.

d) It does not appear that the results in Table 3.4 (Soil Sample Analytical Results) include the qualifiers provided in the data validation reports. NHDES notes the PFOS results for the samples collected from SG-MW02 as an example, but did not complete a comprehensive check of the data in the table. *Please check that the table contains the validated data, and if not, please revise to include this information.*

17) As summarized on the groundwater field sampling logs in Appendix B, some of the groundwater samples appear to have been turbid, with turbidity readings as high as 40 nephelometric turbidity units (NTU). *Please clarify whether samples were filtered and/or centrifuged at the laboratory prior to analysis, and if so, whether this turbidity has influenced the analytical results.*

18) Data validation reports for the soil samples only were provided in Appendix F. Validated data were provided in the above-referenced summary data tables submitted in September 2017 subsequent to submittal of the ISC Report; however, the associated data validation reports were not provided. In addition, data validation report(s) and an updated data table were not provided for the roof wipe and stack tar samples. *Please provide a copy of the data validation reports for the groundwater, roof wipe, and stack tar sample results associated with the sample results presented in the ISC Report.*

Draft Site Investigation Work Plan

Comments below on the draft Site Investigation Work Plan are provided in consideration of NHDES' review of the ISC Report and other relevant data submittals (e.g., Draft Soil Sampling Report[5], 2017 Annual Groundwater Monitoring Summary Report), data from private supply wells sampled by NHDES in the vicinity of the facility, and historical documents available in NHDES

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[5] *Draft Soil Sampling Report Locations Surrounding Saint-Gobain Performance Plastics*, prepared by CT Male, dated March 3, 2017. NHDES comments on this report will be provided under separate cover.

files, as well as observations made during NHDES site visits to the exterior and interior portions of the facility on July 7, 2017 and July 20, 2017.

As previously discussed, significant revisions to the work plan will be required for the scope of work to satisfy the requirements of Env-Or 606.01. The revised work plan (on-facility SI Work Plan) should address the components outlined in Env-Or 606.04-.08 and include a Site Investigation Report that meets the requirements of Env-Or 606.03. The SI activities should determine the source, nature, location, and extent of contamination, including, but not limited to PFAS, at the facility from current and historical site operations.

NHDES makes the following comments on the scope of work to be included in the on-facility SI Work Plan:

1) Additional information is needed about the history of the facility, including the former operations by ChemFab and General Electric (GE), both at the current facility property and at the abutting properties that were formerly associated with the facility. These abutting properties are generally currently undeveloped; however, it is unclear if any operations, such as illicit disposal, may have occurred in these areas. Historical records such as aerial photographs, topographic maps, historical plans and maps, City Directory listings, and other similar information should be used to prepare a detailed summary of the site history and provided in the on-facility SI Work Plan. We understand that SI-related activities on the adjoining properties formerly owned by ChemFab will be included in a separate work plan to be submitted in mid-April.

2) Please provide a comprehensive site plan that shows the locations of the key site features, site buildings, air emissions stacks, current and former subgrade structures, current and former chemical storage areas, and potential release areas should be provided in the revised on-facility SI Work Plan.

3) The scope of the on-facility investigations should thoroughly assess the potential for releases associated with current and historical facility operations, including prior operations by ChemFab and GE, in both interior and exterior areas. If locations of potential historical releases are unknown, investigations should target suspected release areas, rather than exclude the potential releases from consideration. Specific operations and features that should be shown on figures and targeted for soil and/or groundwater sampling, include, but are not limited to the following:

    a) *Structures, including the sanitary sewer line and former trenches, that convey wash water generated during the rinsing of dispersion totes and dip pans.* These structures have the potential to have leaked and released PFAS-containing wash water to the subsurface.

       Empty totes are washed out in the mixing room of the main building, and wash water is captured in a floor drain and conveyed to settling tanks prior to discharge to the sanitary sewer line. A trench drain in this area extends into the manufacturing area, and is reportedly capped and no longer used. Additional information is needed about the former use of this trench drain, its discharge location, and the integrity of the trench system. Prior to 2015, sinks were not plumbed to the settling tanks, but discharged directly to the sanitary sewer system. If other similar structures are present at the facility, these should also be evaluated as potential sources of releases to the subsurface.

Analytical results from sanitary effluent samples collected from the facility by the Town of Merrimack indicate the presence of PFAS, including PFOA and PFOS. NHDES understands that Saint-Gobain also collected samples of sanitary sewer effluent and requests that a copy of the analytical results be provided. Please also provide a description of the design and pilot test approach for the proposed wastewater pre-treatment system.

b) *The floor drain formerly located inside the building.* As noted above, a floor drain was reportedly present inside the building and decommissioned in 2003; however, the location of the drain is unknown based on the information available in NHDES' records. This drain may have resulted in the discharge of PFAS-containing water.

c) *A former limestone tank that reportedly discharged wash water to the ground.* NHDES inspection records from 1987 indicate that Teflon wash was discharged to sinks, which then discharged to a limestone tank, which discharged to the ground. The location of the tank is unclear.

d) *Current and former chemical storage areas and waste storage areas*. These areas include, but are not limited to, the current bulk dispersion storage areas inside the building, the Hazardous Waste Storage building on the east side of the facility, and the flammable storage building on the east side of the facility. In addition, a "chip collection area" and "oil house" are noted on the eastern side of the facility on a 1987 Spill Prevention Pollution Control Plan figure.

e) *Locations where releases of dispersions have occurred at the facility*. As noted above, several releases of dispersions have been documented at the facility in records maintained by NHDES and the Town of Merrimack. These release areas should be evaluated, as well as areas of any other releases that may be identified in records maintained by ChemFab or Saint-Gobain.

During NHDES' site visit, we noted that releases of dispersions in the mixing room resulted in damage to the base of the partition walls of that room. Please evaluate if these releases would have the potential to discharge to the environment. Although located inside the building, they are suggestive of housekeeping practices that are of a concern for potential releases.

f) *Exterior storage areas on the eastern side of the facility*. The highest concentrations of PFAS in facility groundwater were detected southeast of the facility, side- to down-gradient from the facility buildings. This pattern suggests that there are localized on-facility source areas, in addition to the air emission sources of PFAS. As noted during NHDES' site visits, materials and equipment are stored on the eastern side of the buildings, in connex containers, directly on the asphalt, and under cover in open-sided structures. We understand that portions of this area were only paved within the past few years. We also understand that empty dispersion totes are transported to this area for storage in shipping containers prior to off-site transport. During our site visit, NHDES observed dispersion that had leaked from one such container to the asphalt in this area. Potential impacts from these activities should be evaluated.

g) *Leaching from stack char material.* "Stack tar" from one air emission stack sampled as part of the ISC activities contaminated PFOA was detected at 130,000 ng/g, as well as other PFAS at concentrations two-to-three orders of magnitude lower. NHDES understands from our discussions with facility personnel and review of the facility Stormwater Pollution Prevention Plan (SWPPP) that the char material is discharged from the stacks onto the roofs and to the ground around the facility, and that the material is routinely collected and shipped off-facility by a disposal contractor. The visibly observed area of deposition to the ground surface and the potential for leaching of this material should be evaluated as part of the site investigation. Also, please provide a written description as to how the material is managed (e.g., as described in the SWPP), including estimates of the mass produced and frequency of removals from the facility.

h) *Infiltration of contaminated runoff (e.g., stormwater, snowmelt, and irrigation water) to the subsurface*. As noted in the Stormwater and Surface Water Sampling Report[6], PFAS were detected in stormwater samples collected from the on-facility stormwater network. Although the source of the PFAS impacts to stormwater will be evaluated as part of future sampling efforts (as described in the March 30, 2018 work plan submitted to NHDES), the potential for contaminated runoff to impact soil and groundwater quality should be evaluated during the SI. This evaluation should include potential impacts from roof runoff that is not collected directly into a closed stormwater system (e.g., in areas where stormwater from the roof might sheet flow from the building roofs, such as from portions of the New Building and in downspout areas), considering areas where the discharge is to pervious surfaces and/or incompetent impervious surfaces (e.g., cracked pavement). This evaluation should also include snow storage areas, given the potential for snowmelt to have been impacted by deposition from air emission sources, or by particulate matter sourced from the rooftop. Further, if water used for irrigation has been impacted by PFAS, areas of irrigation and potential irrigation runoff should also be included in the evaluation.

i) *Former railroad tracks.* A railroad turnaround appears to be present on the abutting property to the south of the facility and appears to be connected to the tracks at the facility that are no longer in operation. An assessment of the potential for releases from these areas should be evaluated.

j) *Current and former loading dock areas.* We understand that a loading dock was formerly located in the area of the "New Building." Given the potential for releases loading and unloading of materials, including dispersion totes, and that used totes are moved out of the facility in the current loading dock area for storage on the exterior of

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6 *Stormwater and Surface Water Investigation Summary Report, Volumes I and II*, prepared by Golder, dated January 30, 2018.

the building (as shown above), an assessment of potential releases at both the current and former loading dock areas is warranted.

4) Based on groundwater flow directions presented in the ISC Report, there appears to be a gap in the location of monitoring wells in the southwestern portion of the facility. An additional monitoring well, or well couplet, would help better understand groundwater flow in this area.

5) The concentrations of PFAS detected in samples collected from the shallow monitoring wells are greater than those collected from their paired deep monitoring wells, with the exception of the couplet MW-06/-06S. The vertical gradients calculated from groundwater elevation data presented in the ISC Report suggest a very flat, to slightly upward vertical gradient, with the largest vertical gradient observed at monitoring wells MW-06/-06S. A better understanding of vertical gradients and potential differences in water quality between shallow and deep overburden groundwater is needed.

6) As noted above, drilling refusal assumed to be till, boulders, and/or bedrock was encountered in each of the borings at depths ranging from 23.8 to 28 ft bgs when the existing monitoring wells were installed. Better characterization of the low recovery zones and reason for refusal is needed. In addition, the ISC Report indicates that a bedrock rise on the eastern side of the facility is inhibiting groundwater flow to the east and driving groundwater flow towards the south. However, NHDES notes that in the northern portion of the facility property, bedrock is highest on the western side of the facility (at monitoring well MW-02/-02S), and yet groundwater flow in that area of the facility is still shown to be towards the south on the groundwater contour plans provided as Figures 3 and 4 of the ISC Report. Additional assessment of the site hydrogeology, including evaluation of the controls on groundwater flow directions at and in the vicinity of the property, is needed.

7) Deep overburden groundwater at the facility has been impacted with PFAS. In addition, bedrock supply wells sampled by NHDES in the vicinity of the facility are also impacted with PFAS, including wells located both upgradient and downgradient from the facility. As such, an assessment of bedrock groundwater quality at the facility is warranted, and an understanding of the interactions between overburden and bedrock groundwater quality is needed.

8) Additional assessment of the correlation between predicted PFOA deposition from air emissions and resulting soil and groundwater concentrations is warranted. The highest concentration of PFOA detected in soil samples collected as part of the ISC activities was from location MW-06/-06S, at a concentration of 30 ng/g in a sample collected from 5 ft bgs. The highest concentrations of PFOA detected in samples from other exploration locations ranged from 0.46 to 5.1 ng/g. NHDES recommends collecting soil samples from those areas of the facility with the highest predicted deposition of PFOA to correlate PFOA (and other PFAS) deposition with observed soil and groundwater detections. Please provide an assessment of the potential correlation in the on-facility SI report.

9) Based on a review of the soil analytical data presented in the ISC Report, NHDES notes that of the 35 soil samples analyzed for PFAS, almost half of the samples had detections of PFOS at concentrations greater than PFOA, compared with approximately one third of the samples that had PFOA detections greater than PFOS. The highest levels of PFOS were detected in soil samples collected from the eastern side of the facility property, where detections ranged from 18 to 31 ng/g, compared to 3.1 to 7.2 ng/g in samples collected from the western side of the facility. In comparison, PFOS concentrations detected in groundwater samples from the on-facility wells were generally an order of magnitude lower than PFOA, or not detected above laboratory reporting limits. An assessment as to the source of the PFOS should be provided, as well as an explanation for the differences in concentrations between PFOS and PFOA in soil versus groundwater.

10) To better understand the vertical distribution of PFAS in soils at locations where soil borings are completed, NHDES recommends that soil samples be collected from the following intervals down to the water table or bedrock: from 0-2 inches bgs, 2-12 inches bgs, 3-4 feet bgs, 6-8 feet bgs and if necessary at subsequent 5 foot intervals until the bottom of the boring at the water table or bedrock, whichever is shallower. The soil samples below 1 ft bgs should also be adjusted so that they are collected from any mottling observed in the soil horizons, and any changes in soil type / lithology observed during drilling. In select drilling locations, samples should also be collected from depths up to ten feet below the water table, with samples collected from intervals that indicate a change in the stratigraphy.

11) More information is needed about the potential for continued leaching of PFAS from soil to groundwater, including an estimate of the mass of PFAS present in on-facility soils that will continue to leach to groundwater. As such, an approach for this evaluation should be included in the scope of work. NHDES recommends consideration of submittal of soil samples for analysis of synthetic precipitation leaching procedure (SPLP) for PFAS at conditions typical of rainwater, and/or parameters that may be relevant in controlling the distribution and migration of PFAS, including total organic carbon (TOC), pH, major cations, moisture, and grain size. A comparison of these parameters with the detected PFAS concentrations should be provided in the on-facility SI report.

12) NHDES recommends that field instruments used to measured pH and other geochemical parameters during groundwater sampling be calibrated at a minimum at the beginning of each field day, and a calibration check performed in the middle and at the end of each field day. Documentation to this effect should be provided in the on-facility SI report.

13) Two rounds of groundwater monitoring should be included in the SI scope of work. One of these rounds can be concurrent with the quarterly sampling of the existing monitoring wells.

14) The draft work plan contained a Quality Assurance Project Plan (QAPP). Please note that NHDES does not review and approve QAPPs as part of SI activities for state lead managed sites such as this one. SI activities should be completed using industry-standard practices, and the field and sampling methods described in the on-facility SI Work Plan.

15) A total of 23 PFAS have been detected in the samples of various media collected from the facility and surrounding areas (i.e., groundwater from the on-facility monitoring wells and nearby private drinking water supply wells, on-facility and off-facility soils, roof wipes, stack char, surface water, wet weather stormwater discharge, facility air emissions, and facility dispersions[7]). In addition to PFOA and PFOS, which were detected in groundwater samples collected from the on-facility monitoring wells at concentrations up to 7,300 and 440 ng/L, respectively, other detected PFAS include PFCAs (for example perfluorohexanoic acid [PFHxA], perfluoroheptanoic acid [PFHpA], and perfluoronanonoic acid [PFNA]); perfluorosulfonic acids (PFSAs); and precursor compounds that have the potential to break down into perfluoroalkyl acids (PFAAs) in the environment.

Given the detections of these PFAS, and the potential for the presence of precursor compounds that may break down into PFOA or PFOS, NHDES stongly recommends that samples collected during the SI activities be submitted for analysis of a longer list of PFAS than what is currently used for the quarterly groundwater monitoring of the on-facility wells. NHDES understands that many commercial laboratories with PFAS capabilities currently report between 20 to 30 PFAS. NHDES recommends that samples be analyzed for this expanded list.

More information is needed to better understand the potential mass of PFAS that could transform into PFOA, PFOS, and other PFAAs once released into the environment (i.e., “precursors”). As such, NHDES recommends that a subset of samples be submitted for analysis Total Oxidizable Precursor (TOP) Assay to get general understanding of potential precursor mass.

NHDES understands that fluorinated replacement compounds have been substituted for PFOA in the newer formulations used by the facility since the phase out of production of PFOA in the United States. Perfluoro-2-propoxypropanoaic acid (HFPO-DA/”GenX”) was detected in one of the dispersion samples and in a stack char sample collected from the facility. GenX has not been detected in the samples collected from private drinking water supply wells in the area by NHDES, but is not known if this compound is present in soil and groundwater at the facility. As such, NHDES would like to see the SI include assessment for GenX and any other potential replacement compounds (e.g., 4,8-dioxa-3H-perfluorononanoic acid/“ADONA”) that may have been used at the facility.

Based on a review of data collected during the SI, Saint-Gobain could include a recommendation in the report for NHDES to consider a more limited analyte list for subsequent monitoring and testing.

16) In general, the list of PFAS detected in groundwater, soil, stormwater, surface water, stack char, roof wipe samples, and dispersions is generally similar; however, some differences in the detected compounds are noted. For example, longer-chain PFAS compounds have been detected in soil and stormwater, but less frequently and at lower concentrations or not

[7] Data from the facility’s air emissions and dispersions are available in *Perfluorinated Sulfonic Acids and Perfluorinated Carboxylic Acids Testing Program Report*, prepared by Weston Solutions, dated July 2016

at all in groundwater samples. The site investigation should compare the PFAS detected in various site media and explain potential causes for these differences.

Closing

In closing, please provide two submittals that address the comments provided above:

1) A revised ISC Report should be provided that addresses comments 1 through 18 in the ***Draft Initial Site Characterization Report*** section above. Please provide the revised report by May 14, 2018.

2) A revised on-facility SI Work Plan should be provided that addresses comments 1 through 17 in the ***Draft Site Investigation Work Plan*** section above. Please provide the work plan by June 8, 2018. The work plan should include a schedule for implementation of the field work and report preparation, as well as upload of data to NHDES' Environmental Monitoring Database (EMD). NHDES expects that all field work for this investigation will be completed in calendar year 2018.

NHDES appreciates the work completed to date by Saint-Gobain related to the on-facility site investigation activities. We would be happy to arrange a meeting to discuss the proposed scope of work prior to submittal to facilitate our review and approval process. Please contact me if you would like to discuss further or if you have questions regarding this letter.

Sincerely,

Lea Anne S. Atwell

Lea Anne S. Atwell, PG, Emerging Contaminants Coordinator
Hazardous Waste Remediation Bureau
Tel: (603) 271-6572
Fax: (603) 271-2181
Email: LeaAnne.Atwell@des.nh.gov

ec: Edward J. Canning, Saint-Gobain
Kirk Moline, PG, C.T. Male Associates
Ross W. Bennett, PE, Golder Associates
Clark Freise, Assistant Commissioner, NHDES
Michael J. Wimsatt, PG, Director, NHDES WMD
Karlee Kenison, PG, Administrator, NHDES HWRB
Kate Emma Schlosser, PE, NHDES HWRB
Eileen Cabanel, Town Manager, Town of Merrimack
Attention Health Officer, Town of Merrimack
Richard Sawyer, Town Manager, Town of Bedford
Attention Health Officer, Town of Bedford
Troy Brown, Town Administrator, Town of Litchfield
Attention Health Officer, Town of Litchfield
Attention Health Officer, City of Manchester

APPENDIX A-2

RESPONSE TO NHDES COMMENTS

Appendix A-2: Response to NHDES Site Investigatoin Work Plan Comments dated April 13, 2018
Saint-Gobain Performance Plastics
Merrimack, New Hampshire

Comment #	Comment	SGPP Response
1	Additional information is needed about the history of the facility, including the former operations by ChemFab and General Electric (GE), both at the current facility property and at the abutting properties that were formerly associated with the facility. These abutting properties are generally currently undeveloped; however, it is unclear if any operations, such as illicit disposal, may have occurred in these areas. Historical records such as aerial photographs, topographic maps, historical plans and maps, City Directory listings, and other similar information should be used to prepare a detailed summary of the site history and provided in the on-facility SI Work Plan. We understand that SI-related activities on the adjoining properties formerly owned by ChemFab will be included in a separate work plan to be submitted in mid-April.	A revised site history has been included to address this comment
2	Please provide a comprehensive site plan that shows the locations of the key site features, site buildings, air emissions stacks, current and former subgrade structures, current and former chemical storage areas, and potential release areas should be provided in the revised on-facility SI Work Plan.	A comprehensive site plan has been included as Figure 3 in the Revised Work Plan.
3	The scope of the on-facility investigations should thoroughly assess the potential for releases associated with current and historical facility operations, including prior operations by ChemFab and GE, in both interior and exterior areas. If locations of potential historical releases are unknown, investigations should target suspected release areas, rather than exclude the potential releases from consideration. Specific operations and features that should be shown on figures and targeted for soil and/or groundwater sampling, include, but are not limited to the following:	
a)	*Structures, including the sanitary sewer line and former trenches, that convey wash water generated during the rinsing of dispersion totes and dip pans.* These structures have the potential to have leaked and released PFAS-containing wash water to the subsurface. Empty totes are washed out in the mixing room of the main building, and wash water is captured in a floor drain and conveyed to settling tanks prior to discharge to the sanitary sewer line. A trench drain in this area extends into the manufacturing area, and is reportedly capped and no longer used. Additional information is needed about the former use of this trench drain, its discharge location, and the integrity of the trench system. Prior to 2015, sinks were not plumbed to the settling tanks, but discharged directly to the sanitary sewer system. If other similar structures are present at the facility, these should also be evaluated as potential sources of releases to the subsurface. Analytical results from sanitary effluent samples collected from the facility by the Town of Merrimack indicate the presence of PFAS, including PFOA and PFOS. NHDES understands that Saint-Gobain also collected samples of sanitary sewer effluent and requests that a copy of the analytical results be provided. Please also provide a description of the design and pilot test approach for the proposed wastewater pre-treatment system.	Structures that convey wash water have been included as a potential release area (PRA). A description of the pilot test approach and analytical results from relevant sanitary effluent sampling will be submitted to NHDES separately upon completion of process water pilot test activities.
b)	*The floor drain formerly located inside the building.* As noted above, a floor drain was reportedly present inside the building and decommissioned in 2003; however, the location of the drain is unknown based on the information available in NHDES' records. This drain may have resulted in the discharge of PFAS-containing water.	This floor drain is included as a PRA in the work plan. SGPP recently interviewed facility personnel, reviewed state and local records and was unable to determine the location of this former floor drain. Due to the uncertainty in the location of this PRA, no investigations specific to this PRA are proposed at this time. Should new information become available, and/or sampling associated with other PRAs indicates potential significant impact beneath the Facility building, additional investigations may be proposed.
c)	*A former limestone tank that reportedly discharged wash water to the ground.* NHDES inspection records from 1987 indicate that Teflon wash was discharged to sinks, which then discharged to a limestone tank, which discharged to the ground. The location of the tank is unclear.	Available information suggests that the "limestone tank" referred to in this comment is the R&D area settling tank. When the R&D settling tank was cleaned out in 2017; SGPP observed and removed limestone media from the tank. SGPP assumes that the limestone media was placed in the tank as a neutralizing media for potential acid discharges. SGPP is not aware of any information, besides the interview responses in the 1987 inspection report, which suggests that the R&D settling tank discharged to the ground. Regardless, SGPP has identified potential releases of wash water in the area of the R&D settling tank as part of the Weaving Room Settling Tank Area PRA in the revised Work Plan.
d)	*Current and former chemical storage areas and waste storage areas*. These areas include, but are not limited to, the current bulk dispersion storage areas inside the building, the Hazardous Waste Storage building on the east side of the facility, and the flammable storage building on the east side of the facility. In addition, a "chip collection area" and "oil house" are noted on the eastern side of the facility on a 1987 Spill Prevention Pollution Control Plan figure.	Current and former chemical storage areas and waste storage areas have been identified in the revised Work Plan as PRAs.

Appendix A-2: Response to NHDES Site Investigatoin Work Plan Comments dated April 13, 2018
Saint-Gobain Performance Plastics
Merrimack, New Hampshire

Comment #	Comment	SGPP Response
e)	*Locations where releases of dispersions have occurred at the facility.* As noted above, several releases of dispersions have been documented at the facility in records maintained by NHDES and the Town of Merrimack. These release areas should be evaluated, as well as areas of any other releases that may be identified in records maintained by ChemFab or Saint-Gobain. During NHDES' site visit, we noted that releases of dispersions in the mixing room resulted in damage to the base of the partition walls of that room. Please evaluate if these releases would have the potential to discharge to the environment. Although located inside the building, they are suggestive of housekeeping practices that are of a concern for potential releases.	SGPP is aware of the potential for release from this area, but has no knowledge that the partition wall was "damaged" (other than staining of the wall). SGPP does not agree that the conditions in the mixing room are "suggestive of housekeeping practices that are of concern for potential releases". A Facility Release History Summary is included as Appendix B in the revised Work Plan. The Facility Release History Summary indicates that the Facility responded rapidly to releases when they occurred. Regardless, locations of potential historical on-property releases have been identified as PRAs in the revised Work Plan.
f)	*Exterior storage areas on the eastern side of the facility.* The highest concentrations of PFAS in facility groundwater were detected southeast of the facility, side- to down-gradient from the facility buildings. This pattern suggests that there are localized on-facility source areas, in addition to the air emission sources of PFAS. As noted during NHDES' site visits, materials and equipment are stored on the eastern side of the buildings, in connex containers, directly on the asphalt, and under cover in open-sided structures. We understand that portions of this area were only paved within the past few years. We also understand that empty dispersion totes are transported to this area for storage in shipping containers prior to off-site transport. During our site visit, NHDES observed dispersion that had leaked from one such container to the asphalt in this area. Potential impacts from these activities should be evaluated.	The hazardous waste storage building and connex container area have been identified as PRAs in the revised Work Plan.
g)	*Leaching from stack char material.* "Stack tar" from one air emission stack sampled as part of the ISC activities contaminated PFOA was detected at 130,000 ng/g, as well as other PFAS at concentrations two-to-three orders of magnitude lower. NHDES understands from our discussions with facility personnel and review of the facility Stormwater Pollution Prevention Plan (SWPPP) that the char material is discharged from the stacks onto the roofs and to the ground around the facility, and that the material is routinely collected and shipped off-facility by a disposal contractor. The visibly observed area of deposition to the ground surface and the potential for leaching of this material should be evaluated as part of the site investigation. Also, please provide a written description as to how the material is managed (e.g., as described in the SWPP), including estimates of the mass produced and frequency of removals from the facility.	Based on Golder's observations, the discharge of stack char materials is generally limited to the roof top. SGPP is not aware of discharge of stack char materials to the ground surface, besides the aerial deposition of particulates already acknowledged. Regardless, SGPP has added a PRA for the ground surface in the immediate vicinity of the stacks to the revised Work Plan. Golder has not observed stack char materials on the ground surface in the vicinity of the towers, therefore, there is no "visibly observed area of deposition to the ground surface". The potential for leaching of hypothetically-present char materials on the ground surface near the stacks will be evaluated via sampling of soil from soil borings SG-SB-A, SG-SB-G and SG-SB-H. With regard to an evaluation of the potential for leaching of this material, see response to Comment 11. A summary of routine roof inspection and cleaning activities was included in the April 5, 2018 Roof Drain Survey and Cleaning Activities Summary.
h)	*Infiltration of contaminated runoff (e.g., stormwater, snowmelt, and irrigation water) to the subsurface*. As noted in the Stormwater and Surface Water Sampling Report6, PFAS were detected in stormwater samples collected from the on-facility stormwater network. Although the source of the PFAS impacts to stormwater will be evaluated as part of future sampling efforts (as described in the March 30, 2018 work plan submitted to NHDES), the potential for contaminated runoff to impact soil and groundwater quality should be evaluated during the SI. This evaluation should include potential impacts from roof runoff that is not collected directly into a closed stormwater system (e.g., in areas where stormwater from the roof might sheet flow from the building roofs, such as from portions of the New Building and in downspout areas), considering areas where the discharge is to pervious surfaces and/or incompetent impervious surfaces (e.g., cracked pavement). This evaluation should also include snow storage areas, given the the facility by the Town of Merrimack indicate the presence of PFAS, including PFOA and PFOS. NHDES understands that Saint-Gobain also collected samples of sanitary sewer effluent and requests that a copy of the analytical results be provided. Please also provide a description of the design and	SGPP personnel indicated that snow is usually managed in areas adjacent to roads and parking lots but did not identify areas of significant snow "stockpiling". SGPP does not have irrigation. However, at the request of NHDES, the potential release associated with stormwater or snow melt infiltration is identified as a PRA in the revised Work Plan. Several borings installed by C.T. Male as part of ISC investigation activities are located in areas of stormwater runoff (MW-01/MW-01S) or snow management (MW-01/MW-01S, MW-03/MW-03S, MW-04/MW-04S). Soil and groundwater results from these investigations will be compared to the results generated from investigations in other areas to determine if stormwater runoff or snow management are potential significant sources of PFAS. In addition, the proposed investigations under PRA-15: Stormwater Infiltration Catch Basin will evaluate the potential influence of stormwater on soil and groundwater quality.
i)	*Former railroad tracks.* A railroad turnaround appears to be present on the abutting property to the south of the facility and appears to be connected to the tracks at the facility that are no longer in operation. An assessment of the potential for releases from these areas should be evaluated.	To Golder's knowledge, neither SGPP nor its predecessors used the railroad tracks for storage of chemicals, or that a release occurred along tracks. However, the on-property portions of the former railroad tracks have been included as a PRA.

Comment #	Comment	SGPP Response
j)	*Current and former loading dock areas.* We understand that a loading dock was formerly located in the area of the "New Building." Given the potential for releases loading and unloading of materials, including dispersion totes, and that used totes are moved out of the facility in the current loading dock area for storage on the exterior of the building (as shown above), an assessment of potential releases at both the current and former loading dock areas is warranted.	The current and former loading docks have been included as a PRA in the revised Work Plan.
4	Based on groundwater flow directions presented in the ISC Report, there appears to be a gap in the location of monitoring wells in the southwestern portion of the facility. An additional monitoring well, or well couplet, would help better understand groundwater flow in this area.	The scope-of-work in the revised WP includes installation of a shallow and deep overburden well (MW-07S and MW-07) in this area.
5	The concentrations of PFAS detected in samples collected from the shallow monitoring wells are greater than those collected from their paired deep monitoring wells, with the exception of the couplet MW-06/-06S. The vertical gradients calculated from groundwater elevation data presented in the ISC Report suggest a very flat, to slightly upward vertical gradient, with the largest vertical gradient observed at monitoring wells MW-06/-06S. A better understanding of vertical gradients and potential differences in water quality between shallow and deep overburden groundwater is needed.	The investigation activities proposed will evaluate vertical gradients and potential differences in water quality between shallow and deep overburden groundwater. A new pair of shallow and deep overburden wells (MW-09S and MW-09) have been included in the scope-of-work in this area in the revised Work Plan.
6	As noted above, drilling refusal assumed to be till, boulders, and/or bedrock was encountered in each of the borings at depths ranging from 23.8 to 28 ft bgs when the existing monitoring wells were installed. Better characterization of the low recovery zones and reason for refusal is needed. In addition, the ISC Report indicates that a bedrock rise on the eastern side of the facility is inhibiting groundwater flow to the east and driving groundwater flow towards the south. However, NHDES notes that in the northern portion of the facility property, bedrock is highest on the western side of the facility (at monitoring well MW-02/-02S), and yet groundwater flow in that area of the facility is still shown to be towards the south on the groundwater contour plans provided as Figures 3 and 4 of the ISC Report. Additional assessment of the site hydrogeology, including evaluation of the controls on groundwater flow directions at and in the vicinity of the property, is needed.	As described in the revised Work Plan, borings greater than 20 feet will be advanced using sonic drilling methods to improve sample recovery at depth and to confirm the depth to bedrock. The proposed scope-of-work includes advancement of 6 soil borings to the top of bedrock and installation of 5 bedrock monitoring wells to better characterize the site hydrogeology.
7	Deep overburden groundwater at the facility has been impacted with PFAS. In addition, bedrock supply wells sampled by NHDES in the vicinity of the facility are also impacted with PFAS, including wells located both upgradient and downgradient from the facility. As such, an assessment of bedrock groundwater quality at the facility is warranted, and an understanding of the interactions between overburden and bedrock groundwater quality is needed.	The proposed scope-of-work outlined in the revised Work Plan includes installation of 5 bedrock monitoring wells. The proposed bedrock wells are all co-located with shallow and deep overburden wells to better characterize the interactions between overburden and bedrock groundwater.
8	Additional assessment of the correlation between predicted PFOA deposition from air emissions and resulting soil and groundwater concentrations is warranted. The highest concentration of PFOA detected in soil samples collected as part of the ISC activities was from location MW-06/-06S, at a concentration of 30 ng/g in a sample collected from 5 ft bgs. The highest concentrations of PFOA detected in samples from other exploration locations ranged from 0.46 to 5.1 ng/g. NHDES recommends collecting soil samples from those areas of the facility with the highest predicted deposition of PFOA to correlate PFOA (and other PFAS) deposition with observed soil and groundwater detections. Please provide an assessment of the potential correlation in the on-facility SI report.	The air deposition model developed for the Preliminary Air, Soil, and Water Modeling Technical Memorandum (Barr, 2017) did not model on-Facility air deposition. SGPP will collect soil samples at various radial distances and will evaluate this soil data within the context of the PRAs including aerial deposition in the SI report.
9	Based on a review of the soil analytical data presented in the ISC Report, NHDES notes that of the 35 soil samples analyzed for PFAS, almost half of the samples had detections of PFOS at concentrations greater than PFOA, compared with approximately one third of the samples that had PFOA detections greater than PFOS. The highest levels of PFOS were detected in soil samples collected from the eastern side of the facility property, where detections ranged from 18 to 31 ng/g, compared to 3.1 to 7.2 ng/g in samples collected from the western side of the facility. In comparison, PFOS concentrations detected in groundwater samples from the on-facility wells were generally an order of magnitude lower than PFOA, or not detected above laboratory reporting limits. An assessment as to the source of the PFOS should be provided, as well as an explanation for the differences in concentrations between PFOS and PFOA in soil versus groundwater.	An evaluation the distribution of PFOS distribution in soil and the differences in concentrations between PFOS and PFOA in soil versus groundwater has been included in the objectives section of the SI Work Plan and will be included in the SI report.
10	To better understand the vertical distribution of PFAS in soils at locations where soil borings are completed, NHDES recommends that soil samples be collected from the following intervals down to the water table or bedrock: from 0-2 inches bgs, 2-12 inches bgs, 3-4 feet bgs, 6-8 feet bgs and if necessary at subsequent 5 foot intervals until the bottom of the boring at the water table or bedrock, whichever is shallower. The soil samples below 1 ft bgs should also be adjusted so that they are collected from any mottling observed in the soil horizons, and any changes in soil type / lithology observed during drilling. In select drilling locations, samples should also be collected from depths up to ten feet below the water table, with samples collected from intervals that indicate a change in the stratigraphy.	The scope-of-work included in the revised Work Plan includes soil sampling at the requested depth intervals.

Appendix A-2: Response to NHDES Site Investigatoin Work Plan Comments dated April 13, 2018
Saint-Gobain Performance Plastics
Merrimack, New Hampshire

Comment #	Comment	SGPP Response
11	More information is needed about the potential for continued leaching of PFAS from soil to groundwater, including an estimate of the mass of PFAS present in on-facility soils that will continue to leach to groundwater. As such, an approach for this evaluation should be included in the scope of work. NHDES recommends consideration of submittal of soil samples for analysis of synthetic precipitation leaching procedure (SPLP) for PFAS at conditions typical of rainwater, and/or parameters that may be relevant in controlling the distribution and migration of PFAS, including total organic carbon (TOC), pH, major cations, moisture, and grain size. A comparison of these parameters with the detected PFAS concentrations should be provided in the on-facility SI report.	Samples collected from a subset of borings will be analyzed for pH, major cations, moisture, and grain size. SGPP is not proposing to conduct SPLP analyses for the following reasons: • There is a high potential for false positive analytical results because SPLP methods require the use equipment with many Teflon components. • SPLP is traditionally used to demonstrate that leaching of soils will not result in an exceedance of a groundwater standard and is typically used to evaluate contaminants with high Koc values. SPLP methods involve agitating soils to provide a conservatively high estimate of the mass of contaminant that could leach from a soil. The results do not inform the length of time that it will take for a given mass to leach from a soil. • The best approach to evaluating the long-term leachability of soils to groundwater is measuring PFAS concentrations in groundwater over time. SGPP is currently developing a data set to evaluate this through quarterly groundwater sampling of on-Property monitoring wells.
12	NHDES recommends that field instruments used to measured pH and other geochemical parameters during groundwater sampling be calibrated at a minimum at the beginning of each field day, and a calibration check performed in the middle and at the end of each field day. Documentation to this effect should be provided in the on-facility SI report.	Standard operating procedures included in the revised Work Plan include requirements for field instrument calibration in accordance with manufacture specifications.
13	Two rounds of groundwater monitoring should be included in the SI scope of work. One of these rounds can be concurrent with the quarterly sampling of the existing monitoring wells.	The scope-of-work included in the revised Work Plan specifies two rounds of groundwater sampling.
14	The draft work plan contained a Quality Assurance Project Plan (QAPP). Please note that NHDES does not review and approve QAPPs as part of SI activities for state lead managed sites such as this one. SI activities should be completed using industry-standard practices, and the field and sampling methods described in the on-facility SI Work Plan.	The revised Work Plan does not include a QAPP. SI activities will be completed using industry-standard practices, and the field and sampling methods described in the revised Work Plan.
15	A total of 23 PFAS have been detected in the samples of various media collected from the facility and surrounding areas (i.e., groundwater from the on-facility monitoring wells and nearby private drinking water supply wells, on-facility and off-facility soils, roof wipes, stack char, surface water, wet weather stormwater discharge, facility air emissions, and facility dispersions7). In addition to PFOA and PFOS, which were detected in groundwater samples collected from the on-facility monitoring wells at concentrations up to 7,300 and 440 ng/L, respectively, other detected PFAS include PFCAs (for example perfluorohexanoic acid [PFHxA], perfluoroheptanoic acid [PFHpA], and perfluoronanonoic acid [PFNA]); perfluorosulfonic acids (PFSAs); and precursor compounds that have the potential to break down into perfluoroalkyl acids (PFAAs) in the environment. Given the detections of these PFAS, and the potential for the presence of precursor compounds that may break down into PFOA or PFOS, NHDES stongly recommends that samples collected during the SI activities be submitted for analysis of a longer list of PFAS than what is currently used for the quarterly groundwater monitoring of the on-facility wells. NHDES understands that many commercial laboratories with PFAS capabilities currently report between 20 to 30 PFAS. NHDES recommends that samples be analyzed for this expanded list. More information is needed to better understand the potential mass of PFAS that could transform into PFOA, PFOS, and other PFAAs once released into the environment (i.e., "precursors"). As such, NHDES recommends that a subset of samples be submitted for analysis Total Oxidizable Precursor (TOP) Assay to get general understanding of potential precursor mass. NHDES understands that fluorinated replacement compounds have been substituted for PFOA in the newer formulations used by the facility since the phase out of production of PFOA in the United States. Perfluoro-2-propoxypropanoaic acid (HFPO-DA/"GenX") was detected in one of the dispersion samples and in a stack char sample collected from the facility. GenX has not been detected in the samples collected from private drinking water supply wells in the area by NHDES, but is not known if this compound is present in soil and groundwater at the facility. As such, NHDES would like to see the SI include assessment for GenX and any other potential replacement compounds (e.g., 4,8-dioxa-3H- perfluorononanoic acid/"ADONA") that may have been used at the facility. Based on a review of data collected during the SI, Saint-Gobain could include a recommendation in the report for NHDES to consider a more limited analyte list for subsequent monitoring and testing.	SGPP notes that GenX was not detected in the dry weather flow sample collected by NHDES nor in samples collected by NHDES from nearby residential wells. NHDES has not established an AGQS for GenX. Regardless, the scope-of-work presented in the revised SI Work Plan includes anlaysis of a subset of soil and groundwater samples for GenX and ADONA. SGPP will also analyze for GenX in stormwater and surface water samples collected this summer. The results of this work will be evaluated to determine whether additional GenX or ADONA sampling is required. TOP data would be most useful when collected from soils with high concentrations of PFAS present. Because there is no method to field screen soils for PFAS, the scope-of-work in the revised Work Plan includes analysis of TOP for soil samples collected from the borings for bedrock wells MW-04B and MW-06B at the approximate depth interval where higher PFOA concentrations were detected in soils samples collected from the MW-04 or MW-06 borings during ISC.

Appendix A-2: Response to NHDES Site Investigatoin Work Plan Comments dated April 13, 2018
Saint-Gobain Performance Plastics
Merrimack, New Hampshire

Comment #	Comment	SGPP Response
16	In general, the list of PFAS detected in groundwater, soil, stormwater, surface water, stack char, roof wipe samples, and dispersions is generally similar; however, some differences in the detected compounds are noted. For example, longer-chain PFAS compounds have been detected in soil and stormwater, but less frequently and at lower concentrations or not at all in groundwater samples. The site investigation should compare the PFAS detected in various site media and explain potential causes for these differences.	The SI report will include an evaluation of PFAS between media.

APPENDIX B

FACILITY RELEASE HISTORY

Appendix B: Facility Release History Summary
Saint-Gobain Performance Plastics
Merrimack, New Hampshire

Date	Material	Estimated Volume	Location	Notes
December 2003	Latex dispersion	25 gallons	Loading dock area	The spill was reported to NHDES by Cyn Environmental Services on December 11, 2003 (NHDES, 2003). The report indicates that a 55-gallon fiber drum failed during transport resulting a release from a box trailer to an asphalt surface near a storm drain. Absorbents were used to remove pooled material from the trailer and asphalt, but a portion of the spill entered the storm drain. The spill report indicates that the receiving drain and “select down-gradient drains” were inspected, but that no notable impact was observed due to rainy weather conditions.
April 2004	Aqueous Teflon® resin dispersion	10 – 20 gallons	Loading dock area	SGPP reported a release to NHDES on April 1, 2004 (SGPP, 2004). The report indicates that a tote containing a Teflon® dispersion was punctured during off-loading from a delivery truck resulting in a release to a parking lot area and storm drain. The released liquids were reportedly absorbed and contained in drums for disposal. The storm drain and “outfall of the storm drain” were inspected for impact, but impacts were not observed.
September 2008	Sanitary waste water	Unknown	Off-Property, near railroad tracks	SGPP reported a release to the Town of Merrimack (Town) Waste Water Treatment Facility (WWTF) on September 8, 2008 (SGPP, 2008) and to NHDES by the Town WWTF on September 9, 2008 (Merrimack, 2008). The report indicates that sanitary waste water was observed to be “bubbling from a manhole cover” near the railroad tracks. SGPP pumped out the manhole and observed a blockage consisting of “sticks ranging in size from 1” to 4” in diameter and up to 2 long” that had accumulated in the manhole. SGPP removed the debris and normal flow resumed.
May 2011	Oil lubricant	Unknown	Between New Manufacturing Building and Hazardous Waste Storage Building	The spill was reported by SGPP to the National Response Center (NRC) on May 20, 2011 (NRC, 2011). The report indicated that an oil sheen was observed entering a storm drain catch basin from unprotected equipment stored outside. SGPP covered the equipment and blocked the storm drain as part of the immediate response. Clean Harbors arrived the same day to clean the impacted asphalt surface, remove remaining oil from a sump in the equipment, and inspect the stormwater outfall. No impacts were observed at the outfall.
September 2012	APFO-containing formulation	200 gallons	Facility interior	As part of a response to NHDES' Request for Information (Archer & Greiner, 2016), SGPP reported that a release occurred inside the facility when transferring formulation from a tote located on the 2nd floor to a tote located on the 1st floor. The material was absorbed and containerized for disposal.
June 2015	Formulation	99 lbs (dry weight)	Facility interior	As part of a response to NHDES' Request for Information (Archer & Greiner, 2016), SGPP reported that material was spilled during manufacturing and migrated to pavement outside of the building through the north and east walls at slab level. Storm drains were reportedly not impacted. The material was absorbed and containerized for disposal.
March 2017	Hydraulic Oil	100 gallons	Southwest corner of Main Building	C.T. Male (2017b) on behalf of SGPP reported a release to NHDES on March 17, 2017. The report indicates that a release occurred from a faulty hydraulic cylinder in the facility elevator. Approximately 50 gallons of hydraulic oil was recovered immediately; the remaining hydraulic oil reportedly entered the annular space between the hydraulic cylinder and the steel shaft casing in which the cylinder was housed, which is packed with sand. A work plan was submitted to NHDES for the replacement of the hydraulic cylinder and removal of the impacted sand.

APPENDIX C

GENERAL FIELD METHODS FOR PFAS SAMPLING PROGRAMS

APPENDIX C

GENERAL FIELD METHODS FOR PFAS SAMPLING PROGRAMS

1.0 GENERAL APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures that shall be used during implementation of this perfluorinated compound (PFAS) sampling program.

Due to the extremely low method detection limits associated with PFAS analysis (i.e., nanograms per liter [ng/l]) and the many potential sources of trace levels of PFASs, field personnel shall employ the greatest caution by strictly following the protocols described herein. Frequent replacement of nitrile gloves and decontamination of non-dedicated sampling equipment in accordance with the appropriate procedures will reduce the potential for false detections of PFASs.

This SOP includes the following:

- Considerations regarding food packaging and food consumption during PFAS sampling programs
- Field gear and clothing restrictions
- Personal hygiene requirements
- Sample area access restrictions
- Field equipment decontamination

Some of the provisions of the PFAS sampling program requirements described herein may conflict with standard health and safety procedures (e.g., use of insect repellant or sunscreen). Therefore, prior to implementation of a field program subject to these General Provisions, an Addendum to the site-specific Health and Safety Plan (HASP) shall be prepared to address any potential conflicts between the requirements described herein and standard health and safety procedures.

2.0 RESPONSIBILITIES

The Field Team Leader and field personnel have the shared responsibility to oversee and ensure that the PFAS sampling program is performed in accordance with the program-specific protocols described in this SOP. The Field Team Leader shall ensure that on-site personnel, including subcontractors and third parties that may have direct access to the sampling area, understand and comply with this SOP. Field personnel shall be notified of these requirements a minimum of three days prior to the start of field work in order to have the time to appropriately comply with many of the food and clothing requirements prior to arriving at the site.

3.0 GENERAL FIELD METHODS

3.1 Food Consumption

Components of some food packages have been treated to resist wetting. Historically, this was achieved through the use of PFASs. Accordingly, field personnel shall avoid the use of paper bags and other paper packaging to transport food to the site, including pre-wrapped foods and snacks (e.g., chocolate bars, energy bars, granola bars, potato chips, etc.). Field personnel shall not bring any fast food to the site that uses any form of paper wrapping including such sandwich wrappers or paper drinking cups. If possible, field personnel shall use hard plastic or stainless-steel food containers. Field personnel shall not use aluminum foil, wax paper, or coated textiles to transport food to the site.

APPENDIX C

GENERAL FIELD METHODS FOR PFAS SAMPLING PROGRAMS

The Teflon® coating on some frying pans contains fluorinated compounds and as such represents a potential source of PFASs. Field personnel shall not transport to or consume food at the site that has been prepared using a Teflon® coated cooking utensil.

Field personnel shall not consume food or beverages in the field vehicle or in the immediate vicinity of the sample location. Prior to consuming food or beverages, field personnel shall remove their nitrile gloves and coveralls and move to a location a minimum distance of 35 feet away from the sample location, preferably in the downwind direction. When finished eating or drinking, field personnel shall wash their hands, put their coveralls back on and put on a new pair of nitrile gloves prior to returning to the work area.

3.2 Field Gear and Clothing Restrictions

Because treatments to provide water resistant, water proof, or stain-resistant clothing include the use of PFASs, field personnel shall not wear any water resistant, water proof, stain-resistant treated clothing or Tyvek clothing during the field program. Permissible outer field clothing for PFAS sampling programs includes clothing made from natural fibers, preferably cotton, and rain gear made of polyethylene, vinyl or PVC. Clothing made of synthetic fibers shall be avoided (i.e., reflective vests); however, during cold-weather field events, it shall be allowable to wear synthetic under-layers, provided that they be completely covered by clothing made of natural fibers.

Field clothing shall be laundered with a minimal amount of detergent and no fabric softener or scented products shall be used. Once field clothing has been washed appropriately, field clothing shall be washed a second time on a rinse-only cycle, using only water, prior to drying. Anti-static dryer sheets shall not be used when drying field clothing. Field clothing shall preferably be old cotton clothing that has been laundered many times, as new clothing may contain PFAS related treatments. Clothing containing Gore-Tex™ shall not be worn during the sampling program, as Gore-Tex™ clothing contains a PFAS membrane.

Because field vehicle seats may have been treated with PFAS-containing products for stain resistance, the seats of field vehicles shall be covered with a well laundered cotton sheet or blanket for the duration of the field program in order to avoid direct contact between field personnel clothing and vehicle seat fabric. Measures taken to mitigate field personnel contact with field vehicle seat fabric shall not in any way interfere with the functionality or impede the use of vehicle safety belts.

Waterproof field books shall not be used; field notes shall be recorded on loose paper using aluminum clip boards. Plastic clip boards, self-sticking notes, binders or spiral hard cover notebooks shall not be used. Field notes shall be recorded in pen or pencil. Markers shall not be used.

Most safety footwear is constructed of leather and synthetic materials that have been treated to provide some degree of waterproofing and/or increased durability. Therefore, footwear materials represent a potential source of trace PFASs. Field personnel contact with safety footwear including donning footwear or tying laces shall not occur within 35-feet of the sampling area. If footwear must be adjusted, field personnel shall re-locate to an area a minimum of 35-feet from the sampling area, preferably in a downwind direction, and make the necessary adjustments. Nitrile gloves shall be worn when contacting footwear. The nitrile gloves worn while contacting footwear shall be removed and new nitrile gloves shall be put on prior to re-entering the sampling area.

APPENDIX C

GENERAL FIELD METHODS FOR PFAS SAMPLING PROGRAMS

Disposable nitrile gloves shall be worn at all times. A new pair of nitrile gloves shall be donned prior to the following activities at each sample location:

- Contact with laboratory-suppled sample containers or PFAS-free water containers
- Decontamination of sampling equipment
- Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve, bailer, etc.)
- Insertion of silicon tubing into the peristaltic pump
- Completion of monitoring well purging
- Groundwater and soil sample collection
- Handling of QA/QC samples including field blanks and equipment blanks
- After the handling of any non-dedicated sampling equipment or contact with non-decontaminated surfaces

3.3 Personal Hygiene

Field personnel shall not use shampoo, conditioner, body gel, cosmetic cream, or hand cream as part of their personal showering routine on the day of a sampling event, as these products may contain surfactants and represent a potential source of PFASs. Field personnel shall follow their normal hygiene routine the night before a sampling event and then rinse with water only the morning before a sampling event. The use of bar soap is acceptable; however, bar soap including moisturizers shall be avoided.

Field personnel shall not use moisturizers, cosmetics, dental floss, sunscreen, and/or insect repellent (unless they are made with natural ingredients or DEET in the case of insect repellent) for the duration of the field program, either on-site or off-site, as these products may contain trace PFASs.

3.4 Sample Area Access

Visitors, including contractors or site personnel, who are not following these general PFAS sampling program protocols shall not be allowed to approach within 35 feet of the sample area until PFAS sample collection activities are complete and the PFAS sample container has been enclosed in a Ziploc® storage bag and placed in the sample cooler.

3.5 Sample Containers and Handling

Sample containers shall not be handled without first donning a new, clean pair of nitrile gloves. Samples shall only be collected in high density polyethylene (HDPE) or polypropylene containers provided by the laboratory for specific PFAS use (no Teflon liner). Glass containers shall not be used due to the potential for loss of PFAS through sorption. Sample container labels shall be completed after collection of the sample using a non-gel pen or a pencil. The sample shall be collected first and the lid to the sample container shall be re-sealed before the sample container label is completed.

APPENDIX C

GENERAL FIELD METHODS FOR PFAS SAMPLING PROGRAMS

3.6 Sample Storage and Shipment

Analytical samples shall be stored on ice, maintained at approximately 4 degrees Celsius (ºC) and transported by overnight courier to ELLE under proper chain of custody protocols. Field personnel shall only use new, fresh ice. Reusable chemical or gel ice packs shall not be used as these may contain PFAS. Tracking numbers for all shipments shall be provided once the sample coolers have been shipped to ensure their timely delivery.

Samples shall packed consistent with ELLE's packing requirements (typically included on a form mailed with the bottles/chains of custody). Typically, this includes the following:

Double checking bottles are appropriately labeled with location names, sample dates and times, and analyte(s), and match with chain of custody. Samples bottles from the same location should be bagged together (with the exception of PFAS bottles, which will be bagged separately), and the outside of the bag shall be labeled with the sample location.

Glass bottles/vials shall be wrapped in bubble wrap, or placed in foam packing cubes, prior to being bagged.

PFAS samples shall be shipped in PFAS-specific coolers, with a PFAS trip blank per PFAS cooler.

Coolers will be lined with a larger plastic bag, with 5+ lbs of ice in a zipock bag, followed by samples in ziplock bags and an additional 5+ lbs of ice in a ziplock bag. The large plastic bag shall then be zip-tied shut. Chain of custody should be photographed, and placed in a ziplock bag on top of the large plastic bag before sealing cooler. *REMEMBER: The temperature blank bottle must be inside of the large plastic bag on top of the ice*. Ensure that the coolers are dry prior to packing so that no stray water is likely to leak from the cooler while in transit.

Coolers containing samples must be taped shut and a lab-supplied custody seal must be signed, dated, and affixed across the edge of the lid of the cooler. *REMEMBER: Even unused coolers which don't contain samples must be taped shut when being shipped back to the lab.* If the cooler contains samples with short hold times, affix the appropriate lab-supplied sticker indicating short hold times on the lid of the cooler. The coolers should be labeled on the packing tape with "1 of X," "2 of X," etc. so the lab will know if a cooler is missing.

Samples shall be shipped overnight, with Saturday delivery. Lab-supplied shipping labels should specify this. Retain shipping receipts from FedEx with tracking numbers (to confirm delivery).

The FedEx at the Manchester Airport (Londonderry) is open until 8:15PM, but to make sure coolers make it onto the last plane, ***delivery to FedEx should be no later than 7:30PM.***

Designate a field team member or someone in the office to confirm FedEx delivery to the lab the following day – delivery is typically by 10:00AM (but may not show up in the system until 11:00AM)

APPENDIX D

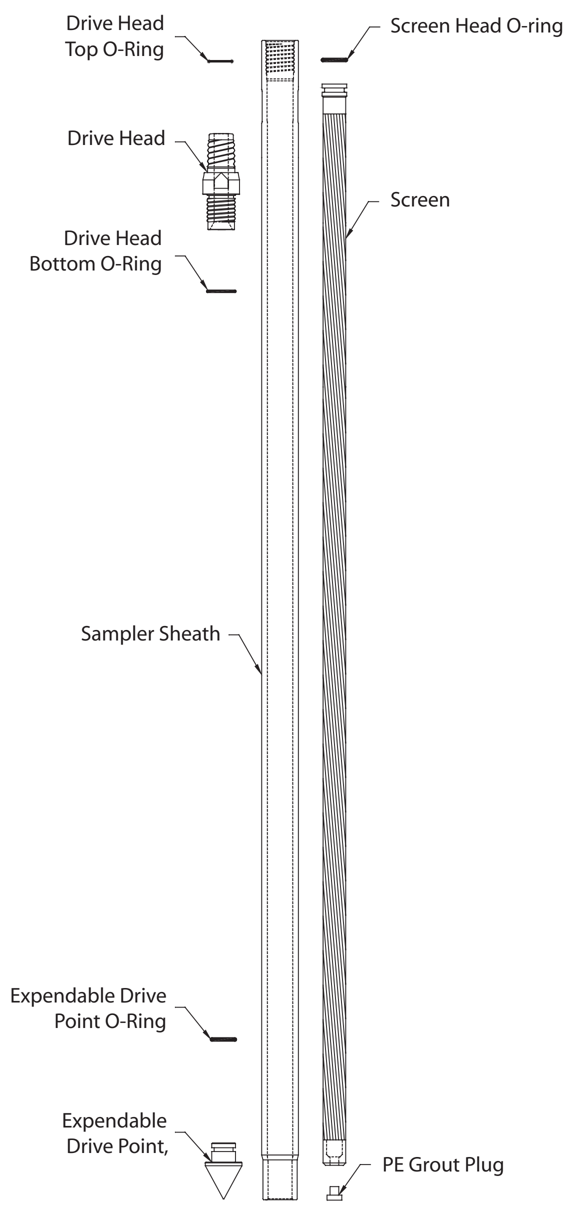
GEOPROBE SCREEN POINT 16 GROUNDWATER SAMPLER STANDARD OPERATING PROCEDURE

GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3142

PREPARED: November, 2006



GEOPROBE® SCREEN POINT 16 GROUNDWATER SAMPLER PARTS

Geoprobe® and Geoprobe Systems®, Macro-Core® and Direct Image® are Registered Trademarks of Kejr, Inc., Salina, Kansas

Screen Point 16 Groundwater Sampler is manufactured under U.S. Patent 5,612,498

1.0 OBJECTIVE

The objective of this procedure is to drive a sealed stainless steel or PVC screen to depth, deploy the screen, obtain a representative water sample from the screen interval, and grout the probe hole during abandonment. The Screen Point 16 Groundwater Sampler enables the operator to conduct abandonment grouting that meets American Society for Testing and Materials (ASTM) Method D 5299 requirements for decommissioning wells and borings for environmental activities (ASTM 1993).

2.0 BACKGROUND

2.1 Definitions

Geoprobe®: A brand name of high quality, hydraulically powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and monitoring, soil conductivity and contaminant logging, grouting, and materials injection.

Screen Point 16 (SP16) Groundwater Sampler: A direct push device consisting of a PVC or stainless steel screen that is driven to depth within a sealed, steel sheath and then deployed for the collection of representative groundwater samples. The assembled SP16 Sampler is approximately 51.5 inches (1308 mm) long with an OD of 1.625 inches (41 mm). Upon deployment, up to 41 inches (1041 mm) of screen can be exposed to the formation. The Screen Point 16 Groundwater Sampler is designed for use with 1.5-inch probe rods and machines equipped with the more powerful GH60 Hydraulic Hammer. Operators with GH40 Series hammers may chose to use this sampler in soils where driving is difficult.

Rod Grip Pull System: An attachment mounted on the hydraulic hammer of a direct push machine which makes it possible to retract the tool string with extension rods or flexible tubing protruding from the top of the probe rods. The Rod Grip Pull System includes a pull block with rod grip jaws that are bolted directly to the machine. A removable handle assembly straddles the tool string while hooking onto the pull block to effectively grip the probe rods as the hammer is raised. A separate handle assembly is required for each probe rod diameter.

2.2 Discussion

In this procedure, the assembled Screen Point 16 Groundwater Sampler (Fig. 2.1A) is threaded onto the leading end of a Geoprobe® probe rod and advanced into the subsurface with a Geoprobe® direct push machine. Additional probe rods are added incrementally and advanced until the desired sampling interval is reached. While the sampler is advanced to depth, O-ring seals at each rod joint, the drive head, and the expendable drive point provide a watertight system. This system eliminates the threat of formation fluids entering the screen before deployment and assures sample integrity.

Once at the desired sampling interval, extension rods are sent downhole until the leading rod contacts the bottom of the sampler screen. The tool string is then retracted approximately 44 inches (1118 mm) while the screen is held in place with the extension rods (Fig. 2.1B). As the tool string is retracted, the expendable point is released from the sampler sheath. The tool string and sheath may be retracted the full length of the screen or as little as a few inches if a small sampling interval is desired.

There are three types of screens that can be used in the Screen Point 16 Groundwater Sampler. Two of the these, a stainless steel screen with a standard slot size of 0.004 inches (0.10 mm) and a PVC screen with a standard slot size of 0.010 inches (0.25 mm), are recovered with the tool string after sampling. The third screen is also manufactured from PVC with a standard slot size of 0.010 inches (0.25 mm), but is designed to be left downhole when sampling is complete. This disposable screen has an exposed screen length of approximately 43 inches (1092 mm). The two screens that are recovered with the sampler both have an exposed screen length of approximately 41 inches (1041 mm).

(continued on following page)

An O-ring on the head of the stainless steel screens maintains a seal at the top of the screen. As a result, any liquid entering the sampler during screen deployment must first pass through the screen. PVC screens do not require an O-ring because the tolerance between the screen head and sampler sheath is near that of the screen slot size.

The screens are constructed such that flexible tubing, a mini-bailer, or a small-diameter bladder pump can be inserted into the screen cavity. This makes direct sampling possible from anywhere within the saturated zone. A removable plug in the lower end of the screens allows the user to grout as the sampler is extracted for further use.

Groundwater samples can be obtained in a number of ways. A common method utilizes polyethylene (TB25L) or Teflon® (TB25T) tubing and a Check Valve Assembly (GW4210). The check valve (with check ball) is attached to one end of the tubing and inserted down the casing until it is immersed in groundwater. Water is pumped through the tubing and to the ground surface by oscillating the tubing up and down.

An alternative means of collecting groundwater samples is to attach a peristaltic or vacuum pump to the tubing. This method is limited in that water can be pumped to the surface from a maximum depth of approximately 26 feet (8 m). Another technique for groundwater sampling is to use a stainless steel Mini-Bailer Assembly (GW41). The mini-bailer is lowered down the inside of the casing below the water level where it fills with water and is then retrieved from the casing.

The latest option for collecting groundwater from the SP16 sampler is to utilize a Geoprobe® MB470 Series Mechanical Bladder Pump (MBP)*. The MBP may be used to meet requirements of the low-flow sampling protocol (Puls and Barcelona 1996, ASTM 2003). Through participation in a U.S. EPA Environmental Technology Verification study, it was confirmed that the MB470 can provide representative samples (EPA 2003).

**The Mechanical Bladder Pump is manufactured under U.S. Patent No. 6,877,965 issued April 12, 2005.*

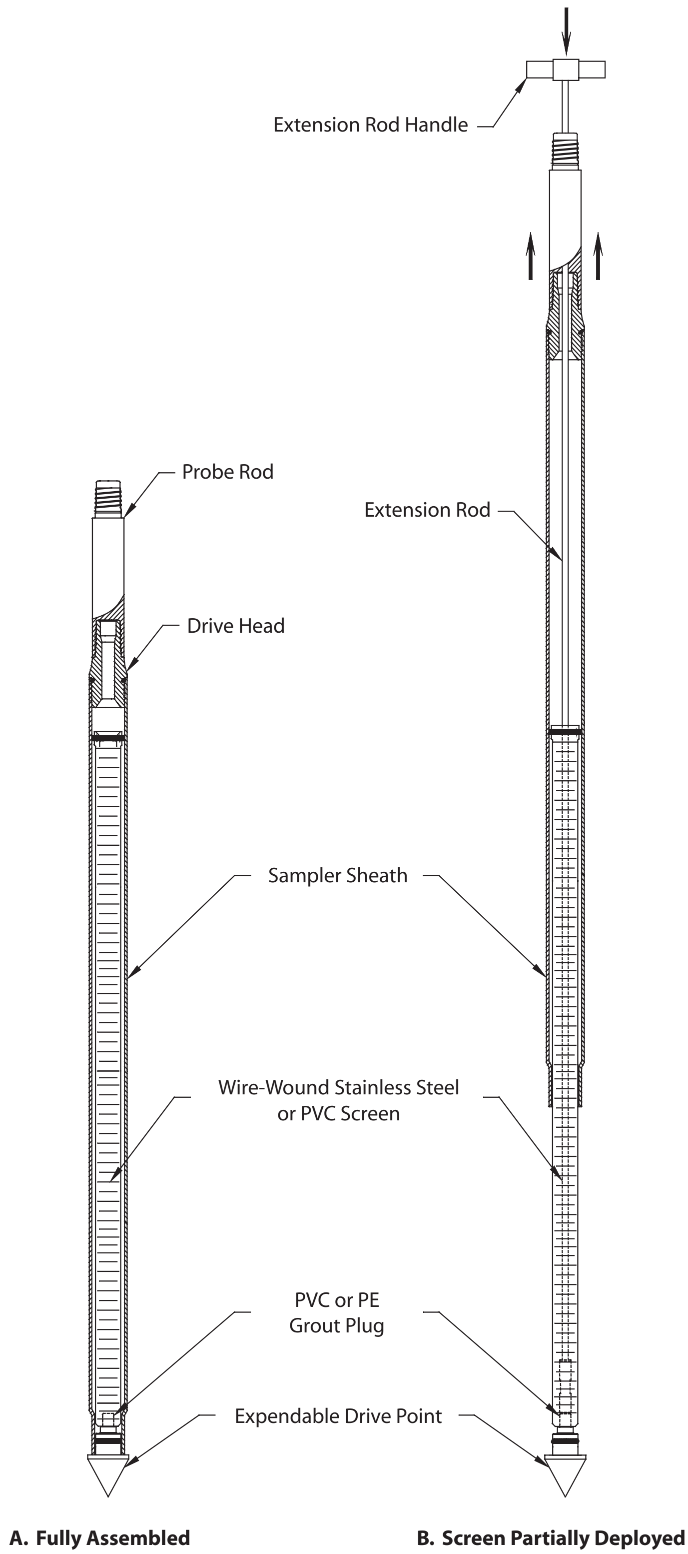


FIGURE 2.1
Screen Point 16 Groundwater Sampler

3.0 TOOLS AND EQUIPMENT

The following tools and equipment can be used to successfully recover representative groundwater samples with the Geoprobe® Screen Point 16 Groundwater Sampler. Refer to Figures 3.1 and 3.2 for identification of the specified parts. Tools are listed below for the most common SP16 / 1.5-inch probe rod configurations. Additional parts for optional rod sizes and accessories are listed in Appendix A.

SP16 Sampler Parts	Part Number
SP16 Sampler Sheath	15187
SP16 Drive Head, 0.5-inch bore, 1.5-inch rods*	18307
SP16 O-ring Service Kit, 1.5-inch rods *(includes 4 each of the O-ring packets below)*	15844
O-rings for Top of SP16 Drive Head, 1.5-inch rods only (Pkt. of 25)	*15389*
O-rings for Bottom of SP16 Drive Head (Pkt. of 25)	*13196*
O-rings for GW1520 Screen Head (Pkt. of 25)	*GW1520R*
O-rings for SP16 Expendable Drive Point (Pkt. of 25)	*GW1555R*
Screen, Wire-Wound Stainless Steel, 4-Slot*	GW1520
Grout Plugs, PE (Pkg. of 25)	GW1552K
Expendable Drive Points, steel, 1.625-inch OD (Pkg. of 25)*	GW1555K
Screen Point 16 Groundwater Sampler Kit, 1.5-inch Probe Rods *(includes 1 each of: 15187, 18307, 15844, GW1520, GW1535, GW1540, GW1555K, and GW1552K)*	15770

Probe Rods and Probe Rod Accessories	Part Number
Drive Cap, 1.5-inch probe rods, threadless, (for GH60 Hammer)	12787
Pull Cap, 1.5-inch probe rods	15090
Probe Rod, 1.5-inch x 60-inch*	11121

Extension Rods and Extension Rod Accessories	Part Number
Screen Push Adapter	GW1535
Grout Plug Push Adapter	GW1540
Extension Rod, 60-inch*	10073
Extension Rod Coupler	AT68
Extension Rod Handle	AT69
Extension Rod Jig	AT690
Extension Rod Quick Link Coupler, pin	AT695
Extension Rod Quick Link Coupler, box	AT696

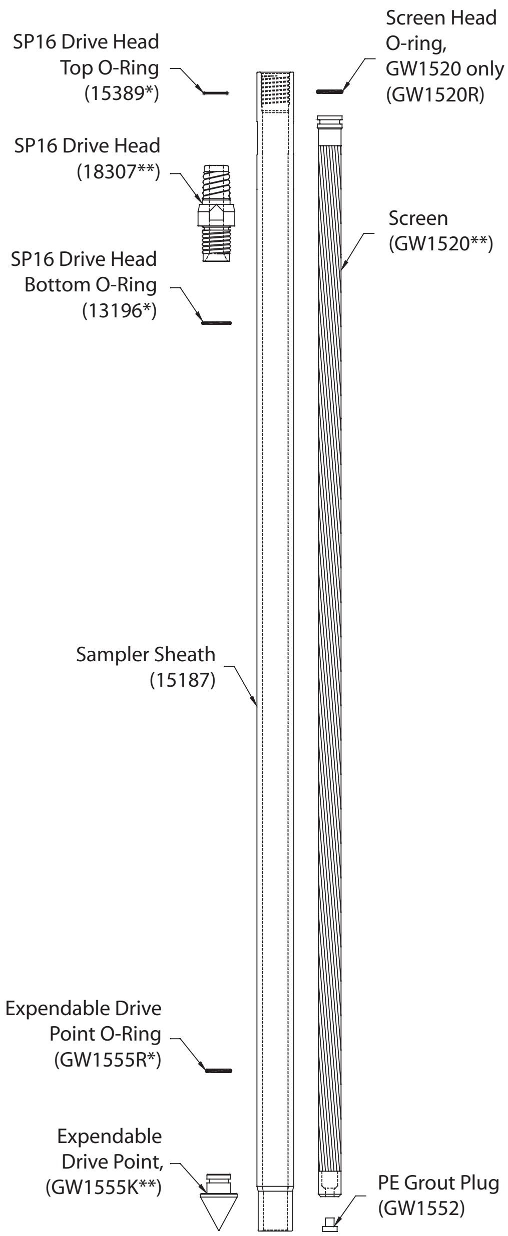
Grout Accessories	Part Number
Grout Nozzle, for 0.375-inch OD tubing	GW1545
High-Pressure Nylon Tubing, 0.375-inch OD / 0.25-inch ID, 100-ft. (30 m)	11633
Grout Machine, self-contained*	GS1000
Grout System Accessories Package, 1.5-inch rods	GS1015

Groundwater Purging and Sampling Accessories	Part Number
Polyethylene Tubing, 0.375-inch OD, 500 ft.*	TB25L
Check Valve Assembly, 0.375-inch OD Tubing*	GW4210
Water Level Meter, 0.438-inch OD Probe, 100 ft. cable*	GW2000
Mechanical Bladder Pump**	MB470
Mini Bailer Assembly, stainless steel	GW41

Additional Tools	Part Number
Adjustable Wrench, 6.0-inch	FA200
Adjustable Wrench, 10.0-inch	FA201
Pipe Wrenches	NA

* See Appendix A for additional tooling options.

** Refer to the Standard Operating Procedure (SOP) for the Mechanical Bladder Pump (Technical Bulletin No. MK3013) for additional tooling needs.



* Included in the SP16 O-ring Service Kit (15844)
** Part numbers show most common tool configuration. See Appendix A for alternative parts.

FIGURE 3.1
SP16 Sampler Parts

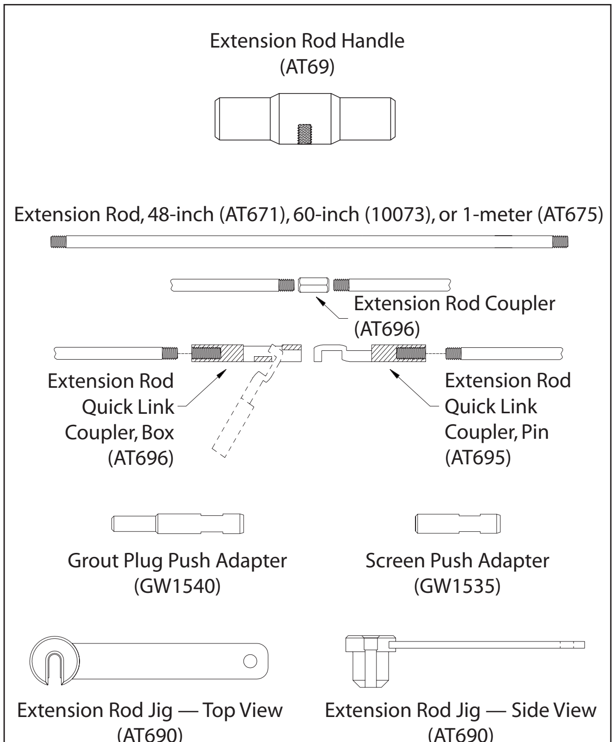


FIGURE 3.2
Geoprobe® Extension Rods and Accessories

4.0 OPERATION

4.1 Basic Operation

The SP16 sampler utilize a stainless steel or PVC screen which is encased in an alloy steel sampler sheath. An expendable drive point is placed in the lower end of the sheath while a drive head is attached to the top. O-rings on the drive head and expendable point provide a watertight sheath which keeps contaminants out of the system as the sampler is driven to depth.

Once the sampling interval is reached, extension rods equipped with a screen push adapter are inserted down the ID of the probe rods. The tool string is then retracted up to 44 inches (1118 mm) while the screen is held in place with the extension rods. The system is now ready for groundwater sampling. When sampling is complete, a removable plug in the bottom of the screen allows for grouting below the sampler as the tool string is retrieved.

4.2 Sampler Options

The Screen Point 15 and Screen Point 16 Groundwater Samplers are nearly identical. Subtle differences in the design of the SP16 sampler make it more durable than the earlier SP15 system. Operators of GH60-equipped machines should always utilize SP16 tooling. Operators of machines equipped with GH40 Series hammers may also choose SP16 tooling when sampling in difficult probing conditions.

A 1.75-inch OD Expendable Drive Point (17066K) and Disposable PVC Screen (16089) provide two useful options for the SP16 sampler. The 1.75-inch drive point may be used when soil conditions make it difficult to remove the sampler after driving to depth. The disposable PVC screen may be left downhole after sampling (when regulations permit) to eliminate the time required for screen decontamination.

4.3 Decontamination

In order to collect representative groundwater samples, all sampler parts must be thoroughly cleaned before and after each use. Scrub all metal parts using a stiff brush and a nonphosphate soap solution. Steam cleaning may be substituted for hand-washing if available. Rinse with distilled water and allow to air-dry before assembly.

4.4 SP16 Sampler Assembly (Figure 4.1)

Part numbers are listed for a standard SP16 sampler using 1.5-inch probe rods. Refer to Page 6 for screen and drive head alternatives.

1. Place an O-ring on a steel expendable drive point (GW1555K). Firmly seat the expendable point in the necked end of a sampler sheath (15187).

2. Install a PE Grout Plug (GW1552) in the bottom end of a Wire-wound Stainless Steel Screen (GW1520). Place a GW1520R O-ring in the groove on the top end of the screen.

3. Slide the screen inside of the sampler sheath with the grout plug toward the bottom of the sampler. Ensure that the expendable point was not displaced by the screen.

4. Install a bottom O-ring (13196) on a Drive Head (18307 or 15188). Thread the drive head into the sampler sheath using an adjustable wrench if necessary to ensure complete engagement of the threads. Attach a Drive Cap (12787 or 15590) to the top of the drive head.

   NOTE: The 18307 drive head should be used whenever possible as the smaller 0.5-inch ID provides a greater material cross-section for increased durability.

Sampler assembly is complete.

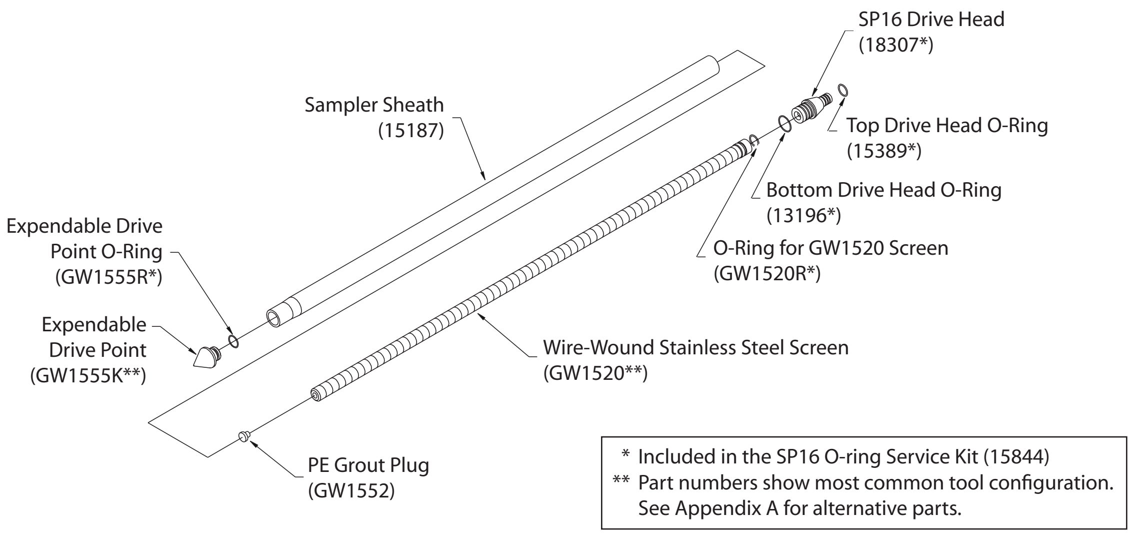


FIGURE 4.1
Screen Point 16 Groundwater Sampler Assembly

4.5 Advancing the SP16 Sampler

To provide adequate room for screen deployment with the Rod Grip Pull System, the probe derrick should be extended a little over halfway out of the carrier vehicle when positioning for operation.

1. Begin by placing the assembled sampler (Fig. 2.1.A) in the driving position beneath the hydraulic hammer of the direct push machine as shown in Figure 4.2.

2. Advance the sampler with the throttle control at slow speed for the first few feet to ensure that the sampler is aligned properly. Switch to fast speed for the remainder of the probe stroke.

3. Completely raise the hammer assembly. Remove the drive cap and place an O-ring in the top groove of the drive head. Distilled water may be used to lubricate the O-ring if needed.

Add a probe rod (length to be determined by operator) and reattach the drive cap to the rod string. Drive the sampler the entire length of the new rod with the throttle control at fast speed.

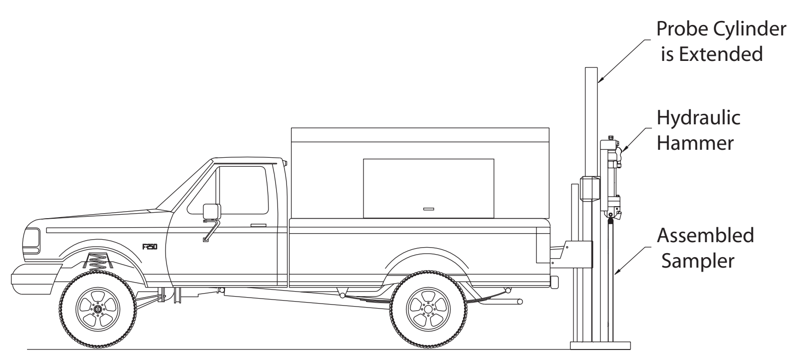


FIGURE 4.2
Screen Point 16 Groundwater Sampler in Driving Position

4. Repeat Step 3 until the desired sampling interval is reached. Approximately 12 inches (305 mm) of the last probe rod must extend above the ground surface to allow attachment of the puller assembly. A 12-inch (305 mm) rod may be added if the tool string is over-driven.

5. Remove the drive cap and retract the probe derrick away from the tool string.

4.6 Screen Deployment

1. Thread a screen push adapter (GW1535) on an extension rod of suitable length (AT671, 10073, or AT675). Attach a threaded coupler (AT68) to the other end of the extension rod. Lower the extension rod inside of the probe rod taking care not to drop it down the tool string. An extension rod jig (AT690) may be used to hold the rods.

2. Add extension rods until the adapter contacts the bottom of the screen. To speed up this step, it is recommended that Extension Rod Quick Links (AT695 and AT696) are used at every other rod joint.

3. Ensure that at least 48 inches (1219 mm) of extension rod protrudes from the probe rod. Thread an extension rod handle (AT69) on the top extension rod.

4. Maneuver the probe assembly into position for pulling.

5. Raise (pull) the tool string while physically holding the screen in place with the extension rods (Fig. 4.3.B). A slight knock with the extension rod string will help to dislodge the expendable point and start the screen moving inside the sheath.

   Raise the hammer and tool string about 44 inches (1118 cm) if using a GW1520 or GW1530 screen. At this point the screen head will contact the necked portion of the sampler sheath (Fig. 4.3.C.) and the extension rods will rise with the probe rods. Use care when deploying a PVC screen so as not to break the screen when it contacts the bottom of the sampler sheath.

   The Disposable Screen (16089) will extend completely out of the sheath if the tool string is raised more than 45 inches (1143 mm). Measure and mark this distance on the top extension rod to avoid losing the screen during deployment.

6. Remove the rod grip handle, lower the hammer assembly, and retract the probe derrick. Remove the top extension rod (with handle) and top probe rod. Finally, extract all extension rods.

7. Groundwater samples can now be collected with a mini-bailer, peristaltic or vacuum pump, tubing bottom check valve assembly, bladder pump, or other acceptable small diameter sampling device.

   When inserting tubing or a bladder pump down the rod string, ensure that it enters the screen interval. The leading end of the tubing or bladder pump will sometimes catch at the screen head giving the illusion that the bottom of the screen has been reached. An up-and-down motion combined with rotation helps move the tubing or bladder pump past the lip and into the screen.

4.7 Abandonment Grouting for GW1520 and GW1530 Screens

The SP16 Sampler can meet ASTM D 5299 requirements for abandoning environmental wells or borings when grouting is conducted properly. A removable grout plug makes it possible to deploy tubing through the bottom of GW1520 and GW1530 screens. A GS500 or GS1000 Grout Machine is then used to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling. Attach the rod grip puller to the top probe rod. Raise the tool string approximately 4 to 6 inches (102 to 152 cm) to allow removal of the grout plug.

2. Thread the Grout Plug Push Adapter (GW1540) onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the grout plug at the bottom of the screen. Attach the handle to the top extension rod. When the extension rods are slightly raised and lowered, a relatively soft rebound should be felt as the adapter contacts the grout plug. This is especially true when using a PVC screen.

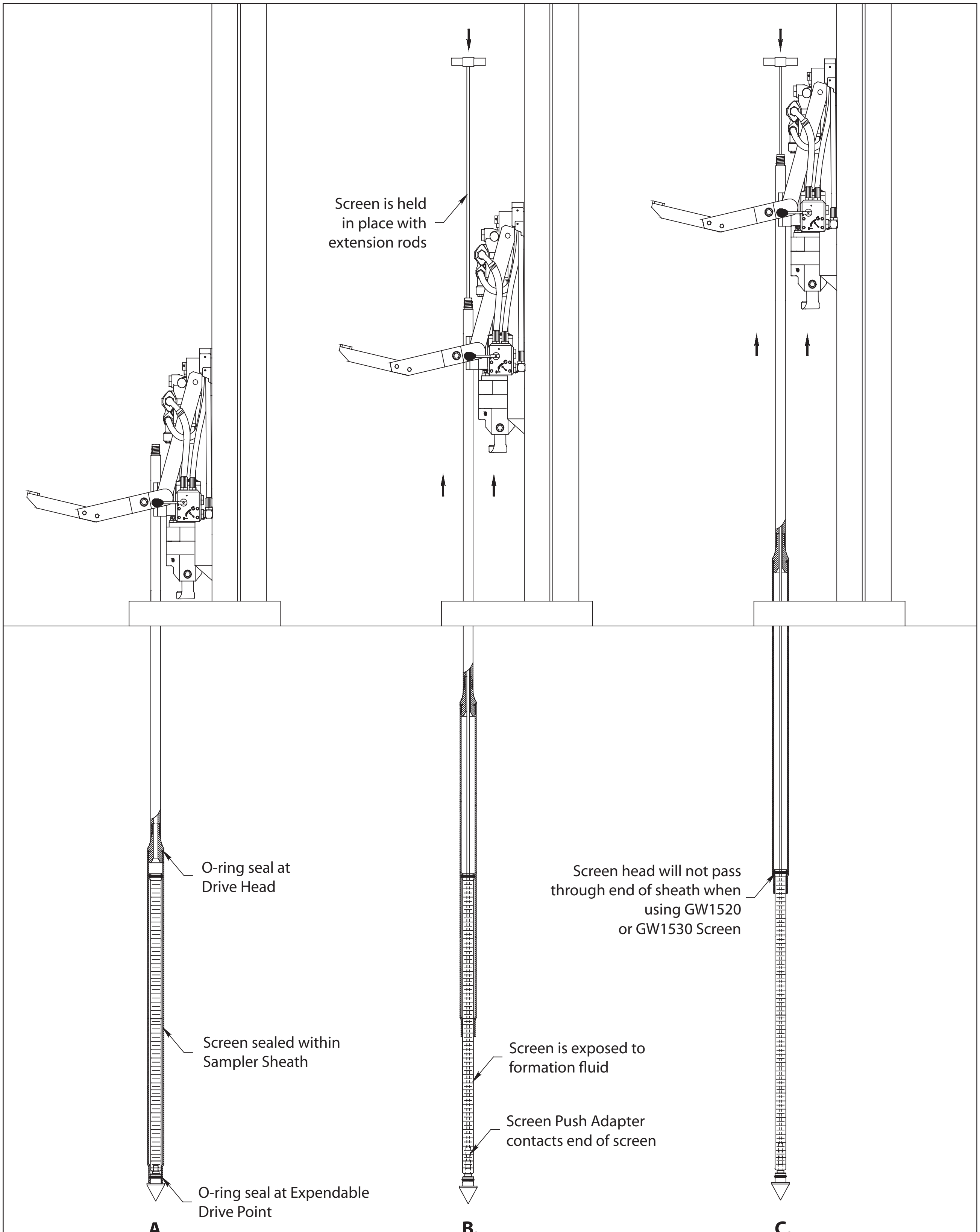


FIGURE 4.3
Screen Deployment for SP16 Sampler

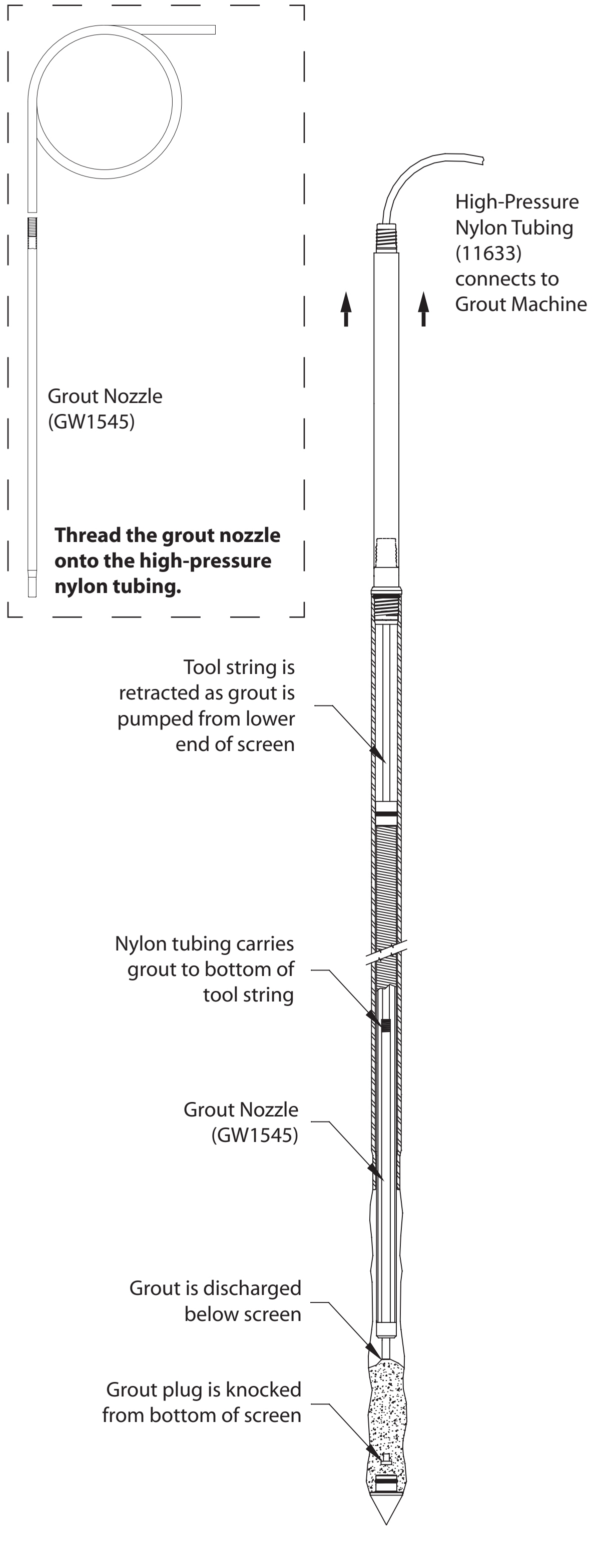


FIGURE 4.4
Grouting the SP16 Sampler With a GW1520 or GW1530 Screen

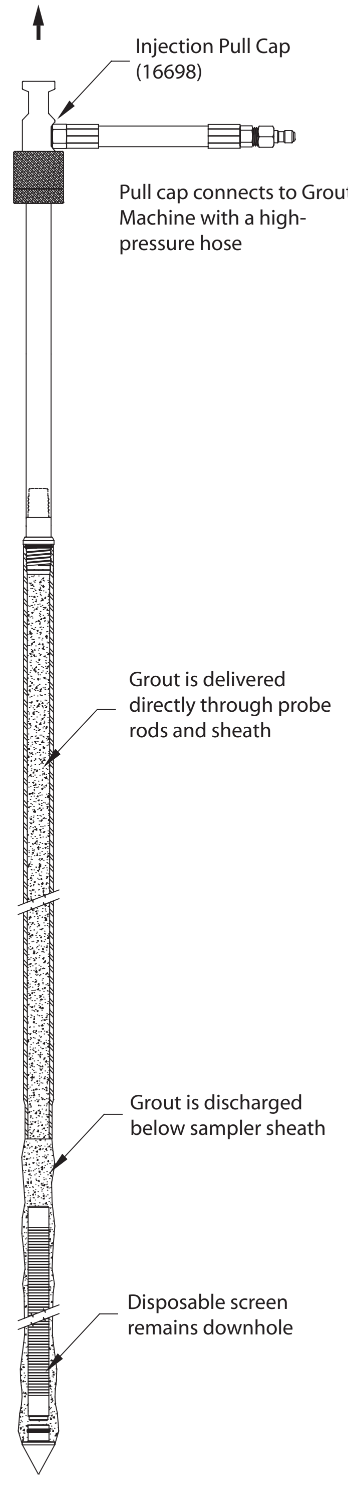


FIGURE 4.5
Grouting the SP16 Sampler With a 16089 Disposable Screen

3. Place a mark on the extension rod even with the top of the probe rod. Apply downward pressure on the extension rods and push the grout plug out of the screen. The mark placed on the extension rod should now be below the top of the probe rod. Remove all extension rods.

   Note: When working with a stainless steel screen, it may be necessary to raise and quickly lower the extension rods to jar the grout plug free. When the plug is successfully removed, a metal-on-metal sensation may be noted as the extension rods are gently "bounced" within the probe rods.

4. A Grout Nozzle (GW1545) is now connected to High-Pressure Nylon Tubing (11633) and inserted down through the probe rods to the bottom of the screen (Fig. 4.4). It may be necessary to pump a small amount of clean water through the tubing during deployment to jet out sediments that settled in the bottom of the screen. Resistance will sometimes be felt as the grout nozzle passes through the drive head. Rotate the tubing while moving it up-and-down to ensure that the nozzle has reached the bottom of the screen and is not hung up on the drive head.

   Note: *All probe rods remain strung on the tubing as the tool string is pulled. Provide extra tubing length to allow sufficient room to lay the rods on the ground as they are removed. An additional 20 feet is generally enough.*

5. Operate the grout pump while pulling the first rod with the rod grip pull system. Coordinate pumping and pulling rates so that grout fills the void left by the sampler. After pulling the first rod, release the rod grip handle, fully lower the hammer, and regrip the tool string. Unthread the top probe and slide it over the tubing placing it on the ground near the end of the tubing.

6. Repeat Step 5 until the sampler is retrieved. Do not bend or kink the tubing when pulling and laying out the probe rods. Sharp bends create weak spots in the tubing which may burst when pumping grout. Remember to operate the grout pump only when pulling the rod string. The probe hole is thus filled with grout from the bottom up as the rods are extracted.

7. Promptly clean all probe rods and sampler parts before the grout sets up and clogs the equipment.

4.8 Abandonment Grouting for the 16089 Disposable Screen

ASTM D 5299 requirements can also be met for the SP16 samplers when using the 16089 disposable screen. Because the screen remains downhole after sampling, the operator may choose either to deliver grout to the bottom of the tool string with nylon tubing or pump grout directly through the probe rods using an Injection Pull Cap (16698). A GS500 or GS1000 Grout Machine is needed to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling with the rod grip puller.

2. Thread the screen push adapter onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extension rods until the adapter contacts the bottom of the screen. Attach the handle to the top extension rod.

3. The disposable screen must be extended at least 46 inches (1168 mm) to clear the bottom of the sampler sheath. Considering the length of screen deployed in Section 4.7, determine the remaining distance required to fully extend the screen from the sheath. Mark this distance on the top extension rod.

4. Pull the tool string up to the mark on the top extension rod while holding the disposable screen in place.

   The screen is now fully deployed and the sampler is ready for abandonment grouting. Apply grout to the bottom of the tool string during retrieval using either flexible tubing (as described in Section 4.7) or an injection pull cap (Fig. 4.5). This section continues with a description of grouting with a pull cap.

5. Remove the rod grip handle and maneuver the probe assembly directly over the tool string. Thread an Injection Pull Cap (16698) onto the top probe rod and close the hammer pull latch over the top of the pull cap.

6. Connect the pull cap to a Geoprobe® grout machine using a high-pressure grout hose.

7. Operate the pump to fill the entire tool string with grout. When a sufficient volume has been pumped to fill the tool string, begin pulling the rods and sampler while continuing to operate the grout pump. Considering the known pump volume and sampler cross-section, time tooling withdrawal to slightly "overpump" grout into the subsurface. This will ensure that all voids are filled during sampler retrieval.

   The grouting process can lubricate the probe hole sufficiently to cause the tool string to slide back downhole when disconnected from the pull cap. Prevent this by withdrawing the tool string with the rod grip puller while maintaining a connection to the grout machine with the pull cap.

4.9 Retrieving the Screen Point 16 Sampler

If grouting is not required, the Screen Point 16 Sampler can be retrieved by pulling the probe rods as with most other Geoprobe® applications. The Rod Grip Pull System should be used for this process as it allows the operator to remove rods without completely releasing the tool string. This avoids having the probe rods fall back downhole when released during the pulling procedure. A standard Pull Cap (15164) may still be used if preferred. Refer to the Owner's Manual for your Geoprobe® direct push machine for specific instructions on pulling the tool string.

5.0 REFERENCES

American Society of Testing and Materials (ASTM), 2003. D6771-02 Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. ASTM, West Conshocken, PA. (www.astm.org)

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Appendix A
ALTERNATIVE PARTS

The following parts are available to meet unique soil conditions. See section 3.0 for a complete listing of the common tool configurations for the Geoprobe® Screen Point 16 Groundwater Sampler.

SP16 Sampler Parts and Accessories	**Part Number**
SP16 Drive Head, 0.625-inch bore, 1.5-inch rods	15188
Expendable Drive Points, aluminum, 1.625-inch OD (Pkg. of 25)	GW1555ALK
Expendable Drive Points, steel, 1.75-inch OD (Pkg. of 25)	17066K
Screen, PVC, 10-Slot	GW1530
Screen, Disposable, PVC, 10-Slot	16089

Groundwater Purging and Sampling Accessories	**Part Number**
Polyethylene Tubing, 0.25-inch OD, 500 ft.	TB17L
Polyethylene Tubing, 0.5-inch OD, 500 ft.	TB37L
Polyethylene Tubing, 0.625-inch OD, 50 ft.	TB50L
Check Valve Assembly, 0.25-inch OD Tubing	GW4240
Check Valve Assembly, 0.5-inch OD Tubing	GW4220
Check Valve Assembly, 0.625-inch OD Tubing	GW4230
Water Level Meter, 0.375-inch OD Probe, 100-ft. cable	GW2001
Water Level Meter, 0.438-inch OD Probe, 200-ft. cable	GW2002
Water Level Meter, 0.375-inch OD Probe, 200-ft. cable	GW2003
Water Level Meter, 0.438-inch OD Probe, 30-m cable	GW2005
Water Level Meter, 0.438-inch OD Probe, 60-m cable	GW2007
Water Level Meter, 0.375-inch OD Probe, 60-m cable	GE2008

Grouting Accessories	**Part Number**
Grout Machine, auxiliary-powered	GS500

Probe Rods, Extension Rods, and Accessories	**Part Number**
Probe Rod, 1.5-inch x 1-meter	17899
Probe Rod, 1.5-inch x 48-inch	13359
Drive Cap, 1.5-inch rods (for GH40 Series Hammer)	15590
Rod Grip Pull Handle, 1.5-inch Probe Rods (for GH40 Series Hammer)	GH1555
Extension Rod, 48-inch	AT671
Extension Rod, 1-meter	AT675

Geoprobe Systems®
A DIVISION OF KEJR, INC.

Corporate Headquarters
601 N. Broadway • Salina, Kansas 67401
1-800-GEOPROBE (1-800-436-7762) • Fax (785) 825-2097
www.geoprobe.com

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