

Supplemental Site Investigation: Long Falls Paperboard No. 6 Fuel Oil Release

161 Wellington Road
Brattleboro, VT
SMS #19900482 and 20184828



PROJECT NO.

P19-015

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Title and Approval Page

Document Title

Supplemental Site Investigation: Long Falls Paperboard No. 6 Fuel Oil Release, 161 Wellington Road, Brattleboro, VT SMS #19900482 and 20184828

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Executive Summary

Stone Environmental, Inc. (Stone) has prepared this Supplemental Site Investigation (SSI) Report on behalf of the Town of Brattleboro, Vermont, and the Vermont Department of Environmental Conservation (VT DEC). The SSI was completed to assess a release of No. 6 fuel oil at the Long Falls Paperboard (LFP) facility located at 161 Wellington Road, Brattleboro, Vermont (the Site; Figure 1 in Appendix A). This SSI Report has been prepared in accordance with the VT DEC Investigation and Remediation of Contaminated Properties Rule (IRule) dated July 6, 2019 and the approved Work Plan dated October 14, 2020.

According to a Phase I ESA completed by Ramboll US Environ Corporation (2015 Ramboll), the Site has been in continuous use as a paper mill since it was originally developed in 1960 by Case Brothers which operated at the Site until 1967 at which time it was acquired by Boise Cascade. The facility was operated by Boise Cascade until 1989 when the name was changed to Specialty Paper Board, Inc, which ultimately was renamed as FiberMark, Inc. in 1998. FiberMark filed for bankruptcy in 2004 and reemerged under new ownership of Silver Point Capital in 2006 before subsequently being acquired by America Securities in 2008. The FiberMark business was sold to Neenah in 2015 and operated as Neenah until purchase by BDCC in December 2018. Upon purchase by BDCC, Long Falls Paperboard took over facility operations.

Several environmental assessments have been performed at the Site, beginning in 1989. A Corrective Action Plan (CAP) was recently completed by LE Environmental (LEE) and approved by VT DEC. LEE also recently submitted a Self-Implementing Cleanup Plan to the United States Environmental Protection Agency (EPA) for removal of polychlorinated biphenyl contaminated sludge from an overflow wastewater treatment lagoon.

The focus of the SSI was to assess a release of an unknown volume of No. 6 fuel oil that was discovered at the Site during removal of two underground storage tanks (USTs) in 1990. Subsequent environmental investigations related to the No. 6 fuel oil release were conducted until 1994 when the Vermont Department of Environmental Conservation (VT DEC) Sites Management Section (SMS) issued a Sites Management Activity Complete (SMAC) designation (SMS #1990-0482). A file review of available SMS #1990-0482 files, completed by Stone in March 2020 identified several data gaps in previous environmental assessments related to the No. 6 fuel oil release and recommended additional assessment to better understand Site hydraulic conditions, contaminant transport pathways, and potential risk to the Connecticut River and two on-Site non-potable water supply wells used by LFP in the paper manufacturing process.

Work completed between November 25, 2020 and January 25, 2021 included:

- Collection of a non-aqueous phase liquid (NAPL) sample to evaluate potential mobility of No. 6 fuel oil in the subsurface.
- Advancement of six soil borings to depths ranging between 80 and 170 feet below ground surface to evaluate soil quality, the geologic setting, and extent of NAPL. Two soil samples were collected for analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and extractable petroleum hydrocarbons (EPH).

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- Three groundwater monitoring wells were installed and along with select existing wells were sampled to evaluate groundwater quality and the groundwater flow regime. Both Site water supply wells were also sampled. Groundwater and water supply samples were analyzed for VOCs and SVOCs.
 - Select groundwater monitoring wells, one of the Site water supply wells, and the Connecticut River (via staff gauge) were instrumented with pressure transducers for two weeks to evaluate the physical properties of the aquifer.

Based on the results of the SSI, Stone makes the following conclusions:

1. NAPL: NAPL observed in the vadose zone is likely present as immobile residual phase NAPL ganglia. The limited vertical extent of free phase NAPL observed at MW-16 has a specific gravity greater than Site groundwater and therefore is a DNAPL. Based on the DNAPLs high viscosity and low hydraulic conductivity, the DNAPL is immobile. Calculation of the height of NAPL required to penetrate the water-saturated pores (137 meters) confirms that the few feet of NAPL present at the Site is not nearly thick enough to exert enough pressure to displace groundwater and migrate further downward.
2. Soil: Several contaminants of concern were detected in soil from the boring advanced through the presumed center of the NAPL plume with benzo(a)pyrene and naphthalene concentrations exceeding their respective non-resident VSS. In this location, the SPLP analysis also shows naphthalene exceeding the VGES, suggesting these contaminants could leach from water infiltrating through the NAPL and potentially impact groundwater. However, the ground surface above the NAPL plume is paved, limiting infiltration of precipitation. Based on groundwater results, naphthalene, and benzo(a)pyrene are not leaching from the NAPL plume. Outside of the defined extent of the plume, no contaminants of concern were detected at concentrations exceeding the resident VSS indicating that soil contamination is limited to the extent of the NAPL plume.
3. Groundwater quality: No contaminants of concern were detected at concentrations above laboratory reporting limits in any of the five groundwater monitoring wells sampled. MTBE was detected in process water samples collected from the “Deep” and “Shallow” well supplies but at concentrations below the VGES. MTBE detections, and naphthalene previously detected in the water supplies, are likely attributed to a source other than the former No. 6 fuel oil USTs. The depth to bedrock is greater than 170 feet bgs. Based on the absence of dissolved phase contaminants near the NAPL plume, immobile nature of the NAPL, and Site hydrogeological conditions, contamination of the bedrock aquifer is very unlikely.
4. Aquifer physical properties: The unconfined aquifer had a slight upward vertical component of the hydraulic gradient from the lower to upper portions of the aquifer during January 2021. Under these conditions, downward migration of NAPL and dissolved phase contamination cannot occur. The vertical component of the hydraulic gradient may alternate from upward to downward in response to fluctuations in the Connecticut River surface water elevations and whether the River is a gaining or losing river. There is a hydraulic connection between the Connecticut River and the No. 6 fuel oil source area but no discernable connection between the source area and Site water supply wells. The Site water supply wells do not likely pump water from the No. 6 fuel oil source area, instead drawing water from the higher hydraulic conductivity gravel soils observed in the western portion of the Site or possibly the Connecticut River.

Based on these conclusions and data collected, Stone makes the following recommendations:

- No additional assessment related to the release of No. 6 fuel oil at the Site is recommended.

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- Due to the potential periodic VGES exceedances of MTBE and naphthalene from an unknown source, an institutional control should limit the use of water withdrawn from the “Deep” and “Shallow” water supply wells to use as non-potable process water.

Supplemental Site Investigation: Long Falls Paperboard No. 6 Fuel Oil Release, 161
Wellington Road, Brattleboro, VT SMS #19900482 and 20184828

Cover Photo: Long
Falls Paperboard,
October 30, 2019

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1. Introduction

Stone Environmental, Inc. (Stone) has prepared this Supplemental Site Investigation (SSI) Report on behalf of the Town of Brattleboro, Vermont and the Vermont Department of Environmental Conservation (VT DEC). The SSI was completed to assess a release of No. 6 fuel oil at the Long Falls Paperboard (LFP) facility located at 161 Wellington Road, Brattleboro, Vermont (the Site; Figure 1 in Appendix A). A release of an unknown volume of No. 6 fuel oil was discovered at the Site during removal of two underground storage tanks (USTs) in 1990. Subsequent environmental investigations related to the No. 6 fuel oil release were conducted until 1994 when the Vermont Department of Environmental Conservation (VT DEC) Sites Management Section (SMS) issued a Sites Management Activity Complete (SMAC) designation (SMS #1990-0482).

A file review of available SMS #1990-0482 files, completed by Stone in March 2020 identified several data gaps in previous environmental assessments related to the No. 6 fuel oil release at the Site and recommended additional assessment to better understand Site hydraulic conditions, contaminant transport pathways, and potential risk to sensitive receptors – specifically the Connecticut River and two on-Site non-potable water supply wells used by LFP in the paper manufacturing process. Based on VT DEC’s request for additional assessment of the No. 6 fuel oil release (via email from Shawn Donovan on September 16, 2020), the scope of work of this SSI was developed to:

1. Assess the extent and mobility of No. 6 fuel oil in the subsurface.
2. Evaluate groundwater quality in the new monitoring well network and water supply wells, including VOCs and PAHs.
3. Measure the vertical component of the hydraulic gradient to determine potential contaminant transport pathways that may not have been intercepted by historic or current groundwater monitoring wells.
4. Evaluate potential vertical heterogeneities in the aquifer and zones of higher hydraulic conductivity that may serve as preferential contaminant transport pathways.
5. Examine the hydraulic influence of both the Connecticut River and on-Site water supply wells on groundwater, specifically near the former UST source area, to evaluate potential contaminant migration and risk to both sensitive receptors.

The Site is currently owned by the Brattleboro Development Credit Corporation (BDCC) and operated by LFP. Site contact information is summarized below.

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1.1. Site Description

The Site is located at 42.88783° north latitude and 72.54689° west longitude and is situated on a 39.52-acre parcel of land located at 161 Wellington Road in Brattleboro, Vermont (Figure 1). A Site Vicinity Map is provided as Figure 2 in Appendix A. The Site includes an approximately 200,000-square foot paper manufacturing plant, an associated wastewater treatment plant and lagoons, and a sand filter house. The manufacturing facility is a concrete and metal structure with a partial basement and partial second floor. The facility was constructed in 1960, with several additions being constructed between the late 1960s and late 1990s. The paper manufacturing plant was formerly heated using No. 6 fuel oil. Two 25,000-gallon underground storage tanks (USTs) containing No.6 fuel oil, one which was observed to be leaking, were removed from immediately south of the building in 1990 and two new No. 6 fuel oil USTs were installed south of the former UST locations – these USTs are still present in the subsurface and are in operation for backup fuel storage. The paper manufacturing plant’s current natural gas heating system is serviced by an above ground gas island and associated underground piping located immediately southeast of the plant and existing USTs.

The Site is generally flat and is situated on an alluvial terrace of the Connecticut River and is zoned for industrial use. Process water for the plant is pumped primarily from the Connecticut River; the plant is also served by two on-site process water supply wells (“Shallow Well” and “Deep Well”) installed in the overburden (i.e., not drilled into bedrock) in the southwestern corner of the site. The facility is also serviced by the municipal public water system. The bathrooms and laboratory are served by an on-site septic system located to the northwest of the wastewater treatment plant lagoons.

The Site is bound to the east and south by the Connecticut River, to the northeast by an undeveloped woodland, to the southwest by an electrical substation and Wellington Road, and to the north and northwest by several commercial properties, including: the BDCC Business Park, Suburban Propane, C&S Wholesale Grocers, and now closed Windham Solid Waste Management District (SWMD) Landfill.

1.2. Site History

According to a Phase I Environmental Site Assessment (ESA) completed by Ramboll US Environ Corporation (2015 Ramboll), the Site has been in continuous use as a paper mill since it was originally developed in 1960 by Case Brothers, which operated at the Site until 1967, at which time it was acquired by Boise Cascade. The facility was operated by Boise Cascade until 1989 when the name was changed to Specialty Paper Board, Inc., which was renamed as FiberMark, Inc. in 1998. FiberMark Inc. filed for bankruptcy in 2004 and reemerged under new ownership of Silver Point Capital in 2006 before subsequently being acquired by America Securities in 2008. The FiberMark Inc. business was sold to Neenah in 2015 and operated as Neenah until purchase by BDCC in December 2018. Upon purchase by BDCC, Long Falls Paperboard took over facility operations.

1.3. Prior Environmental Investigations – The Site

1.3.1. Various Environmental Assessments, Phase I ESAs, and Environmental Compliance Reviews, 1989-2015

Several environmental assessments, including Phase I ESAs and Limited Environmental Compliance Reviews, were performed on behalf of the owner and/or operator of the facility, the earliest available of which was performed in 1989 and the most recent in 2018. These assessments have been generally referenced in each subsequent assessment, including LEE's 2018 Phase I ESA, so the results of those assessments are not individually summarized. The available assessments include:

- Boise Cascade Corporation, Environmental Compliance Audit, Pressboard Products Mill, Brattleboro, Vermont, performed by C-E Engineering, May 1989
- Phase I ESA, Limited ACM and SVM Survey and Regulatory Compliance Review, FiberMark, performed by Tighe & Bond, November 2007
- Phase I Environmental Site Assessment and Limited Environmental Compliance Review of FiberMark, Inc., prepared by ENVIRON International Corporation, December 2007
- Phase I Environmental Site Assessment, FiberMark, prepared by Clayton Group Services, Inc., September 2003
- Phase I Environmental Site Assessment and Limited Environmental Compliance Review, FiberMark North America Inc., prepared by Ramboll Environ US Corporation, June 2015

1.3.2. No. 6 Fuel Oil Release Investigation Reports, 1990-1994

In February 1990, two 25,000-gallon underground storage tanks (USTs) containing No. 6 fuel oil USTs were excavated and removed from the property (Figure 3). Griffin International, Inc. (Griffin) performed an initial site investigation in 1990 and follow-up monitoring in 1994, recommending that the Site be considered for a Site Management Activities Complete (SMAC) designation, which was reportedly granted in 1994.

Environmental assessments associated with the No. 6 fuel oil release was managed by the VT DEC under SMS #1990-0482. In March 2020 under contract with the Town of Brattleboro, Stone prepared a file review summary of available SMS #1990-0482 files, including:

- Griffin International, Inc. (Griffin) Report on the Investigation of Subsurface Petroleum Contamination, Specialty Paperboard, Brattleboro, Vermont dated July 1990 (previously reviewed as part of Stone's Phase II Environmental Site Assessment, October 14, 2019 (2019 Phase II ESA)),
- Letter to Griffin from Barr Engineering Company Re: Qualifications and Experience in Petroleum Remediation Services for Specialty Paperboard, Inc., Brattleboro, Vermont dated October 24, 1990,
- Barr Engineering Company Feasibility Study, Remediation of No. 6 Fuel Oil Release, Specialty Paperboard, Inc. Brattleboro Mill, Brattleboro, Vermont dated January 1991,
- ESE Biosciences Group Biofeasibility Evaluation and Biotreatment Design included as an attachment to the Barr Engineering Company Feasibility Study.
- Letter from Environmental Assessment and Remediation, Inc. to Mr. Charles Schwer of the VT DEC dated February 20, 1991,
- Griffin letter to Mr. Richard Spiese of the VT DEC RE: No. 6 Fuel Oil Contamination, Specialty Paperboard, Brattleboro, VT (VT DEC Site #90-0482) dated October 18, 1994,
- Maps (two files),
- Correspondence related to SMS #1990-0482 (sixty-four files), and
- Site scoring criteria (seven files).

A file review summary was prepared by Stone dated March 27, 2020. A summary of the 1990 Griffin report, 1991 Barr Engineering Company (Barr) feasibility study and ESE Biosciences Group biofeasibility evaluation and biotreatment design, and salient correspondence is summarized in the following subsections.

1.3.2.1. Griffin Report on the Investigation of Subsurface Petroleum Contamination, Specialty Paperboard, Brattleboro, Vermont, July 1990

In response to the discovery of a leaking UST in 1990, Soils Engineering, Inc. completed three soil borings, MW-1, SB-1, and MW-2 (Figure 4) to evaluate the extent of soil contamination. No. 6 fuel oil was observed in soil boring MW-1 from 8 feet below ground surface (bgs) to 47 feet bgs. No petroleum was encountered in SB-1 at a maximum exploratory depth of 50 feet bgs or within MW-2. MW-1 and MW-2 were constructed as monitoring wells and SB-1 was backfilled.

Griffin completed four additional soil borings and monitoring wells in May 1990, including MW-3, MW-4, SB-2, and SB-3 (Figure 4). Thick black petroleum contamination was observed in soil boring MW-3 from 21.5 to 67 feet bgs and in SB-2 from 15 to 72 feet bgs and was observed to be in contact with groundwater. No petroleum contamination was observed within SB-3 or MW-4. Groundwater monitoring wells were installed in borings MW-3 and MW-4 and were constructed of 20 (MW-3) and 25 (MW-4) feet of 2-inch diameter 0.010-inch PVC well screen with enough riser pipe to extend to the ground surface.

Hydraulic measurements made in MW-1 through MW-4 in May and June 1990 indicated that the direction of groundwater flow was to the north-northwest. Based on the configuration of monitoring wells and exclusion of data from MW-3, it is Stone's opinion that there was insufficient data in the 1990 Griffin investigation to accurately determine groundwater flow direction.

Groundwater samples were collected from each of the four groundwater monitoring wells on May 18 and June 25, 1990 and were analyzed by EPA Methods 601 (halocarbons), 602 (purgeable aromatics), and 418.1 (hydrocarbons). During the June 25, 1990 groundwater sampling event, three wells associated with the adjoining landfill (MW-5, -6, and -7) and one of the two on-Site water supply wells were sampled and analyzed by the methods listed above. MW-3 was not sampled on June 25, 1990 due to the presence of free product within the well. Based on analytical results:

- MTBE and benzene were detected in MW-3 at concentrations above their respective Vermont Groundwater Enforcement Standard (VGES). The presence of methyl tert-butyl ether (MTBE) in groundwater samples collected near historic USTs indicate that No. 6 fuel oil is likely co-mingled with gasoline that was likely released from a former gasoline UST. The gasoline UST was formerly located approximately 60 feet southwest of the No. 6 fuel oil USTs (Figure 4).
- Several chlorinated volatile organic compounds (CVOCs) were detected in groundwater samples collected near the former USTs. CVOCs detected at concentrations above their respective VGES included tetrachloroethylene (PCE; MW-1, MW-2, and MW-4) and vinyl chloride (MW-2, MW-3, and MW-4). Griffin indicated that the likely source of CVOCs is from upgradient industrial properties, the nearby landfill, or wastes disposed of along the bank of the Connecticut River.
- PCE and trichloroethene (TCE) was detected in MW-6 at concentrations exceeding VGES. Note: MW-6 is located over a quarter of a mile northeast and likely cross-gradient of the No. 6 fuel oil release area. The CVOCs PCE and TCE in this well are likely associated with the

adjoining and upgradient Windham SWMD Landfill. CVOCs detected in groundwater samples collected from No. 6 fuel oil area monitoring wells are likely from a separate on-Site or upgradient source.

1.3.2.2. Letter from Griffin to Specialty Paperboard, Inc. on October 26, 1990

This status report indicates groundwater monitoring wells MW-1, -2, -3-, 4, - 10, -13, -14, -15, and -16 were sampled on October 24, 1990 and analyzed for organic compounds by EPA Method 624 and petroleum hydrocarbons by New York State Method 310-13. Results were not available. Water level in the Connecticut river was high as a result of recent rainfall and was observed approximately 1.5-inches below the top of the staff gauge. Water temperatures in wells located closest to the No. 6 fuel oil release ranged from 3 to 5 degrees (scale not indicated) higher than wells further from the release. The Johnson Company (JCO) had completed pump tests, which indicate water levels between Site wells and the Connecticut River water levels are correlated and that the supply well does not noticeably affect the contaminated area of the Site.

1.3.2.3. Barr Engineering Company Feasibility Study, Remediation of No. 6 Fuel Oil Release, Specialty Paperboard, Inc. Brattleboro Mill, Brattleboro, Vermont, January 1991

Barr prepared a feasibility study (FS), as a subcontractor to Griffin, to evaluate remedial options for the release of No. 6 fuel oil from former Site USTs.

Barr estimated a maximum of 68,100 gallons of No. 6 fuel oil is present within 3,530 cubic yards (yd³) of soil extending from 10 to 70 feet below ground surface based on the following assumptions:

- The highest total petroleum hydrocarbon (TPH) concentration previously measured (50,000 milligrams per kilogram {mg/kg}) represents the average TPH concentration in the contaminated soil.
- Soil bulk density is 1,850 kilograms per cubic meter (kg/m³).
- No. 6 fuel oil has a specific gravity of 970 kg/m³.

Based on slug tests reportedly conducted on a Site water supply well by JCO in 1990, Barr estimated geometric mean and maximum hydraulic conductivity of the Site aquifer of 0.02 and 0.08 centimeters per second (cm/sec), respectively. At the time the FS was prepared, TPH was not detected in groundwater located forty feet in the direction presumed to be downgradient of No. 6 fuel oil contaminated soil in contact with groundwater. Considering the low water solubility and high viscosity of No. 6 fuel oil and Site hydrogeologic conditions, Barr indicated that No. 6 fuel oil would have become immobile in the subsurface due to both capillary action and increased viscosity as it cooled and was unlikely to migrate 300 feet to the Connecticut River. Barr's risk evaluation identified soil, groundwater, and surface water as potentially impacted media but indicated that there is little risk to nearby sensitive receptors based on the physical properties of No. 6 fuel oil, unlikelihood that contaminated groundwater would migrate off-Site, and lack of groundwater use for potable water.

Remedial Alternatives evaluated based on technical effectiveness, technical feasibility/implementability, secondary environmental factors, and cost included:

Soil Alternatives:

- A. Capping contaminated soil by maintaining the asphalt parking lot surrounding the facility to limit infiltration of water. This alternative assumed that biannual groundwater monitoring would be

conducted to monitor the dissolved phase groundwater plume in order to determine whether additional remedial actions would be required in the future.

- B. In-situ volatilization (e.g., soil venting) involves applying a vacuum to vapor extraction wells to remove VOCs from soil vapor and treating the effluent. This alternative assumed groundwater monitoring would be conducted as described above for the soil cap alternative.
- C. Excavation and off-Site disposal would involve excavating the contaminated soil and transporting to a landfill for disposal. Based on the depth of No. 6 fuel oil contamination (72 feet bgs) and proximity to the Site building, excavation would be difficult to implement and poses risk to the building's structural integrity.
- D. Excavation and on-Site disposal are the same as alternative C except a lined containment system would be constructed on-Site for disposal of contaminated soil.
- E. Excavation and thermal desorption in an asphalt plant is the same as alternative C except soil would be transported to an asphalt plant where it would be used as aggregate following thermal desorption of No. 6 fuel oil. This practice is no longer acceptable by the VT DEC.
- F. Excavation and land treatment are the same as alternative C except soil would be spread approximately in a six-inch layer nutrients and pH buffers would be applied and tilled and irrigated. No. 6 fuel oil mass would be reduced by biodegradation and photo-oxidation. This practice is no longer acceptable by the VT DEC.
- G. In-situ biological treatment involves introducing nutrients and oxygen while maintaining pH and soil moisture conditions to enhance naturally occurring bacteria to degrade the No. 6 fuel oil into benign byproducts.

Groundwater Alternatives:

- H. Groundwater recovery (e.g., pump and treat) involves extracting groundwater from the aquifer, treating, and re-injecting.
- I. Free product recovery would involve installing a large diameter well, pumping water to create a cone of depression in the water table and removing the No. 6 fuel oil that accumulates on top of the water drawn into the well.

Barr indicated that the likely immobile nature of No. 6 fuel oil, limited ability for water infiltration due to the presence of asphalt, low concentrations and limited extent of dissolved phase VOCs, and dilution that would likely occur if the dissolved phase VOC plume reached the Connecticut River, the release of No. 6 fuel oil at the Site poses little risk to human health and the environment. To manage long-term liability related to the release of No. 6 fuel oil, Barr recommended implementing soil remedial alternative G, in-situ bioremediation, possibly augmented by first removing free product as described in groundwater alternative I, free product recovery.

1.3.2.4. ESE Biosciences Group (EBIO) Biofeasibility Evaluation and Biotreatment Design

A bench-scale biofeasibility study for in-situ bioremediation technologies was conducted by EBIO on behalf of Griffin. A composite soil sample, collected from 40 and 65 feet bgs from SB-A, and a groundwater sample (MW-16) were enriched with trace metals and nutrients and compared to control samples that did not

undergo enrichment. Soil and groundwater samples submitted for the biofeasibility study were contaminated with No. 6 fuel oil. The purpose of the control sample was to mimic how No. 6 fuel oil would degrade under natural Site conditions.

The study found that indigenous microorganisms are adapted to Site contaminants and toxicity effects would not likely inhibit bioremediation. After seven days, microorganism growth increased by an order of magnitude in enriched soil compared to no increase in microorganism growth in the control soil. In the enriched soil sample, a 74% reduction of petroleum hydrocarbons was measured at day 14 of the experiment and a 91% reduction of petroleum hydrocarbons was observed at the end of the experiment on day 21. No significant change in petroleum hydrocarbon concentrations were observed in the control sample at the end of the experiment.

EBIO concluded that Site petroleum hydrocarbons are biodegradable and indigenous microorganisms can degrade the petroleum hydrocarbons under the right conditions and recommended in-situ bioremediation for the Site. EBIO indicated that a conceptual design for in-situ bioremediation was provided to Griffin in proposal #90.0178 dated July 20, 1990 and is described in detail within this report along with conceptual drawings and description of the groundwater modeling methodology used to support the design. The groundwater model assumed that the aquifer is isotropic, vertically homogenous, and disregarded hydraulic influence of the Connecticut River.

1.3.2.5. Griffin Quarterly Groundwater Monitoring Reports

A letter from Griffin to Specialty paperboard, Inc. dated April 4, 1991 included analytical results from the March 22, 1991 groundwater monitoring event. 3.69 feet of No. 6 fuel oil was measured in MW-3 and 0.23 feet of product was measured in MW-15.

A letter from Griffin to Specialty paperboard, Inc. dated August 15, 1991 included analytical results from the July 12, 1991 groundwater monitoring event. This letter indicated:

- MW-17 is a duplicate of MW-2. Note: a monitoring well with the identification MW-17 was subsequently installed in 1992.
- No detectable concentrations of for total recoverable petroleum hydrocarbons (EPA Method 418.1) were detected in MW-2 and MW-4, located downgradient of the No. 6 fuel oil release area.
- 2.5 feet of No. 6 fuel oil was measured in MW-3 and 1.5 feet in MW-15.
- Water level elevations were generally 1.25 feet lower than the March 1991 monitoring event. The river gauge was no longer in place.

A letter from Griffin to Specialty paperboard, Inc. dated November 25, 1991 included analytical results from the October 14, 1991 groundwater monitoring event. This letter indicated:

- MW-17 is a duplicate of MW-2.
- No detectable concentrations of for total recoverable petroleum hydrocarbons (EPA Method 418.1) were detected in MW-2 and MW-4, located downgradient of the No. fuel oil release area.
- 1.0 foot of No. 6 fuel oil was measured in MW-3 and 1.5 feet in MW-15.
- Water level elevations were generally 1.0 foot higher than measurements made in July 1991. These changes were attributed to seasonal fluctuations in the water table.

A letter from Griffin to Specialty paperboard, Inc. dated February 11, 1992 included analytical results from the January 17, 1992 groundwater monitoring event. This letter indicated:

- MW-17 is a duplicate of MW-2.

-
- No detectable concentrations of for total recoverable petroleum hydrocarbons (EPA Method 418.1) were detected in MW-2 and MW-4, located downgradient of the No. 6 fuel oil release area.
 - 3.48 feet of No. 6 fuel oil was measured in MW-3 and 2.78 feet in MW-15.
 - Water level elevations were generally 0.25 feet lower than October 1991. These changes were attributed to seasonal fluctuations in the water table.
 - Griffin proposed to reduce groundwater monitoring frequency to semi-annual.

A letter from Griffin to Specialty paperboard, Inc. dated July 27, 1992 included analytical results from the July 1, 1992 groundwater monitoring event. This letter indicated:

- MW-17 is a duplicate of MW-2.
- No detectable concentrations of for total recoverable petroleum hydrocarbons (EPA Method 418.1) were detected in MW-2 and MW-4, located downgradient of the No. 6 fuel oil release area, or MW-13 and MW-14.
- Low levels of CVOCs were detected in MW-1 and MW-14.
- Low levels MTBE was detected in MW-4 and MW-13.

A letter from Griffin to Specialty Paperboard, Inc. dated October 15, 1992 indicated that monitoring well (MW-17) was installed fifteen feet from MW-3 adjacent to the heated underground fuel conduits. The following observations were made:

- Soils at MW-17 were saturated with No. 6 fuel from approximately 20 to 73 feet bgs. The highest PID reading of 50 ppm was measured at the water table interface and decreased to 24 ppm at the terminal boring depth of 75 feet bgs.
- Soil temperatures of vadose zone soils ranged from 25° C to 28° C and decreased to 21° C below the water table. Griffin indicated that groundwater temperatures away from the No. 6 fuel oil range between 11° C to 17° C.
- Several days after well installation, No.6 fuel oil was present at 70 feet below top of casing and was too viscous to penetrate with the meter.

1.3.2.6. Griffin Report on August 1994 Groundwater Sampling and Analysis for Specialty Paperboard, Brattleboro, Vermont performed by Griffin International, Inc., October 1994

The 1994 Griffin report summarizes results of groundwater monitoring conducted in August 1994. Liquid levels were gauged in ten Site monitoring wells (MW-1, -2, -3, -4, -9, -11, -12, -14, -15, and -16) and groundwater samples collected from seven monitoring wells (MW-1, -2, -4, -9, -11, -12, and -14) using bailers. No. 6 fuel oil was present in monitoring wells MW-3 (68.18 feet bgs), -15 (68.85 feet bgs), and -16 (68.00 feet bgs) and was too viscous for the interface probe to pass and allow for thickness measurement. Free product had not been previously observed in MW-16. Griffin inferred the direction of groundwater flow to be to the south – southeast towards the Connecticut River.

Groundwater samples were analyzed for VOCs by EPA Method 8240 and for total petroleum hydrocarbons (TPH) by EPA Method 418.1. MTBE and CVOCs were detected at concentrations below current VGES except for in MW-11, where MTBE was detected at a concentration of 14.2 micrograms per liter ($\mu\text{g/L}$), which exceeds the current VGES of 11 $\mu\text{g/L}$. Based on these results, Griffin recommended that the Site be considered for a Sites Management Activity Completed (SMAC) designation.

1.3.2.7. VT DEC letter to Specialty Paperboard, Inc. dated November 14, 1994

The VT DEC issued a SMAC designation for the Site based on:

- Two USTs removed from the Site on February 1 and 2, 1990 had a release of No. 6 fuel oil.

-
- Investigations at the Site to date have indicated that the No. 6 fuel oil is extremely viscous and will not migrate.
 - Groundwater sampling and analysis at the Site indicate that groundwater contaminant concentrations are either non-detect or below VGES.

1.3.3. LE Environmental Phase I ESA, December 2018

LEE completed a Phase I ESA on December 12, 2018 of the Neenah Paper Manufacturing facility on behalf of the BDCC (2018 LEE). The Phase I was performed using the *Standard Practice for Environmental Site Assessments: Phase I ESA Assessment Process*, published by ASTM International as Standard Practice E1527-13. The Phase I was performed as part of environmental due diligence in anticipation of purchasing the property. The Phase I ESA revealed no evidence of RECs in connection with the property, except for the following:

1. Documented No. 6 fuel oil release (historical REC and REC) due to leaking USTs.
2. Potential petroleum contamination due to diesel and gasoline USTs removed in 1988.
3. Use of the property for paper manufacturing for 58 years, which may have resulted in soil, groundwater and/or soil vapor contamination. Potential contaminants of concern include volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, dioxin, and perfluorinated chemicals (PFCs).
4. Potential chemical and petroleum discharge to basement floor sumps and underground piping of unknown integrity possibly resulting in releases via piping breaches.
5. Visible and potential releases from equipment in the storage yard.
6. Potential for subsurface contamination due to an abandoned drum.
7. Filled area at the north end of the property with undocumented fill materials.
8. Windham Solid Waste Management District (SWMD) landfill documented and potential influence on the property's groundwater quality (Controlled REC).
9. Potential soil and groundwater contamination from the active septic system north of the mill.
10. Potential soil and groundwater contamination from the unused septic system east of the mill.
11. Potential contamination in connection with the active rail line adjoining the west side of the facility.
12. Potential releases of hazardous substances and/or petroleum products from the historical printing press adjoining the property to the west.

LEE made the following recommendations further assessment to determine whether these RECs constitute an actual release to the environment:

1. The Phase II ESA should include soil, groundwater, and soil gas testing. Chlorinated VOC (CVOC) detections in groundwater at 70-foot depth suggest there is a source of CVOCs in the nearby soils.
2. Groundwater monitoring wells from the previous site investigation may be present beneath the pavement. These wells were 70-80 feet deep and in light of the cost of replacement, a geophysical survey to attempt to locate the buried wells might be cost effective.
3. Groundwater beneath the northern portion of the property in the Class IV zone is non-potable and its investigation may be less of a priority than elsewhere on the property. The contents of the fill area should be evaluated via backhoe test pits to determine if hazardous substances and/or petroleum products are present and whether there is soil contamination.
4. A video evaluation of the basement sump and piping system could provide useful information on the condition of the piping and whether there are breaches that should be evaluated for soil contamination.

1.3.4. Weston & Sampson Limited PFAS Sampling, December 2018

On December 12, 2018, Weston & Sampson (W&S) collected a sample of wastewater treatment plant biosolids and submitted it for per- and polyfluoroalkyl substances (PFAS) analysis as well as synthetic precipitation leaching procedure (SPLP) for PFAS (2018 WSE). W&S also collected groundwater samples from the two on-Site facility production wells and liquid samples of the wastewater treatment plant effluent and lagoon liquids and submitted them to a laboratory for PFAS analysis. PFASs were not detected in the biosolids sample, however, Perfluorobutanoic acid (PFBA), perfluoropentanoic acid (PFPeA) and perfluorooctanesulfonic acid (PFOS) were detected in the biosolids SPLP analysis sample above the method detection limit, but below the method reporting limit, at estimated concentrations of 6.19 nanograms per liter (ng/L), 4.00 ng/L and 4.11 ng/L, respectively. Perfluorooctanoic acid (PFOA) and PFOS were detected in the wastewater treatment plant effluent sample at concentrations of 2.59 (estimated) and 17.1 ng/L, respectively. PFBA, perfluorohexanoic acid (PFHxA) and PFOS were detected in the liquid sample collected from the lagoon at concentrations of 4.13 ng/L (estimated), 8.02 ng/L and 10.2 ng/L (estimated), respectively.

1.3.5. Stone Environmental Phase II ESA, October 2019

Stone conducted a Phase II ESA of the Site on behalf of the Town of Brattleboro, VT DEC, and the Windham Regional Commission (WRC) on behalf of the BDCC. The Phase II ESA was completed to evaluate whether RECs identified in the 2018 LEE Phase I ESA and the operation of wastewater treatment lagoons constitute an actual release of petroleum or hazardous materials to the environment. Phase II ESA work completed that is salient to the No. 6 fuel oil SSI is summarized as follows.

Stone located four historic wells within the fuel release area, including MW-1, -3, -4, and -16. MW-1 and MW-3 were dry to depths of 72.1 feet bgs and 72.0 feet bgs, respectively. Depth to water in MW-4 was 80 feet bgs and the total depth was 83 feet bgs. Approximately one-foot of heavy petroleum non-aqueous phase liquid (NAPL) was encountered at 68 feet bgs in MW-16.

One soil boring (IP-03/3a) was advanced immediately south of the former UST area and approximately 25-foot northeast of MW-4. One soil sample was collected from 70.5 feet bgs and analyzed for VOCs (8260C), SVOCs (8270D and 8270D-SIM), and 23 target analyte metals (6010D, 7471B, and 4500CN-CE). No VOCs or SVOCs were detected in the soil sample collected from IP-03 at concentrations exceeding Vermont Soil Standards (VSS) for residential properties.

A groundwater monitoring well was constructed at IP-03 to a depth of 75 feet bgs, developed, and a groundwater sample collected and analyzed for VOCs (8260C), SVOCs (8270D), TAL Metals and cyanide (6010D, 6020B, 7470A, and 9010C/9012B), and per- and polyfluoroalkyl substances (PFAS; 537-modified). No VOCs or SVOCs were detected in the groundwater sample collected from IP-03.

Two additional soil borings and groundwater monitoring wells (IP-02 and IP-07) were installed in locations presumed to be downgradient of the suspected former locations of diesel and gasoline USTs. No VOCs or SVOCs were detected in groundwater samples collected from these locations.

Stone collected water samples from the two on-Site water supply wells ('Deep' and 'Shallow'), which contained naphthalene and lead at concentrations above the VGES and MTBE at concentrations below the VGES. The presence of naphthalene and MTBE in the on-Site supply wells indicate that petroleum products may have migrated southwest, possibly due to hydraulic influence of the supply wells or there is another unidentified on or off-Site source that is impacting these wells.

Stone concluded that No. 6 fuel oil from the pre-1990 release is still present in the subsurface, but not at concentrations high enough to impact sensitive receptors, e.g., downgradient groundwater or soil.

1.3.6. Stone Environmental, Inc. File Review, March 2020

Stone performed a review of available SMS #1990-0482 on behalf of the Town of Brattleboro. The purpose of the file review was to identify data gaps to help determine whether additional assessment is required to support remedial planning associated with No. 6 fuel oil contamination at the Site. A summary of SMS #1990-0482 files reviewed is included in Section 1.3.2 of this SSI Work Plan. Stone identified the following data gaps:

1. The effects on groundwater flow direction by surface water elevation changes in the Connecticut River and operation of two on-Site water supply wells is poorly understood.
 - a. The absence of VOCs or SVOCs in groundwater samples collected from IP-02 and IP-07 would indicate that petroleum contaminants are not migrating to the southwest from the No. 6 fuel release area. However, the presence of naphthalene and MTBE in a 2019 water supply sample indicate that water supply wells may influence groundwater flow from the No. 6 fuel release area to the southwest or there is another unidentified on or off-Site source for these contaminants. Dissolved phase petroleum contaminants from the former gasoline (MTBE and naphthalene) and No. 6 fuel oil (naphthalene) USTs may follow downward vertical hydraulic gradients along flow lines that are not intercepted by monitoring wells IP-02 and IP-07. Based on the coarse channel deposits observed at the Site, the main transport mechanism for dissolved phase contaminants is expected to be advection of groundwater, not diffusion.
 - b. Pump test data collected by JCO in 1990 reportedly indicated no hydraulic connection between on-Site water supply wells and groundwater monitoring wells in the No. 6 fuel release area. However, this data, which was not available for review, may have been collected during a time of high surface water elevations in the Connecticut River. This data may be representative of Site hydraulic conditions when the Connecticut river is a losing stream, but not when it is a gaining stream relative to groundwater.
 - c. Dissolved phase contamination associated with the No. 6 fuel oil release does not appear to be migrating towards the Connecticut River. However, the vertical hydraulic gradient has not been assessed and dissolved phase contaminants may follow downward vertical hydraulic gradients along flow lines that are not intercepted by monitoring wells located downgradient of the former UST area (e.g., IP-03 and MW-4).
 - d. Hydraulic data collected in 1991 from a staff gauge in the Connecticut River and two Site monitoring wells during a water supply pump test and monitoring well slug tests were not included in SMS #1990-0482 files.
2. PAH groundwater data (as SVOCs) has only been collected one time in 2019. This is insufficient to conclude that there are no adverse effects to groundwater from the No. 6 fuel oil release.
3. The potential impact to sensitive receptors from uptake of naphthalene and lead into Site water supply wells at concentrations above VGES is poorly understood. Water supply wells provide

non-contact process water. It is likely that on-Site water treatment practices volatilize naphthalene prior to discharge to the Connecticut River. However, this assumption should be verified.

4. Griffin attributed the detection of No. 2 fuel oil in a groundwater sample collected from MW-16 in 1990 to degradation of No. 6 fuel oil. Instead, the petroleum hydrocarbons identified in the groundwater may have been the lighter carbon fractions of No. 6 fuel oil that dissolved in the groundwater.
5. Bioremediation technologies have advanced significantly since 1991 and have been demonstrated to work poorly in the vadose zone. Stone identified the following data gaps in the 1991 feasibility study:
 - a. The volume and physical properties of No. 6 fuel oil is poorly understood. Barr calculated the volume of No. 6 fuel oil based on assumed TPH concentrations, soil bulk density, and No. 6 fuel oil specific gravity. TPH concentrations varied widely based on analytical method. Calculations of No. 6 fuel oil volume and analysis of mobility should be based on measured physical properties and contaminant concentrations following contemporary analytical methods.
 - b. The groundwater modeling methodology used to support the 1991 bioremediation design assumed that the aquifer is isotropic, vertically homogenous, and disregarded hydraulic influence of the Connecticut River. Should bioremediation be considered as a remediation technology for No. 6 fuel oil at the Site, design needs to account for anisotropy and heterogeneities in the aquifer and hydraulic influence of both the Connecticut River and on-Site water supply wells.
 - c. A No. 6 fuel oil NAPL sample should have been included in the 1991 biofeasibility evaluation and biotreatment design. Other remedial technologies should have been considered for vadose zone contamination.
6. The current extent of No. 6 fuel oil is unknown. However, it is unlikely, based on the physical properties, that No. 6 fuel oil would have migrated significantly since the 1990s environmental investigations.

Based on the file review, Stone updated the Conceptual Site Model (CSM) and recommended additional assessment related to the No. 6 fuel oil release to evaluate the vertical component of the hydraulic gradient, potential transport of dissolved phase contamination in the deeper portions of the unconsolidated aquifer, establishing the hydraulic head relationship between the No. 6 fuel oil source area, the Connecticut River, and Site water supply wells, process water quality, physical properties of No. 6 fuel oil, and collection of No. 6 fuel oil contaminated soil samples for bench scale treatability tests.

1.3.7. LE Environmental Brownfields Corrective Action Investigation, August 2020

LEE completed a Corrective Action Investigation on behalf of BDCC, including assessment of holding basin sludge, a soil quality assessment related to vanadium concentrations detected at concentrations in excess of Vermont Soil Standards during the 2019 Phase II ESA, and groundwater monitoring for PFAS. LEE concluded that remedial action related to the No. 6 fuel oil release is not warranted other than institutional controls.

1.3.8. LE Environmental Evaluation of Corrective Action Alternatives, September 2020

LEE completed an Evaluation of Corrective Action Alternatives (ECAA) on behalf of BDCC relative to management of metal, dioxin, PFAS, and PCB contaminated sludge within the wastewater treatment lagoon system overflow basin. Corrective actions considered included 1) no action, 2) on-Site capping of contaminated materials, and 2) off-Site disposal of contaminated materials. LEE recommended alternative 3 and the ECAA was approved by the VT DEC on December 14, 2020.

1.3.9. LE Environmental Corrective Action Plan, February 2021

Following approval of the ECAA, LEE drafted a CAP that detailed off-site disposal of contaminated wastewater treatment lagoon system overflow basin materials and use of institutional controls to prevent residential development on-Site. The CAP has been approved by VT DEC following a 30-day public comment period. Pending approval of a Self-Implementing Cleanup Plan submitted to the EPA Region PCB coordinator in February 2021, LEE anticipates that the CAP will be implemented in the Spring of 2021.

2. Methods

SSI field work was performed by Stone between November 25, 2020 and January 25, 2021. Field notes are provided in Appendix B.

2.1. Work Plan Deviations

Deviations from the approved Work Plan are detailed below:

1. Bedrock was not encountered at IP-3D, which was advanced to 170 feet below ground surface (bgs). This Work Plan deviation limits Stone's understanding of the Site's geologic setting and ability to evaluate the relationship between the unconfined and bedrock aquifers. Based on the vertical extent of stained soil (75.5 feet bgs) and lack of groundwater contamination near the source area, and physical properties of the unconfined aquifer, it is unlikely that the release of No. 6 fuel oil has resulted in contamination of the bedrock aquifer.
2. Three soil samples were collected and analyzed for VOCs, SVOCs, and EPH instead of two soil samples as described in the Work Plan. This deviation improves Stone's ability to evaluate soil quality near the No. 6 fuel oil source area.
3. Process water samples were collected after ten minutes of purging instead of fifteen minutes. Based on the high volume of water used in each supply well, the samples collected are representative of process water and this deviation does not affect data quality or usability.

2.2. NAPL Assessment and Utility Demarcation

To determine the physical properties of the No. 6 fuel oil and determine its mobility, a sample of No. 6 fuel oil was collected from existing monitoring well MW-16 on November 25, 2020. The sample was collected using a homemade bailer constructed of a metal pipe with a poly vinyl chloride (PVC) coupling on the open end and a metal cap on the other end. The sample, MW-16, was submitted to Integrated Geosciences Laboratories, LLC (IGL) of Houston, Texas to measure the specific gravity, dynamic viscosity, and fluid density of the No. 6 fuel oil at three temperatures (70°F, 100°F, and 130°F), plus the surface and interfacial tension for each fluid pair (NAPL and water, NAPL and air, and water and air) at 100°F. Stone was unable to remove the viscous NAPL plug within MW-16; therefore, a groundwater sample was not collected from MW-16

While on-site, Stone marked the Site for public utility clearance by DigSafe and observed Vermont Underground Locators perform private utility clearance surrounding the proposed soil boring locations.

A groundwater sample was collected from monitoring well IP-3S (approximately 35 feet east of MW-16) on January 6, 2021 and submitted to IGL for use in the surface and interfacial tension analyses with the NAPL sample collected on November 25th, 2020 from monitoring well MW-16. Groundwater was collected during groundwater sampling using the low-flow methodology outlined in Stone's SOPs and Section 2.4.2. Purge water was contained in a 55-gallon drum and, pending VT DEC approval, will be discharged to the ground surface at the Site.

The values measured by IGL were used to estimate the height of No. 6 fuel oil required to penetrate the water-saturated pores at the water table (Section 3.2).

2.3. Soil Assessment

2.3.1. Soil Boring Advancement

Stone observed the advancement of six soil borings (IP-01D, IP-03D, IP-25, IP-26, IP-27, and IP-28) between December 14, 2020 and December 31, 2020 to evaluate the extent of the No. 6 fuel oil in soil and soil quality. The six borings were advanced using a sonic drill rig operated by Cascade Technical Services of Gardner, Massachusetts (Cascade). IP-25, -26, and -27 were advanced to a depth of 80 feet below ground surface (bgs) to define the horizontal and vertical extent of NAPL near the former UST source area. IP-01D and IP-28 were advanced to 110 feet bgs and IP-03D was advanced to 170 feet bgs. The deepest boring (IP-03D) was advanced to attempt to determine the depth to bedrock. Soil boring locations were geographically positioned using a sub-meter GPS and are depicted on Figure 5 in Appendix A.

Soils encountered during drilling were logged for color, texture, and moisture as detailed in Stone's SOP. Visual or olfactory evidence of contamination was noted. At a minimum, soil from approximately every two-foot vertical interval was placed in a resealable polyethylene bag and the headspace screened for VOCs using a PID equipped with a 10.6 electron volt lamp. Peak PID readings were recorded on field forms.

2.3.2. Soil Sample Collection

Three soil borings were advanced near the location of the NAPL, identified in previous investigations, to further evaluate the extent of No. 6 fuel oil and its potential mobility. Two of the soil borings (IP-25 and IP-26) were advanced just outside of the presumed extent of the NAPL plume, to the northeast and southeast. One soil boring (IP-27) was advanced near the presumed center of mass of the NAPL plume.

Three discrete soil samples (one from each boring) were selected based on the location of elevated PID readings and submitted to Con-Test Analytical Laboratory of East Longmeadow Massachusetts (Con-Test) for VOC analysis by EPA Methods 8260, SVOC analysis by EPA method 8270, and EPH analysis by the Massachusetts Department of Environmental Protection (MDEP) method. One discrete soil sample from IP-27 (IP27-56.0) was selected from the interval observed to be most saturated with NAPL and submitted to Con-Test for synthetic precipitation leaching procedure (SPLP) for VOCs, SVOCs, and EPH. One field duplicate (IP25-52'-FD) and one trip blank were collected for quality assurance/quality control (QA/QC) purposes. Soil sample identifications included:

- IP25-52'
- IP26-63.0
- IP-27-59.0

Due to the presence of NAPL in IP-27, this borehole was grouted to 10 feet bgs as the drill casing was retracted. Unstained soil generated from IP-27 was used to backfill the remaining 10 feet. Soil cuttings were used as backfill in the other borings and the annulus between well riser and borehole walls to the extent practicable. Excess soil cuttings were contained in 55-gallon drums on-Site. NAPL-impacted soil cuttings from IP-27 were segregated from all other soil cuttings.

2.4. Groundwater Quality and Aquifer Physical Properties Assessment

2.4.1. Groundwater Monitoring Well Installation

Monitoring wells were installed in soil borings IP-01D, IP-03D, and IP-28 (Figure 5) to assess the groundwater quality, physical properties of the aquifer, and groundwater flow regime. Monitoring wells IP-01D and IP-03D were installed adjacent to the existing shallow monitoring wells IP-01/IP-01S (between the supply wells and former UST area) and IP-03/IP-03S (approximately 10 feet southeast of the presumed NAPL plume). Monitoring well IP-28 was installed approximately 30 feet east-northeast of the industrial water supply wells.

Monitoring wells were constructed of 2-inch diameter Schedule 40 PVC with 5-foot 0.010-slot machine slotted screens. A sand pack, consisting of #1 silica sand, was installed within the annular space to approximately 2 feet above the screened interval. The screen and sand pack were sealed from meteoric input with approximately 2 to 3 feet of bentonite chips. The remaining annular space was backfilled with cuttings generated during the drilling of the associated bore hole. Wells were completed with flush-mount road boxes set within a concrete pad. Monitoring well construction details are summarized in Table 1, below.

Table 1: Summary of Groundwater Monitoring Wells

Well ID	Total Depth (feet bgs)	Top of Screen Interval (feet bgs)	Top of Sand Pack (feet bgs)	Top of Well Seal (feet bgs)
IP-01D	110	105	103	100
IP-03D	110	105	102	99
IP-28	110	105	102	99

Abbreviations: bgs – below ground surface

Following installation, the wells were developed using a Waterra Hydrolift pump. Purge water was contained in 55-gallon drums stored on-Site pending groundwater laboratory analytical results from low-flow sampling. The top of the monitoring well casing, as well as the height of the adjacent Connecticut River, was surveyed relative to an assigned site datum using a total station on December 21, 2021.

2.4.2. Groundwater Sampling

Stone returned to the Site on January 5, 2021 and January 6, 2021 to collect groundwater samples to assess groundwater quality. Samples were collected from the newly installed monitoring wells and the pre-existing shallower well of the couplets (IP-01 S/D, IP-03 S/D, and IP-28). Groundwater samples were collected using low-flow methodology in accordance with Stone SOPs. Samples were collected using a bladder pump and dedicate 1/4-inch Teflon-lined tubing. Physical and chemical field parameters, including dissolved oxygen (DO), pH, specific conductance, temperature, and oxidation-reduction potential (ORP) were measured using a calibrated multi-parameter water quality meter equipped with a flow-through cell. Turbidity was measured using a stand-alone turbidity meter.

Monitoring wells were purged until the following parameters stabilized for three consecutive readings:

- pH ± 0.1 unit;
- Specific Conductance $\pm 3\%$;
- ORP ± 10 millivolts (mV);
- DO $\pm 10\%$, or 3 consecutive readings below 0.5 mg/L;
- Temperature $\pm 3\%$; and

-
- Turbidity $\pm 10\%$, or 3 consecutive readings below 5 nephelometric turbidity units (NTU)

Following stabilization, groundwater samples were collected directly into laboratory-supplied bottles for VOCs, SVOCs, and EPH analyses. Samples were placed in an ice-filled cooler and transported under chain of custody procedures to Con-Test. One field duplicate and two VOC trip blanks (one per day) were collected for quality assurance/quality control (QA/QC) purposes. Groundwater generated during purging of the wells was contained on-Site in 55-gallon drums pending analytical results.

2.4.3. Pressure Transducer and Staff Gauge Installation

A staff gauge was installed within the Connecticut River near the LFP pump house on December 21, 2020. The location was selected based on its likelihood of remaining ice-free in the winter due to its proximity to an outfall, operated by LFP, while still being far enough from the outfall to avoid turbulent flow. The staff gauge, monitoring wells IP-01S/D, IP-03S/D, IP-28, and the “Deep” water supply well were instrumented with pressure transducers to determine the vertical hydraulic gradient (at the two well couplets) and evaluate the effects of pumping at the supply wells and fluctuations in surface water elevations within the Connecticut River on the Site unconsolidated aquifer. Pressure transducers were installed between January 5 and 11, 2021 and collected depth to water measurements every five minutes until they were retrieved on January 25, 2021, when pressure transducer data was downloaded and the staff gauge was removed. LFP also provided Stone with daily groundwater withdrawal rates from the “Deep” and Shallow” water supply wells for January 11 to 25, 2021.

2.4.4. Process Water Sampling

On January 6, 2021, Stone collected a grab sample of process water from each of the Site supply wells (the Shallow Well and Deep Well) to provide contemporaneous water quality data with the groundwater assessment. Process water was collected near where the water supply lines enter the manufacturing facility in the same location that water supplies were sampled during the 2019 Phase II ESA. The supply wells were purged for ten minutes, then collected and submitted to Con-Test for VOCs and SVOC analyses by EPA Methods 8260 and 8270, respectively.

2.5. Investigation Derived Waste

Investigation Derived Waste (IDW) generated during the SSI included purge water, soil cuttings, tubing, decontamination fluids, soil core liners, and personal protective equipment, such as gloves. Soil, purge water, and decontamination liquids generated during the SSI were contained on-Site within US DOT-approved, 55-gallon drums pending analytical results of soil and groundwater samples. Tubing, soil core liners, and PPE were disposed of as solid waste.

Based on the absence of Site contaminants in groundwater samples, Stone recommends, with VT DEC approval, discharging liquid IDW to the ground surface at the Site. Except for soil cuttings from IP-27, Stone recommends, with VT DEC approval, thin-spreading soil cuttings on-Site based on the absence of evidence of contamination at all other investigation points and lack of contaminants of concern in soil samples. Soil cuttings from IP-27 should be transported off-Site for disposal/treatment in accordance with their waste characteristics.

3. Evaluation of Investigation Results

Soil and groundwater analytical results are tabulated in the following tables in Appendix D:

- Table D1: Concentrations of Semi-Volatile Organic Compounds in Soil
- Table D2: Concentrations of Extractable Petroleum Hydrocarbons in Soil
- Table D3: Concentrations of Volatile Organic Compounds in Soil
- Table D4: Synthetic Precipitation Leaching Procedure for Semi-Volatile Organic Compounds in Soil
- Table D5: Synthetic Precipitation Leaching Procedure for Extractable Petroleum Hydrocarbons in Soil
- Table D6: Synthetic Precipitation Leaching Procedure for Volatile Organic Compounds in Soil
- Table D7: Concentrations of Semi-Volatile Organic Compounds in Groundwater
- Table D8: Concentrations of Extractable Petroleum Hydrocarbons in Groundwater
- Table D9: Concentrations of Volatile Organic Compounds in Groundwater

Full laboratory reports are included in Appendix E.

3.1. Relevant Regulatory Criteria

Samples collected during the SSI were compared to the following regulatory criteria:

- Soil:
 - Vermont Soil Standards (VSS) for resident and non-resident properties published in the (VT DEC's) Investigation and Remediation of Contaminated Properties Rule (IRule; effective July 6, 2019) as Appendix A - § 35-APX-A1.
 - May 2020 EPA Regional Screening Levels (RSLs) for residential and industrial soils.
- Groundwater:
 - Vermont Groundwater Enforcement Standards (VGES) published as Appendix 1 of Chapter 12 of the Vermont Environmental Protection Rules: Groundwater Protection Rule and Strategy, adopted July 6, 2019.

3.2. NAPL Assessment

The sample of No. 6 fuel oil collected from MW-16 was used to analyze the physical properties of the No. 6 fuel oil and determine its mobility. The specific gravity, density, and viscosity of the No. 6 fuel oil was calculated at three temperatures (70°F, 100°F, and 130°F), while the surface and interfacial tension for each fluid pair (NAPL and water, NAPL and air, and water and air) was calculated at 100°F. The IGS laboratory analytical report is provided in Appendix E.

Table 2 summarizes the specific gravity, density, and viscosity of the No. 6 fuel oil and groundwater. At temperatures ranging from 70°F to 130°F, the specific gravity of the No. 6 fuel oil ranges from 1.001 to 0.997, the density ranges from 1.002 grams per cubic centimeter (g/cc) to 0.983 g/cc, and the viscosity ranges from 13,987 centipoise (cP) to 2,312 cP. Both the specific gravity and density are slightly greater than groundwater

at 70°F. At average annual groundwater temperatures in Vermont (approximately 42-47°F¹), the No. 6 fuel oil will show a specific gravity and density even greater relative to groundwater. Additionally, the viscosity is high at 70°F and would be higher at lower temperatures found in the subsurface. This suggests that the No. 6 fuel oil acts as a DNAPL due to its specific gravity and density but is highly viscous as further discussed.

Table 2: Specific Gravity, Density, and Viscosity of No. 6 Fuel Oil

Sample ID	Matrix	Temperature (°F)	Specific Gravity	Density (g/cc)	Viscosity	
					Centistokes	Centipoise
IP-03S	Groundwater	70	0.9994	0.9974	0.9880	0.9850
		100	0.9986	0.9917	0.6980	0.6930
		130	0.9933	0.9793	0.5280	0.5170
MW-16	NAPL	70	1.0006	1.0016	14,108.11	13,986.90
		100	0.9990	0.9924	8,229.48	8,149.23
		130	0.9973	0.9833	2,350.84	2,311.56

Abbreviations: °F – degrees Fahrenheit; g/cc – grams per cubic centimeter

Table 3 summarizes interfacial tension and surface tension results for groundwater, NAPL, and air. The interfacial tension for the NAPL and groundwater is 27.03 dynes per centimeter (dyn/cm), while the surface tension between the NAPL and air is 31.26 dyn/cm and the surface tension between the groundwater and air is 69.56 dyn/cm.

Table 3: Interfacial / Surface Tension of Groundwater, NAPL, and Air

Phase Pair		Temperature	Interfacial Tension
Sample ID / Phase	Sample ID / Phase	(°F)	Dynes/centimeter
IP-03S / Groundwater	NA / Air	100	69.56
MW-16 / NAPL	NA / Air	100	31.26
MW-16 / NAPL	IP-03S / Groundwater	100	27.03

Abbreviations: °F – degrees Fahrenheit; NA – not applicable

The laboratory values for density and interfacial tension at 100°F were used to calculate the height of NAPL required to penetrate the water-saturated pores at the water table (Mercer and Cohen, 1990).

$$\begin{aligned}
 z_n &= (2\sigma\cos\theta)/[rg(\rho_n-\rho_w)] \\
 &= (2 * 0.027 \frac{kg}{s^2} * \cos(45^\circ))/[0.00003 m * 9.81 \frac{m}{s^2} * (992.45 \frac{kg}{m^3} - 991.75 \frac{kg}{m^3})] \\
 &= 137 m
 \end{aligned}$$

¹ https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/ex/jne_henrys_map.html

where z_n is the height of the NAPL, σ is the interfacial tension between the NAPL and water, θ is the contact angle between the NAPL and a quartz slide, r is the radius of the water-filled pore, g is acceleration due to gravity, ρ_n is the density of the NAPL, and ρ_w is the density of the water.

Published values were selected from the literature for θ and r as these values were not estimated from laboratory analyses. A value of 45° was selected for the contact angle. This value was measured by Powers et al. (1996) as the contact angle between No. 2 fuel oil and a quartz slide, submerged in groundwater. Additionally, pore throat radii estimated by Nsir and Schäfer (2010) using a geometric model and probabilistic approach determined to mean radii for a medium sand to be 0.03 millimeters (mm). This value was used for r .

Using these variables, the height of NAPL required to penetrate the water-saturated pores was calculated to be 137 meters, or 450 feet. Because the actual height of the NAPL is approximately 0.24 feet, this confirms that the NAPL will not penetrate below the water table and is therefore immobile. Also, as the NAPL sample was collected at 67.8 feet below ground surface, even if the vadose zone were fully saturated with the No. 6 fuel oil, the NAPL column would not have enough pressure to displace the groundwater in the saturated zone.

Also consider the derivation of hydraulic conductivity from Darcy's law:

$$K = \frac{cd^2 \rho g}{\mu}$$

Where K is hydraulic conductivity, cd^2 is a property of the aquifer matrix, and ρ (mass density) and μ (viscosity) are properties of the fluid.

Appendix E provides the results of testing the No. 6 NAPL from MW-16 and Site groundwater water for both density and viscosity.

The laboratory results indicate that the difference in the density of the two fluids is less than 0.004 g/cc.

The difference of the viscosity of the two fluids however is significant. At 70° F the difference in viscosity between the NAPL and water is 13,985.915 centipoise, with the NAPL viscosity: 13986.90 and the viscosity of water: 0.985 centipoise.

The NAPL will likely be more viscous at actual Site subsurface temperatures, which are likely close to 50° F or slightly less.

As discussed above, Barr estimated the mean hydraulic conductivity as 0.02 cm/sec. Considering cd^2 and g constant, and ρ of both water and NAPL to be essentially equivalent to 1, then μ is the controlling variable in the equation to estimate K . Therefore, the NAPL conductivity could be as low as 1.4×10^{-6} cm per second at 70 degrees. It will be lower at actual aquifer/groundwater temperatures.

With z_n height of 137-meters for the NAPL and the very low NAPL conductivity, the No. 6 will both not be able displace groundwater in the saturated zone or migrate significant horizontal distances.

3.3. Soil Assessment

Soils recovered from the six borings predominantly consisted of sand with a higher proportion of gravel to the southwest at IP-28. The coarsening and fining of the sand units is shown on Cross Section A-A' in Appendix A. While little gravel was identified in the other borings, gravel at IP-28 was present from 13-22 feet bgs, 29-61 feet bgs, and 67-110 feet bgs. Other borings did, however, show coarser sand units from approximately 61-89

feet bgs and 121-140 feet bgs. NAPL was visually identified in soil boring IP-27 from 41-75.5 feet bgs as black stained soil exhibiting a hydrocarbon odor. Boring logs are provided in Appendix C.

PID readings were less than 5 ppm at all depths screened in each boring except for IP-25 and IP-27. At IP-25, elevated PID readings, greater than 5 ppm, were measured from 51-54 feet bgs. At IP-27, the highest PID readings were measured from 46-74 feet, generally corresponded to depths that NAPL was observed. PID readings are included on soil boring logs in Appendix C. The highest PID from each boring included:

- IP-01D: 5.0 ppm at 52 feet bgs,
- IP-03D: 2.3 ppm at 42 feet bgs,
- IP-25: 68.0 ppm at 52 feet bgs,
- IP-26: 4.1 ppm at 63 feet bgs,
- IP-27: 124.5 ppm at 70 feet bgs, and
- IP-28: 1.7 ppm at 32 feet bgs.

Several contaminants of concern were detected at concentrations above laboratory reporting limits in each soil sample. In soil sample IP27-59.0, where NAPL was observed and a PID reading of 120.4 ppm was measured, benzo(a)pyrene (B[a]P) and naphthalene were the only contaminants of concern detected at concentrations exceeding their respective non-resident VSS. No contaminants of concern were detected at concentrations exceeding resident VSS in soil samples IP25-52.0' or IP26-63.0. Table 4, below, summarizes B(a)P and naphthalene soil analytical results, which are also depicted on Figure 6 in Appendix A. Toxicity equivalency quotients (TEQ) were calculated for the seven carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in accordance with Appendix F of the IRule and summed to compare to the B(a)P-TEQ. One-half the reporting limit was used to calculate the TEQ where an analyte was not detected at a concentration above the laboratory reporting limit, in accordance with IRule. B(a)-TEQs are included in Table 4, below, and Tables D1 and D2 in Appendix D.

Table 4: B(a)P-TEQ and Naphthalene Results – Soil Samples

Analytical Method	SVOCs (8270)		VOCs (8260)	EPH (MDEP)
Sample ID	B(a)P-TEQ (mg/kg)	Naphthalene (mg/kg)	Naphthalene (mg/kg)	Naphthalene (mg/kg)
VSS – Resident	0.07	2.7	2.7	2.7
VSS – Non-Resident	1.54	16	16	16
IP-25(52')	<0.220	<0.19	0.00053 J	<0.11
IP-26(63')	<0.208	<0.18	0.0043	<0.11
IP-27(59')	10.7	11	12	18

Notes: SVOCs – semi-volatile organic compounds; VOCs – volatile organic compounds; EPH – extractable petroleum hydrocarbons; VSS – Vermont Soil Standards; mg/kg – milligrams per kilogram; bold results indicate detections of the analyte; shaded results indicate an exceedance of the Resident VSS; Orange borders indicate an exceedance of the non-resident VSS; < indicates analyte was not detected, laboratory reporting limit provided; J – estimated concentration between the method detection limit and laboratory reporting limit.

SPLP results from soil sample IP27-56.0 were compared to the VGES to evaluate risk to groundwater from contaminants of concern leaching from NAPL saturated soil. Several contaminants of concern were detected in the SPLP soil sample. Naphthalene and methylene chloride were the only contaminants detected at concentrations in excess of their respective VGES (Table 5). Methylene chloride was also found in the

laboratory blank and is likely a laboratory contaminant. Low levels of methylene chloride were also detected in soil sample IP-26-63.0, which is also likely the result of laboratory contamination.

Table 5: Concentrations of SVOCs, VOCs, and EPH (SPLP) for IP-27(56')

Analytical Method	SVOCs (8270)		VOCs (8260)	EPH (MDEP)
Sample ID	Methylene Chloride (µg/L)	Naphthalene (µg/L)	Naphthalene (µg/L)	Naphthalene (µg/L)
VGES	5	0.5	0.5	0.5
IP-27(56')	12 B	11	21	13

Notes: VGES – Vermont Groundwater Enforcement Standards; µg/L – micrograms per liter; bold results indicate detections of the analyte; shaded results indicate an exceedance of the enforcement standard(s); B – analyte was detected in the laboratory blank as well as the sample

3.4. Groundwater Assessment

3.4.1. Groundwater Quality

Physical and chemical properties of groundwater were measured during low flow groundwater sampling and are summarized in Table 6, below. pH values were slightly acidic to alkaline, ranging from 6.30 to 9.77. Specific conductance values, indicating a greater concentration of inorganic dissolved solids, were slightly elevated at IP-01S and IP-03D. Dissolved oxygen (DO) and oxygen reduction potential (ORP) values showed a pronounced difference between the shallow and deep monitoring wells. Shallow wells (screened approximately 70-75 feet bgs) demonstrated higher DO and positive ORP, indicating an aerobic environment. Deep wells (screened from 105-110 feet bgs) demonstrated low DO and negative ORP, indicating an anaerobic environment. Field sheets showing the physical and chemical parameters collected during low flow sampling are included in Appendix B.

Table 6: Physical and Chemical Parameters of Groundwater

Location ID	Temperature (°C)	pH (s.u.)	DO (mg/L)	ORP (mV)	Specific Conductivity (µS/cm)	Turbidity (NTU)
IP-01S	11.3	7.10	11.98	110.8	1032	9
IP-01D	10.3	9.77	1.37	-248.2	870	9.76
IP-03S	13.7	6.30	11.81	216.8	92.3	38
IP-03D	13.3	6.44	1.11	-347.6	1053	19
IP-28	11.3	7.01	1.17	-379.6	422.6	35

Notes: ORP = oxygen reduction potential; mV = millivolts; s.u. = standard units; pH = log hydrogen ion concentration; DO = dissolved oxygen; mg/L = milligrams per liter; µS/cm = microSiemens per centimeter; NTU = nephelometric turbidity units; °C = degrees centigrade; shaded values indicate shallow groundwater

No contaminants of concern were detected at concentrations above laboratory reporting limits in any of the five groundwater monitoring wells sampled. Methyl tert-butyl ether (MTBE) was detected in process water samples collected from the “Deep” and “Shallow” wells but at concentrations below the VGES (Table 7).

Table 7: Process Water MTBE Concentrations

VOCs	VGES ($\mu\text{g/L}$)	Shallow Well ($\mu\text{g/L}$)	Deep Well ($\mu\text{g/L}$)
MTBE	11	7.9	1.7

Notes: VGES – Vermont Groundwater Enforcement Standards; MTBE – methyl tert-butyl ether; $\mu\text{g/L}$ – micrograms per liter; bold results indicate detections of the analyte

3.4.2. Aquifer Physical Properties

Pressure transducer data, manual water level measurements, and water withdrawal rates from both Site supply wells were used to estimate the vertical hydraulic gradient and radius of influence of the supply wells.

Water level measurements were collected during low flow sampling, upon deployment of the pressure transducers, and upon retrieval of the pressure transducers as summarized in Table 8, below. Measurements show that horizontal groundwater flow between IP-01S/D and IP-03S/D may fluctuate from northeast to southwest, although the primary direction of flow is likely to the southeast toward the Connecticut River (see historical groundwater contours depicted on Figure 4 in Appendix A). Between IP-01D and IP-28, horizontal flow to the southwest (toward the production wells) is more pronounced, likely due to pumping of the production wells and drawdown of the water table.

Table 8: Manual Water Level Measurements

Well ID	Date	Depth to Water (ft btoc)	Elevation (feet*)
IP-01S	January 6, 2021	69.18	131.846
	January 11, 2021	69.27	131.756
	January 25, 2021	69.33	131.696
IP-01D	January 5, 2021	68.60	131.945
	January 11, 2021	68.76	131.785
	January 25, 2021	68.82	131.725
IP-03S	January 6, 2021	68.04	131.609
	January 11, 2021	68.13	131.519
	January 25, 2021	68.18	131.469
IP-03D	January 5, 2021	67.35	131.899
	January 25, 2021	67.55	131.699
IP-28	January 6, 2021	68.70	130.478
	January 11, 2021	68.12	131.058
	January 25, 2021	68.64	130.538
Deep Well	January 11, 2021	71.33	NM
	January 25, 2021	75.15	NM
Staff Gauge	December 21, 2021	-	131.209

Notes: ft btoc – feet below top of casing; *Elevation relative to assigned Site datum; NM – not measured

The vertical component of the hydraulic gradient was calculated at the two sets of paired monitoring wells, IP-01S/D and IP-03S/D using the formula below, using water elevation measurement taken on January 11 and 25, 2021. The vertical component of the hydraulic gradient at well pair IP-01S/D was -0.0082 (upward) on both January 11 and 25, 2021. The vertical component of the hydraulic gradient at well pair IP-03S/D was -0.011 and -0.0065 (also upward) on January 11 and 25, 2021, respectively. These values show a slight upward

gradient of groundwater from the lower to upper portion of the unconfined sand aquifer. A sample calculation for well pair IP-01S/D on January 11, 2021 is shown below.

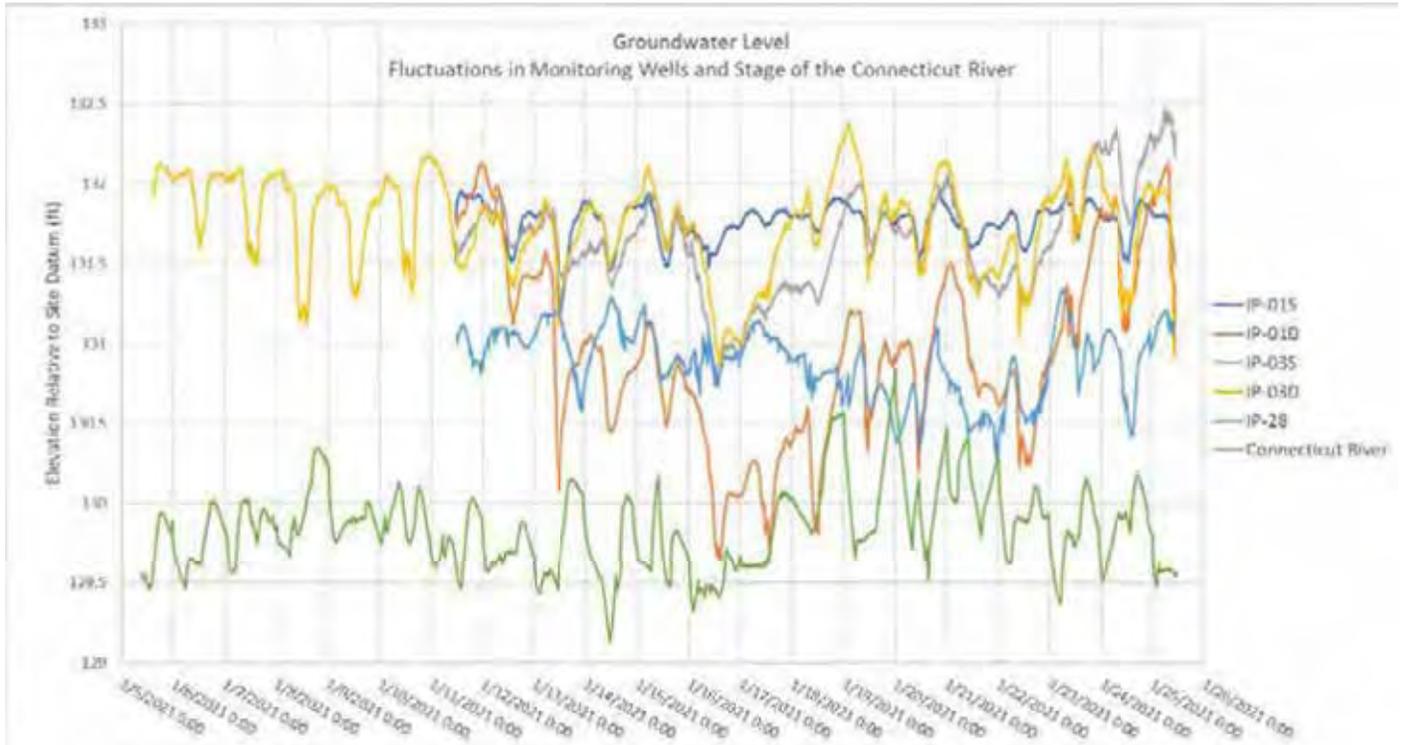
$$\begin{aligned} \text{Vertical hydraulic gradient} &= \frac{\Delta h}{\Delta y} = \frac{h_{IP-01S} - h_{IP-01D}}{\Delta y} = \frac{131.756 \text{ ft} - 131.785 \text{ ft}}{126.026 \text{ ft} - 90.545 \text{ ft}} \\ &= -8.17 \times 10^{-4} \end{aligned}$$

where Δh is the change, or difference, in hydraulic head between the monitoring wells and Δy is the distance between the bottom of each of the paired monitoring wells.

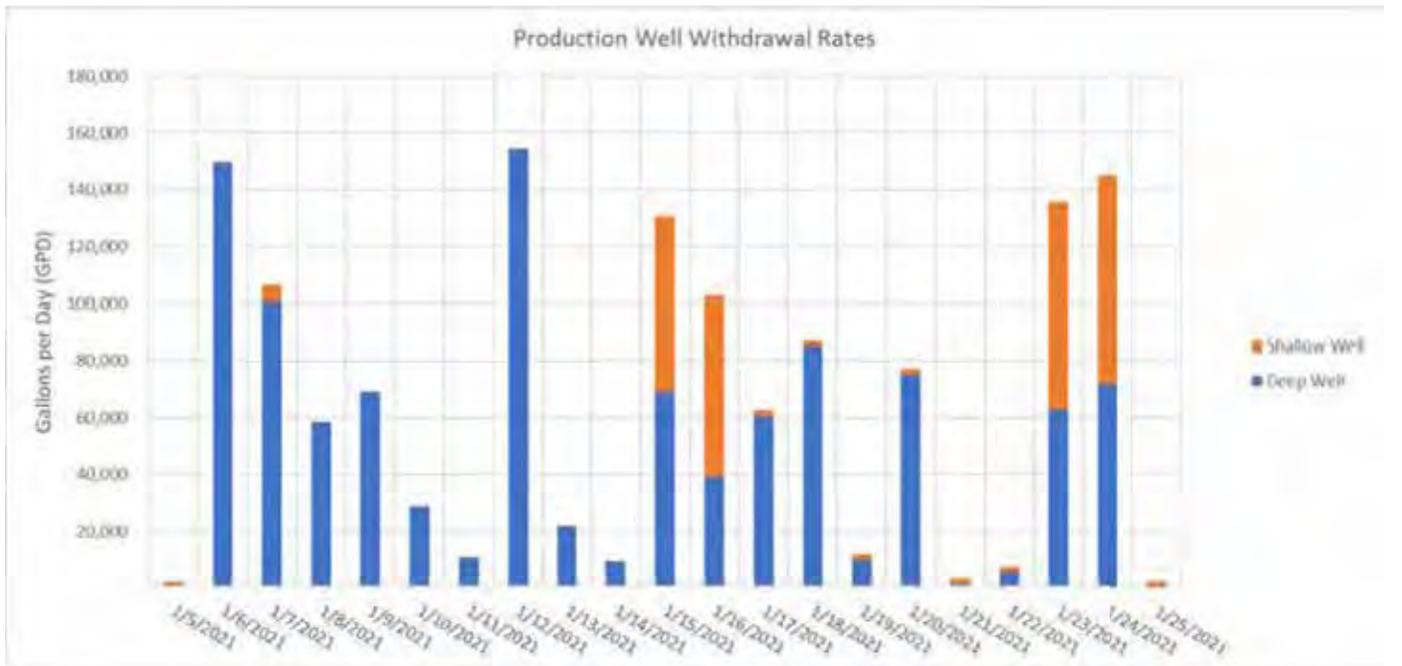
Pressure transducer data from the five monitoring wells (IP-01S/D, IP-03S/D, IP-28), the Deep water supply well, and the staff gauge were plotted as groundwater level fluctuations/river stage versus time. Data from two of the pressure transducers (in wells IP-03S and IP-03D) demonstrated erroneous readings due to the pressure transducer cable being lowered following setting a reference value. Depth to water readings were corrected by calculating the difference between the reading immediately prior to and following movement of the cable and applying this difference to all readings following movement of the cable. Although readings were impacted, the values were shifted and should still demonstrate the same fluctuations in water level from one reading to the next.

Graph 1, below, shows groundwater level fluctuations in the monitoring wells and river stage in the Connecticut River from January 5, 2021 through January 25, 2021. Fluctuations/river stage can be compared to the daily pumping rates for the Shallow and Deep supply wells (Graph 2). Graph 1 shows more pronounced fluctuations in the deep monitoring wells than the shallow wells of the well pairs, and in IP-28. IP-28 also shows more variability in water level on a shorter time scale with a greater number of peaks and troughs in a given time. Graphs showing groundwater level fluctuations for each individual monitoring well, the Deep supply well, and the staff gauge are provided in Appendix F. This is discussed in detail in the Conceptual Site Model

Graph 1: Groundwater Level Fluctuations in Monitoring Wells and Stage of the Connecticut River from January 5, 2021 to January 25, 2021



Graph 2: Production Well Withdrawal Rates for the Shallow Well and Deep Well from January 5, 2021 to January 25, 2021



4. Quality Assurance and Quality Control

4.1. Field Duplicates

Two field duplicate samples were collected (one for soil and one for groundwater) during the SSI field work. Field duplicate sample results are summarized in the Appendix D tables.

To assess precision of the analytical results, relative percent difference (RPD) values were calculated for each primary-duplicate sample pair using the following formula:

$$RPD = \frac{|C_1 - C_2|}{\frac{C_1 + C_2}{2}} \times 100$$

Where: C1 = Concentration of a given target analyte in the Primary Sample, and

C2 = Concentration of a given target analyte in the Field Duplicate sample

RPDs could not be calculated for SVOC and EPH soil samples and all groundwater samples since analytes were not detected above laboratory reporting limits in the parent-duplicate sample pairs. RPD for the IP25-52' parent-duplicate sample pair ranged from 3% (acetone) to 6% (2-butanone), which is well below the EPA acceptance criteria of 50% for soil.

4.2. Trip Blanks

One VOC trip blank sample accompanied each sample cooler shipped to Con-Test that contained soil or groundwater samples for VOC analysis. No VOCs were detected in the trip blanks indicating that samples were not contaminated during transport to the laboratory.

5. Conceptual Site Model

The CSM presented herein is based on results from the SSI and historical investigations and assessments of the Site, as described above, and is specific to the No. 6 fuel oil release. Other Site contaminants of concern are not discussed. The CSM includes a discussion of the known physical, geologic, and hydraulic attributes of the Site and surrounding area, how No. 6 fuel oil was likely released at the Site, transport pathways, fate mechanisms, and potential routes of exposure to ecological and human receptors. The CSM provides the context from which the site investigation is developed and a framework to make sound Site management decisions.

5.1. Topography

Ground surface at the Site is generally flat, except along the Connecticut River where the land slopes steeply downward approximately 70 feet. Ground surface in the surrounding area north and northwest of the Site generally slopes to the south and east.

5.2. Geology

5.2.1. Bedrock Geology

According to the Agency of Natural Resource (ANR) Atlas, the Site is underlain by schist (primary) and metawacke (secondary) bedrock. Bedrock was reported at depths of 137 and 142 feet below ground surface in two bedrock wells drilled to the west and southwest of the Site where ground surface elevations are similar to the Site. Overburden groundwater production wells at the Site were reportedly drilled to between 100 and 150 ft bgs. Therefore, it is anticipated that bedrock in the portion of the site with known No. 6 fuel oil contamination will be found below the deepest unconsolidated material production well at approximately 150 ft bgs. Bedrock was not encountered in IP-3D drilled to a depth of approximately 170 feet below ground surface on 12/14/2020.

The bedrock groundwater is not expected to be affected by surficial groundwater flow. The hydrogeologic relationship between the groundwater in the unconsolidated materials and the bedrock is unknown, as well as vertical hydraulic gradients between the two regimes. However, based on the site location adjacent to the Connecticut river, the bedrock groundwater is likely discharging to the Connecticut river with the river acting as a regional bedrock groundwater discharge area. There should be an upwards gradient between the bedrock groundwater and the river that will prevent any dissolved contamination in the unconsolidated materials from flowing downwards into the bedrock aquifer.

5.2.2. Unconsolidated Geology

Unconsolidated materials at the site are likely a mixture of glacial-lacustrine and post glacial deposits with areas of these materials reworked as the Connecticut River has meandered across and cut down through the glacial-lacustrine deposits after glacial lakes drained.

Overburden soils at the Site are mapped as fluvial sands. Griffin's 1990 Investigation of Subsurface Petroleum Contamination report described subsurface soils as "nearly horizontal stratigraphic sequences, each

measuring approximately one-foot thick and that they begin as coarse, well rounded, well sorted sand at the top and grade into fine, silty sand at the bottom” of each sequence. Griffin further concluded that the stratigraphic sequence planes dip slightly to the south.

During the Stone Environmental Phase II ESA, strata observed during the installation of groundwater monitoring wells did not concur with this prior assessment. While lower-energy (e.g., fine sands and silt) stratigraphic units were observed in select borings, such as IP-05 and IP-03, high-energy deposits (medium to coarse sands through gravel and cobbles) were common above the water table. We interpret this variability within Site strata to be indicative of a meandering river system bisecting through previously deposited lacustrine deltaic sediments as described above. Coarser sediments with angular to sub-angular grains, like those that are prominent between 0 and 20 ft bgs Site-wide, suggest that these sediments are close to their source and that the paleo-Connecticut River flowed at high velocities along the Site.

The available boring logs at this site do indicate that while the glaciolacustrine deposits were deposited in a lower energy environment than the more recent alluvial deposits, the logs do show geologic variability within the sediments with some areas of coarser grained materials below the water table. These areas will have higher hydraulic conductivity (K) than finer grained materials and will act as preferential pathways for contaminant transport (ITRC, 2011).

Glacio-lacustrine deposits commonly fine downwards and are often underlain by lacustrine clays. No boring logs have been drilled deep enough to confirm or deny the presence of lacustrine clay in this location. Glacio-lacustrine deposits are also commonly underlain by coarse, high energy glacial outwash. These often have high K values and can produce significant amounts of water to wells. Considering the depth of the on-Site production wells and the amount of water they reportedly produce, there is a possibility that glacial outwash may exist at depth at this site. Groundwater withdrawal reports provided by Long Falls Paperboard indicate that 17,197,347 gallons of water was withdrawn from the ‘shallow well’ in 2019 (monthly average of 1,433,112 gallons) and 81,626,589 gallons of water was withdrawn from the ‘deep well’ in 2017 (monthly average of 6,802,216 gallons).

Soil borings drilled between 12/14/2020 and 12/31/2020 encountered similar unconsolidated materials with interbedded higher and lower K zones. See Figure 8 cross section for a summary of the unconsolidated materials encountered in the December 2020 drilling.

5.3. Hydrogeology

Depth to water in the No. 6 fuel oil release has been measured between 66 and 69 feet bgs during several monitoring events conducted between 1990 and 1994 and again in 2019. Based on surrounding area topography, groundwater flow would be presumed to be east or southeast toward the Connecticut.

In many places in the Connecticut river valley, the water table will rise and lower to a significant effect based on the stage of the river. At this Site however, we may not see as significant variations in the stage of the river as elsewhere in the valley due to the impoundment of the Connecticut River by the Vernon Dam at Vernon, Vermont approximately 10 miles downstream of the Site.

Therefore, whether the river is a gaining or losing stream may be strongly related to the elevation of the groundwater table based on annual variations in recharge to the water table. At least periodically, the Connecticut River may be a losing stream in the vicinity of the Site when the elevation of the water table is lower than the elevation of the river. Please note that concurrent hydraulic monitoring data collected in 1990 from a staff gauge in the Connecticut River and Site groundwater monitoring wells was not available within available SMS #1990-0482 files. Water table elevations in IP-01S, IP-01D, IP-3S, IP-28, and the Deep Water

Supply well were collected between January 11, 2021 through January 26, 2021 and for the staff gauge and IP-03D were collected between January 5, 2021 and January 26, 2021.

There was an apparent diurnal pattern to the river stage with the stage rising and lowering between approximately 0.5 and 1.0 feet over roughly every 24 hours period between January 5 and January 26, 2021. The groundwater elevations exhibited a similar pattern that did not correlate with the river very well. It is however likely that the changes in the river level do affect the groundwater elevation, but there appears to be a lag time between when the river rises or lowers and the groundwater elevation rising or lowering. It is not clear if the river was gaining or losing during the test. As stated above this is probably dependent on annual variations in the regional recharge to groundwater.

The relationship between the staff gauge data and the elevation of the water in the deep production well was not as clear as between the monitoring well data and the staff gauge. The effect of the periodic pumping of the two water supply wells probably masks the relationship to the river elevation, but there does appear to be at least a slight correlation.

Groundwater contour maps created during a prior environmental assessment of the Site indicate groundwater surface gradient toward the river (Griffin, 1994). Groundwater elevation data collected as part of the 2019 Phase II ESA showed slight horizontal gradients to the east and southeast. Based on this information, and in the absence of multiple rounds of groundwater and surface water level data, we would expect the Connecticut to be both a losing and gaining stream near the LFP property as discussed above. The groundwater flow direction was less clear during this investigation than in the earlier investigations. The horizontal component of the hydraulic gradient in the wells measured indicated a very slight flow away from the river. This could indicate that the river was a losing river during the period when the data were collected.

A slightly upwards vertical gradient was measured in the two shallow-deep paired monitoring well sets installed in this investigation. In January 2020, the gradient in IP-03S and 03D was -0.11 and -0.0065, and in IP-01S and 01D the gradient was -0.0082. These are very slight upward gradients.

Site geology indicates that the saturated aquifer contaminated with No. 6 fuel oil is likely glaciolacustrine in origin but there are no available data on the thickness of the aquifer or whether or not it is underlain by clay, a high K glacial outwash aquifer, or both. As stated above, IP-3D was drilled to a depth of 170 feet without encountering any bedrock or clay at depth. Groundwater flow in a deeper aquifer could be significantly different than in the lacustrine deposits, potentially flowing southwards below the river.

Operation of the two Site water supply wells likely influences groundwater flow direction. The extent of the influence is unknown either horizontally or vertically. As indicated in the 1990 Griffin report, pumping from the supply wells may not affect the water level in the existing monitoring wells in the No. 6 fuel oil release area at the Site. The data collected in this investigation supports the theory that the water supply pumping wells do not pump water from the area where the No. 6 oil was released.

The groundwater elevation graph does not show a clear response to the water supply well pumping in any of the monitoring wells measured in January 2021. The monitoring wells were clearly influenced by the diurnal changes in river stage but did not show a direct response to pumping in the water supply wells. The water supply wells are likely completed in a higher K gravelly zone as indicated in the Figure 8 cross section. This gravel zone was not encountered in IP-26 or 27 adjacent to the No. 6 release area or in IP-3D which was the deepest boring drilled in this investigation. Gravel soils were observed in IP-28, which is closest to the production wells.

The area of contribution to the supply wells is likely limited to the gravely deposit and may include the river.

Based on slug tests conducted on a Site water supply well by JCO in 1990, geometric mean and maximum hydraulic conductivity of the Site aquifer was estimated a of 0.02 cm/sec and 0.08 cm/sec. According to Griffin, pumping tests completed by JCO in 1990 indicated that there is a strong hydraulic connection between potentiometric surfaces in Site monitoring wells and the Connecticut River but no noticeable connection between water supply and monitoring wells. Griffin also indicated that the water level in the Connecticut River was very high from recent rain fall. If these conditions persisted during JCO's pumping tests, potential hydraulic effects on the No. 6 fuel release area from the water supply wells may not have been noticeable due to broader and pronounced hydraulic effects of the Connecticut River, which was likely a losing stream at that time.

The connection between the unconsolidated, overburden aquifer and the bedrock aquifer is unknown.

5.4. Release Mechanisms

The only known documented contaminant releases at the Site are from various petroleum surface spills and releases from No. 6 fuel oil USTs. Reported petroleum spills were generally contained (except for a reported release that impacted the on-site clarifier) and the No. 6 fuel oil leaking UST release received a VT DEC SMAC letter in 1994. However, at that time soil and groundwater were not sampled for the primary constituents of No. 6 fuel oil: polycyclic aromatic hydrocarbons (PAHs). No SVOCs, including PAHs, were detected in groundwater samples collected in 2019 at locations presumed to be downgradient of the No. 6 fuel release (e.g., IP-03, 02, and 07). Additional undocumented releases of petroleum products may have occurred at the Site or nearby properties. The nearest known off-Site release occurred on adjoining former The Book Press property from five USTs removed in 1992 that were used to store diesel, naphtha, kerosene, alcohol, and gasoline. Specifically, releases were documented from the naphtha and gasoline USTs.

5.5. Contaminant Distribution, Fate and Transport

Petroleum products as Non-Aqueous Phase Liquids (NAPLs), containing VOCs and SVOCs, will tend to migrate downward through soil to the groundwater table with some of the product adsorbing to soil particles or held in pore spaces above the water table as residual phase ganglia. Petroleum NAPLs most often have a specific gravity less than water and are known as Light Non-Aqueous Phase Naples (LNAPLs) and may float on top of the water table and will tend to stay high in the groundwater column. As the water table rises and lowers, LNAPL on the surface of the water table that drops during periods of low water table may trapped in pores spaces and become residual phase NAPL below the water table when the water table rises again.

No. 6 fuel oil can sometimes have specific gravities higher than water and can be a DNAPL (ITRC, 2015). NAPL and water densities for the Site were tested at 70, 100, and 130 ° F.

Temperature (°F)	Density NAPL g/cc MW-16	Density Water g/cc IP-035
70	1.016	0.9974
100	0.9924	0.9917
130	0.9833	0.9793

The NAPL density was greater than water at all three temperatures tested, so the No. 6 Fuel Oil is a DNAPL at this site. As the difference in density increases with lower temperatures, the DNAPL density is expected to be greater at actual subsurface temperatures than in the laboratory.

Based on the available data, it is likely that most of the No. 6 NAPL was held in the unsaturated zone as residual phase NAPL ganglia with the 1990 investigation indicating that there was only a small area with No.6 found on the water table. This has been confirmed by the other investigations since 1990. SPLP analysis of a soil sample containing residual phase NAPL ganglia indicate that naphthalene and benzo(a)pyrene could potentially leach from impacted soil. However, the ground surface at the NAPL plume is paved and contaminants do not appear to be leaching from soil, based on the absence of naphthalene and benzo(a)pyrene in groundwater samples collected from nearby monitoring wells.

In the 2019 Stone Environmental Phase II, investigation point IP-03 was advanced as close as practicable to the former leaking No. 6 fuel oil USTs. Less than 1 part per million by volume (ppmv) photoionization detector (PID) response was measured in screened soils to the water table. In the soil sample collected at 70.5 feet depth, no VOCs or SVOCs were detected above screening values. Of note, an extremely low detection of tetrachloroethene in this soil sample was estimated at 0.00029 mg/Kg, many orders of magnitude below the VSS Resident standard of 2.4 mg/Kg. In groundwater, no VOCs of concern or SVOCs were detected in IP-03.

Free-phase petroleum product was detected in monitoring well MW-16 in 2019 and 2020 at an elevation > 10 feet above the observed water table; it is unknown if this is representative of current in-situ conditions as it could be the same No. 6 fuel oil present as it was left when last monitored in 1994, which was measured at the same depth of 68 feet bgs.

Soil borings IP-25 and 26 were drilled in 2020 adjacent to the one well with liquid NAPL (MW-16) and did not exhibit any signs of NAPL in the boring logs (no staining, no odor, not visible NAPL) above or below the water table.

Soil boring IP-27 was drilled in the center of the NAPL source area. The boring logs report visible “hardened” “dry” pieces of NAPL mixed with interbedded medium to coarse sandy materials in the aquifer matrix from 40 to 45 feet bgs and black stained soil from 45 to 55 and 60 to 75 feet bgs. None of the NAPL appeared mobile or continuous. No NAPL was found between 76 and 80 feet below ground surface.

A soil sample taken from IP-27 at 59 feet bgs surface contained naphthalene at 11 mg/kg and B(a)P-TEQ at 10.7 mg/kg, which exceed their respective non-resident VSS. Soil samples taken at 52 feet bgs in IP-25 and 63 feet bgs in IP-26 and did not contain either naphthalene or B(a)P-TEQ at concentrations above laboratory detection limits.

The depth of contamination related to the No. 6 fuel oil, both as NAPL and dissolved phase has not been assessed although based on the results of the investigations, the extent of NAPL does not appear to extend past the area estimated by Griffin in 1990 as shown on Figure 6 and may be smaller. The 2021 data also do not demonstrate the presence of naphthalene or B(a)P-TEQ above laboratory detection limits in groundwater collected from monitoring wells IP-01S, -01D, -03S, -03D, or 28.

The 2019 samples of water collected from the shallow and deep production wells collected from the influent piping to the paper plant, demonstrated the presence of MTBE detections in each of these samples at concentrations of 2.0 µg/L and 9.9 µg/L, below the VGES standard of 11 µg/L. The 2021 samples demonstrated MTBE at concentrations of 7.9 µg/L in the shallow well and 1.7 µg/L in the deep well. In 2019, Naphthalene was estimated to be in the water samples from the production wells in concentrations above standards. No naphthalene was detected in these wells in 2021 at concentrations above the laboratory

detection limit of 0.31 $\mu\text{g/l}$ (below the VGES standard of 0.5 $\mu\text{g/l}$). The data collected to date from this site strongly indicate that the source of the MTBE in the production wells is not from the former No. 6 fuel oil release location. The data also strongly indicate that any naphthalene that may have at one time been detected in the production wells is also not likely related to the No. 6 fuel oil release.

MTBE was detected in a 1994 groundwater sample collected from nearby former monitoring well MW-11 located between the production wells and the river at a concentration of 14.2 $\mu\text{g/L}$. These data indicate that petroleum products may have migrated and/or were hydraulically influenced due to pumping to the production well area and in the absence of a continuing source, are and/or would be expected to decline over time.

Barr (1991) estimated the volume of the No. 6 fuel oil present in the subsurface, estimated to be 68,100 gallons to persist as a long-term source. The estimated volume of No. 6 NAPL present should only be considered an estimate with its accuracy undemonstrated. Data collected in 2020 and 2021 cannot confirm or deny this estimate but indicate that it is probably an over-estimate.

5.6. Sensitive Receptor Evaluation

Contamination from the No. 6 fuel oil release has been evaluated for its potential to adversely affect sensitive receptors. Table 9 presents the potentially affected media, potential pathways, and potential receptors.

Table 9. Sensitive Receptors Evaluation – No. 6 Fuel Oil Release

Affected Media	Potential Pathways	Sensitive Receptors/Potential Risk
Surface Water	Overland flow of stormwater runoff and groundwater discharge	Connecticut River / Low – No petroleum VOCs or SVOCs associated with the No. 6 fuel release have been detected in groundwater at concentrations above VGES at locations immediately downgradient of the release.
Surface Soil	Direct contact to contaminated materials	Site users & trespassers / Low – Soil contaminated by the release of No. 6 fuel oil is at least eight feet bgs and located below an asphalt parking lot.
Subsurface Soil	Direct contact with No. 6 fuel oil contaminated soil	Groundwater / Low – The presence of No. 6 fuel oil in the subsurface does not appear to be resulting in migration of dissolved phase groundwater contamination beyond the release area. Construction workers / Medium – Future excavations within the No. 6 fuel oil release area may encounter contaminated soil.
Groundwater	Infiltration of surface water through impacted soil may leach contaminants to groundwater.	Potential discharge to Connecticut River / Low – See surface water. Potential uptake into facility process water / Medium – naphthalene and lead were detected in the sample collected from the 'Deep' production well at concentrations above VGES.
Sediment	Discharge of contaminated soils to the Connecticut River from stormwater.	Potential discharge to the Connecticut River / Low
Air	Vapor intrusion of petroleum VOCs.	Potential Vapor Intrusion from subsurface VOCs / Low Potential volatilization of VOCs in soil (current or future) / Low

Abbreviations: VOCs – volatile organic compounds; SVOCs- semi-volatile organic compounds

6. Conclusions and Recommendations

Based on the results of the SSI, Stone makes the following conclusions:

1. NAPL: NAPL observed in the vadose zone is likely present as immobile residual phase NAPL ganglia. The limited vertical extent of free phase NAPL observed at MW-16 has a specific gravity greater than Site groundwater and therefore is a DNAPL. Based on the DNAPLs high viscosity and low hydraulic conductivity, the DNAPL is immobile. Calculation of the height of NAPL required to penetrate the water-saturated pores (137 meters) confirms that the few feet of NAPL present at the Site is not nearly thick enough to exert enough pressure to displace groundwater and migrate further downward.
2. Soil: Several contaminants of concern were detected in soil from the boring advanced through the presumed center of the NAPL plume with benzo(a)pyrene and naphthalene concentrations exceeding their respective non-resident VSS. In this location, the SPLP analysis also shows naphthalene exceeding the VGES, suggesting these contaminants could leach from water infiltrating through the NAPL and potentially impact groundwater. However, the ground surface above the NAPL plume is paved, limiting infiltration of precipitation. Based on groundwater results, naphthalene, and benzo(a)pyrene are not leaching from the NAPL plume. Outside of the defined extent of the plume, no contaminants of concern were detected at concentrations exceeding the resident VSS indicating that soil contamination is limited to the extent of the NAPL plume.
3. Groundwater quality: No contaminants of concern were detected at concentrations above laboratory reporting limits in any of the five groundwater monitoring wells sampled. MTBE was detected in process water samples collected from the “Deep” and “Shallow” well supplies but at concentrations below the VGES. MTBE detections, and naphthalene previously detected in the water supplies, are likely attributed to a source other than the former No. 6 fuel oil USTs. The depth to bedrock is greater than 170 feet bgs. Based on the absence of dissolved phase contaminants near the NAPL plume, immobile nature of the NAPL, and Site hydrogeological conditions, contamination of the bedrock aquifer is very unlikely.
4. Aquifer physical properties: The unconfined aquifer had a slight upward vertical component of the hydraulic gradient from the lower to upper portions of the aquifer during January 2021. Under these conditions, downward migration of NAPL and dissolved phase contamination cannot occur. The vertical component of the hydraulic gradient may alternate from upward to downward in response to fluctuations in the Connecticut River surface water elevations and whether the River is a gaining or losing river. There is a hydraulic connection between the Connecticut River and the No. 6 fuel oil source area but no discernable connection between the source area and Site water supply wells. The Site water supply wells do not likely pump water from the No. 6 fuel oil source area, instead drawing water from the higher hydraulic conductivity gravel soils observed in the western portion of the Site or possibly the Connecticut River.

Based on these conclusions and data collected, Stone makes the following recommendations:

- No additional assessment related to the release of No. 6 fuel oil at the Site is recommended.

-
- Due to the potential periodic VGES exceedances of MTBE and naphthalene from an unknown source, an institutional control should limit the use of water withdrawn from the “Deep” and “Shallow” water supply wells to use as non-potable process water.

7. References

Barr Engineering Company, January 1991. *Feasibility Study, Remediation of No. 6 Fuel Oil Release, Specialty Paperboard, Inc. Brattleboro Mill, Brattleboro, Vermont*

Griffin International, Inc., 1990. Report on the Investigation of Subsurface Petroleum Contamination, Specialty Paperboard, Brattleboro, Vermont, July.

LE Environmental, 2018. LE Environmental Phase I Environmental Site Assessment Report, Neenah Northeast LLC, December 12.

LE Environmental, 2020. *Brownfields Corrective Action Investigation Report, Long Falls Paperboard, 161 Wellington Road, Brattleboro, Vermont 05301*, August 14.

LE Environmental, 2021. *Corrective Action Plan, Long Falls Paperboard, 161 Wellington Road, Brattleboro, Vermont 05301*, February 2.

Mercer, J.W. and Cohen, R.M. (1990). A review of immiscible fluids in the subsurface: Properties, models, characterization and remediation. *J. Contam. Hydrol.*, 6: 107-163.

Nsir, K. and Schäfer, G. (2010). A pore-throat model based on grain-size distribution to quantify gravity-dominated DNAPL instabilities in a water-saturated homogeneous porous medium. *Comptes Rendus Geoscience*, 342: 881-891.

Powers, S.E., Anckner, W.H., and Seacord, T.F. (1996). Wettability of NAPL-contaminated sands. *J. Environ. Eng.*, October: 889-896.

Stone Environmental, Inc., 2019. *Phase II Environmental Site Assessment Report: Long Falls Paperboard Facility, Brattleboro, Vermont*, October 14.

Stone Environmental, Inc., 2020. *File Review Summary 0 Long Falls Paperboard No. 6 Fuel Oil Release (SMS #1990-0482)*, March 27.

Rambol Environ, 2015. Phase I Environmental Site Assessment and Limited Environmental Compliance Review of Fibermark North America, Inc., Brattleboro, Vermont, June.

Vermont Department of Environmental Conservation, 2019. *Investigation and Remediation of Contaminated Properties Rule*, July 6.

Weston & Sampson, 2018. Limited Baseline PFAS Sampling, December 2018, Tables 1 and 2.

OBSERVATIONS AND REMARKS

Project Name/Description: LFP Fuel Oil SI Soil Assessment + well installation	 STONE ENVIRONMENTAL 535 Stone Cutters Way / Montpelier / VT / 05602 / USA 802.229.4541 / info@stone-env.com / www.stone-env.com
SEI Project #: 14-015	Client/Sponsor: Town of Brattleboro

12/14/20

- on-site @ 9 am
 - LJR + Cascade already on-site
 - Signed in + spoke to Gabby Constantin upon arrival
 - began drilling at IP-3D at 10:30 am
 - drilled to 80' at IP-3D
 - off-site @ 1615
- Driller: Frank Gardella
Helper: Marshall Daniels

12/15/20

- on-site @ 8 am
 - Cascade on-site already setting up
 - continued drilling at IP-3D
 - drilled to 170' at IP-3D
 - off-site @ 1630
- IP-3D: soil recovered in 10-foot increments, recovered in 5-foot increment for a few consecutive runs, incorrectly identified as 5-foot runs for entire boring in log

12/16/20

- on-site @ 8 am
 - Cascade on-site already setting up
 - Set monitoring well at IP-3D, screened 105-110' 0.3-99' (E) SWR 12/14/20
 - Sand pack - 102-110' bentonite 99-102', native fill ~~to 0.3'~~ below surface, cement + flush-mounted roadbox at surface
 - began drilling at IP-1D at ~11:30 am
 - hand cleared IP-1D due to potential presence of utility
 - background PID reading increased to ~0.3 around time of measurement of IP-1D 22' and onwards
 - drilled to 70' at IP-1D
 - off-site @ 1615
- *spoke to Gabby regarding snow removal for 12/17

Signed: Paul Robby

Date: 12/14/20 - 12/18/20
12/21/20 - 12/23/20
 Page: 1 of 3

OBSERVATIONS AND REMARKS

Project Name/Description: LFP Fuel Oil SI Soil Assessment + well installation	 STONE ENVIRONMENTAL 535 Stone Cutters Way / Montpelier / VT / 05602 / USA 802.229.4541 / info@stone-env.com / www.stone-env.com
SEI Project #: 19-015	Client/Sponsor: Town of Brattleboro

12/17/20

- on-site at 7:45 am
- Cascade already on-site
- received ~1" of snow overnight, 7:45-9:00 cleared snow around IP-11D
- 9:00- drill rig would not start, cancelled drilling for the day
- off-site at 9:15 am

12/18/20

- on-site at 8:15 am
- Cascade already on-site setting up
- continued drilling at IP-11D, advanced to 110'
- set monitoring well at IP-11D, screened 105-110' sand pack - 103-110', bentonite chips 100-103', native fill to 24' drillers to finish well construction on Monday 12/21
- Frank the driller said he needs to leave by 3 pm
- off-site at 3:15 pm

12/21/20

- LSR on-site @ 7:20 Cascade completing IP-01D well construction and setting up @ IP-28. Calibrated PID Plog corrected, SYR 12/22/20
- 09:10 begin IP-28. Plog interval ID indicating 5' deeper than actual (e.g. 5-10' is recorded as 10-15'). Raw data is correct
- 14:30 drilling stopped to get more water. LSR+SR installed staff gauge in CT River
- 15:00 drilling resumed

12/22/20

- SYR on-site @ 8 am, Cascade already on-site
- continued drilling at IP-28, advanced to 110'
- set monitoring well at IP-28, screened 105-110' sand pack 102-110', bentonite chips 99-102', native fill to ~0.3-99', cement + flush-mounted road box at surface

Signed: _____

[Handwritten Signature]

Date: _____

12/14/20-12/18/20
 12/21/20-12/23/20 3
 Page: 2 of 3

OBSERVATIONS AND REMARKS

Project Name/Description:

LFP Fuel Oil SF
Soil Assessment + Well Installation

STONE ENVIRONMENTAL

535 Stone Cutters Way / Montpelier / VT / 05602 / USA
802.229.4541 / info@stone-env.com / www.stone-env.com

SEI Project #:

19-015

Client/Sponsor:

Town of Brattleboro

12/22/20 (cont'd)

- began drilling at 10-25 @ 11:30, terminated boring at target depth of 80' at 16:00
- collected soil samples 1P25-52' and 1P25-52'-FD where highest PID reading located
- 14:00: attempted purged 1P-3D, purged about 1/6 volume of 55-gal drum (between 5 + 10 gal?) before tubing slipped to bottom of well + valve clogged with silt.
- off-site @ 17:00
- cascade off-site @ ~ 16:15

12/23/20

- SYR on-site @ 8:15 am, Cascade already on-site
- driller + rig info not savings in Plog, drill rig = Boart Longyear 100C
- 8:15 - drilled & cemented roadbox at 1P-10 + 1P-28, changed jaws on rig, broke, attempted to fix screw on drill rig, backfilled 1P-28 with soil, purged 1P-3D with cement bit surface, minimized to 1P-26
- SYR purged 1P-3D with new 1/2" tubing until water was clear, filled 2/3 of 55-gal drum
- ran out of 1/2" tubing + could not purge 1P-28
- 12:30 - began drilling at 1P-26, advanced to 50'
- 15:30 - Cascade off-site
- 15:30-16:00 - attempted to purge 1P-28 w/ 3/8" tubing, unsuccessful, must be issue with valve
- 16:15 - met Phil Jones from Green Mtn. Messenger + gave him samples from 1P-25 plus field duplicate. Con-Test will pick-up from Green Mtn tomorrow
- 16:30 - off-site

Signed: Pat RataDate: 12/14/20-12/18/20,
12/21/20-12/23/20Page: 3 of 3

Location Long Falls Paper Date 12/30/20
 Project / Client 19-015 / LFP

0645: stone onsite, obj. complete soil borings in NAPL source area to 80'. weather: ~10°F, P. cloudy.

Frank w/ cascade on-site. Cal'd PID, Cascade warming drill rig. 0700 continue drilling IP-26.

1025 reached target depth of 80' end of boring. Cascade helper on-site (Rob)

1030 collected IP-26-63.0 (VOCs, EPH, SVOCs) from interval exhibiting highest PID values (~3-4 ppm) and unit was wet. cuttings.

Cascade tries out tooling. Borehole back filled w/ V patched asphalt w/ concrete Pad.

~1140-1200 cascade off-site for lunch

Begin IP-27. started getting into NAPL ~ 40 ft bgs. Heaviest staining ~ 45-57.50 ft then becoming less impacted.

1550 collected IP-27-56.0 (SLP VOCs, % moisture, SLP EPH, SLP SVOCs) in most saturated portion

1600 collected IP-27-59.0 (VOCs, EPH, SVOCs) plus highest PID reading (120.4 ppm).

Post-6 EOD check on PID & wrap up for day. To continue @ 60-80' tomorrow

1610 Cascade off-site, 1620 Stone off-site
 Daniel J. Cunn 12/30/20

Location Long Falls Paper Date 12/31/20
 Project / Client 19-015 / LFP

0650 stone + cascade on-site. weather: ~52°F, light rain. obj. complete IP-27 to 80'.

Rig warming, DTC cal'd PID 0715 continue IP-27 @ 60'.

~820 target depth of 80' reached, end of boring. Heaviest NAPL contamination appears to be in ~55-57.5 & 71.5-75.0' ft

bgs w/ varying degrees of contamination present between. See boring log details for more observations & comparative saturation.

NAPL appeared to end @ 75.6' & transitional to clean, med. to Co, br, Suel. PID = 0.1 @ 75.78.0'

Soil cuttings & NAPL impacted consumables put in 55-gal drum (1.5 drums).

850 cascade begins tripping tooling & grouting borehole during extraction.

Note: PID reading high (110.2 ppm) at EOD.

930 LBR onsite for survey.

Drill rig process water / deion water from IP-27 put in drum. All drums + trash

moved to designated area-eastern parking lot survey complete. Cascade to finish demobilizing and will be off-site soon. Stone off-site @ 1240
 Daniel J. Cunn

OBSERVATIONS AND REMARKS

Project Name/Description: LFP Fuel Oil SI well Development + Staff Gauge Installation	 STONE ENVIRONMENTAL 535 Stone Cutters Way / Montpelier / VT / 05602 / USA 802.229.4541 / info@stone-env.com / www.stone-env.com
SEI Project #: 19-015	Client/Sponsor: Town of Brattleboro

- on-site @ 1030
- Cascade + LSR on-site installing IP-28
- IP-10 - depth to water = 67.80' from TOC
- began developing IP-10 at 11:13, issues purging using Wadman, purged by hand beginning at 11:39, ceased purging at 12:05, purge ~2 gal, water clear during entire duration of purge
- IP-30 - depth to water = 67.55' from TOC
- attempted to develop IP-30 from ~12:30 - 14:15, unable to purge water from well, well attempt again tomorrow with larger diameter tubing (may be issue with valve)
- ~14:30 - installed staff gauge in river beside pump house
- LSR off-site @ ~1545, took over logging soils 15:45 - 1600
- PID EOD check: 116.2 ppm
- off-site @ 420

Signed: Paul Rath Date: 12/21/20

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: 19-015 **Date:** 12/14/20 **Sampler (Sig/Date):** RL 11/14/20
SEI Project Number: Long Falls Paperboard Fuel Oil **Task:** Soil Assessment 12/14/20
Project Location: 161 Wulphaton Rd, Brattleboro VT **Checked By/Date:**
Weather Conditions (AM): 30s, overcast **Weather Conditions (PM):** high 30s, overcast

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Post Calibration Check		
Model NO.:	Start Time	/End Time		Start Time	/End Time		
Unit ID NO.:	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0		±0.1 pH Units			
pH (7)	SU	7.0		±0.1 pH Units	7.0		±0.3 pH Units
pH (10)	SU	10.0		±0.1 pH Units			
ORP	mV			±10 mV			±10 mV
Specific Conductance	µs/cm			±0.5% of Standard			±5% of Standard
Dissolved Oxygen	%			±2% of Standard			±0.5 mg/L of sat. val.
Temperature	°C						
Baro. Press.	mmHg						

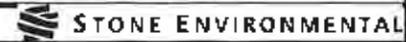
TURBIDITY METER		Meter Type:	Model NO.:	Unit ID NO.:
	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
	NTU			±0.3 NTU of stan. Or
	NTU			1.0 NTU or less. ±5%
	NTU			of standards >5 NTU

PHOTONIZATION DETECTOR		Meter Type:	Model NO.:	Unit ID NO.:
	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
Background	ppmv	0.0	0.0	within 5 ppmv of BG
Span Gas	ppmv	100	102.7	±10% of standard

O ₂ -LEL 4 GAS METER		Meter Type:	Model NO.:	Unit ID NO.:
	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)
Methane	%	50		±10% of standard
O ₂	%	20.9		±10% of standard
H ₂ S	ppmv	25		±10% of standard
CO	ppmv	50		±10% of standard

Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
 Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD	Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source:	pH (4)	
Trip Blank Source:	pH (7)	
Sample Preservative Source:	pH (10)	
Disposable Filter Type:	ORP	
DO Calibration Fluids Source:	Spec. Conductivity	
Other:	Turb. Stan.	
	Turb. Stan.	
	Turb. Stan.	
	PID Scan Gas	
	O ₂ -LEL	
	Other	



* - Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. ** - If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: 19-015 Date: 12/15/20 Sampler (Sig/Date): Sub #1 12/15/20
 SEI Project Number: Long Falls Paperboard Fuel Oil SI Task: Soil Assessment + monitoring well installation
 Project Location: 161 Wellington Rd, Brentwood Checked By/Date: _____
 Weather Conditions (AM): 20s, sunny + clear Weather Conditions (PM): 20s, sunny + clear

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		*Acceptance	Start Time	/End Time	
Unit ID NO.:	Units	Standard Value	Meter Value	Criteria (AM)	Standard Value	Meter Value	Criteria (PM)
pH (4)	SU	4.0	_____	±0.1 pH Units	7.0	_____	±0.3 pH Units
pH (7)	SU	7.0	_____	±0.1 pH Units			
pH (10)	SU	10.0	_____	±0.1 pH Units			
ORP	mV	_____	_____	±10 mV	_____	_____	±10 mV
Specific Conductance	µs/cm	_____	_____	±0.5% of Standard	_____	_____	±5% of Standard
Dissolved Oxygen	%	_____	_____	±2% of Standard	_____	_____	±0.5 mg/L of sat. val.
Temperature	°C	_____	_____	_____	_____	_____	_____
Baro. Press.	mmHg	_____	_____	_____	_____	_____	_____

TURBIDITY METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	*Acceptance
			Criteria (AM)	Criteria (PM)
NTU	_____	_____	±0.3 NTU of stan. Of	±0.3 NTU of stan. Of
NTU	_____	_____	1.0 NTU or less. ±5%	1.0 NTU or less. ±5%
NTU	_____	_____	of standards >5 NTU	of standards >5 NTU

PHOTONIZATION DETECTOR		Meter Type: <u>Ion Science Tiger</u>	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	*Acceptance
			Criteria (AM)	Criteria (PM)
Background	ppmv	0.0	within 5 ppmv of BG	within 5 ppmv of BG
Span Gas	ppmv	100	±10% of standard	±10% of standard

O ₂ -LEL 4 GAS METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	*Acceptance
			Criteria (AM)	Criteria (PM)
Methane	%	50	±10% of standard	±10% of standard
O ₂	%	20.9	±10% of standard	±10% of standard
H ₂ S	ppmv	25	±10% of standard	±10% of standard
CO	ppmv	50	±10% of standard	±10% of standard

Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
 Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD		Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source:	_____	pH (4)	_____
Trip Blank Source:	_____	pH (7)	_____
Sample Preservative Source:	_____	pH (10)	_____
Disposable Filter Type:	_____	ORP	_____
DO Calibration Fluids Source:	_____	Spec. Conductivity	_____
Other:	_____	Turb. Stan.	_____
		Turb. Stan.	_____
		Turb. Stan.	_____
		PID Scan Gas	_____
		O ₂ LEL	_____
		Other	_____

NOTES: EDD calibration out of range



* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. ** - If meter reading is not within acceptance criteria, clean/replace probe and re calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: Long Falls Boardwalk Fuel Oil ST Date: 12/14/20 Sampler (Sig/Date): 12/14/20
 SEI Project Number: 19-015 Task: Soil assessment + monitoring well installation
 Project Location: 161 Well-Newton Rd, Brattleboro Checked By/Date: _____
 Weather Conditions (AM): low 20s, cloudy Weather Conditions (PM): 20s, cloudy

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		*Acceptance	Start Time	/End Time	
Unit ID NO.:	Units	Standard Value	Meter Value	Criteria (AM)	Standard Value	Meter Value	Criteria (PM)
pH (4)	SU	4.0	_____	±0.1 pH Units	7.0	_____	±0.3 pH Units
pH (7)	SU	7.0	_____	±0.1 pH Units			
pH (10)	SU	10.0	_____	±0.1 pH Units			
ORP	mV	_____	_____	±10 mV	_____	_____	±10 mV
Specific Conductance	µs/cm	_____	_____	±0.5% of Standard	_____	_____	±5% of Standard
Dissolved Oxygen	%	_____	_____	±2% of Standard	_____	_____	±0.5 mg/L of sat. val.
Temperature	°C	_____	_____	_____	_____	_____	_____
Baro. Press.	mmHg	_____	_____	_____	_____	_____	_____

TURBIDITY METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	Criteria (AM)
NTU	_____	_____	_____	±0.3 NTU of stan. Of
NTU	_____	_____	_____	1.0 NTU or less. ±5%
NTU	_____	_____	_____	of standards >5 NTU

PHOTIONIZATION DETECTOR		Meter Type: <u>Ion Science Tiger</u>	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	Criteria (AM)
Background	ppmv	0.0	_____	within 5 ppmv of BG
Span Gas	ppmv	100	<u>49.3</u>	±10% of standard

O ₂ -LEL 4 GAS METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance	Criteria (AM)
Methane	%	50	_____	±10% of standard
O ₂	%	20.9	_____	±10% of standard
H ₂ S	ppmv	25	_____	±10% of standard
CO	ppmv	50	_____	±10% of standard

Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
 Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD	Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source: _____	pH (4) _____	_____
Trip Blank Source: _____	pH (7) _____	_____
Sample Preservative Source: _____	pH (10) _____	_____
Disposable Filter Type: _____	ORP _____	_____
DO Calibration Fluids Source: _____	Spec. Conductivity _____	_____
Other: _____	Turb. Stan. _____	_____
	Turb. Stan. _____	_____
	Turb. Stan. _____	_____
	PID Scan Gas _____	_____
	O ₂ (1) _____	_____
	Other _____	_____

NOTES:
 PID background reading began drifting upward ^{12/14/20} around 12:00 in afternoon around reading for 10-10 22!



* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SDPs for Field Instrument Calibration [EQASOP FieldCalibrat] and Low Stress Purging and Sampling [EQASOP-GW001], each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. **= If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: LFP Fuel Oil SE Date: 12/18/20 Sampler (Sig/Date): Paul Wint
 SEI Project Number: 19-015 Task: Soil assessment + monitoring well installation
 Project Location: 1st Wellington Rd, Brattleboro Checked By/Date: _____
 Weather Conditions (AM): 20s, blizzard cloudy Weather Conditions (PM): 20s, sunny

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Post Calibration Check		
Model NO.:	Start Time	/End Time		Start Time	/End Time		
Unit ID NO.:	Units	Standard Value	Meter Value	Standard Value	Meter Value	Acceptance Criteria (AM)	Acceptance Criteria (PM)
pH (4)	SU	4.0	_____	±0.1 pH Units	7.0	_____	±0.3 pH Units
pH (7)	SU	7.0	_____	±0.1 pH Units			
pH (10)	SU	10.0	_____	±0.1 pH Units			
ORP	mV	_____	_____	±10 mV			±10 mV
Specific Conductance	µs/cm	_____	_____	±0.5% of Standard			±5% of Standard
Dissolved Oxygen	%	_____	_____	±2% of Standard			±0.5 mg/L of sat. val.
Temperature	°C	_____	_____				
Baro. Press.	mmHg	_____	_____				

TURBIDITY METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	Acceptance Criteria (AM)	Acceptance Criteria (PM)
NTU	_____	_____	±0.3 NTU of stan. Of 1.0 NTU or less. ±5% of standards >5 NTU	_____
NTU	_____	_____		_____
NTU	_____	_____		_____

PHOTONIZATION DETECTOR		Meter Type: <u>Ion Science Tiger</u>	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	Acceptance Criteria (AM)	Acceptance Criteria (PM)
Background	ppmv	0.0	within 5 ppmv of BG	0.0
Span Gas	ppmv	100	±10% of standard	100

O ₂ -LEL & GAS METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	Acceptance Criteria (AM)	Acceptance Criteria (PM)
Methane	%	50	±10% of standard	50
O ₂	%	20.9	±10% of standard	20.9
H ₂ S	ppmv	25	±10% of standard	25
CO	ppmv	50	±10% of standard	50

Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
 Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD	Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source: _____	pH (4) _____	_____
Trip Blank Source: _____	pH (7) _____	_____
Sample Preservative Source: _____	pH (10) _____	_____
Disposable Filter Type: _____	ORP _____	_____
DO Calibration Fluids Source: _____	Spec. Conductivity _____	_____
Other: _____	Turb. Stan. _____	_____
	Turb. Stan. _____	_____
	Turb. Stan. _____	_____
	PID Scan Gas _____	_____
	O ₂ L ₂ _____	_____
	Other _____	_____



* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. ** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: Loug Falls Paperboard Date: 12/21/20 Sampler (Sig/Date): SR 12/21/20
 SEI Project Number: 19-015 Task: Install JP-28
 Project Location: Brattleboro, VT Checked By/Date: _____
 Weather Conditions (AM): ~30°F, cloudy Weather Conditions (PM): _____

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		Standard Value	Meter Value	Standard Value	Meter Value
Unit ID NO.:	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	_____	±0.1 pH Units	7.0	_____	±0.3 pH Units
pH (7)	SU	7.0	_____	±0.1 pH Units		_____	±10 mV
pH (10)	SU	10.0	_____	±0.1 pH Units		_____	±5% of Standard
ORP	mV	_____	_____	±10 mV	_____	_____	±0.5 mg/L of sat. val.
Specific Conductance	µs/cm	_____	_____	±0.5% of Standard	_____	_____	_____
Dissolved Oxygen	%	_____	_____	±2% of Standard	_____	_____	_____
Temperature	°C	_____	_____	_____	_____	_____	_____
Baro. Press.	mmHg	_____	_____	_____	_____	_____	_____

TURBIDITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		Standard Value	Meter Value	Standard Value	Meter Value
Unit ID NO.:	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
	NTU	_____	_____	±0.3 NTU of stan. Of 1.0 NTU or less. +5% of standards >5 NTU	_____	_____	±0.3 NTU of stan. Of 1.0 NTU or less. ±5% of standards >5 NTU

PHOTIONIZATION DETECTOR					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		Standard Value	Meter Value	Standard Value	Meter Value
Unit ID NO.:	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
Background	ppmv	0.0	<u>0.0</u>	within 5 ppmv of BG	0.0	_____	within 5 ppmv of BG
Span Gas	ppmv	100	<u>99.4</u>	±10% of standard	100	_____	±10% of standard

O ₂ -LEL 4 GAS METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		Standard Value	Meter Value	Standard Value	Meter Value
Unit ID NO.:	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
Methane	%	50	_____	±10% of standard	50	_____	±10% of standard
O ₂	%	20.9	_____	±10% of standard	20.9	_____	±10% of standard
H ₂ S	ppmv	25	_____	±10% of standard	25	_____	±10% of standard
CO	ppmv	50	_____	±10% of standard	50	_____	±10% of standard

- Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
- Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD		Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source:	_____	pH (4)	_____
Trip Blank Source:	_____	pH (7)	_____
Sample Preservative Source:	_____	pH (10)	_____
Disposable Filter Type:	_____	ORP	_____
DO Calibration Fluids Source:	_____	Spec. Conductivity	_____
Other:	_____	Turb. Stan.	_____
NOTES:	_____	Turb. Stan.	_____
		Turb. Stan.	_____
		PID Scan Gas	_____
		O ₂ -LEL	_____
		Other	_____



* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. ** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

Stone Environmental, Inc. Field Instrument Calibration Record

Project Name: Long Falls Paperboard Fuel oil SE Date: 12/22/20 Sampler (Sig/Date): SYR 12/22/20
 SEI Project Number: 19-015 Task: Soil assessment + well installation
 Project Location: Brattleboro, VT Checked By/Date: _____
 Weather Conditions (AM): low 30s, cloudy + foggy Weather Conditions (PM): 30s, partly cloudy

MULTI-PARAMETER WATER QUALITY METER					Post Calibration Check		
Meter Type:	AM Calibration				Start Time	/End Time	
Model NO.:	Start Time	/End Time		*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH {4}	SU	4.0	_____	±0.1 pH Units	7.0	_____	±0.3 pH Units
pH {7}	SU	7.0	_____	±0.1 pH Units	_____	_____	_____
pH {10}	SU	10.0	_____	±0.1 pH Units	_____	_____	_____
ORP	mV	_____	_____	±10 mV	_____	_____	±10 mV
Specific Conductance	µs/cm	_____	_____	±0.5% of Standard	_____	_____	±5% of Standard
Dissolved Oxygen	%	_____	_____	±2% of Standard	_____	_____	±0.5 mg/L of sat. val.
Temperature	°C	_____	_____	_____	_____	_____	_____
Baro. Press.	mmHg	_____	_____	_____	_____	_____	_____

TURBIDITY METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	*Acceptance Criteria (PM)
NTU	_____	_____	±0.3 NTU of stan. Of 1.0 NTU or less. ±5% of standards >5 NTU	±0.3 NTU of stan. Of 1.0 NTU or less. ±5% of standards >5 NTU

PHOTONIZATION DETECTOR		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	*Acceptance Criteria (PM)
Background	0.0	0.0	within 5 ppmv of BG	within 5 ppmv of BG
Span Gas	100	117.5	±10% of standard	±10% of standard

O ₂ -LEL 4 GAS METER		Meter Type:	Model NO.:	Unit ID NO.:
Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	*Acceptance Criteria (PM)
Methane	50	_____	±10% of standard	±10% of standard
O ₂	20.9	_____	±10% of standard	±10% of standard
H ₂ S	25	_____	±10% of standard	±10% of standard
CO	50	_____	±10% of standard	±10% of standard

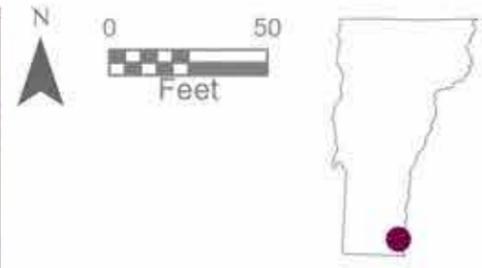
- Equipment calibrated within the Acceptance Criteria specified for each parameter listed above.
 Equipment not calibrated within the Acceptance Criteria specified for each parameter listed above**.

MATERIALS RECORD	Calibration Standard Lot #	Exp. Date
Deionized/Distilled Water Source: _____	pH {4}	_____
Trip Blank Source: _____	pH {7}	_____
Sample Preservative Source: _____	pH {10}	_____
Disposable Filter Type: _____	ORP	_____
DO Calibration Fluids Source: _____	Spec. Conductivity	_____
Other: _____	Turb. Stan.	_____
	Turb. Stan.	_____
	Turb. Stan.	_____
	PID Scan Gas	_____
	O ₂ LEL	_____
	Other	_____

NOTES: Calibrated PID twice at beginning of day, first reading = 117.5, second reading = 101.3. Inaccurate due to fog?



* - Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP GW001), each dated 1/19/2010. Additional acceptance criteria obtained from instrument specific manufacturer recommendations. ** - If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.



LEGEND

- Site Boundary
- Parcel Boundary
- No. 6 Fuel Oil Extent (Griffin, 1990)
- Existing Monitoring Well
- Production Well
- 2020 Sample Locations
- Monitoring Well
- Soil Boring
- Cross Section A-A'

131.00' Water Level Measurement

Water level measurements taken prior to low flow sampling, pressure transducer deployment and pressure transducer removal. Dates shown correspond to the three water level measurement events, respectively. IP-3D water level measurement shows only the events from low flow sampling and pressure transducer removal.

Measurements relative to assigned local site datum.

Source: Esri World Imagery, Stone Environmental, VCGI
 Path: O:\PROJ-19\EAR\19-015 Long Falls Paper Phase II
 ESA\GIS\MapDocuments\PpresentationsAndReports\19-015
 Long Falls Paper Phase II ESA\19-015 Long Falls Paper
 Phase II ESA.aprx Figure 5 - No. 6 Fuel Oil Sample
 Locations Exported: 2/15/2021 3:39 PM by Irajnak

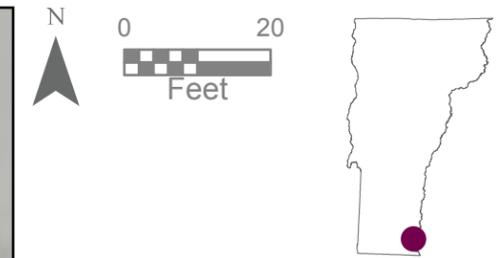
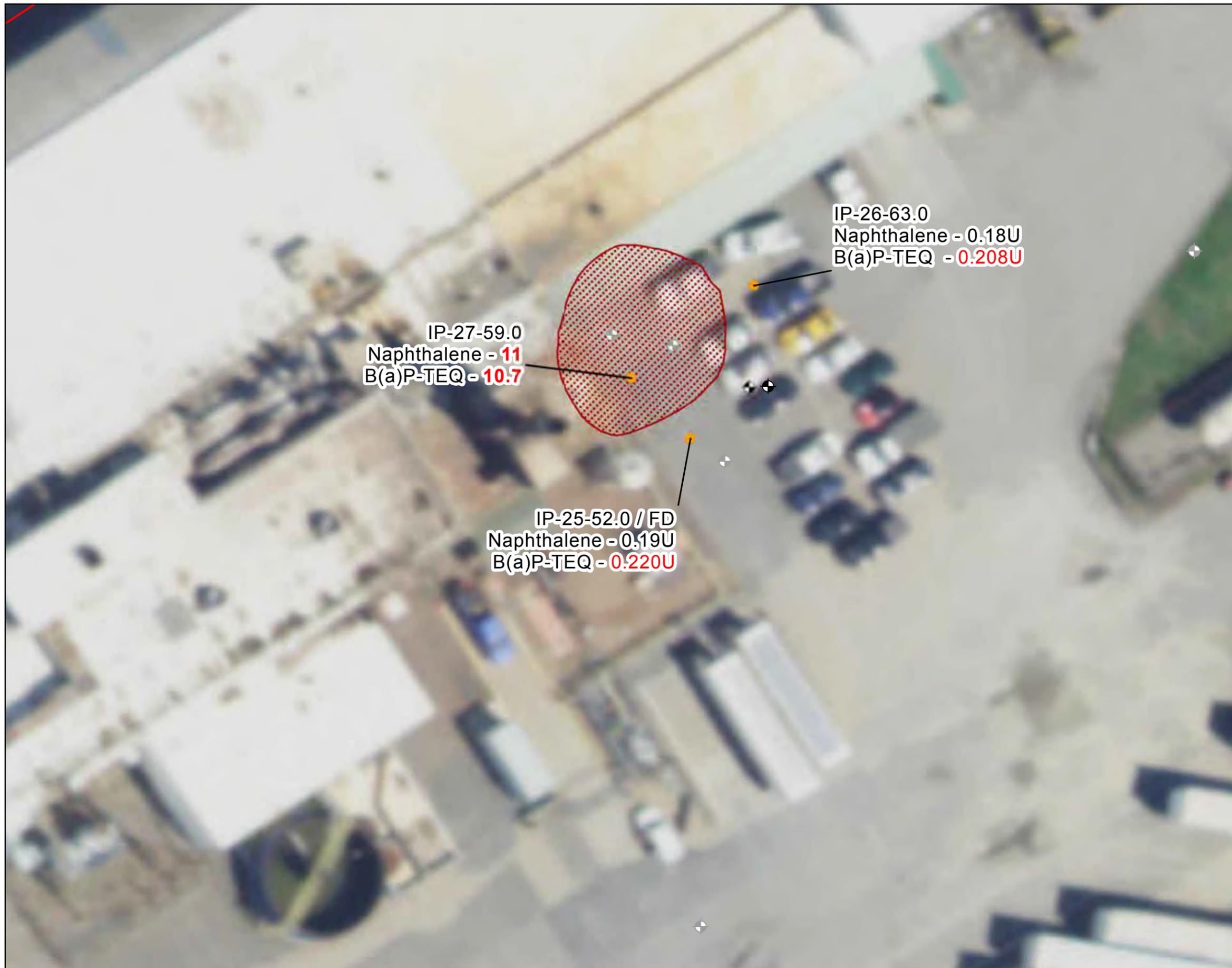
**Figure 5: No. 6 Fuel Oil
SSI Sample Locations**

Long Falls Paperboard
Supplemental Site Investigation

Prepared For
Town of Brattleboro, Vermont

STONE ENVIRONMENTAL

Shallow Well Deep Well



- LEGEND**
- Existing Monitoring Well
 - SSI Monitoring Well Location
 - Soil Boring
 - No. 6 Fuel Oil Extent (Griffin, 1990)

Notes:
 mg/kg - milligrams per kilogram (parts per million)
 Bold results indicate detections of the analyte
 Red results indicate an exceedence of the enforcement standard(s)
 U - Analyte not detected; limit of quantitation listed

Vermont Soil Standards (IRule, July 2019):
 Naphthalene Residential - 2.7 mg/kg
 Naphthalene Non-Residential - 16 mg/kg
 B(A)P-TEQ Residential - 0.07 mg/kg
 B(A)P-TEQ Non-Residential - 1.54 mg/kg

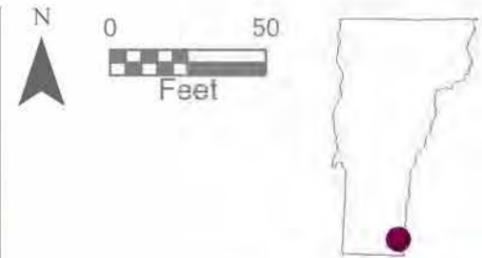
Source: Esri World Imagery, Stone Environmental, No. 6 Fuel Oil Extent derived from Report on the Investigation of Subsurface Petroleum Contamination Specialty Paperboard, Griffin International, Inc., July 1990.
 Path: O:\PROJ-19\EAR\19-015 Long Falls Paper Phase II ESA\GIS\MapDocuments\PpresentationsAndReports\19-015 Long Falls Paper Phase II ESA\19-015 Long Falls Paper Phase II ESA.aprx Figure 6 - No. 6 Fuel Oil Concentrations
 Soil Exported: 2/2/2021 10:32 AM by Irajnak

Figure 6: SVOC Concentrations in Soil

Long Falls Paperboard
Supplemental Site Investigation

Prepared For
Town of Brattleboro, Vermont

STONE ENVIRONMENTAL



LEGEND

- SSI Monitoring Well Location
- Soil Boring
- Existing Monitoring Well
- Production Well
- Site Boundary
- Parcel Boundary
- No. 6 Fuel Oil Extent (Griffin, 1990)

Notes:
 ug/L - micrograms per liter (parts per billion)
 Bold results indicate detections of the analyte
 U - Analyte not detected; limit of quantitation listed

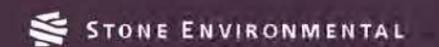
Vermont Groundwater Enforcement Standard (VGES):
 Methyl tert-Butyl Ether (MTBE) - 11 ug/L

Source: Esri World Imagery, Stone Environmental, No. 6 Fuel Oil Extent derived from Report on the Investigation of Subsurface Petroleum Contamination Specialty Paperboard, Griffin International, Inc., July 1990. Groundwater contours Path: O:\PROJ-19\EAR\19-015 Long Falls Paper Phase II ESA\GIS\MapDocuments\PpresentationsAndReports\19-015 Long Falls Paper Phase II ESA\19-015 Long Falls Paper Phase II ESA.aprx Figure 7 - No. 6 Fuel Oil Groundwater Exported: 2/4/2021 2:03 PM by Irajnak

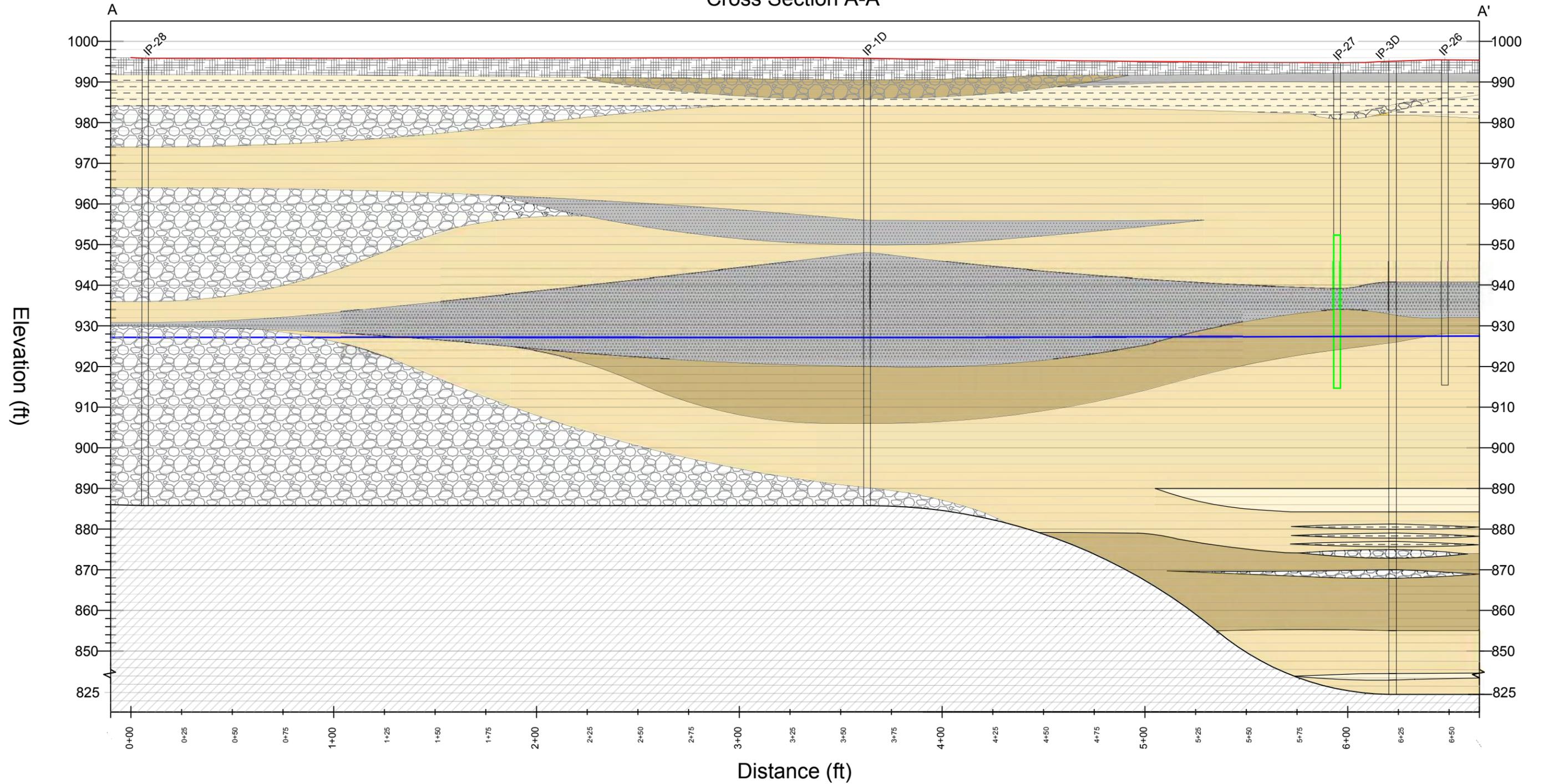
Figure 7: VOC Concentrations in Groundwater

Long Falls Paperboard
 Supplemental Site Investigation

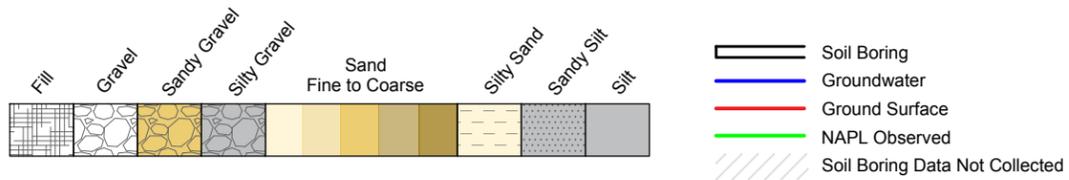
Prepared For
 Town of Brattleboro, Vermont



Cross Section A-A'



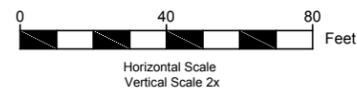
LEGEND



Notes:
 MW-3D transposed to fit cross section A-A'. Horizontal major grid lines from 1000' to 850' is 10' per unit. The vertical scale changes to 25' below 850'.

Sources:
 Ground elevation from site survey conducted by Stone Environmental Inc. 8/27/2019. A local site datum was assigned.
 Monitoring well locations were surveyed by Stone Environmental 12/31/2020.

#	Date	Drwn	Chk'd	App'd	Description



STONE ENVIRONMENTAL
535 Stone Cutters Way / Montpelier / VT / 05602 / USA
 802.229.4541 / info@stone-env.com / www.stone-env.com

A-A' Cross Section
Long Falls Paperboard
Supplemental Site Investigation
 Brattleboro Vermont

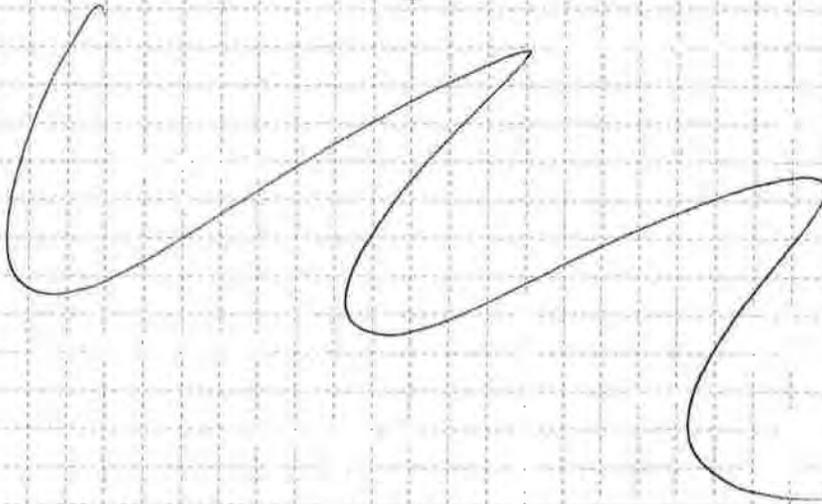
File: O:\PROJ\19\EAR\19-015 Long Falls Paper Phase II ESA\Drawings\AutoCAD\19-015_Survey_Data.dwg

Appendix B: Field Notes

OBSERVATIONS AND REMARKS

Project Name/Description: <div style="font-size: 1.5em; font-family: cursive;">LFP SSI</div>	STONE ENVIRONMENTAL <small>535 Stone Cutters Way / Montpelier / VT / 05602 / USA 802.229.4541 / info@stone-env.com / www.stone-env.com</small>
SEI Project #: S1E 11/24/20 20 of 19-015 4.2	Client/Sponsor: Town of Brattleboro

- on-site at 9:30 am, met Gabby
- VT underground locators on-site at 10 am
- 10 meter marking being locations + utility clearance near former UST area
- R2 accuracy - 17.3 cm
- 10:40 am: assessed stream gauge location. Bank grade not too steep, would permit installation. Stream bank consists of rip rap at edge of water, difficult to tell how far rip rap extends into river.
- VT underground locators. I'd 2 water lines in former UST area, IP-25 moved 3' southeast, IP-26 moved 5' east
- VT underground locators off-site at 12:30 pm
- 12:45 pm - began attempting collection of NAPL sample
- 67.80" depth to NAPL in MW-16
- recovered ~300 mL of NAPL from MW-16
- off-site at 3:15 pm
- spoke to Gabby upon leaving, she will provide records for production wells showing flow rates



Signed: Paul Paul Date: 11/24/20