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REPORT ON

SITE CHARACTERIZATION SCOPE OF STUDY
CHAPEL STREET FORMER MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

By Haley & Aldrich, Inc.
Rocky Hill, Connecticut

For
The Southern Connecticut Gas Company
Orange, Connecticut

File No. 131638-002
April 2018

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4 April 2018
File No. 131638-002

Department of Energy and Environmental Protection
Water Protection and Land Reuse
Remediation Division
79 Elm Street
Hartford, Connecticut 06106-5127

Attention: John Duff

Subject: Site Characterization Scope of Study
Chapel Street Former MGP Site
347 Chapel Street
New Haven, Connecticut

Dear John:

On behalf of the Southern Connecticut Gas Company and pursuant to Item B.2.b of the Consent Order dated January 5, 2018 and in accordance with the deadline in the "Scope and Schedule" approved by the Connecticut Department of Energy and Environmental Protection on December 4, 2017, Haley & Aldrich, Inc. is pleased to submit this Site Characterization Scope of Study for the Chapel Street Former MGP Site located at 347 Chapel Street in New Haven, Connecticut. Please contact us if you have any comments or questions.

Sincerely yours,
HALEY & ALDRICH, INC.

Sean M. Carroll, LEP
Associate | Environmental Remediation Engineer

STATE OF CONNECTICUT
SEAN M. CARROLL
No. 533
LICENSED
ENVIRONMENTAL PROFESSIONAL

Enclosures

c: Shawn Crosbie; Sean Murphy, The Southern Connecticut Gas Company

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1. Introduction

A Consent Order between the Southern Connecticut Gas Company (SCG) and the Connecticut Department of Energy and Environmental Protection (CT DEEP) was executed on January 5, 2018, requiring SCG to investigate and remediate the Chapel Street former Manufactured Gas Plant (MGP) Site (The Site). The Consent Order defines The Site as being comprised of two parcels on which historical gas manufacture activities occurred: the 347 Chapel Street property, currently owned by SCG, and the 259 East Street property, currently owned by Simkins Industries. This Characterization "Scope of Study" has been prepared in accordance with the requirement in Section B.2.b of the Consent Order and in compliance with the schedule in the September 2017 "Investigation and Remediation Work Scope and Schedule, Chapel Street Former MGP Site", prepared by Haley & Aldrich and approved by CT DEEP on December 4, 2017.

1.1 SCOPE OF STUDY – PURPOSE AND DOCUMENT ORGANIZATION

The purpose of this document is to provide a framework and schedule for the characterization of the Site, in compliance with the January 2018 Consent Order. This Scope of Study will provide a proposed investigation scope and approach for the Site characterization, including proposed characterization methods, locations, anticipated depths, the initial list of potential contaminants of concern, and an anticipated schedule for completing the characterization work. It is understood and expected that this information is provided to indicate the anticipated extent of the sampling program, but that actual exploration locations may be modified, eliminated or added in the field based on conditions encountered during the characterization program. It is also understood that if the scope of work proposed herein is insufficient to delineate the extent of Site-related contamination, CT DEEP will be notified, and additional characterization work will be performed. CT DEEP will advise SCG if a revised Scope of Study is required.

This Scope of Study is organized as follows:

- Section 1: Introduction, summary of Site history, current site conditions, definition of terms and preliminary conceptual site model;
- Section 2: Site characterization program overview, which provides a summary of the anticipated approach to characterization of Site-related contaminants and the proposed methods for the land portion of the Site and the Mill River;
- Section 3: Site characterization work scope, which provides additional details regarding the proposed investigation methods, investigation locations, etc.;
- Section 4: Field sampling plan, which provides some detail regarding field methods and equipment;
- Section 5: Quality assurance and quality control, which provides a summary of anticipated QA/QC methods;
- Section 6: Indicates that the results of the investigation will be provided to CT DEEP in an Investigation Report; and
- Section 7: Presents a proposed schedule for the work.

1.2 REGULATORY SETTING AND PROJECT OBJECTIVES

In January 1996, The State of Connecticut promulgated the Remediation Standard Regulations (RSRs). The RSRs provide numeric baseline criteria used to evaluate the need for clean-up at certain properties including "Establishments" as defined within Section 22a-134 of the Connecticut General Statues (C.G.S.), those undergoing "Voluntary Remediation" pursuant to Section 22a-133 of the C.G.S., and those subject to CT DEEP enforcement action. As stated in the proposed Consent Order, the subject Site must conduct appropriate assessment, investigation and, as necessary, remediation to meet the requirements of the Consent Order and demonstrate compliance with the RSRs.

The Site is an industrial/commercial property located within an area where CT DEEP has classified the groundwater as "GB." Applicable RSR criteria include:

Residential Direct Exposure Criteria (RDEC) and Industrial/Commercial Direct Exposure Criteria (I/CDEC);
GB Pollutant Mobility Criteria (GBPMC);
Residential Volatilization Criteria (RVC) and Industrial/Commercial Volatilization Criteria (I/CVC); and
Surface Water Protection Criteria (SWPC).

The PMC apply to soils above the seasonal high groundwater table; the DEC apply to soil within 15 ft of the ground surface. The VC and SWPC apply to groundwater. Given that the intention is to place an Industrial/Commercial Environmental Land Use Restriction (ELUR) on the property, future investigation data will also be compared to I/CDEC and I/CVC as allowed by the RSRs.

The Mill River, which bounds the Site to the East and North, is classified as SD/SB. This surface water classification indicates that it presently does not meet water quality criteria or one or more designated uses due to pollution. The goal for such water is Class SB.

1.3 SITE SETTING

The 347 Chapel Street property is located east of downtown New Haven, Connecticut and is bounded by Chapel Street to the South, the Mill River to the east and north, and a north/south railroad right-of-way to the west. The Site layout is depicted on Figure 1.

The property east of the railroad track is owned by the SCG and is currently used by Gateway Terminal, which operates a shipping terminal and storage for bulk materials (rock, aggregate, sand, and road salt) and construction materials (steel) that arrive by trucks, trains, and barges. There are several piles of bulk materials on the Site, partially contained by modular pre-cast concrete walls. These piles are dynamic; their size and location change with time, as materials are imported, stored, processed, and exported. A railroad spur comprised of three railroad tracks is located in the central portion of the Site. Three buildings are located in the southwestern portion of the site: a former Office, a former Power Plant, and a former Laboratory. Large salt or sand-salt mixture stockpiles are located in the northern and southern portions of the Site. The eastern and northeastern Site boundary is a retaining wall, comprised primarily of stone blocks (large granite and sandstone blocks) and concrete separating the 347 Chapel Street property from the Mill River. The elevation of the top of the retaining wall is approximately 7.5 to 8.5 ft above mean sea level (NGVD 1929), which is approximately 2 to 3 ft above the typical high tide level in the Mill River.

The 259 East Street property west of the railroad right-of-way north of Chapel Street, east of East Street, and south of Ives Place is owned by Simkins Industries and is leased to Gateway Terminal for materials storage operations. MGP activity (primarily gas storage in gas holders) occurred on this parcel as well.

Prior to filling the Site for development, the Site was a tidal marsh along the western shore of the Mill River. Beginning in the late 1800s, filling occurred along the Mill River and the western shoreline moved eastward, creating the land east of the railroad. From 1861 until the mid-1960's, the site was operated as a manufactured gas plant (MGP). The MGP was razed in the mid-1960's, except for three buildings (office, power plant, and laboratory buildings). From this time until 1994, the Site was used by Southern Connecticut Gas as an operations center and maintenance facility. Starting in 1998, the Site has been leased to Gateway Terminal for use as a bulk material storage facility.

1.4 SITE DEFINITIONS

Details regarding the site history and conceptual site model are provided in the Haley & Aldrich report, Phase I Environmental Site Assessment, Chapel Street Former MGP Site," dated January 2018 (Phase I Report) and in the "Consent Order Compliance – Scope and Schedule, Chapel Street Former MGP Site (the "Site"), 347 Chapel Street, New Haven, Connecticut," prepared by Haley & Aldrich, Inc., prepared for UIL Holdings, Inc., dated 21 December 2015. A summary of the Site history, areas of concern and operable units is presented below.

1.5 HISTORICAL OVERVIEW

As is the case for much of New Haven, especially in areas adjacent to waterways, the majority of the Site consists of filled land, which prior to filling was tidal marshland along the Mill River. The nature of the fill is not yet well understood, but based on what is known about fill in and around New Haven, it is expected to consist of coal and wood ash and cinders, building debris, and other materials that were typically used for fill in the 1800s as land was created to expand the City.

1.5.1 Mill River

The Mill River shoreline has changed over time. In 1842, the Mill River encompassed the former MGP site with the shoreline extending east towards the railroad alignment. By 1886, the northeast quadrant of the former MGP site had been filled, with a seawall bounding the Mill River and the southeast quadrant remained as a harbor to the Mill River. By 1901, the southeast quadrant of the former MGP site had been filled, with the current seawall configuration bounding the Mill River which has remained unchanged.

1.5.2 Owner and Operations Overview

Beginning in the 1860s, the site operated as a former MGP site as summarized below.

Date	Description
Prior to 1853	Tidal Marsh
1853	New Haven Gas Company purchased the Site.
1853-1924	The Site was gradually filled and the property west of the railroad tracks was acquired.
1861-1960s	Gas was produced at the Site during this period; Site was developed with a tank farm; parts of the Site were used as lumber yard, brass foundry, tar processing and storage, and ammonia plant.
1950s	Large holder was constructed.
1960s-1992	Most of the plant structures were razed.
1967	New Haven Gas Company becomes Southern Connecticut Gas Company (SCG).

1989	Large holder caught on fire as it was demolished.
1967-1994	Site occupied by SCG Operations Center and Offices.
1994-1998	Site was vacant.
1998-present	SCG is the current property owner. Site leased to Gateway Terminals for the storage of salt, coal, metal and large boulders.

1.5.3 The MGP process and Identified Areas of Concern

Manufactured gas plants were the primary energy producers during the late 19th and early 20th Centuries; just about every city or large town had at least one MGP during that time period. These gas plants would heat coal in the absence of oxygen, capture the gas that was generated, sometimes using steam (this method was referred to as "water gas") and sometimes vaporizing oil into the gas to increase its energy content. Hot gas was generated in "retorts", which would then need to be cooled and the impurities removed before the gas could be fed into the subsurface piping of the gas distribution system. The hot gas was typically fed through "condensers", which cooled the gas through contact with air or water; as the gas cooled, tars and oils would condense and settle out of the gas as liquids. Equipment such as a "tar separator" was often used to separate tar from oil and watery condensate. MGPs commonly collected oil and tar as a byproduct and sold it for use in the chemical industry or for use on roads, roofs, and in other products. Similarly, ammonia was often collected as a byproduct for sale. The abundance of tar processing features and the presence of the oil, tar and ammonia tanks in close proximity to the River, where the products could easily be transferred to ships, indicates that this was done at this MGP. The entities labelled "Tarbond Products" and the "Am. Tar Products Co." in the northern portion of the Site were likely business off-shoots from the MGP dedicated to collection, processing, and re-sale of tar products.

Other impurities such as cyanide and sulfur were removed from the gas as it was fed through purifiers, typically a series of box-like structures with iron-impregnated wood chips or other media. In between the various processes described above, gas would be stored in "relief holders". After purification, the finished gas was stored in "gas holders", which were large cylindrical structures (typically 50 ft to 160 ft in diameter and more than 100 ft tall) that telescoped up and down with the gas pressure inside them. From the gas holders, the gas would be metered out into the distribution system by the meter house.

Based on the preliminary conceptual site model, the following "On-Site" 11 AOCs have been identified (please refer to Figure 2 for the AOC boundaries):

AOC ID	AOC NAME
Onsite AOCs	
1	Tank Farm and Ammonia Plant North
2	Holder Area on the property currently owned by Simkins Industries West of Railroad ROW
3	Holder No. 7 Southeast
4	Eastern Waterfront
5	Northeastern Waterfront
6	Tar Tanks Along Mill River East
7	Buildings Center of Site
8	Buildings South of Railroad Spurs

AOC ID	AOC NAME
9	Buildings East of Railroad ROW
10	Mill River Sediments
11	Site-wide Groundwater

The table below lists off-site AOCs; i.e., potential AOCs located on other properties not associated with former gas manufacturing activities and not the subject of this investigation, but which may have affected the Site.

AOC ID	AOC NAME
Offsite AOCs	
12	Railroad ROW
13	Adjacent Simkins Property North of the Site
14	Adjacent HB Ives Property West

1.5.4 Former MGP Site Operable Units (Operable Units A, B, C, D, E, and F)

For project planning purposes, we have divided the MGP-affected areas into the following six "Operable Units" (OUs; refer to Figure 3 for locations) based on ownership and current use:

- OU-A: 347 Chapel Street waterfront and Mill River sediments
- OU-B: Northern stockpile area
- OU-C: Southern stockpile area
- OU-D: Commercial stone yard
- OU-E: Roadways and rail tracks on 347 Chapel Street property
- OU-F: Property west of the Penn Central rail ROW, north of Chapel Street, east of East Street, and south of Ives Street, which is owned by Simkins Industries

1.5.5 Structures and Features

Five gas holders, an oil and gas tank area located north on the site, tar tanks east along the Mill River, and MGP support buildings located on the center and southern portions of the site historically were present onsite. An active railroad line has run through the center of the site since at least the mid-1800s. A description of the history of site structures and features is presented in the Phase I report.

1.5.6 Adjoining Properties

North: Immediately north of the site was The New Haven Pulp and Board Company which was founded in 1901. The plant was occupied and used as a manufacturer of paper products through the early 2000s. In 2010 the buildings were demolished and the property has remained vacant. Simkins Industries, the third generation company owner, is listed as the current owner.

South: Immediately south of the site is Chapel Street. Beyond Chapel Street were a series of industrial/commercial properties. From at least 1886 through 1920s, the New Haven Steam Saw Mill and Lumber Sheds were located south of Chapel Street. By 1951, these properties were vacant. By 1973, a former filling station and current auto service station was located at the corner of Chapel and

East Streets. Also by 1973, a scrap metal yard currently occupied and owned by York Hill Trap Rock Quarry Co. (who sells rock and concrete products) was located on the former saw mill property.

East: The Mill River is located east of the site.

West: Immediately west of the site is East Street. Beyond East Street were a series of industrial/commercial properties. The 1886 Sanborn Map depicts The L. Candee Rubber Works (est 1842), C. T. Warner Iron Foundry, and New Haven Brewing Company. By 1901, the Rubber Works and Barrel Storage/ Repairing occupied the property. By 1923, The L. Candee Rubber Works occupied the entire block but the plant was closed in 1929. In 1951, the entire block was controlled by the Associated Realty Corp and occupied by various tenants labeled as “bowling”, “lofts”, and “machine shop”. These buildings were demolished and in 1965, a new building was constructed for The H.B. Ives Co who manufactured “builders hardware”. The H.B. Ives Co closed in 2009 and this building was vacant in 2010, demolished in 2011, and used as a storage yard since 2012

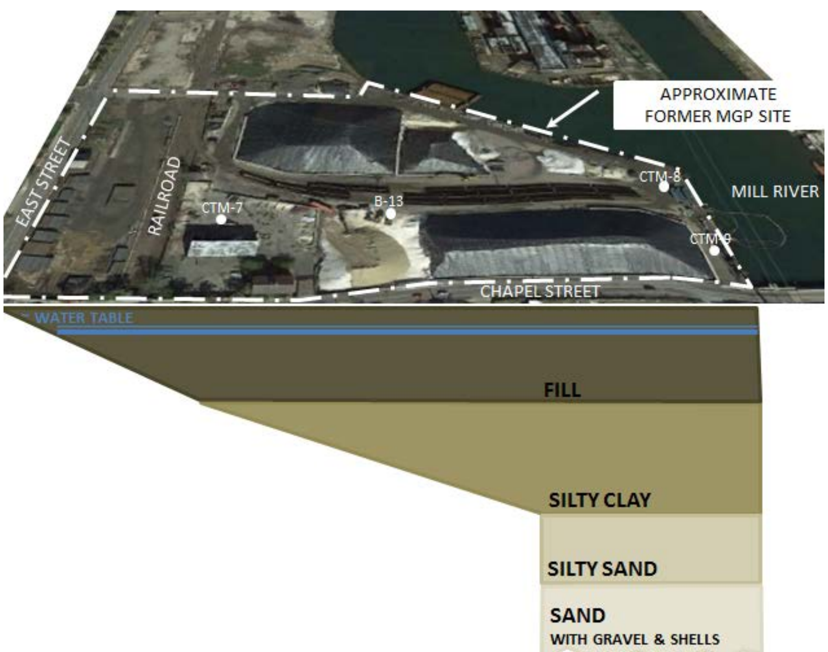
1.6 PREVIOUS SUBSURFACE CHARACTERIZATION

Previous subsurface characterization work is summarized in the Phase I Report; prior exploration locations are shown on Figure 4.

1.7 PRELIMINARY CONCEPTUAL SITE MODEL

1.7.1 Geology

The site geology has changed over time due to changes in the Mill River shoreline and associated filling activities. Soil borings conducted by C.T. Main in 1992 provide the basis for a preliminary conceptual geologic cross section below consisting of fill, silty clay, silty sand, sand and then bedrock.



1.7.2 Hydrology

Groundwater is tidally influenced and brackish. The general gradient is expected to be toward the Mill River to the east; however this gradient is expected to be both relatively slight and dynamic, fluctuating with the tidal cycles. Depth to groundwater observed is generally 4 to 8 ft bgs.

1.7.3 Potential Sources of Contamination

A review of historical maps indicates the presence of numerous potential sources of contamination associated with former MGP features. These features include former gas holders, oil, tar, and ammonia tanks associated with a tank farm and ammonia plant in the northern portion of the Site, tar processing equipment in the west-central portion of the Site, tar tanks along the Mill River east onsite, buildings including purifiers, a tar well, and at the center of the site, buildings south of railroad spurs, buildings south of railroad right-of-way, and subsurface utilities, including tar and oil piping that is believed to have been below ground.

As discussed earlier in this report, there is evidence that, especially by the early 1900s, tar was collected, processed, and shipped off-site for sale and re-use. However, leakage from such storage facilities may have occurred, and early (pre-1900) MGP practices are generally known to have been less effective at containing MGP by-products.

1.7.4 Constituents of Concern

MGP residuals in the form of non-aqueous phase liquid (NAPL) are expected to be present in the subsurface. Dense NAPL (DNAPL) sinks to a lower confining layer and light NAPL (LNAPL) concentrates at the water table elevation and smears across the water table.

Potential chemical constituents of concern (COCs) associated with MGP residuals include volatile organic compounds (VOCs), semi- volatile organic compounds (SVOCs; predominantly poly-cyclic aromatic hydrocarbons, [PAHs]), metals, and cyanide. Cyanide is often a byproduct of the MGP purification process; however it is also present as an anti-caking agent in the road salt stored on the Site, therefore detection of cyanide is not necessarily evidence of MGP contamination. Additionally, ammonia is often a byproduct of the MGP process and on the northern portion of the site there was an ammonia plant; therefore ammonia is also a constituent of concern. Polychlorinated biphenyls (PCBs) were not typically used at MGPs; however PCBs were used in natural gas compressor stations and have been detected in some natural gas transmission and distribution systems and associated equipment. If natural gas meters or other equipment were stored or serviced at the property during the post-MGP era, PCB contamination may be present in surficial soils.

Based on this Site history, the proposed initial list of potential COCs are the following:

- VOCs (CT DEEP RCP list);
- SVOCs (CT DEEP RCP list);
- Priority pollutant metals (PP-13);
- Ammonia;
- Cyanide; and
- PCBs (see below).

It is anticipated that this initial COC list will be adjusted based on the results of the first phases of investigation. For instance, it may be appropriate to reduce the SVOC analyte list to PAHs (known to be abundant in coal tar), to reduce the VOC list to BTEX compounds (also known to be abundant in coal tar), and to remove metals and PCBs if there is not evidence of a release of these contaminants on the Site.

Note that PCBs were invented after the era of manufactured gas production and are typically not a COC on MGP sites, unless they are present due to releases associated with a subsequent use. Haley & Aldrich is not aware of a release of PCBs on the property based on the review of previous information performed to date. PCBs are included as a potential COC based on the possibility that SCG may have stored or serviced natural gas meters or other natural gas equipment that may have contained PCBs. Former SCG operations areas will be sampled to assess whether a release of PCBs has occurred on the property, and whether PCBs should remain a Site COC.

It is well documented that urban fill in the New Haven area contains elevated concentrations of metals (e.g., lead, arsenic) and PAHs. We anticipate performing file reviews at CT DEEP and using other sources of information to develop an understanding of urban background metals and PAH concentrations in the soils and sediments in the vicinity of the Site. Therefore, the detection of the contaminants alone does not necessarily indicate a Site-related release. One of the objectives of this characterization program will be to distinguish Site-related impacts from general urban fill conditions.

1.7.5 Potential Migration of Contamination

LNAPL, if present onsite, is expected to be observed in the vicinity of the water table beneath or adjacent to former MGP structures associated with oil or gas purification (e.g., condensers, purifiers, oil or fuel tanks, etc.). Vertical migration of LNAPL is limited by fluctuations in the water table. Horizontal migration of LNAPL is influenced by groundwater gradients, which are expected to be nominal. A passive oil recovery system operated from approximately 1990 to 1994 in the northern tank farm area adjacent to the former pump house. A RE Wright oil bailer was used and approximately 1,000-gallons of oil (4,000-gallons oil/water) was removed. The system was shut down around 1994 when the system was not producing enough oils to warrant keeping it in operation.

DNAPL may be present beneath former MGP structures associated with tar (e.g., tar wells, tar piping, gas holders, tar separators, tar tanks, etc.). Oil-like material (OLM) and tar-like material (TLM), associated with releases from structures such as these, have been observed in the fill onsite. Vertical migration of DNAPL is limited by geologic confining layers; DNAPL tends to be mobile through sand and less mobile through clays. Sandy layers, if present within the silty clay layer, can allow downward vertical migration of DNAPL. Additionally, the silty clay confining layer was penetrated for the installation of hundreds of foundation piles during construction of MGP buildings and gas holders, possibly resulting in preferential pathways for contaminant migration. Horizontal migration of DNAPL is influenced by geology and subsurface utilities, which can create preferential pathways. In previous investigations (CT Main, 1992), DNAPL has been observed in the eastern portion of the former MGP site. Deep borings (CTM-1, CTM- 7, and CTM-9) conducted by CT Main in 1992 have suggested the presence of OLM extending into the sandy layers beneath the silty clay at 40 to 50 ft bgs; however because the 1992 CT Main borings were completed using hollow-stem augers (HSA), these deeper impacts require confirmation during future investigation activities to determine the vertical extent of impacts. Offsite migration of MGP residuals via subsurface utilities has been observed to the Mill River causing impacts to sediment. It is not known at this time if MGP residuals have migrated offsite in the northern, western, or southern directions.

2. Site Characterization Program Overview

2.1 SITE SAFETY, LOGISTICS AND ACCESS LIMITATIONS

As discussed in the Scope and Schedule and in Section 1 of this Scope of Study, the Site is currently used by Gateway terminal to store large quantities of road salt, for use on the roads in the Greater New Haven Area during the winter. Haley & Aldrich understands based on communications with Gateway that Gateway accepts salt deliveries from global salt suppliers and does not have complete control over the timing of salt deliveries. Over the majority of the year, large salt piles cover the majority of the Site. Additionally, Gateway stores large boulders and stone in other portions of the Site, and uses the Simkins property west of the rail tracks to store steel bars.

Safety will be an important consideration in planning Site characterization activities. There are numerous Site operations that use large equipment with potential to harm characterization personnel. Gateway personnel use large dump trucks to import large quantities of salt onto the Site over relatively short periods of time when salt shipments arrive. Rail cars are used to import steel bars to the Site, and an excavator with a magnetic attachment removes the steel from the rail cars, stacking them in piles on the Site. The operators of these machines are not accustomed to having drill rigs, smaller vehicles and pedestrians on Site. Pro-active coordination with Gateway personnel prior to and during characterization work (e.g., regarding schedule, procedures, and precautions) will be critical to performance of a safe characterization program. Additionally, the contamination in environmental media poses risks. A Site-Specific Health and Safety Plan (HASP) will be prepared as a stand-alone document to describe training requirements, policies, and procedures to protect worker safety. The HASP will include provisions for air monitoring in the worker breathing zone using a photoionization detector (PID). Daily job safety meetings will be performed to discuss the work planned for the day, the hazards associated with those tasks, and the safe working procedures to be followed to prevent injury. Site characterization personnel and on-Site Gateway personnel will attend these meetings to review the planned activities for the day and review the communications plan. The HASP will be updated as needed to remain current and relevant to the work being performed.

Because of the various materials storage operations that occur year-round on the Site, characterization of the former MGP Site will be performed in phases, as access to various portions of the property is feasible. SCG will coordinate with Gateway on the investigation schedule, and will make use of times when the salt piles are drawn down – typically in early spring, after winters with average to above average numbers of snow and ice storms. SCG will need to negotiate access with the owner of the Simkins property prior to performing characterization work on that property, and coordinate that work with the steel import/export schedule. Access to the Mill River for sediment characterization is less restricted than on the MGP Site, and will proceed on its own timetable.

2.2 CHARACTERIZATION PROGRAM OBJECTIVES

The overall objectives of the characterization program are to define the extent of Site-related contamination on the Site and in the Mill River, and to assess potential exposure risks to human health and the environment.

The Scope and Schedule defines the characterization objectives for the former MGP Site (i.e., **OU-B, OU-C, OU-D, OU-E, and OU-F**; refer to Figure 3 for OU boundaries) as listed below.

- Characterize the horizontal and vertical extent of Site-related contamination. Anticipating a containment remedy, the investigation will focus on the Site perimeter to assess the potential for off-site contaminant migration however additional site investigation may be deemed necessary by the Commissioner; and
- Identify and remediate sources of contamination, such as underground tanks or other structures containing tars or oils (SCG will consider interim actions as practicable and appropriate).

The CT DEEP-approved Scope and Schedule defines the Site Characterization objectives for **OU-A** (i.e., the waterfront of the former MGP and the Mill River, refer to Figure 3) as listed below.

- The Mill River is presently and has historically been an active shipping channel with extensive industrial activity occurring adjacent to the River and within its general vicinity. Direct discharges to the River and indirect run-off from these uses have likely resulted in sediment contamination and ecological degradation unrelated to the Site. Therefore, the local ambient background conditions will be characterized by collecting sediment and surface water samples at upstream and downstream locations. Background samples will be representative of fully mixed conditions within the river and will not be collected in the immediate area of influence of other known sources of contamination.

- Delineate the horizontal and vertical extent of site-related contaminants to determine the nature and extent of Site-related contamination in the Mill River sediments;

- Delineate the nature and extent of site-related contamination that is impacting the groundwater and Mill River surface water; and

- Characterize the horizontal and vertical extent of site-related contaminants on the 347 Chapel Street property along the upland waterfront.

The next two sections describe the characterization methods proposed for use at the Site to achieve the goals listed above.

2.3 ANTICIPATED CHARACTERIZATION METHODS – FORMER MGP SITE

A wealth of historical MGP operational information is stored in SCG archives, in the form of historical site plans, building and gas holder foundation design plans, and piping layout diagrams. Much of this historical information has been compiled onto historical site plans, some of which were included in the Phase I Report (Haley & Aldrich, February 2018). This historical information will be used to guide the Site characterization program, focusing investigation efforts on areas where suspected sources of contamination are located.

Multiple lines of evidence will be used to delineate the extent of Site-related contamination. The extent of MGP residuals will be delineated using the following tools and data:

- The Tar-specific Green Optical Screening Tool (TarGOST®), a laser-induced fluorescence subsurface probing tool developed by Dakota Technologies, Inc. (Dakota) of Fargo, North Dakota. The TarGOST tool is pushed into the subsurface using a Geoprobe or Cone Penetrometer and shines a green laser light through a window in the side of the probe, which causes PAH molecules in coal tar to fluoresce. TarGOST provides a log of fluorescence vs. depth for each hole, clearly identifying the depth intervals at which coal tar is present.

- Soil borings and field descriptions of soil will be logged, categorized, and used to understand subsurface geology and identify MGP impacts. Staining, odors, PID headspace readings, and the presence of apparent separate phase liquids (either oil-like material [OLM] or tar-like material [TLM]) will be noted on logs and used to delineate the extent of contamination. Soil borings will be overlapped with TarGOST in areas where TarGOST indicated the presence of coal tar and in areas where TarGOST did not indicate the presence of coal tar in order to calibrate the two data types.

- Test pits will be performed to investigate potential sources of sources of contamination. These could be former MGP structures or features shown on historical site plans or otherwise suggested to be present by other characterization data.

- Soil samples for laboratory analysis: TarGOST and soil descriptions will be the two primary lines of evidence used to indicate where MGP impacts are present, and analytical soil data would likely exceed regulatory criteria. The primary uses of analytical soil data will be to (i) define Site-specific urban background conditions and (ii) to define the horizontal and vertical extent of contamination and assess RSR compliance. Soil samples will be collected in some impacted areas to understand the correlation between constituent concentrations, observational data and TarGOST fluorescence response.

- Groundwater elevation measurements and samples for laboratory analysis will be collected from monitoring wells in order to delineate the nature and extent of site-related contamination in groundwater and assess the nature and magnitude of contaminant flux to the Mill River.

The lines of evidence listed above will be combined into a Site Conceptual Model that will integrate former MGP sources of contamination, geology, and the extent of contamination and assess potential exposure risks to humans and the environment. While TarGOST and observational data will be the primary lines of evidence used to identify areas with high concentrations of MGP residuals, soil and groundwater samples and laboratory analytical data will be used to delineate the horizontal and vertical extent of Site-related contamination.

2.4 ANTICIPATED CHARACTERIZATION METHODS – MILL RIVER

The Mill River is a dynamic, tidal, urban waterway. We understand, based on communications with the Concord, Massachusetts branch of the New England District of the US Army Corps of Engineers, that the Mill River was dredged fifteen times between 1903 and 1982, and that it has not been dredged since 1982. The maintained channel appears to have been on the east side of the Mill River, opposite from the former MGP Site.

As with the upland MGP characterization, a lines of evidence approach will be used to characterize the Mill River. The extent of Site-related contamination in the Mill River will be delineated using the following tools and data:

- Define reference conditions (i.e., urban ambient background) in sediment using a set of sediment samples (anticipated to be approximately 10 to 20 samples) collected upstream and downstream of the Site from fully mixed areas of the Mill River, representative of general background conditions. Reference samples will be collected beyond the influence of other known or suspected sources of contamination.

- Delineate the extent of MGP DNAPL and high concentrations of PAHs in sediments using Dart Samplers. Dart samplers are a sediment screening tool designed to identify sediments containing high levels of PAHs and PAH-rich NAPL. Dart samplers are a continuous rod coated with solid-phase extraction (SPE) media. Because of their hydrophobic nature, PAHs are attracted to and absorbed into the SPE media. Once absorbed, the PAHs are held in solid, stable solution. Darts are typically deployed in sediments for 1 to 2 days, then removed and sent to Dakota for analysis using an Ultra-Violet Optical Screening Tool (UVOST®) laser-induced fluorescence (LIF) reader. PAHs fluoresce under the UV laser light; higher magnitude responses are indicative of the presence of NAPL, and lower magnitude responses may represent elevated PAH concentrations, even in the absence of NAPL. Once the excitation light causes the contained PAHs to fluoresce, the response is converted into a digital representation. The fluorescent response (relative to a standard Reference Emitter [RE]) over the length of each Dart (i.e., depth below sediment surface [bss]) is recorded in a fluorescence vs. depth graph.

- Sediment cores will be performed using vibracore or other sediment coring methods. Cores will be described in detail, noting observational evidence of contamination including staining, presence of OLM or TLM, PID headspace readings, etc. Samples will be collected for laboratory analysis to establish the horizontal and vertical extent of Site-related contamination. Samples will be collected from 0-6 inch, 6-12-inch, 1-2 ft, 2-3 ft., etc. in order to understand the depth profile of contamination. At a minimum, sediment samples will be analyzed for PAH-34 and BTEX compounds (i.e., common constituents of coal tar, which is known to be present in the River from previous releases), and total cyanide. Other analytes (such as SVOCs, VOCs, metals, and PCBs) may be added if they are detected in upland MGP soil samples at concentrations that indicate releases of these compounds have occurred on the Site. Forensic and other analyses may be used to differentiate Site-related contamination from the background PAH and other contamination in the Mill River that is not related to the Site.

- Surface water samples will be collected upstream, near the Site, and downstream to assess the Site's impact on surface water quality.

3. Site Characterization Work Scope

The proposed work scope for Site Characterization is presented in this section. As discussed in the Scope and Schedule, it is anticipated that this characterization work will be performed in phases. The upland MGP Site characterization work in particular will need to be coordinated with the on-Site materials storage activities, performing investigation on the Site as portions of the Site are accessible. Proposed exploration locations are presented on Figure 5. As discussed in Section 1.1, this proposed scope of work is provided to indicate the anticipated extent of the sampling program; actual exploration locations will be modified, eliminated and added in the field based on conditions encountered during the characterization program. It is also understood that if at some point during the Investigation SCG determines that the scope of work proposed herein is insufficient to delineate the extent of Site-related contamination, CT DEEP will be notified, and additional characterization work will be performed.

As discussed in Section 2, the proposed work includes multiple tools that will be used to collect multiple lines of evidence to support delineation of Site-related contamination. In this section, the characterization activities are divided into the following categories:

- Subsurface soil (including saturated soils below the water table)
- Surface soil
- Groundwater and Surface Water
- Mill River Sediments

This section also includes a discussion of other work scope aspects, such as anticipated laboratory analytical methods, surveying of locations and elevations, waste management, etc.

3.1 UTILITY MARK-OUT AND EXPLORATION LOCATION MARK-OUT

Prior to each phase of investigation work, field personnel and a surveying subcontractor will mobilize to the Site to mark (with flagging or paint) the proposed exploration locations. Once the sample locations are marked, Connecticut Call Before You Dig will be contacted to mark underground utilities. If necessary, private vendors and/or SCG personnel will be contacted for assistance with mark-out of utilities. Once the utilities are marked, field equipment and personnel will be mobilized to the Site.

3.2 SUBSURFACE SOIL INVESTIGATION

3.2.1 Objectives

The overall objectives of the subsurface soil investigation are to:

- Identify potential sources of contamination;
- Define the presence of MGP residuals in and around the MGP structures; and
- Delineate the horizontal and vertical extent of Site-related contaminants in soil.

Additionally, if in the course of the investigation it is discovered that an interim remedial action would be appropriate to address a source of contamination (e.g., a leaking UST), such an action will be proposed to CT DEEP.

3.2.2 Geophysical Survey

Geophysical surveys may be used in areas of former MGP structures or piping to assist in the identification of such structures. The site-specific effectiveness of geophysics at the Site will be evaluated during the early phases of investigation, and it will be determined whether this tool will provide useful data, and whether to continue to use it in later phases of investigation.

3.2.3 Test Pits

Proposed test pit locations are summarized on Figure 5. In general, test pits are proposed to investigate the presence of potential sources or conveyances of contamination, such as former MGP features or piping. Areas with observable NAPL impacts not delineated vertically or laterally by test pits will be noted for TarGOST® explorations.

Test pits will be excavated with a backhoe or excavator. In some circumstances, soft-dig excavation methods may be used to avoid damaging features such as pipes. Excavated soil that shows signs of NAPL impact will be temporarily staged on plastic sheeting next to the test pit locations. Soil will be visually characterized for color, texture, and moisture. The presence of visible staining, NAPL (if encountered), odors, and PID headspace will be noted. In general, each test pit will be excavated to the water table surface or to the base foundation of historic structures. No dewatering of test pits is planned. It is expected that up to two subsurface soil samples may be collected from each test pit for laboratory analysis.

The test pits are intended to be opportunities for visual observation and collection of soil samples from test pits for laboratory analysis is generally not anticipated. Some soil samples may be collected at the discretion of the field geologist or technician. If collected, soil samples will be analyzed for some or all of the potential COCs listed in Section 1.7.4.

Soils excavated from the test pits will be returned to the test pits in generally the reverse order from which they were removed (i.e. the last soil removed will be the first soil replaced such that the soil stratigraphy remains generally unchanged).

3.2.4 TarGOST®

TarGOST® will be used to investigate the horizontal and vertical distribution of NAPL (i.e., tars and oils) in the subsurface. Since its first full-scale use in 2003, TarGOST has been shown at hundreds of MGP, coal tar refining, and creosote sites to be an effective tool for delineation of PAH-rich NAPL, enabling a more rapid pace of investigation and achieving a spatially dense data set, reducing uncertainty in delineation of MGP residuals. Proposed TarGOST® locations are summarized on Figure 5. Proposed TarGOST® locations were selected to collect sufficient information to understand the NAPL distribution in the overburden soil. The actual number of TarGOST® explorations completed will vary, as needed, to adequately characterize the lateral or vertical extent of NAPL.

TarGOST® explorations will be completed by Dakota Technologies, Inc. (Dakota) of Fargo, North Dakota. The TarGOST® device will be advanced using a direct-push Geoprobe or Cone Penetrometer Test (CPT) rig to a target depth. The probe has a sapphire window in the side allowing direct fluorescent measurements as the probe is steadily advanced into the soil. Coal tars and oils contain large amounts of naturally fluorescent PAHs. Fluorescence response is directed back up to the ground surface via cabling strung through the Geoprobe rods to be analyzed by a mass spectrometer in real time. The responses are indicated throughout each probe on a graph of fluorescence versus depth at a high data density of approximately one inch per data point. Coal tar will register sharp increases in fluorescence when encountered. Dakota will produce a log reporting the TarGOST® fluorescence response over with depth intervals noted.

In order to relate the TarGOST results to soil boring and other data, the following calibrations will be performed.

1. The TarGOST response will be calibrated to site specific soils and tars by creating a calibration curve of fluorescence response vs. coal tar concentration. Samples of Site soil and tar (assuming such a sample can be obtained, from a monitoring well for example) will be provided to Dakota and Dakota will create a series of soil-tar mixtures containing varying amounts of coal tar. Dakota will collect samples from the mixtures which will be sent for laboratory analysis for PAHs. The fluorescence response at each coal tar concentration will then be plotted to create a calibration curve of TarGOST fluorescence response as a function of the % NAPL and total PAH concentrations in the prepared samples.
2. TarGOST® explorations (at least 5) will be performed in NAPL-free locations (based on soil boring data) to obtain representative background fluorescence response data;
3. At least 5 pairs of co-located soil boring – TarGOST pairs will be performed within about 3 feet of each other in an area where coal tar impacts are present. The soil recovered in the soil borings will be logged and photographed and compared against the TarGOST results.
4. At least 5 pairs of duplicate TarGOST® probes will be performed within 3 feet of each other to assess repeatability and accuracy of the TarGOST probe.

These four tests of the TarGOST technology are intended to provide a sense of what the TarGOST results mean, and how the fluorescence response relates to conventional soil boring and laboratory analytical data. The TarGOST results are intended to be used to delineate NAPL; use of TarGOST is not intended to replace soil and groundwater analytical samples for comparison to RSR criteria. Therefore soil and groundwater samples will be the primary lines of evidence to define the horizontal and vertical extent of Site-related contamination. Note that #3 and #4 above do not provide a perfect comparison due to heterogeneity in subsurface conditions: even within 3 ft, conditions can vary significantly.

TarGOST® and any conventionally drilled confirmatory explorations will be abandoned by tremi-grouting from the bottom of the borehole to the top upon completion.

3.2.5 Soil Borings and Monitoring Wells

Soil borings are proposed for the purpose of characterizing the Site geologic conditions and for collection of soil samples to delineate the extent of Site-related contamination. Soil samples will be collected from soil borings at the discretion of the field geologist or technician for laboratory chemical analysis for the Site COCs. Soil sampling depths will vary; however generally will focus on obtaining data required to assess compliance with the RSRs (i.e., Direct Exposure Criteria and Pollutant Mobility Criteria) and to understand the horizontal and vertical extent of contamination in Site soils. In general, representative soil samples will be collected from intervals where contamination is indicated by field observational data such as staining, odors, or elevated PID screening results. In some cases, field observational data will be used in lieu of laboratory data to identify contaminated intervals, such as where field observational data indicate the presence of NAPL. Soil samples will also be collected from below the contaminated intervals to delineate the vertical extent of contamination. In addition to delineated site impacts, some soil borings will be performed to collect data for geotechnical purposes. Groundwater monitoring wells will be completed at selected soil boring locations to evaluate groundwater flow direction, flow rate, and quality, particularly at or near the site boundaries.

Proposed locations for soil borings and monitoring wells are summarized on Figure 5. The proposed locations were selected based on review of data collected from the previous soil borings and the locations of former MGP structures. The actual number and placement may be adjusted in the field as necessary based on subsurface conditions encountered during the implementation of the test pits, TarGOST® explorations, and other soil borings.

Care will be exercised to prevent mobilizing DNAPL to greater depths during performance of soil borings. If DNAPL is encountered above the silty clay confining layer that may pose a risk of migration during the boring process, the boring will be double-cased by installing a casing into the silty clay layer, grouting the bottom of the hole and then extending a 'telescoped' smaller diameter boring through the silty clay to investigate the underlying sand layer.

We currently anticipate using three different types of soil boring methods for different purposes: Geoprobe, sonic, and hollow-stem auger. The purpose and use of these three drilling methods is described below.

3.2.5.1 Geoprobe

Shallow soil borings (approximately 25 to 40 ft deep) will generally be completed using a Geoprobe. Continuous soil sampling will be conducted at each boring location by advancing a macrocore sampling device. Soil recovered from each sample interval will be visually characterized for color, texture, and moisture content. The presence of visible staining, NAPL (if encountered), odors, and PID headspace will be noted. Soil samples will be collected for laboratory analysis at the discretion of the field geologist or technician.

Explorations will be abandoned by tremi-grouting from the bottom of the borehole to the top upon completion.

3.2.5.2 Sonic Rig

Deeper soil borings will typically be completed using a sonic drill rig. Continuous soil sampling will be conducted at each boring locations by advancing a macrocore sampling device. Soil recovered from each sample interval will be visually characterized for color, texture, and moisture content. The presence of visible staining, NAPL (if encountered), odors, and PID headspace will be noted. Soil samples will be collected for laboratory analysis at the discretion of the field geologist or technician.

Explorations will be abandoned by tremi-grouting from the bottom of the borehole to the top upon completion.

3.2.5.3 Hollow Stem Auger Rig

Borings where geotechnical analysis is required will be completed using a hollow stem auger rig. Standard 2-ft soil sampling will be conducted at each boring locations by advancing a split spoon sampling device. Blow counts and standard penetration tests (SPTs) will be recorded and performed. Soil recovered from each sample interval will be visually characterized for color, texture, and moisture content. The presence of visible staining, NAPL (if encountered), odors, and PID headspace will be noted.

Generally, a soil sample from each stratigraphy will be collected for geotechnical analysis. The soils samples selected will have no free product, minimal staining, minimal odors, and low PID readings.

Soil recovered from each sample interval will be visually characterized for color, texture, and moisture content. The presence of visible staining, NAPL (if encountered), odors, and PID headspace will be noted. Soil samples will be collected for laboratory analysis at the discretion of the field geologist or technician.

Explorations will be abandoned by tremi-grouting from the bottom of the borehole to the top upon completion.

3.2.5.4 Monitoring Wells

Surface mount monitoring wells will be installed at select soil boring locations as shown on Figure 5. The monitoring wells will be constructed using two-inch diameter Schedule 40 polyvinyl chloride (PVC) pipe and will be screened over a ten foot interval with 0.010"slotted PVC screen. The screen interval will be determined in the field based on observed subsurface conditions.

Each monitoring well will be checked for the presence of NAPL and then developed by bailing or pumping until the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less, or until pH and conductivity measurements have stabilized. Water generated by monitoring well development and equipment decontamination will be placed in steel 55-gal drums or an onsite polyethylene storage tank for storage. Purge water will be sampled, characterized, and sent to an appropriately permitted water treatment facility for treatment.

3.2.6 NAPL Contingency Plan

The preliminary conceptual Site model based on available information is that the Site geology consists of fill, contaminated with MGP NAPL in places, overlying a silty clay layer (the historic river/marsh sediments), which overlie a deeper sand layer. It is expected that the silty clay layer limits downward migration of DNAPL, where present in the fill layer. Therefore efforts will be made in the characterization program to limit penetrations of the silty clay layer where DNAPL is observed in the fill, and if investigation through the silty clay is warranted, take precautions to prevent downward migration of DNAPL.

If NAPL is observed, the field geologist or technician will first judge if the NAPL is lighter or denser than water (i.e., LNAPL or DNAPL). If a determination cannot be easily made, representative samples will be selected for field testing, such as a shake test. To perform a shake test:

- Place a small sample of NAPL-containing soil in a clear jar;
- Fill jar ¾ full with water;
- Close jar and manually shake for several seconds; and

- Allow jar to site for up to 5 minutes to allow potential emulsions to settle.

The determination of light or dense NAPL can be made by observing whether the NAPL floats or sinks.

If DNAPL is interpreted, drilling may continue through the DNAPL-impacted interval to determine the approximate vertical extent, except where continued drilling would risk breaching a confining unit or MGP-related structure (confining with respect to DNAPL). If DNAPL is encountered immediately above a potential confining unit or MGP structure, one of the following possible actions will be taken:

1. If deeper drilling and characterization are desired at the locations where a confining unit is identified, the boring will be cased from ground surface into the silty clay layer, and the bottom of the casing will be grouted. Drilling will resume inside the casing once the grout has set. If DNAPL is identified below the potential confining unit, and no deeper confining unit has been identified in which an outer casing may be set, the borehole will be abandoned and grouted.
2. If deeper drilling and characterization are desired at locations where a former MGP-related structure is encountered in a boring (e.g., a tar separator or gas holder foundation bottom) with significant accumulations of NAPL above or within the structure, the borehole will be abandoned by tremi-grouting from the bottom of the borehole to ground surface and additional attempts will be tried within the structure and completed if feasible. If significant NAPL is present in the additional borings within the structure, an alternative nearby location will be selected immediately outside of the footprint of the former structure.
3. If deeper drilling and characterization are not warranted below the silty clay layer, the borehole will be abandoned by tremi-grouting from the bottom of the borehole to the ground surface.
4. If NAPL characterization data or NAPL recovery are desired, a monitoring well may be installed inside the borehole with a grouted-in 2-ft sump.

3.3 SURFACE SOIL SAMPLING

Currently, due to the current Site use and because the majority of the Site is covered by asphalt, concrete, gravel, or other surfacing, the potential for human exposure to surface soils is very limited. Additionally, it is anticipated that the majority of the Site will undergo some type of soil remediation, which would remove or treat surface soils. Therefore, only limited surface soil sampling is anticipated. The need for more detailed surface soil sampling will be reevaluated in the RAP, based on the extent of the proposed remedy. As an example, the RAP would propose surface soil sampling as part of the remedy design stage in areas where soil remediation to address deeper contamination is not proposed, in order to assess compliance with the RSRs and evaluate the need for remediation of soils proposed to be left in place.

3.4 GROUNDWATER SAMPLING

3.4.1 Objectives

The overall objectives of the groundwater sampling are to:

- Delineate the distribution of Site-related contaminants in groundwater;
- Determine horizontal and vertical groundwater flow patterns; and
- Assess the groundwater-surface water interaction and compliance with the surface water protection criteria.

3.4.2 Sampling

Each well will be checked for the presence of NAPL prior to purging. If DNAPL is observed to be present in sufficient volume at a monitoring well, the DNAPL may be sampled and analyzed for specific gravity, viscosity, surface tension, interfacial tension, and possibly chemical fingerprinting, if such information is needed.

Following the purging, one groundwater sample will be collected from each monitoring well using low-flow sampling techniques for laboratory analysis for the Site COCs. Field parameters collected during groundwater sampling will consist of pH, oxidation/reduction potential (ORP), turbidity, temperature, conductivity and dissolved oxygen.

The presence of NAPL in a well at any point in the lifetime of the well will bias the results of a groundwater sample (i.e., such a sample will not be representative of subsurface conditions). Therefore, groundwater samples will not be collected from wells that have at any point been found to contain NAPL.

Groundwater sampling will be performed on a quarterly basis for a minimum of two years, in order to understand seasonal variations in subsurface conditions.

3.4.3 Flow Pattern Characteristics

Following the collection of groundwater samples, falling or rising head permeability tests will be conducted at approximately 25% of the new wells installed to measure the hydraulic conductivity of the formation surrounding the screened interval of each monitoring well. Water level drawdown will be monitored using an electronic water level indicator or data logging pressure transducer.

A comprehensive round of fluid-level measurements from the new and existing groundwater monitoring wells will be conducted to determine general groundwater flow direction at the Site. In order to understand tidal effects on groundwater flow, the tidal cycle will be captured in at least two monitoring events, and the stage of the tide at the time of groundwater gauging will be noted. Groundwater levels will be measured to the nearest one-hundredth of a foot, from a reference point at the top of the northern side of the inner casing. The measurements will be converted to elevations based on the surveyed monitoring well reference elevation. The groundwater elevation information will be used to calculate hydraulic gradient across the Site. which in conjunction with the hydraulic conductivity test results to calculate horizontal groundwater flow velocities beneath the Site.

3.5 SEDIMENT INVESTIGATION

3.5.1 Objectives

The overall objectives of the sediment sampling are:

- Collect background (a.k.a., reference) sediment and surface water samples to characterize the local ambient background conditions representative of fully mixed conditions within the river at upstream and downstream locations, avoiding the immediate area of influence of other known sources of contamination; and

- Delineate the horizontal and vertical extent of site-related contaminants to determine the nature and extent of contamination in the Mill River sediments.

The second objective listed above will be accomplished in two general phases:

1. Delineate the extent of coal tar impacted sediments and high concentrations of PAHs, using Darts and observational data; and
2. Delineate the extent of Site-related contaminants present in excess of ambient urban background conditions, based on laboratory analysis of sediment samples.

3.5.2 Data Collection

3.5.2.1 Reference Core Samples

A minimum of ten reference sediment cores will be collected. The reference cores will be collected from locations understood to be representative of fully mixed conditions within the river and not collected in the immediate area of influence from other sources. In order to avoid collecting reference cores from areas of contaminated sediments associated with other sources of contamination, Haley & Aldrich performed a CT DEEP file review in March 2018, to understand the extent of known or potential sediment contamination in proximity to the Site. Although there are several known contaminated sites in close proximity to the Site (refer to the listing in Figure 3-1 on the next page), evidence of sediment contamination was found only for the United Scrap facility, upstream of the Site on the eastern branch of the Mill River.

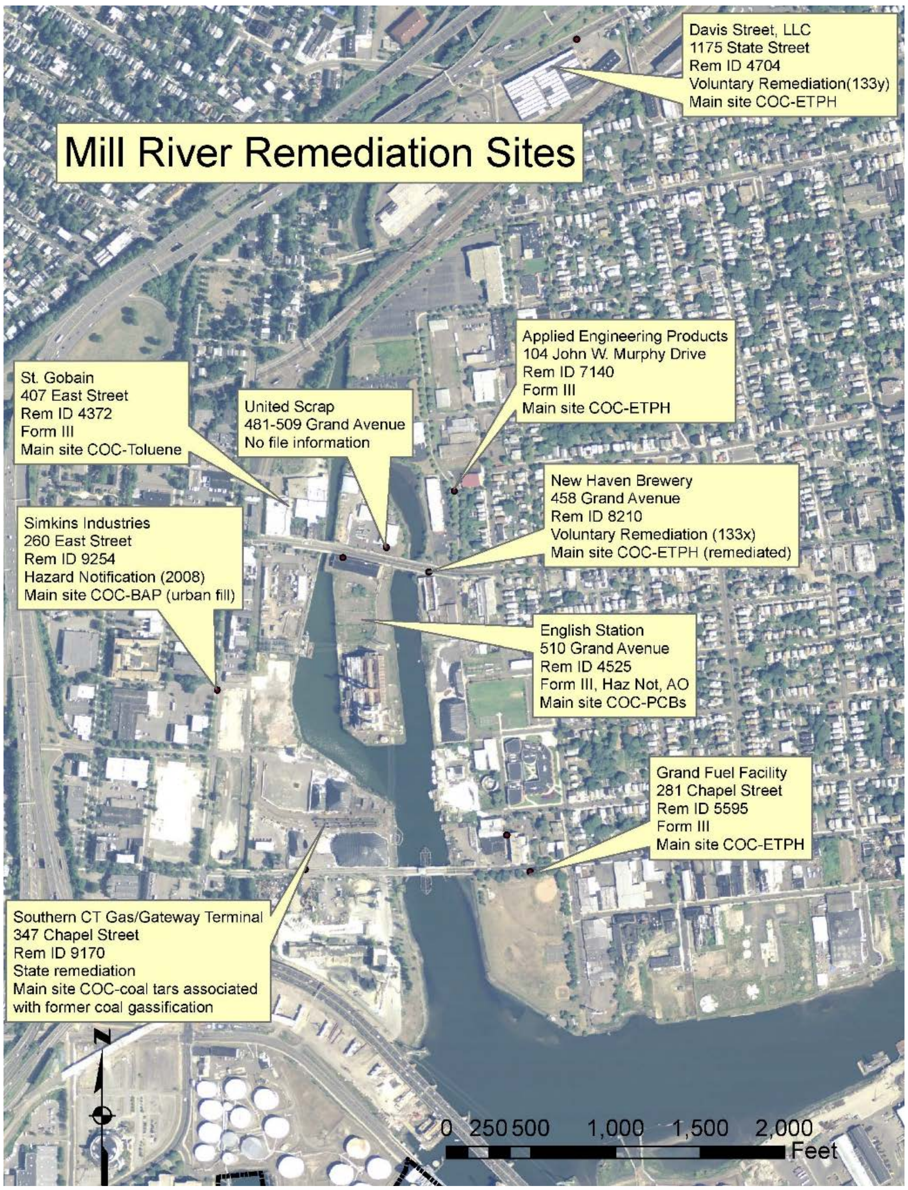


Figure 3-1 Identified contaminated sites in proximity to the Site (provided by CT DEEP)

Proposed reference sample core locations are shown on Figure 6. These locations were selected to avoid the known contaminated sites listed in Figure 3-1 above. As a general rule, reference core locations will be a minimum of 20 ft out into the Mill River channel, to avoid potential near-shore contributions. Some reference sediment cores will be collected from within the USACOE maintained (i.e., dredged) channel, but the majority will be collected outside the maintained channel, in order to enable accurate comparison with the sediments adjacent to the former MGP Site, which are outside the maintained channel. Reference cores will be at least 4 ft deep/long and will be sampled at the intervals of 0-6 inches, 6-12 inches, 1 to 2 ft, 2 to 3 ft, and 3 to 4 ft, and will be analyzed for the Site COCs. PAH analysis of background sediment samples collected from reference cores will be PAH-34, which includes alkylated PAH constituents typically present in coal tar, for the purposes of forensic analysis, if needed to discern Site-related PAHs from background PAHs.

3.5.2.2 Reference Surface Water Samples

A minimum of four reference surface water samples will be collected from upstream (minimum 2 locations) and downstream (minimum 2 locations) of the Site, to characterize general background conditions in the Mill River. Reference samples will be collected out a minimum of 50 ft from the shoreline and will be located in the main channel of the River, away from visible evidence of contamination (e.g., surface water sheen). Samples will be collected using a peristaltic pump from approximately 2 ft below the water surface, and will be analyzed for the Site COCs. This sampling will be performed a minimum of twice.

3.5.2.3 Dart Samplers

Dart Samplers will be deployed to delineate the extent of coal tar-impacted sediments. Proposed Dart Sampling locations are shown on Figure 5.

Similar to the TarGOST calibration procedure, in order to relate the Dart results to observational and sediment analytical data, the following calibrations will be performed.

1. The Dart response will be calibrated to site specific sediments and NAPL by creating a calibration curve of Dart fluorescence response vs. NAPL concentration. Sediment samples containing varying degrees of coal tar impacts (based on observational and laboratory analytical data) will be provided to Dakota and Dakota will expose those samples to a Dart Sampler. The results of these analyses will be used to create an approximate calibration curve of Dart fluorescence response as a function of the total PAH concentrations in the samples.
2. A minimum of 5 Dart Samplers will be deployed in background locations to establish the background range of Dart response.
3. At least 5 pairs of co-located vibracore – Dart pairs will be performed within about 3 feet of each other in an area where coal tar impacts are present in sediment. The vibracore observational data (i.e., observations of staining, odors, and PID readings) will be compared with the Dart logs for each location.

3.5.2.4 Sediment Core Sample Collection

Intact sediment cores will be collected using Vibracore or other sediment coring methods. Proposed sediment core locations are shown on Figure 5. The cores will be logged, photographed, and screened for contamination with a PID. Samples will be collected for laboratory analysis of the Site COCs (including PAH-34 analysis) at intervals of 0-6 inches, 6-12 inches, 1 to 2 ft, 2 to 3 ft, and 3 to 4 ft.

3.5.2.5 River Bottom Elevations

A reference point on the Mill River seawall will be surveyed for elevation, and a pressure datalogger will be installed in the River at a known depth below the reference point. The water depth will be measured at each Dart or sediment core sampling location and will be recorded along with the time of the measurement. River water surface elevations will be calculated over each sampling day as a function of time using the pressure datalogger data, and the water depth measurements will then be used to calculate the elevation of the top of the sediment surface at each sampling location. These data will be used to contour the current river bottom surface within the sampling area.

3.5.2.6 Surface Water Sampling

Surface water samples will be collected from a minimum of four locations adjacent to the former MGP Site seawall. Samples will be collected using a peristaltic pump from approximately 2 ft below the water surface, and will be analyzed for the Site COCs. This sampling will be performed a minimum of two times.

3.6 LABORATORY ANALYSES

Soil and groundwater samples will be submitted to a state-certified laboratory for analysis, in accordance with the CT DEEP Reasonable Confidence Protocols if available, or EPA SW-846 otherwise. Laboratory-provided glassware will be used. Laboratory analytical methods are listed in the table below.

Table 3.6-1 Summary of Analytical Methods

Analyte	SW-846 Method(s)
SOIL	
Ammonia	350.1
Total Cyanide[1]	4500CN-CD/EPA 9010C/9012A/9014
CT RSR 15 Metals	6010, 6020, or 7000
VOCs CTDEEP RCP List	8260
SVOCs CTDEEP RCP List	8270
PCBs[2]	8082
GROUNDWATER / SURFACE WATER	
Ammonia	350.1
Cyanide[1]	4500CN-CD/EPA 9010C/9012A/9014
CT RSR 15 Metals	6010, 6020, or 7000
VOCs CTDEEP RCP List	8260
SVOCs CTDEEP RCP List	8270
SEDIMENT	
Cyanide[1]	4500CN-CD/EPA 9010C/9012A/9014
CT RSR 15 Metals	6010, 6020, or 7000
VOCs CTDEEP RCP List	8260
SVOCs CTDEEP RCP List; EPA-34 PAHs	8270
PCBs[2]	8082

Notes:

1. CT DEEP has stated that standard methods be used to delineate the extent of cyanide in Site soils and Mill River sediments; therefore, total cyanide methods will be used. If needed, additional analytical methods may be employed to assess the biological availability and potential toxicity of cyanide (e.g., free cyanide, amenable cyanide, or physiologically available cyanide).
2. PCBs are not typically an MGP-related COC. Site historical information indicates a low probability that PCBs may have been used or otherwise present on the Site. Therefore, soil sampling will be performed on the Site to assess whether PCBs are present in soil and should be considered a Site COC. If PCBs are not detected in Site soils, PCBs will not be considered a Site COC.

NAPL samples will be analyzed for the parameters listed in Table 3.6-2.

Table 3.6-2 List of NAPL Analytes

Analyte	Matrix	Method	Containers	Preservation	Holding Time
Specific Gravity	NAPL	ASTM D1481	1 – 250mL glass jar	None	None
Viscosity	NAPL	ASTM D445	1 – 250mL glass jar	None	None
Surface Tension	NAPL	ASTM D971	1 – 250mL glass jar	None	None
Interfacial Tension	NAPL	ASTM D971	1 – 250mL glass jar	None	None
Wettability	Soil	Amott-Harvey	Minimum 2" diameter by 6" long core sleeve	Frozen	None

Soil samples collected for geotechnical analysis will be submitted for the analysis listed in Table 3.6-3.

Table 3.6-3 List of Geotechnical Analytes

Analyte	Matrix	Method	Containers	Preservation	Holding Time
Moisture Content	Soil	ASTM D2216	16 oz glass jars	None	None
Particle Size	Soil	ASTM D422	16 oz glass jars	None	None
Atterberg Limits	Soil	ASTM D4318	16 oz glass jars	None	None

3.7 SURVEYING

3.7.1 Upland

Subsequent to the field activities, a surveyor will locate surface soil sampling locations, test pits, TarGOST® explorations, soil borings, monitoring wells, stream elevation reference points, foundations, and any other pertinent locations. For each surveyed location, the surveyor will determine the horizontal location (coordinates) and ground surface elevation. Additionally, for each monitoring well, the surveyor will determine the measuring-point elevation (defined as the top of the inner casing). Elevations will be recorded in reference to NGVD 1929 and coordinates to Connecticut State Grid.

3.7.2 Mill River

Sampling locations within the Mill River will be captured using a differential GPS system on board a vessel and will be collected at the time of sampling. Locations will also be captured using distance from the sea wall at the eastern site boundary and other features at the time of sampling.

3.8 DECONTAMINATION

Non-disposable equipment, including drilling tools and equipment, will be decontaminated prior to first use onsite, between each investigation location, and prior to demobilization. Specific decontamination procedures are provided in Section 4.

3.9 INVESTIGATION-DERIVED WASTE MANAGEMENT

Investigation-derived waste (IDW) will be containerized in appropriate waste containers and stored in an onsite area prior to off-site disposal. Soil cuttings, personal protective equipment (PPE), and spent disposable sampling materials will be segregated by waste type and placed in DOT-approved 55-gal steel drums. Decontamination water and drilling water will be stored in polyethylene tanks or DOT-approved 55-gallon steel drums. Waste storage containers will be appropriately labeled with the contents, generator, location, and date generated. IDW will be sampled per the requirements of the permitted disposal facility.

4. Field Sampling Plan

4.1 GENERAL FIELD GUIDELINES

Underground utilities will be identified prior to drilling or subsurface sampling. Public and privately-owned utilities will be located by contacting responsible agencies by phone so that their underground utilities can be marked at the Site. Other potential on-site hazards such as traffic, overhead power lines, and building hazards will be identified during a Site reconnaissance visit.

The following is a general list of equipment necessary for sample collection.

- Stainless steel spoons and bowls for compositing soil samples;
- Appropriate sample containers provided by the laboratory (kept closed and in laboratory supplied coolers until the samples are collected);
- Chain-of-custody record forms;
- Log book, field sampling records, and indelible ink pens and markers;
- Laboratory grade soap (such as Alconox), reagent grade solvents, and distilled water to be used for decontaminating equipment between sampling stations;
- Buckets, plastic wash basins, and scrub brushes for decontaminating equipment;
- Digital camera;
- Stakes, flags, and/or spray paint to identify sampling locations;
- Shipping labels and forms;
- Safety blade/knife;
- Packing/shipping material for sample bottles;
- Clear plastic tape;
- Duct tape;
- Aluminum foil;
- Re-closable plastic bags; and
- Portable field instruments, including a photoionization detector (PID), water quality parameter meter, conductivity meter, and water-level indicator.

Field log books and forms will be maintained by the field team leader and other team members to provide a daily record of significant events, observations, and measurements during the field investigation.

Information pertinent to the field investigation and/or sampling activities will also be recorded in the log books or on task-appropriate forms. Entries in the log book and/or the task-appropriate form will include, at a minimum, the following information:

- Name of author, date of entry, and physical/environmental conditions during field activity;
- Purpose of sampling activity;
- Location of sampling activity;
- Name of field crew members;
- Name of any site visitors;
- Sample media (soil, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) taken;

- Description of sampling point(s);
- Volume of groundwater removed before sampling (where appropriate);
- Preservatives used;
- Date and time of collection;
- Sample identification number(s);
- Field observations; and
- Any field measurements made, such as pH, temperature, conductivity, water-level, etc.

Original data recorded in field log books, task-appropriate forms, and Chain-of-Custody Records will be written with indelible ink. If an error is made on a document, corrections will be made by crossing a single line through the error and entering the correct information. The erroneous information will not be erased. Any subsequent error discovered on a document will be corrected by the person who made the entry. Subsequent corrections will be initialed and dated.

4.2 SAMPLE LABELING, PACKING, AND SHIPPING

Each sample will be given a unique identification, which will prevent two samples from having the same label.

Samples will be promptly labeled upon collection with the following information:

- Project number and site;
- Unique sample identification;
- Analysis required;
- Date and time sampled;
- Sample type (composite or grab); and
- Preservative, if applicable.

If samples are to be shipped by commercial carrier (e.g., Federal Express), sample bottles/jars will be packed in coolers containing the following:

- A drain plug (if present) that has been sealed with duct tape;
- Water ice packaged in re-sealable plastic bags (not needed for geotechnical samples);
- Appropriate packaging material to help ensure sample integrity while being transported; and
- The completed chain-of-custody in a re-sealable plastic bag, taped in place on the inside cover of the cooler.

The cooler will then be sealed with tape. Samples will be hand delivered or delivered by an express carrier within 48 hours of sample collection. The express carrier will not be required to sign the chain-of-custody form; however, the shipping receipt should be retained by the sampler, and forwarded to the project files.

4.3 EQUIPMENT DECONTAMINATION

4.3.1 Excavator and Drill Rig Decontamination

A decontamination pad will be lined with plastic sheeting on a surface sloped to a sump. The sump must also be lined and of sufficient volume to contain approximately 20 gallons of decontamination water. Test pit and drilling equipment including the excavator bucket, rear-end of the drilling rig, augers, bits, rods, tools, split spoon samplers, and tremie pipe will be cleaned on the decontamination pad with a high pressure hot water "steam cleaner" unit and scrubbed with a wire brush, as needed, to remove dirt, grease, and oil before beginning work in the project area.

If heavy accumulations of tars or oils are present on the excavator bucket or downhole tools, a citrus-based cleaner (e.g., Citra-Solv®) may be used to aid in equipment cleaning. Tools, drill rods, and augers will be placed on sawhorses, decontaminated pallets, or polyethylene plastic sheets following steam cleaning. Direct contact with the ground will be avoided. The excavator bucket, back of the drill rig, augers, rods, and tools will be decontaminated as needed according to the above procedures. Decontamination water will be contained in a dedicated polyethylene tank or 55-gallon open-top drums located on-site. Open-top drums will remain closed when not in use.

Following decontamination of site equipment, the decontamination pad will be decommissioned. The decommissioning will be completed by:

- transferring the bulk of the remaining liquids and solids into the drums, tanks, or roll-off containers; and
- rolling the sheeting used in the decontamination pad onto itself to prevent discharge of the remaining materials to the ground surface. Once rolled up, the polyethylene sheeting will be placed in the roll-off or drums used for disposal of personal protective equipment (PPE) and disposable equipment.

4.3.2 Sampling Equipment Decontamination

Prior to collecting samples, non-dedicated bowls, spoons, hand augers, bailers, and filtering equipment will be washed with potable water and a detergent (such as Alconox). Decontamination may take place at the sampling location as long as liquids are contained in pails, buckets, etc. The sampling equipment will then be rinsed with potable water, followed by a 10 percent “pesticide-grade” methanol rinse, and finally a distilled water rinse. When sampling for inorganic constituents in an aqueous phase, an additional rinse step will be added prior to the rinse with methanol. The rinse step will entail a rinse with a 10 percent “ultra pure-grade” nitric acid followed by a distilled water rinse. Between rinses, equipment will be placed on polyethylene sheets or aluminum foil if necessary. At no time will washed equipment be placed directly on the ground. Equipment will either be used immediately or wrapped in plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location.

4.4 SAMPLE NAMING

The samples types will be designated using the following codes:

- Test Pit – “TP”
- Surface Soil – “SS”
- Soil Boring – “B”
- TarGOST® – “TG”
- Groundwater – “MW”
- Sediment – “SED”
- Dart Sampler – “D”
- Trip Blank – “TB” and
- Equipment Blank – “EB”

The naming convention will be as follows: Use the location id, date, and time (e.g., MW01-020315-1015).

4.5 SUBSURFACE SOIL SAMPLING

4.5.1 Direct Push/Macrocore and Spilt Spoon Sampling Method

Continuous sampling will be completed at subsurface soil borings using macrocore samplers or split spoon samplers. Soils will be visually characterized for color, texture, density, layering, and moisture content. The presence of MGP-related fill materials, NAPL, and obvious odors will be recorded.

Samples will be collected with disposable macrocore liners or from decontaminated split spoons. Non-dedicated stainless steel spoons or trowels used in sample homogenization will be decontaminated after each sample is collected. Sample descriptions, PID readings, and location will be recorded in the field book or on the task-appropriate form. Samples will be selected for laboratory analysis based on:

- their position in relation to potential source areas;
- the visual presence of source materials;
- the relative levels of volatile organics based on PID field screening measurements; and/or
- the discretion of the onsite geologist.

4.5.2 Test Pits

For samples that will be submitted for chemical analysis, stainless steel spoons, trowels, or other non-dedicated sampling devices will be decontaminated after each sample is collected. Sample descriptions, PID readings, and location will be recorded in the field book or on the task-appropriate form.

4.6 SOIL SAMPLE COLLECTION

Samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. Sample containers for volatile organic analyses will be filled first, minimizing exposure time to the atmosphere. Next, a sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated stainless steel tray or bowl with a decontaminated stainless steel trowel or disposable scoop. Laboratory-supplied sample containers for other analytes will then be filled. Duplicate samples will be collected by alternately filling two sets of sample containers.

Where there is sufficient sample volume, representative portions of each soil sample will be placed in a one-pint jar or re-closable plastic bag, labeled, and stored on-site. This container will be labeled with:

- Site;
- boring number;
- interval sampled;
- date; and
- initials of sampling personnel.

These soil samples will be screened for organic vapors using a PID. In addition, a geologist will be on-site during the drilling operations to describe each sample in accordance with the Unified Soil Classification System (USCS), and will include:

- soil type and sorting;
- color;
- feet of recovery;
- moisture content;
- texture;
- grain size and shape;
- relative density;
- consistency;
- visible evidence of residues; and
- any miscellaneous observations.

4.7 TARGOST® SURVEY

TarGOST® probing will be performed by Dakota Technologies, Inc., using either standard direct-push equipment or cone penetrometer equipment, and will produce a depth vs. fluorescence log for each location. As discussed in Section 3.2.4, a TarGOST response curve will be prepared using Site soils and NAPL, and a subset of TarGOST probes will be collocated with soil borings in order to relate fluorescence response values to soil boring results.

A field geologist or technician will monitor the progress of the probe and instruct Dakota to terminate probing as appropriate when the target depth is reached. The TarGOST survey will be dynamic in nature, adjusting probe locations based on the real-time results to delineate the extent of NAPL in the subsurface.

4.8 MONITORING WELL SPECIFICATIONS

Monitoring wells will be installed according to the following specifications:

- PVC 2 inch-diameter threaded, flush joint casing and 10 foot long, 0.010-inch slot screens will be installed.

- Either flush-mounted well vaults or stand-pipe well casings will be used, depending on the location and traffic conditions. Stand-pipe casings are preferred in areas where risk of damage by vehicles is low; flush-mounted vaults will be used in high-traffic areas.

- The annulus around the screens will be backfilled with an appropriate size of silica sand such as Morie #1 sand to a minimum height of one foot above the top of the screen, assuming there is sufficient room to install an appropriate surface seal above the sand.

- An approximately one-foot-thick chipped bentonite seal or slurry (30 gallons water to 25 to 30 pounds bentonite, or relative proportions) will be placed above the sand pack. The pellet seal must be allowed to partially hydrate before placing grout above the seal.

- The remainder of the annular space will be filled with a cement/bentonite grout to approximately 2 feet below grade. The grout will be placed with a tremie pipe from the bottom up. The grout will consist of a cement mixture of one 94-pound bag of Portland cement, approximately 5 pounds of granular bentonite, and approximately 7 gallons of water. The grout will be allowed to set for a minimum of 24 hours before wells are developed.

- A concrete seal or pad, approximately 2 feet in diameter and 1.5 feet below grade, will be installed.

- The north side of the top of the PVC well casing and outer protective casing will be marked and the elevation determined by survey to the nearest 0.01 foot, relative to a fixed benchmark or datum.

- The measuring point on wells will be on the innermost PVC casing, at the north side of the casing.

Exact well construction details, including the following characteristics of each newly installed well, will be recorded in the field log book/task-appropriate form:

- Date/time of construction;
- Drilling method and drilling fluid used;
- Approximate well location;
- Borehole diameter and well casing diameter;
- Well depth;
- Drilling and lithologic logs;
- Casing materials;
- Screen materials and design;
- Sump depth, if installed;
- Casing and screen joint type;
- Screen slot size/length;
- Filter pack material/size;
- Filter pack placement method;
- Sealant materials;
- Sealant placement method;
- Surface seal design/construction;
- Well development procedure;

- Type of protective well cap; and
- Detailed drawing of well (including dimensions).

4.9 MONITORING WELL DEVELOPMENT

A minimum of 24 hours after installation, the monitoring wells will be developed by surging/bailing, using a submersible pump and dedicated polyethylene tubing, or by Waterra inertial displacement pump (or equivalent) and dedicated polyethylene tubing, or other methods at the discretion of the field geologist. Bailing and pumping will continue until the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less, or until pH and conductivity measurements stabilize, assuming a minimum of 10 well volumes of water have been removed from the monitoring well during development. The development water will be placed in steel 55-gallon drums or an on-site polyethylene storage tank for storage prior to being transported for off-site disposal by SCG. Following development, wells will be allowed to recover for a minimum of two weeks before groundwater is purged and sampled. Monitoring well development will be overseen by a qualified person and the duration, method of development, and approximate volume of water removed will be recorded in the field book or task-appropriate form.

4.10 FLUID-LEVEL MEASUREMENTS

A round of fluid-level elevations will be collected in conjunction with each groundwater sampling event. The measurements will be made in as short a timeframe as practical to minimize temporal fluctuations in hydraulic conditions. The following procedure will be used to measure fluid-level depths at monitoring wells:

- Decontaminate the water level probe or oil/water interface probe (for wells expected to contain NAPL).

- Measure the static fluid-level, fluid interfaces (i.e., NAPL/water interface), and sound the bottom of the well (if applicable) with reference to the surveyed elevation mark on the top of the PVC casing. Record all measurements to nearest 0.01-foot and record in the field book.

4.11 LOW-FLOW GROUNDWATER SAMPLING PROCEDURES FOR MONITORING WELLS

This protocol describes the procedures to be used to collect groundwater samples. Wells will not be sampled until well development has been performed. During heavy precipitation events, groundwater sampling will be discontinued until precipitation ceases. When one round of water levels is taken to generate water-elevation data, the water levels will be taken consecutively at one time prior to sampling or other activities.

The following materials, as required, shall be available during groundwater sampling:

- Sample pump;
- Sample tubing;
- Power source (i.e., generator or battery);
- PID;
- Appropriate health and safety equipment as specified in the HASP;
- Plastic sheeting (for each sampling location);

- Dedicated or disposable bailers;
- New disposable polypropylene rope;
- Buckets to measure purge water;
- Water-level probe;
- Six-foot rule with gradation in hundredths of a foot;
- Conductivity/temperature meter;
- pH meter;
- Turbidity meter;
- DO meter;
- ORP meter;
- Appropriate water sample containers;
- Appropriate blanks (trip blank supplied by the laboratory);
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Groundwater sampling logs;
- Chain-of-custody forms;
- Indelible ink pens;
- Site map with well locations and groundwater contours maps; and
- Keys to wells.

The following 21 steps detail the monitoring well sampling procedures:

1. Review materials checklist (above) to ensure that the appropriate equipment has been acquired.

2. Identify site and well sampled on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment used and other pertinent data requested on the logs.

3. Label sample containers using an appropriate label.

4. Use safety equipment, as required in the HASP.

5. Place plastic sheeting adjacent to the well to use as a clean work area.

6. Establish the background reading with the PID and record the reading on the field log.

7. Remove lock from the well and if rusted or broken replace with a new brass keyed-alike lock.

8. Unlock and open the well cover while standing upwind of the well. Remove well cap and place on the plastic sheeting. Insert PID probe in the breathing zone above the well casing following instructions in the HASP.

9. Set out on plastic sheeting the dedicated or disposable sampling device and meters.

10. Prior to sampling, groundwater elevations will be measured at each monitoring well and the presence of LNAPL or DNAPL (if any) within the well will be evaluated. Obtain a water-level depth and bottom of well depth using an electric well probe and record on the sampling log sheet. Clean the well probe after each use with a soapy (Alconox) water wash and a tap water rinse. [Note:

water levels will be measured at groundwater monitoring wells prior to initiating a sampling event].

11. After groundwater elevations are measured and NAPLs are determined not to be present, groundwater will be purged from the wells. If NAPLs are determined present, then a groundwater sample will not be collected (except where specified in the Work Plan), rather a representative NAPL sample may be collected (if required) using a peristaltic pump or other suitable method.

12. Pump, safety cable, electrical lines, and/or tubing (for peristaltic pumps) will be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well.

13. Measure the water level again with the pump in the well before starting the pump. Start pumping the well at 100 to 500 milliliters per minute. Ideally, the pump rate should cause little water-level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every three to five minutes (or as appropriate) during pumping. Care should be taken not to cause the pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump. However, a steady flow rate should be maintained to the extent practicable. Sampling should commence as soon as the volume in the well has recovered sufficiently to permit sample collection.

14. During well purging, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, etc.) every three to five minutes (or as appropriate). The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

    +0.1 for pH
    +3% for specific conductance (conductivity)
    +10 mv for redox potential
    +10% for DO and turbidity

    Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling. If the parameters have stabilized, but the turbidity is not in the range of the 50 NTU goal, the pump flow rate should be decreased to no more than 100 millimeters per minute. Measurement of the indicator parameters should continue every three to five minutes. Measurements for dissolved oxygen (DO) and oxidation reduction potential (ORP) must be obtained using a flow-through cell. Other parameters may be taken in a clean container such as a glass beaker.

15. Fill in the sample label and cover the label with clear packing tape to secure the label onto the container.

16. After the groundwater quality parameters have stabilized as discussed above, obtain the groundwater sample needed for analysis (except for VOCs) directly from the sampling device in the appropriate container and tightly screw on the caps. Remove the pump and collect a groundwater sample for VOC analysis using a clean disposable bailer.

17. Secure with packing material and store at 4 degrees Celsius on wet ice in an insulated transport container provided by the laboratory.

18. After sampling containers have been filled, remove one additional volume of groundwater. Check the calibration of the meters and then measure and record on the field log the physical appearance, pH, ORP, DO, temperature, turbidity, and conductivity.

19. Record the time sampling procedures were completed on the field logs.

20. Place disposable sampling materials (plastic sheeting, disposable bailers, and health and safety equipment) in appropriately labeled containers. Go to the next well and repeat Step 1 through Step 21 until wells are sampled.

21. Complete the procedures for packaging, shipping, and handling with associated chain-of-custody forms.

4.12 FIELD INSTRUMENTS

Field-screening equipment will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to the manufacturer's standard instructions. Records of instrument calibration will be maintained by the field personnel. Copies of the instrument manuals will be maintained on-site by the field personnel.

4.12.1 Portable Photoionization Analyzer

The photoionization analyzer will be a MiniRAE 2000 (or equivalent), equipped with a 10.6 eV lamp. The MiniRAE 2000 is capable of ionizing and detecting compounds with an ionization potential of 10.6 eV or less. This accounts for up to 73% of the VOCs on the Target Compound List.

4.12.2 pH Meter

The pH meter will be calibrated at the start of each day of use, and after very high or low readings as required by this plan. National Institute of Standards and Technology (NIST) traceable standard buffer solutions that bracket the expected pH range will be used. The standards will most likely be a pH of 7.0 and 10.0 standard units. The pH calibration process will be used to set the meter to display the value of the standard being checked. The calibration data will be recorded in field notebooks.

4.12.3 Specific Conductivity Meter

Calibration checks using the appropriate conductivity standard for the meter will be performed at the start of each day of use, and after very high or low readings, as required by this plan. Readings must be within 5% to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer on a weekly basis.

4.12.4 Water-level Meter

The water-level cable will be checked once to a standard to assess if the meter has been correctly calibrated by the manufacturer or vendor. If the markers are incorrect, the meter will be sent back to the manufacturer or vendor.

4.12.5 Turbidity Meter

The turbidity meter will be calibrated daily prior to use. Calibration and maintenance will be conducted in accordance with the manufacturer's specifications. Calibration and maintenance information will be recorded in the field notebook.

5. Quality Assurance and Quality Control (QA/QC)

This project will follow the current versions of the CT DEEP Reasonable Confidence Protocol Guidance documents. The LEP will communicate with the laboratory to communicate expectations that the analytical procedures consistent with the RSRs and RCPs are being used. When collecting samples for laboratory analysis, the following quality control samples will be collected at the indicated frequency. The results of the QC samples will be analyzed with the project data in consideration of the recommendations in the CT DEEP Guidance Document, "Laboratory Quality Assurance and Quality Control Guidance", and incorporated into the analysis of the investigation results. In the event that a bias is detected in the data or data are found to be unacceptable or questionable due to quality control issues, the appropriate data qualifiers will be added or further investigation work will be performed in order to collect the appropriate level of data to support the decision being made.

Parameter	Field QC Analyses			Laboratory QC Sample	
	Trip Blank	Rinse Blank	Field Duplicate	Matrix Spike	Matrix Spike Duplicate
	Frequency	Frequency	Frequency	Frequency	Frequency
Soil					
VOCs	1/cooler	1/day	1/20	1/20	1/20
SVOCs	NA	1/day	1/20	1/20	1/20
PCBs	NA	1/day	1/20	1/20	1/20
Metals and other inorganics	NA	1/day	1/20	1/20	1/20
Water					
VOCs	1/cooler	1/day	1/20	1/20	1/20
SVOCs	NA	1/day	1/20	1/20	1/20
Metals and other inorganics	NA	1/day	1/20	1/20	1/20

Notes:
1/day: One rinse blank per day or one per 20 samples, whichever is more frequent.
Rinse blanks not required when dedicated sampling equipment is used.
QC: Quality Control

6. Data Evaluation and Report

Results of the subsurface characterization investigation, previous investigations, and interim remedial measures that may be performed will be presented in a Comprehensive Investigation Report. The report will include a summary of Site geology and hydrogeology, the horizontal and vertical extent of Site-related contaminants in soil, groundwater, surface water, and sediments, and will present an updated conceptual site model and an evaluation of potential exposure pathways for Site-related COCs. The report will be prepared in general conformance with the CT DEEP Site Characterization Guidance Document dated September 2007 and revised December 2010.

7. Characterization Schedule

The following is the proposed schedule for characterization. Separate schedules are provided for characterization of OU-A and OU-B through OU-F. It is anticipated that the investigation to characterize the Site will be performed in incremental phases, as practical and as various portions of the Site are available for investigation (note that the investigation phases listed below are not intended to correspond to the definitions of "Phase I", "Phase II", etc. as defined in the CT DEEP Site Characterization Guidance Document). Depending on access and the complexity of subsurface conditions, additional phases of investigation may be required to complete the characterization of Site-related contamination. If this is the case, SCG will submit a schedule modification request to CT DEEP.

7.1 OU-A SCHEDULE

The OU-A work along the Site waterfront area and in the Mill River is anticipated to proceed more rapidly than characterization work on the other OUs because access to OU-A is less impeded by the current Site operations. Work will be performed in phases, as needed to characterize Site-related contamination. Three investigative phases are assumed in the schedule below.

Q2 2018: Phase I Investigation
Q4 2018: Phase II Investigation
Q2 2019: Phase III Investigation
Q4 2019: Submit OU-A Investigation Report

Within 18 months of CT DEEP approval of the Investigation Report, SCG will submit a RAP for CT DEEP review and approval. The schedule for remedy design, permitting, remedy implementation and monitoring will be dependent on the scope of the remedy and will be provided in the RAP.

7.2 OU-B, OU-C, OU-D, OU-E, AND OU-F SCHEDULE

Subsurface investigation work on the remainder of the Site (OU-B through OU-F) will be performed on a schedule that accommodates the needs of the on-site business, making use of times when traffic activity is low and smaller volumes of material are stored on the Site. Investigation work is generally not anticipated to occur during the months of December, January, February and March due to the high level of activity on the Site related to road salt handling. Investigation work on OU-F will require an access agreement with the property owner, which may delay investigative work; the schedule below assumes such an access agreement is reached in Q3 2018.

SCG currently anticipates preparing the comprehensive Investigation Report and RAP documents for these OUs as a group. However, depending on the details of the degree and extent of contamination, property access, and the pace of characterization of the operable units (i.e., if there are delays on one or some operable units), SCG may request that CT DEEP allow preparation of Investigation Report and RAP documents for smaller numbers of OUs in order to enable the project to continue to progress.

The following is a proposed schedule for investigation of these OUs:

Q2 2019: Phase I Investigation, OU-B and OU-C
Q3-Q4 2019: Phase I Investigation, OU-D, OU-E, and OU-F

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We currently anticipate performing three iterations of this phased investigation schedule (i.e., the first in 2019, second in 2020, and third in 2021) as needed to complete the delineation of the extent of Site–related contamination. Assuming that three phases is sufficient to characterize the nature and extent of Site-related contamination, the Investigation Report will be completed and submitted for CT DEEP review and approval by the end of June 2022. As appropriate and approved by CT DEEP, interim actions may be performed during this period to address sources identified during the investigation phase of work.

Within 18 months of CT DEEP approval of the Investigation Report, SCG will submit a RAP for CT DEEP review and approval. The schedule for remedy design, permitting, remedy implementation and monitoring will be dependent on the scope of the remedy and will be provided in the RAP.

References

1. State of Connecticut V. The Southern Connecticut Gas Company Consent Order, executed on 5 January 2018

2. Haley & Aldrich, September 2017. Investigation and Remediation Work Scope and Schedule, Chapel Street former MGP Site, 347 Chapel Street, New Haven, CT – Approved by CT DEEP in the January 2018 Consent Order

3. Haley & Aldrich, January 2018. Phase I Environmental Site Assessment, Chapel Street Former MGP Site, 347 Chapel Street, New Haven, Connecticut.

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NOTE

SOURCE: OCTOBER 2014 AERIAL IMAGERY COURTESY GOOGLE EARTH PRO

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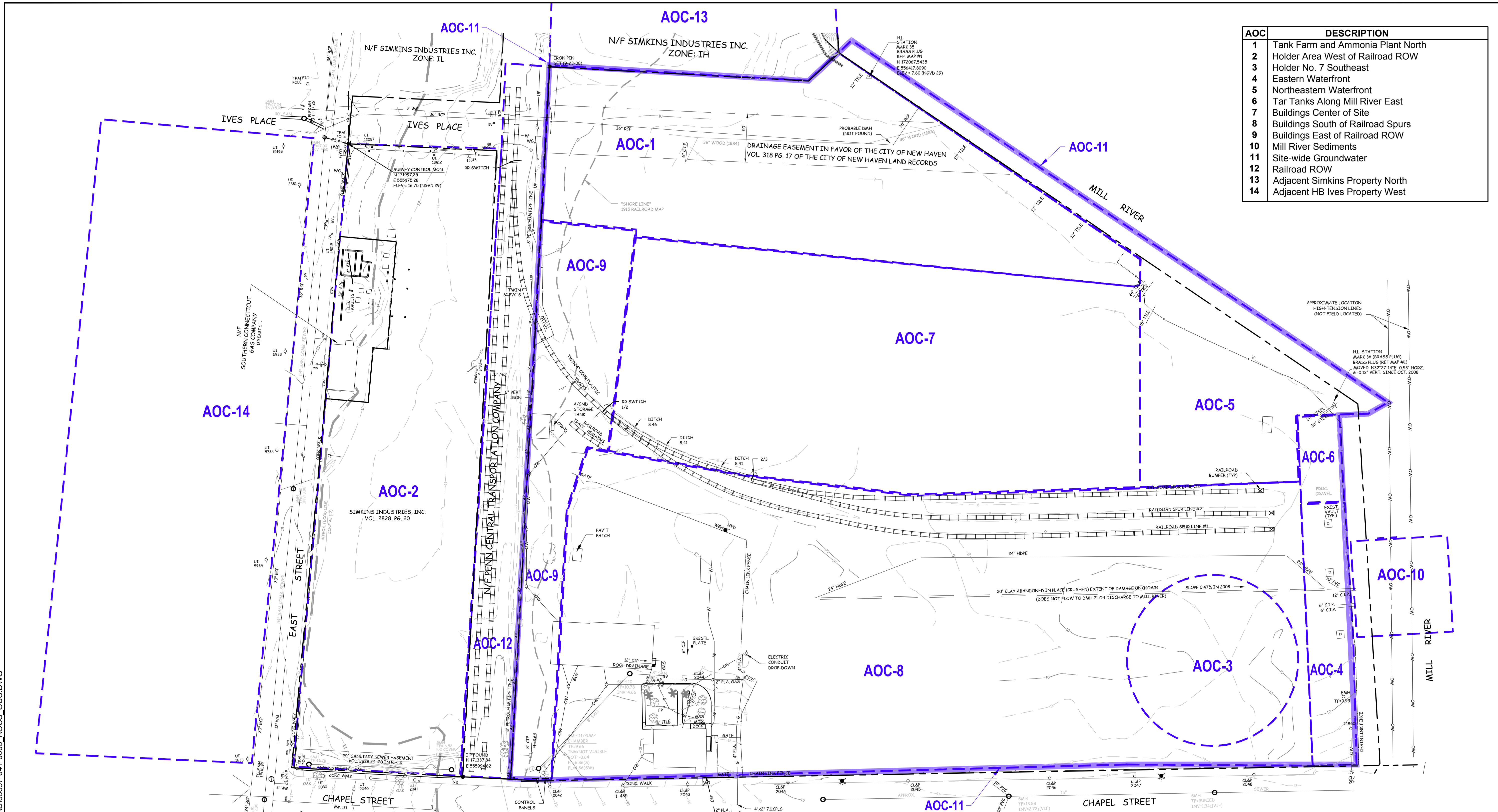
FORMER CHAPEL STREET MGP
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

CURRENT SITE PLAN

SCALE: AS SHOWN
NOVEMBER 2015

FIGURE 1



AOC	DESCRIPTION
1	Tank Farm and Ammonia Plant North
2	Holder Area West of Railroad ROW
3	Holder No. 7 Southeast
4	Eastern Waterfront
5	Northeastern Waterfront
6	Tar Tanks Along Mill River East
7	Buildings Center of Site
8	Buildings South of Railroad Spurs
9	Buildings East of Railroad ROW
10	Mill River Sediments
11	Site-wide Groundwater
12	Railroad ROW
13	Adjacent Simkins Property North
14	Adjacent HB Ives Property West

LEGEND

- AREA OF CONCERN (AOC)
- SITE-WIDE GROUNDWATER AREA OF CONCERN (AOC-11)
- HISTORIC STRUCTURE
- HISTORIC UTILITY

NOTES

1. BASE PLAN IS A DECEMBER 2013 SURVEY BY AESCHLIMAN LAND SURVEYING, INC. (ALS), RECEIVED IN ELECTRONIC FORMAT.
2. HORIZONTAL DATUM REFERENCE: CONNECTICUT STATE GRID (PAGE 5)
3. VERTICAL DATUM REFERENCE: NGVD 1929
4. HISTORICAL FEATURES ARE SHOWN AS GRAY DASHED FEATURES AND WERE LOCATED BASED ON 1934 SANBORN MAPS AND OTHER HISTORIC PLANS. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
5. SUBSURFACE EXPLORATIONS BY OTHERS WERE LOCATED FROM AN UNDATED PLAN PREPARED BY CHARLES T. MAIN, INC., ENTITLED "PLATE 2, 347 CHAPEL STREET, NEW HAVEN, CT. FACILITY CURRENT & PAST INVESTIGATION PROGRAMS. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
6. PREVIOUS EXPLORATIONS SHOWN IN GRAYSCALE.

0 100 200
SCALE IN FEET

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FORMER CHAPEL STREET MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

SITE AREAS OF CONCERN

SCALE: AS SHOWN
DECEMBER 2015

FIGURE 2

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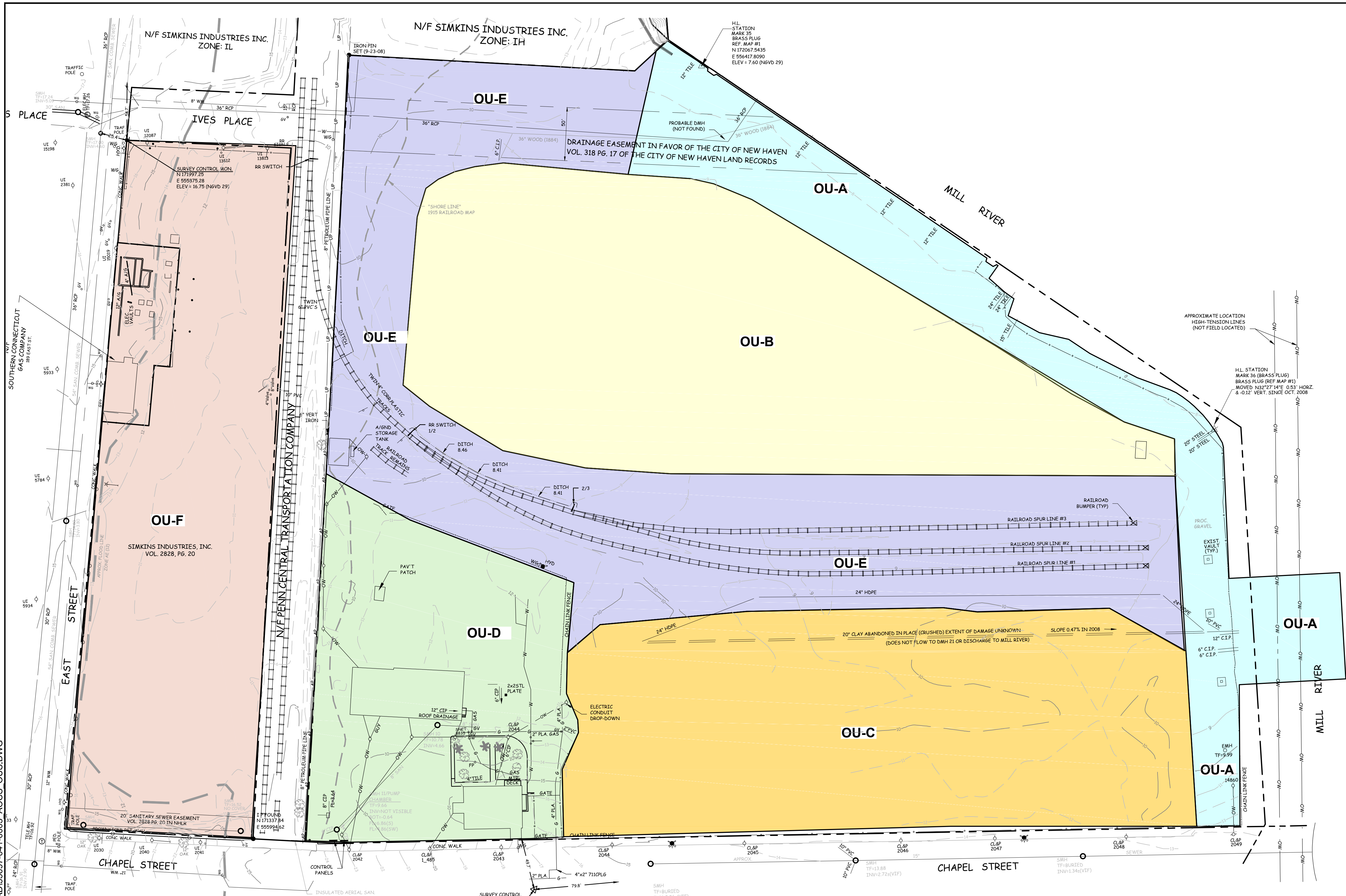


OPERABLE UNIT (OU)	DESCRIPTION
OU-A	347 Chapel Street Property Waterfront and Mill River Sediments
OU-B	Northern Stockpile Area
OU-C	Southern Stockpile Area
OU-D	Commercial Stone Yard
OU-E	Roadways and Rail Tracks on 347 Chapel Street Property
OU-F	Property West of The Penn Central Rail ROW, North of Chapel Street, East of East Street and South of Ives Street, Which Is Owned by Simkins Industries

0 100 200
SCALE IN FEET

LEGEND

OU-A OPERABLE UNIT (SEE TABLE THIS SHEET)

NOTES

1. BASE PLAN IS A DECEMBER 2013 SURVEY BY AESCHLIMAN LAND SURVEYING, INC. (ALS), RECEIVED IN ELECTRONIC FORMAT.
2. HORIZONTAL DATUM REFERENCE: CONNECTICUT STATE GRID (PAGE 5)
3. VERTICAL DATUM REFERENCE: NGVD 1929
4. SUBSURFACE EXPLORATIONS BY OTHERS WERE LOCATED FROM AN UNDATED PLAN PREPARED BY CHARLES T. MAIN, INC., ENTITLED "PLATE 2, 347 CHAPEL STREET, NEW HAVEN, CT. FACILITY CURRENT & PAST INVESTIGATION PROGRAMS. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
5. PREVIOUS EXPLORATIONS SHOWN IN GRAYSCALE.

HALEY ALDRICH

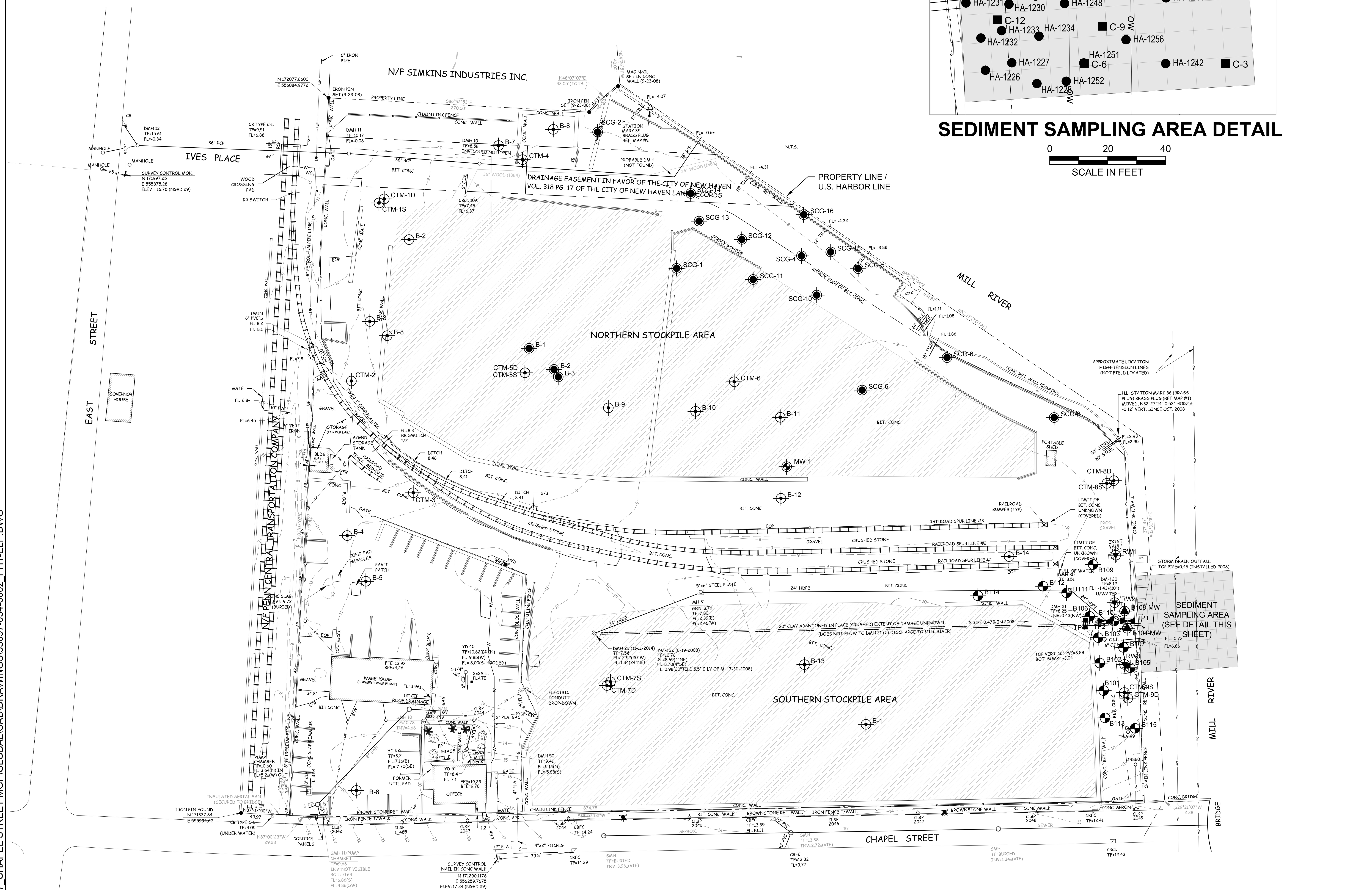
FORMER CHAPEL STREET MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

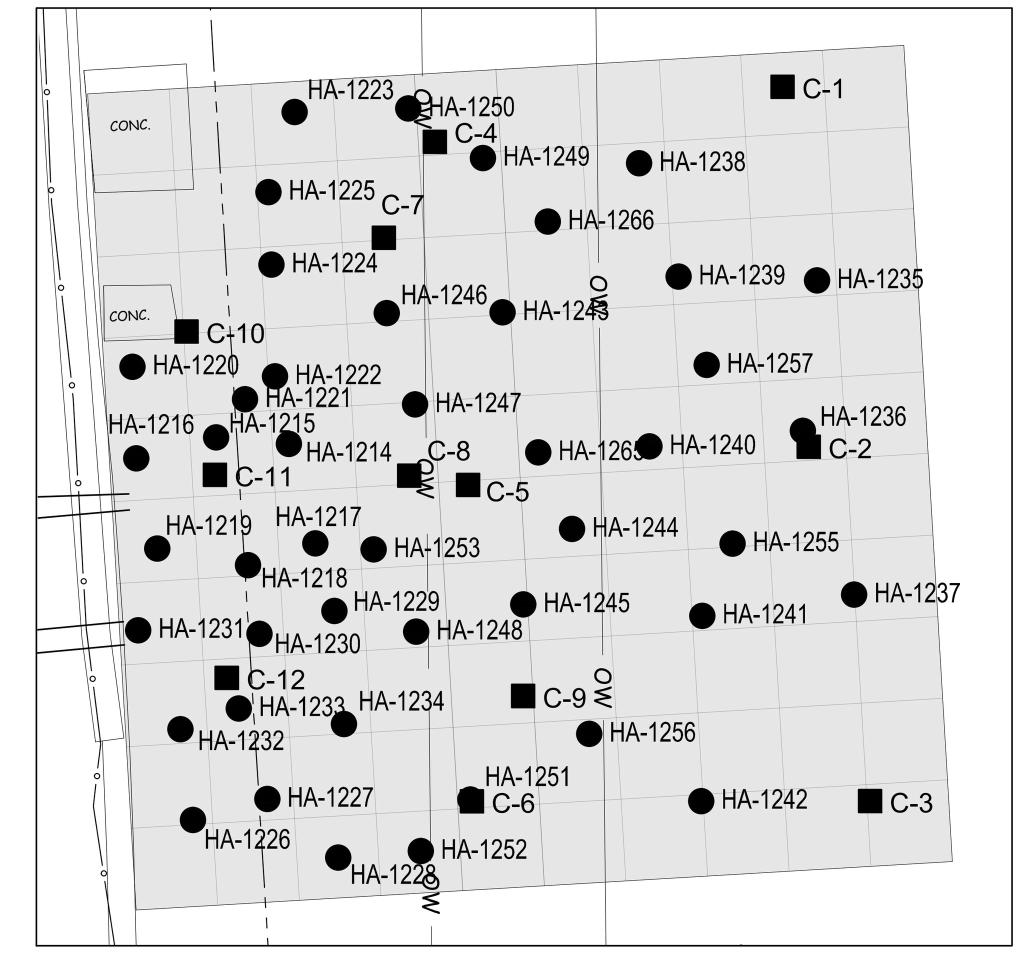
OPERABLE UNITS

SCALE: AS SHOWN
DECEMBER 2015

FIGURE 3

LIBBY, PAT Printed: 12/8/2015 9:21 AM Layout: OU
G:\35697_CHAPEL STREET MGP\041\CAD\35697-041-0003_AOCS_OUS.DWG





SEDIMENT SAMPLING AREA DETAIL

0 20 40
SCALE IN FEET

LEGEND

- 1985 MONITORING WELL LOCATION (YORK WASTEWATER CONSULTANTS)
- 1988 MONITORING WELL LOCATION (GROUND WATER, INC.)
- 1991 BORING (B-1 THROUGH B-9) OR MONITORING WELL (CTM-1 THROUGH CTM-9) LOCATION (CT MAIN)
- 2008 BORING LOCATION (HALEY & ALDRICH, INC.)
- 2008 MONITORING WELL LOCATION (HALEY & ALDRICH, INC.)
- 2008 RECOVERY WELL LOCATION (HALEY & ALDRICH, INC.)
- 2008 TEST PIT LOCATION (HALEY & ALDRICH, INC.)
- 2013 VIBRACORE SEDIMENT SAMPLE LOCATION (HALEY & ALDRICH, INC.)
- 2013 DART SEDIMENT SAMPLE LOCATION (HALEY & ALDRICH, INC.)

NOTES

1. BASE PLAN IS A DECEMBER 2013 SURVEY BY AESCHLIMAN LAND SURVEYING, INC. (ALS), RECEIVED IN ELECTRONIC FORMAT ON .
2. HORIZONTAL DATUM REFERENCE: CONNECTICUT STATE GRID (PAGE 5)
3. VERTICAL DATUM REFERENCE: NGVD 1929
4. SUBSURFACE EXPLORATIONS BY OTHERS WERE LOCATED FROM AN UNDATED PLAN PREPARED BY CHARLES T. MAIN, INC., ENTITLED "PLATE 2, 347 CHAPEL STREET, NEW HAVEN, CT. FACILITY CURRENT & PAST INVESTIGATION PROGRAMS. LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.

HALEY ALDRICH

FORMER CHAPEL STREET MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
JUNE 2015

FIGURE 4

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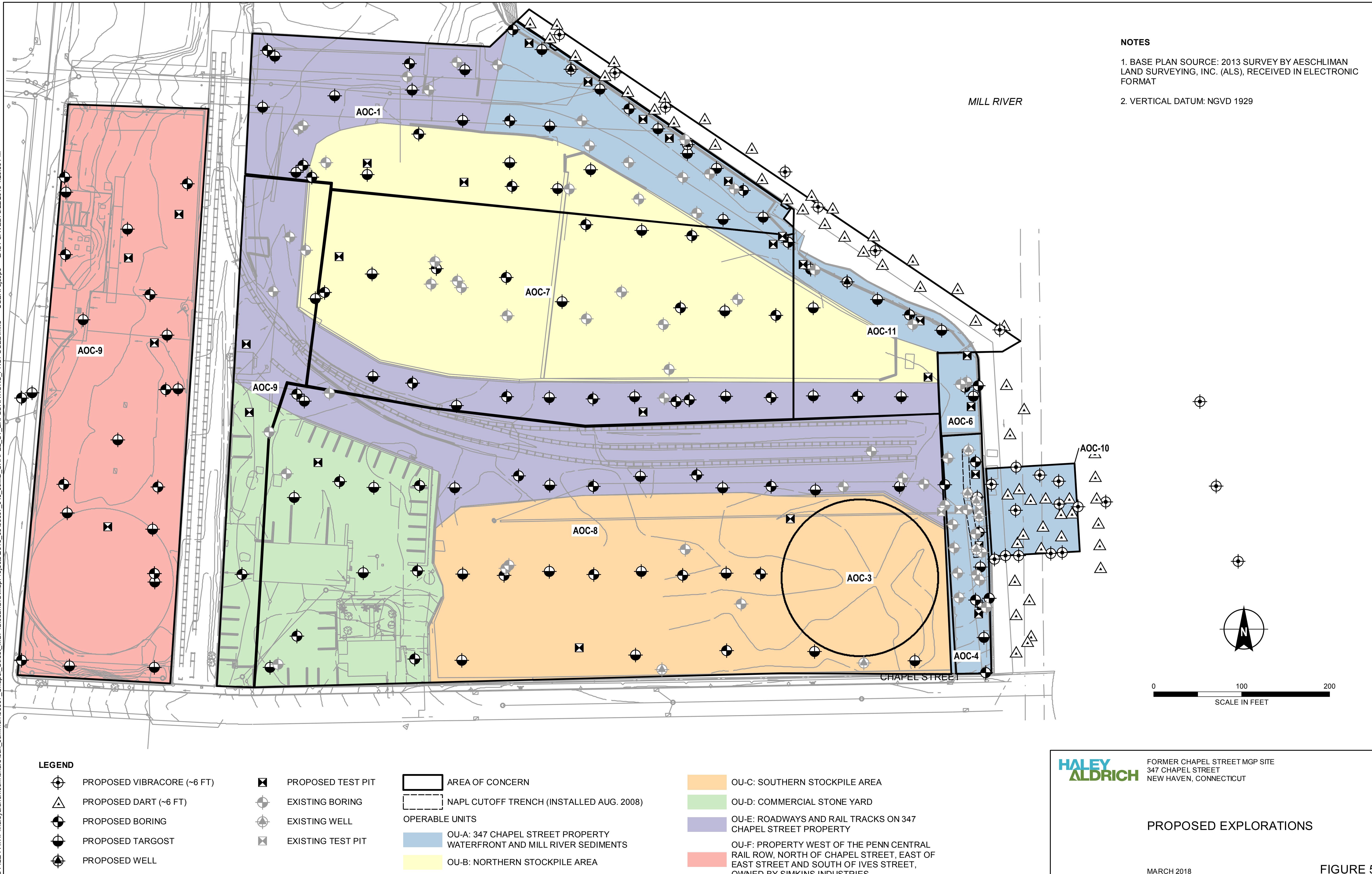
NOTES
1. BASE PLAN SOURCE: 2013 SURVEY BY AESCHLIMAN LAND SURVEYING, INC. (ALS), RECEIVED IN ELECTRONIC FORMAT
2. VERTICAL DATUM: NGVD 1929
MILL RIVER
AOC-1
AOC-7
AOC-11
AOC-9
AOC-9
AOC-6
AOC-10
AOC-8
AOC-3
AOC-4
CHAPEL STREET
0
100
200
SCALE IN FEET
N
LEGEND
PROPOSED VIBRACORE (~6 FT)
PROPOSED DART (~6 FT)
PROPOSED BORING
PROPOSED TARGOST
PROPOSED WELL
PROPOSED TEST PIT
EXISTING BORING
EXISTING WELL
EXISTING TEST PIT
AREA OF CONCERN
NAPL CUTOFF TRENCH (INSTALLED AUG. 2008)
OPERABLE UNITS
OU-A: 347 CHAPEL STREET PROPERTY WATERFRONT AND MILL RIVER SEDIMENTS
OU-B: NORTHERN STOCKPILE AREA
OU-C: SOUTHERN STOCKPILE AREA
OU-D: COMMERCIAL STONE YARD
OU-E: ROADWAYS AND RAIL TRACKS ON 347 CHAPEL STREET PROPERTY
OU-F: PROPERTY WEST OF THE PENN CENTRAL RAIL ROW, NORTH OF CHAPEL STREET, EAST OF EAST STREET AND SOUTH OF IVES STREET, OWNED BY SIMKINS INDUSTRIES
HALEY ALDRICH
FORMER CHAPEL STREET MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT
PROPOSED EXPLORATIONS
MARCH 2018
FIGURE 5

LEGEND

PROPOSED BACKGROUND RIVER EXPLORATION

NOTE

AERIAL IMAGERY SOURCE: ESRI

N

0 300 600
SCALE IN FEET

HALEY ALDRICH

FORMER CHAPEL STREET MGP SITE
347 CHAPEL STREET
NEW HAVEN, CONNECTICUT

BACKGROUND SAMPLE LOCATIONS

MARCH 2018

FIGURE 6

GIS FILE PATH: \\haleyaldrich.com\share\oak_common\35697_Chapel_Street_MGP\Global\GIS\MapProjects\2018_03\35697_045_00MB_PROPOSED_RIVER.mxd — USER: ajospe — LAST SAVED: 3/21/2018 9:45:31 PM