FOCUSED FEASIBILITY STUDY REPORT

GEM CLEANERS SITE
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NEW YORK 11570
NYSDEC Site No. 130082
Work Assignment No. D007620-36

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233

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CERTIFICATION

I, David S. Glass, certify that I am currently a NYS registered professional engineer and that this Feasibility Study Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

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NYS Professional Engineer #	Date	Signature

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1.0 INTRODUCTION

1.1 Purpose and Organization

This Focused Feasibility Study (FFS) Report has been prepared for the Gem Cleaners Inactive Hazardous Waste Disposal Site (Site No. 130082), located at 84 North Village Avenue, Rockville Centre, New York. A Site Location Map is presented in **Figure 1**. A Site Plan is presented in **Figure 2**. This FFS Report was completed in accordance with New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Work Assignment (WA) No. D007620-36, 6 NYCRR Part 375, and DER-10 Technical Guidance for Site Investigation and Remediation (DER-10).

Between March 2018 and March 2019, a Remedial Investigation (RI) was completed for NYSDEC by TRC Engineers, Inc. (TRC) to investigate the nature and extent of soil, sub-slab vapor, indoor air, and groundwater contamination associated with the Site. The findings of the investigation are presented in an August 2019 RI Report (TRC).

This FFS Report describes remedial alternatives that may be implemented to address groundwater impacts identified by the RI. The FFS Report has been organized into seven sections as follows:

- Section 1 – Site background and summary of environmental setting.
- Section 2 – Identification of applicable Standards, Criteria and Guidance (SCGs) that are used to screen remedial technologies and assist in the selection process for potential remedial alternatives.
- Section 3 – Identification and screening of technologies and process options.
- Section 4 – Identification and descriptions of selected remedial alternatives.
- Section 5 – Detailed analysis of each proposed remedial alternative including supporting methodology information and preliminary cost estimates for each alternative.
- Section 6 – Comparative analysis of remedial alternatives.
- Section 7 – Recommended remedial alternative.
- Section 8 – A listing of references used for preparation of this report.

1.2 Site Location and Setting

The Gem Cleaners building was constructed circa 1951 and consists of a one-story building with a basement. The building encompasses a portion of a 0.2-acre parcel and the remainder of the parcel is improved with a two-story building with a basement adjacent to the south side of the Gem Cleaners building (Promise Nails and Spa), a driveway south of the two-story building, and a parking lot with a two-car detached garage west and southwest of the Gem Cleaners building. The Site Investigation Area which was the subject of the RI completed in March 2019

includes the Gem Cleaners building at 82 North Village Avenue and the area bounded by a public parking lot to the west, Washington Street to the south, North Village Avenue to the east, and a parking lot north of the Site building. Additional features and buildings in the Site Investigation Area include a one-story commercial building with multiple tenants north of the Gem Cleaners building at 86 to 96 North Village Avenue and landscaped areas/walkways west of the one-story commercial building, a two-story building with a first floor commercial tenant (Promise Nails and Spa) and a second floor residential apartment (which was under renovation at the time of the RI) adjacent to and south of the Gem Cleaners building at 82 North Village Avenue, a one-story commercial building (Georgette & Co. Hair Salon) at 78 North Village Avenue and a two story commercial building at 70 to 76 North Village Avenue both further south of the Gem Cleaners building, and a two-story residential building southwest of the Gem Cleaners Site at 23 Washington Street. As noted above, west and southwest of the Gem Cleaners building there is a two-car detached garage and a parking lot for the south-adjacent nail salon. The area is urban and moderately developed, primarily consisting of low-rise commercial, residential, and institutional buildings. A Site Location Map is presented in **Figure 1** and major physical features in the vicinity of the Site are shown on **Figure 2**.

1.3 Current and Historic Uses

The Gem Cleaners building is currently vacant. According to the Village of Rockville Centre Department of Public Works Amended Building Zoning Map, the Gem Cleaners Site is zoned for business (B-C). The Site is connected to a public water supply system. Article IV of the Nassau County Public Health Ordinance prevents the installation of private water system wells in areas served by public water systems.

The Gem Cleaners building historically operated as a dry cleaner and tailor shop (Gem Cleaners) between at least 1994 and 2006. The exact dates of operation and use of the Site building prior to the operation as a dry cleaner are unknown. During operation, Gem Cleaners reportedly used early generation dry cleaning equipment including a washer, dryer, cooker, sniffer, filters, air compressor, press, spotting board and vacuum system. With the exception of the vacuum system and air compressor, which were located in the southwest corner of the basement, the equipment was located on the first floor. All dry-cleaning equipment has been removed from the building. A small diameter floor drain, which was reportedly connected to a waste sink in the basement, was located on the first floor along with a conventional washing machine (also reportedly connected to the basement waste sink). Based on prior reports, Gem Cleaners used up to 200 gallons of PCE per year.

The basement of the Gem Cleaners building contains two inactive boilers (i.e., new boiler and old boiler), a boiler feedwater tank and condenser, two inactive 275-gallon fuel oil aboveground storage tanks (ASTs), a waste sink, and a sump. There is a storage area, which at the time of the RI contained five empty 55-gallon drums, located in the northwest portion of the basement. Additionally, there is a 5 foot by 5 foot by 8-inch deep depression (5’ by 5’ depression) in the basement floor near the old boiler. There is a floor drain (stairwell drain), which is a leaching

structure, in the bottom landing of the exterior stairwell located directly west of the basement. The stairwell drain is connected via a buried pipe to a 5-gallon bucket ("drain inlet") below the basement floor of the Gem Cleaners building. There is a steel cover/grate over the 5-gallon bucket. A basement floor plan showing major physical features is presented on Figure 3B of the RI Report.

The sump reportedly received boiler condensate and was fitted with a sump pump and hose that discharged to the waste sink. The purpose of the 5' by 5' depression in the concrete floor is unknown, but it appears to be associated with the old boiler (possibly remnants of a former equipment pad or a cut-out for equipment clearance), based on its proximity to the old boiler and associated piping. The bottom of the 5' by 5' depression is primarily concrete; however, the central portion of the floor of the depressed area was cracked, and a portion of the concrete can be removed, which permitted sampling of soil beneath the depression during the RI.

1.4 Geology and Hydrogeology

Based on the information gathered during the RI and previous investigations, the subsurface geology consists of primarily intermixed layers of sand and silty sand extending to a depth of approximately 100 feet below ground surface (bgs) (MW-101D and MW-107D). A clay layer was encountered in two borings advanced during the RI, MW-109M and MW-110D, at depths ranging from approximately 36 to 40 feet in MW-109M and from approximately 70 to 81 feet in MW-110D. Bedrock was not encountered during the RI drilling program or during prior Site investigations but is expected to be at depths greater than 700 feet bgs. Bedrock was not encountered to the terminal depth (approximately 562 feet bgs) during installation of a well owned by the Village of Rockville Centre (Well No. N9792) located approximately 1,200 feet east of the Site near Maple Avenue. Cross-sections A-A' and B-B' (**Figures 3A and 3B**) show the geology in the Site Investigation Area based on the boring logs completed for the RI.

According to the Surficial Geology Map of New York – Lower Hudson Sheet (1989), the material underlying the Site Investigation Area is classified as outwash sand and gravel. The material is described as: coarse to fine gravel with sand, proglacial fluvial deposition, well round and stratified, generally finer texture away from the ice border with a variable thickness (2 – 20 meters). According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS), subsurface soils in the Site Investigation Area are classified as Urban Land. According to the Bedrock Geology Map of New York State – Lower Hudson (1970, reprinted 1995), bedrock underlying the Site and surrounding area is classified as Monmouth Group, Matawan Group, and Magothy Formation of the Upper Cretaceous age.

During the April 2018 groundwater sampling event, groundwater surface elevations in the shallow monitoring wells ranged from approximately 9.13 feet in monitoring well MW-103 (located on the western side of the Gem Cleaners building) to 9.9 feet in monitoring well MW-101 (located north of the Gem Cleaners building in the

sidewalk along North Village Avenue). Groundwater surface elevations in the intermediate-depth and deep monitoring wells ranged from approximately 8.33 feet in monitoring well MW-110D (located in the sidewalk south of the Gem Cleaners building along Washington Street) to 9.23 feet in MW-107D (located west of the commercial building at 82 North Village Avenue). The apparent predominant groundwater flow direction in shallow overburden was towards the west-southwest in April 2018. The inferred predominant groundwater flow direction in deep overburden was towards the south in April 2018.

During the July 2018 groundwater sampling event, groundwater surface elevations in the shallow monitoring wells ranged from approximately 8.56 feet in monitoring well MW-109 (located in parking lot west of the Gem Cleaners building) to 9.31 feet in monitoring well MW-101 (located in the northeastern part of the RI site investigation area). Groundwater surface elevations in the intermediate-depth and deep monitoring wells ranged from approximately 7.13 feet in monitoring well MW-110D (located in the southwestern part of the RI site investigation area) to 8.44 feet in MW-109M (located south of the Gem Cleaners building). The inferred predominant groundwater flow direction in shallow overburden was towards the west-southwest in July 2018, which is consistent with the results of the April 2018 gauging event. The inferred predominant groundwater flow direction in intermediate/deep overburden was towards the south in July 2018, which is also consistent with the results of the April 2018 gauging event. Groundwater surface elevation measurements and inferred groundwater surface elevation contours, based on measurements in July 2018, are shown on **Figures 4A and 4B**.

1.5 Remedial Investigation and Remedial Action History

A summary of information related to potential sources of contamination, previous investigations, and remedial actions performed on or near the Site is presented below.

Phase II Environmental Subsurface Investigation - Energy & Environmental Analysts, Inc.

A Phase II Environmental Subsurface Investigation (ESI) was conducted by Energy & Environmental Analysts, Inc. (EEA) between 1994 and 1995 following the completion of a Phase I Environmental Site Assessment (ESA). The scope of the Phase II ESI included the advancement of a soil boring through a dry well located in the parking area southwest of the Gem Cleaners building and collection of soil samples at discrete intervals; installation of four monitoring wells [one upgradient (MW-3) and two downgradient (MW-1A and MW-1B) of the dry well and one downgradient (MW-2) of the sump in the basement of the Gem Cleaners building]; and three rounds of groundwater sampling. At the time of the Phase II ESI, the Site was occupied by Gem Cleaners, a dry-cleaning facility which used PCE, according to information in the Phase II Environmental Subsurface Investigation Report.

The results of the Phase II ESI identified PCE in one soil sample collected from 2 to 4 feet bgs in the boring advanced through the dry well at a concentration of 7 micrograms per kilogram (µg/kg), which was below the

NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4046 Recommended Soil Cleanup Objective (SCO) of 1,400 µg/kg (the applicable criteria at the time of the sampling) and is below the 6 NYCRR 375 Unrestricted Use SCO of 1,300 µg/kg and the Commercial Use SCO of 150,000 µg/kg. PCE was not detected in deeper soil samples selected for analysis from the boring advanced through the dry well (i.e., soil samples collected from 8 to 10 feet bgs, 13 to 15 feet bgs and 18 to 20 feet bgs). Groundwater was encountered at approximately 19 feet bgs in the soil boring advanced through the dry well.

PCE was detected in one monitoring well (MW-1A), located south of the exterior stairwell drain inlet, at concentrations above the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Standard ("Class GA Value") of 5 micrograms per liter (µg/L) during each sampling event. The concentrations of PCE detected in MW-1A ranged from 26 µg/L to 56 µg/L. With the exception of one compound, 1,1,2-dichlchloroethene, detected in MW-1A at a concentration of 47 µg/L (above the Class GA Value of 5 µg/L) during the September 1994 sampling event, there were no other compounds detected above Class GA Values, and the results of analysis of the groundwater samples collected from the remaining monitoring wells during each sampling event were below Class GA Values.

Site Assessment & Remediation Report – P.W. Grosser Consulting Engineer & Hydrogeologist, P.C.

P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. (PWGC) prepared a Site Assessment & Remediation Report in 1997 to document the findings of a Site inspection, and investigation and remediation consisting of excavation of the soil below the exterior stairwell adjacent to and west of the Gem Cleaners building. The objective of the Site inspection was to evaluate the potential for an on-Site source area that may have contributed to groundwater contamination.

PWGC completed the inspection of the Gem Cleaners Site building in January 1997. The inspection focused on the operations of the facility and the generation of liquid waste. Based on the findings of the Site inspection, PWGC concluded that the exterior stairwell drain inlet, which historically received waste from the Site's vacuum system vent, was likely the potential source of groundwater contamination. Additionally, since wastewater was reportedly disposed of in the toilet on the ground floor and the basement sump pit and floor drain likely discharged to the waste sink, dye testing was performed by PWGC to document discharge to the sanitary sewer. As part of the dye testing, water soluble tablets were placed in the toilet and waste sink and the manhole in the sidewalk east of the building was inspected. PWGC noted the presence of the dye in the manhole.

PWGC collected a soil sample from 12 to 18 inches below the bottom of the exterior stairwell drainage structure (a leaching structure) for analysis for PCE, trichloroethene (TCE), 1,2-dichloroethene (1,2-DCE), and vinyl chloride. PCE, TCE, and 1,2-DCE were detected in the soil samples at concentrations above the TAGM 4046 Recommended SCOs and current 6 NYCRR 375 Unrestricted Use SCOs but below current 6 NYCRR 375

Commercial Use SCOs. Vinyl chloride was not detected above the reporting limit. A soil boring was advanced through the exterior drain inlet and PCE-impacted soil was identified beneath the drain to approximately 8 feet bgs. The drainage structure at the bottom of the exterior stairwell was removed and surrounding impacted soil was excavated to approximately 8.5 feet bgs and disposed off-site. The excavation was backfilled with clean sand and a new drainage structure was installed in the stairwell landing to prevent flooding.

After implementation of the remedial action, PWGC concluded that the potential source of elevated PCE in groundwater had been removed; and therefore, the concentrations of PCE in MW-1A were expected to return to background levels through natural attenuation. Therefore, no additional investigation was recommended by PWGC.

Preliminary Site Characterization – Gem Cleaners – O'Brien & Gere Engineers, Inc.

O'Brien & Gere Engineers, Inc. (OBG) completed a Preliminary Site Characterization (PSC) in 2006. The scope of the PSC consisted of advancement of eight soil borings in the parking area southwest of the Gem Cleaners building to depths between 36 and 44 feet bgs (where refusal was encountered), laboratory analysis of nine soil samples, collection using a discrete screen point groundwater sampler and laboratory analysis of 15 groundwater samples from the eight borings, collection of a soil and water sample from the dry well (DW-1) in the parking lot for laboratory analysis, and collection of groundwater samples from two existing monitoring wells (MW-1B[1] and MW-2). Soil and groundwater samples and the water sample collected from the dry well were analyzed for VOCs. Note that monitoring wells MW-1A and MW-3 could not be found during the PSC.

VOCs were not detected at concentrations above the TAGM 4046 Recommended SCOs, Unrestricted Use SCOs or Commercial Use SCOs in the soil samples. PCE was detected in groundwater at three locations above the Class GA Value of 5 µg/L, at concentrations ranging from 11.2 to 313 µg/L. Cis-1,2-DCE was detected in groundwater at one location at a concentration of 5.11 µg/L, which is above the Class GA Value of 5 µg/L. The highest concentrations of PCE and 1,2-DCE were detected in the groundwater sample collected at a depth of 21 feet bgs from SB-6/GWS-6 located in the southwest corner of the parking lot, southwest of the Gem Cleaners building. In deeper groundwater samples, collected at depths of 34 feet and 44 feet bgs from SB-6/GWS-6, concentrations of PCE and cis-1,2-DCE were lower. There were no other VOCs detected in groundwater at concentrations above the Class GA Values and VOCs were not detected above Class GA Values in the water sample collected from the dry well. Groundwater flow direction could not be calculated from the data collected

[1] Note that the PSC Report indicates groundwater samples were collected from monitoring well MW-1A (a shallow well); however, based on the reported total depth of the well (60 feet bgs), groundwater samples were likely collected from monitoring well MW-1B.

due to the limited number of permanent monitoring wells, however, the reported direction of regional groundwater flow was from north to south.

Phase II Subsurface Investigation Report - General Consolidated Industries, Inc.

A Phase II Subsurface Investigation was conducted by General Consolidated Industries, Inc. (GCI) on February 7 and 8, 2018. The Phase II Subsurface Investigation included dye tests to confirm the discharge points of several drains in the Site building; the collection of soil samples from the dry well in the parking lot, the exterior stairwell drain, the sump, and from beneath the bottom slab of the 5' by 5' depression in the basement of the Gem Cleaners building ("Boiler Pit"); and collection of one groundwater sample from one existing well (MW-2). The soil samples were submitted to Long Island Analytical Laboratories for analysis for VOCs, semi-volatile organic compounds (SVOCs), and metals and the groundwater sample collected from MW-2 was submitted to Long Island Analytical Laboratories for analysis for VOCs.

Dye testing was completed by mixing a fluorescent tracer dye with water and introducing the solution to the interior drain points. The results of the dye testing indicate the following:

- Interior discharge points in the Gem Cleaners building (including bathrooms in the building and the wastewater sink located in the basement) were confirmed to discharge to the municipal sewer system located on North Village Avenue.
- The drywell located in the parking lot is a leaching structure, and also contains a 6-inch diameter overflow pipe. The overflow pipe leads to the western property line and discharges to the adjacent parking lot.
- The floor drain located at in the bottom landing of the exterior stairwell on the west side of the Gem Cleaners building basement is a leaching structure. The drain contains a pipe which runs under the basement floor slab to a 5-gallon bucket, below the building basement floor. A photograph of the exterior stairwell drain and interior drain inlet is presented below.

- The sump and 5' by 5' depression in the basement of the Gem Cleaners building were inspected and found to each be non-leaching structures.

There were no VOCs detected above the Unrestricted Use SCOs in the soil samples collected during the Phase II Subsurface Investigation, with the exception of acetone detected in the soil samples collected from the floor drain in the bottom landing of the exterior stairwell on the west side of the Gem Cleaners building and in the drywell. In the soil sample collected from the drywell located in the parking lot, two metals (lead and zinc), and two SVOCs (benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene) were detected at concentrations above the Unrestricted Use SCOs, but below the Commercial Use SCOs. In the soil sample collected from the floor drain in the stairwell, five SVOCs (benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) and four (4) metals (chromium[2], copper, lead, and zinc) were detected at concentrations above the Unrestricted Use SCOs; however, only one SVOC, benzo(a)pyrene, was detected marginally above the Commercial Use SCO. In the soil sample collected from the beneath the bottom of the sump in the basement of the Gem Cleaners building, six metals (chromium[2], copper, lead, manganese, nickel, and zinc) were detected at concentrations above the Unrestricted Use SCOs and one metal (copper) was detected at a concentration above the Commercial Use SCO. Finally, in the soil sample collected from beneath the bottom slab of the 5' by 5' depression in the basement of the Gem Cleaners building ("Boiler Pit"), one metal (zinc) was detected at a concentration above the Unrestricted Use SCO, but below the Commercial Use SCO.

No VOCs were detected in the groundwater sample from MW-2 at concentrations above laboratory reporting limits. However, GCI concluded that the drywell, exterior stairwell floor drain, 5' by 5' depression, and sump were not in compliance with applicable United States Environmental Protection Agency (USEPA) and Nassau County Department of Health (NCDOH) Underground Injection Control (UIC) program requirements.

Remedial Investigation - TRC

In 2018 and 2019, for NYSDEC, TRC conducted an RI for the Gem Cleaners Site. The RI field activities were completed between March 2018 and March 2019 and consisted of the following:

- An inspection of the storage area and 55-gallon drums in the closet in the northwest portion of the basement of the Gem Cleaners building.

[2] Based on the SCO for trivalent chromium.

- Advancement, using a direct-push drill rig, of three soil borings in the basement of the Site building (MW-103, MW-104, and MW-105), one soil boring at the bottom of the exterior stairwell, directly south of the drain inlet (MW-102), and one soil boring in the parking lot directly south of the dry well (SB-101). Soil samples were collected continuously during advancement of the direct push borings and 11 soil samples were selected for laboratory analysis from the direct-push soil borings.
- Installation of 10 shallow overburden groundwater monitoring wells (MW-101 through MW-110), one intermediate depth monitoring well (MW-109M), and three deep overburden groundwater monitoring wells (MW-101D, MW-107D, and MW-110D). During advancement of the boreholes for monitoring wells MW-101D, MW-106, MW-107D, MW-108, MW-109M and MW-110D soil samples were collected continuously. A total of 12 soil samples were selected for laboratory analysis.
- Collection and laboratory analysis of one sediment sample from the sump located in the basement of the Gem Cleaners building and one soil sample from beneath the bottom slab of the 5' by 5' depression in the basement of the Gem Cleaners building.
- Collection and laboratory analysis of one sediment sample from the bottom of the drain inlet located in the western portion of the Gem Cleaners building basement, adjacent to MW-103. Additionally, two rounds of samples of the standing liquid in the drain inlet were collected for laboratory analysis.
- Collection and analysis of two rounds of groundwater samples. During the first round, groundwater samples were collected from the 14 newly installed shallow, intermediate-depth and deep monitoring wells and three existing monitoring wells[3]. The second round consisted of the collection and analysis of groundwater samples from 12 groundwater monitoring wells. All 17 monitoring wells were gauged during each groundwater sampling event to obtain data for preparation of groundwater surface elevation contour maps.
- Collection and laboratory analysis of two samples of tracer dye previously utilized in the Gem Cleaners building.
- Vapor intrusion sampling in the Gem Cleaners building and in three adjacent/nearby structures. Two sets of co-located sub-slab vapor and indoor air samples were collected in the Gem Cleaners building and one set of co-located sub-slab vapor and indoor air samples was collected in each of the three adjacent/nearby structures. An additional indoor air sample was also collected on the first floor of the building located directly south of the Gem Cleaners building. Additionally, one outdoor ambient air sample was collected for laboratory analysis.

[3] Groundwater samples were collected from existing monitoring wells MW-1B, MW-2, and MW-3. Monitoring well MW-1A could not be found during the RI and was likely destroyed/damaged.

- A survey of physical features, known utilities, and property boundaries. Additionally, the locations and elevations (ground surface and top of well casing) of the existing and new monitoring wells and the locations and ground surface elevations of the interior and exterior drain inlets and the dry well were surveyed.

RI sample locations are shown on **Figure 5**. A summary of results of the RI is presented below. A detailed discussion of the results of the RI is presented in the August 2019 RI Report.

Soil and Sediment Sampling Results

Soil and sediment samples were analyzed for Target Compound List (TCL) VOCs+10 including 1,4-dioxane. In the sediment sample collected from the bottom of the drain inlet, two VOCs (acetone and 2-butanone) were detected at concentrations above Unrestricted Use SCOs but below Commercial Use SCOs. These compounds are common laboratory contaminants and are not contaminants of concern (COCs) associated with the Gem Cleaners Site. There were no VOCs detected in the remaining soil and sediment samples at concentrations exceeding the Unrestricted Use SCOs.

Groundwater Sampling Results

In general, groundwater flow direction in the shallow overburden aquifer, based on water level elevation measurements during groundwater sampling events, was determined to be predominantly towards the west-southwest. Measurements in the deeper wells indicated flow predominantly towards the south.

Groundwater samples were analyzed for TCL VOCs+10, natural attenuation parameters, and per- and polyfluoroalkyl substances (PFAS). PCE was the only VOC detected in groundwater samples at concentrations greater than Class GA Values. PCE concentrations ranged from non-detect to 52 µg/L and non-detect to 16 µg/L in groundwater samples collected from the shallow and intermediate depth monitoring wells in April 2018 and July 2018, respectively. PCE was detected at the highest concentration during both sampling events in the sample collected from monitoring well GC-MW-109M. PCE was not detected at concentrations greater than Class GA Values in samples collected from deep groundwater monitoring wells.

Results of analysis of groundwater indicated that insufficient concentrations of total organic carbon (TOC) were present in groundwater to support significant rates of reductive biological dechlorination of PCE. Additionally, observed positive oxidation-reduction potential (ORP) conditions during groundwater sampling and results of sulfate analyses indicated geochemical conditions favorable to reductive biological dechlorination of PCE are not present in the area.

Perfluorooctanoic acid (PFOA) was detected at concentrations between 14 and 63 nanograms per liter (ng/L) in the samples collected during the April and July 2018 groundwater sampling events. Perfluorosulfonoic acid (PFOS) was detected at concentrations between 12 and 23 ng/L in the samples collected during the April and July 2018 groundwater sampling events. It was determined that PFAS concentrations detected in groundwater may be representative of background concentrations in the area of the Site. As such, remedial actions for PFAS impacts to groundwater are not considered in this FFS Report.

Standing Liquid

A sample of the standing liquid in the drain inlet located in the western portion of the Gem Cleaners building basement was collected and analyzed for TCL VOCs+10, including 1,4-dioxane during the April 2018 groundwater sampling event. VOCs were not detected at concentrations above Class GA Values.

Samples of the standing liquid in the drain inlet were again collected during the April 2018 and July 2018 sampling events and analyzed for PFAS. PFOA was detected at concentrations of 100 and 210 ng/L in the samples collected during the April 2018 and July 2018 sampling events, respectively. PFOS was detected at concentrations of 12 and 23 ng/L in the samples collected during the April 2018 and July 2018 sampling events, respectively. TRC has prepared an IRM Work Plan to remediate PFAS detected during the RI in the Gem Cleaners basement drain inlet structure. As such, remedial actions to address the PFAS detected in the standing liquid in the basement drain inlet structure are not included in this FFS Report.

Soil Vapor Intrusion Sampling Results

Vapor intrusion sampling was completed in March 2018. The March 2018 vapor intrusion sampling event included the collection of two indoor air samples in the Gem Cleaners building, one indoor air sample in each of the three adjacent buildings, and one ambient air sample. Sub-slab vapor samples were collected concurrently with indoor air samples at each location. One additional indoor air sample was collected on the first floor of Promise Nails and Spa.

PCE was detected in sub-slab vapor at concentrations of 99 micrograms per cubic meter (µg/m³) and 170 µg/m³ in the basement of the Gem Cleaners building; at a concentration of 100 µg/m³ in the basement of Promise Nails Salon and Spa; and at a concentration of 43 µg/m³ in the basement of Georgette & Co. Hair Salon. PCE was not detected in the basement of the residential building. PCE was detected in each indoor air sample at concentrations between 0.37 µg/m³ and 1.1 µg/m³. PCE was detected at a concentration of 0.17 µg/m³ in the ambient air sample. The results of analyses of sub-slab vapor and indoor air samples were evaluated with respect to the New York State Department of Health (NYSDOH) Vapor Intrusion Decision Matrices and it was determined no further action with respect to PCE was necessary.

1.6 Conceptual Site Model

The following conceptual site model describes the nature and extent of the contaminants known to be present at the Site, the dominant fate and transport characteristics, potential exposure pathways, and potential impacts to receptors. The urban Site is not located in close proximity to a surface water body, wetland, or other ecologically significant area.

Based on the results of the RI and prior investigations, the primary COC at the Site is PCE in groundwater. Additionally, PFAS was detected in groundwater samples collected across the Site and in the standing liquid in the drain inlet in the basement of the Gem Cleaners building adjacent to MW-103.

PCE was not detected in the soil or sediment samples collected in the Site Investigation Area; however, physical evidence of contamination (staining, odor and elevated photoionization detector (PID) readings) was identified in one soil boring, MW-103, at depths from approximately 10 to 14 feet below the top of the basement slab in the Gem Cleaners building. Analysis of soil samples collected from MW-103 did not reveal impacts. However, historic sampling results showed limited SVOCs and metals above Unrestricted Use and/or Commercial Use SCOs in subsurface soil. Under current conditions, exposure to subsurface soil is not likely since the building is unoccupied and there are no exposed soil areas. Potential exposure could occur during soil disturbing activities (e.g., utility maintenance, or future redevelopment); however, the frequency and duration of exposure is expected to be low and would be mitigated by appropriate health and safety procedures.

PCE was detected in shallow and intermediate depth groundwater at concentrations above the Class GA Value. The estimated area of the PCE groundwater impacts, above Class GA Values, is approximately 3,000 square feet (refer to **Figure 6)**. However, there does not appear to be a remaining on-Site source that would warrant remediation, based on the detected maximum concentrations and considering that PCE was not detected in soil samples at concentrations above the Unrestricted Use SCOs. Further, the soil beneath the exterior stairwell drain (potential source of VOCs in groundwater) was remediated in 1997. Additionally, of note is that the July 2018 groundwater sampling results show only slight exceedances of the Class GA Value for PCE in the monitoring wells downgradient of the Gem Cleaners building and PCE was not detected above the Class GA Value in the wells furthest downgradient from the Gem Cleaners building (MW-109 and MW-110). The highest concentration of PCE was detected in MW-109M (52 µg/L in April 2018 [later decreasing to 16 µg/L in July 2018]). MW-109M is screened between 10 and 20 feet below the water table and partially extends into an apparent fine grained silty/clay layer, and, therefore, the conditions found in the adjacent shallow well (MW-109) are more representative of shallow groundwater (compared to MW-109M, which is partially screened in a more stagnant [i.e., less permeable] portion of the formation). Additionally, in April 2018, PCE concentrations showed a decrease in the downgradient direction from 35 µg/L in MW-108 to 12 µg/L in MW-109, and in July 2018, the concentration of PCE showed a decrease from 6 µg/L in MW-108 to 3.1 µg/L in MW-109. Therefore, it is expected that reductions in PCE concentration continue further

downgradient, to the southwest of MW-109, and the potential for migration of elevated concentrations of PCE in groundwater beyond the Site Investigation Area is considered low. PCE was not detected at a concentration above the Class GA Value in any of the deep groundwater monitoring wells during the RI.

Additionally, PFOA and PFOS were detected in groundwater; however, the concentrations of PFOA and PFOS in groundwater were relatively consistent across the Site during both sampling events which is an indication that the PFAS concentrations may be representative of background concentrations in the area of the Site. Elevated concentrations of PFOA and PFOS were detected in the standing liquid in the drain inlet adjacent to MW-103; however, it is unlikely that the drain inlet is the source of PFAS in groundwater since the ratios of specific PFAS (i.e., PFOA/PFBA) are different. The higher concentrations of the more mobile PFBA in the drain inlet sample versus the groundwater is a strong indication that the PFAS identified in the drain inlet sample are not impacting the groundwater. Further, concentrations of PFOA and PFOS detected in the groundwater sample collected from MW-103, the monitoring well closest to the drain inlet, are not higher than the concentrations detected in monitoring wells further from the drain inlet.

Groundwater was encountered at depths greater than 8 feet below the top of the basement slab (beneath the Gem Cleaners building) or 15 feet below ground surface in the Site Investigation Area, therefore contact with groundwater is generally unlikely, minimizing the potential for exposure to groundwater at the Site. Groundwater at the Site is not utilized for potable or non-potable purposes and ingestion and absorption of contaminated groundwater do not represent significant potential exposure pathways. There is a potential for exposure to contaminated groundwater during redevelopment and any associated dewatering activities; however, the frequency and duration of potential exposure to contaminated groundwater is expected to be low and would be mitigated by appropriate health and safety procedures. There is potential for exposure to contaminated standing water in the drain inlet in the Gem Cleaners building; however, currently the potential for exposure is minimal since the building is unoccupied. Additionally, an IRM for remediation and closure of the drain inlet structure is planned.

The results of indoor air sampling in the Gem Cleaners building and the three nearby and adjacent structures did not exceed NYSDOH Air Guideline Values (AGVs). Based on comparison of the vapor intrusion sampling results to the NYSDOH Vapor Intrusion Decision Matrices, no further action was recommended for the Gem Cleaners Site building, Georgette & Co. Hair Salon, and the residential building. Further action (i.e., identifying the source(s) and resampling or mitigation) was recommended to address carbon tetrachloride in the indoor air sample collected in the basement of the Promise Nails and Spa building. Xylenes and ethylbenzene were detected in indoor air and/or sub-slab vapor samples in the Gem Cleaners building, Georgette & Co. Hair Salon, and the Promise Nails and Spa and in the indoor air sample collected in the residential building; however, these compounds were not detected in groundwater and were either not detected or detected at low levels below the Unrestricted Use SCOs in soil in the Site Investigation Area. Further, concentrations of xylenes and ethylbenzene detected in indoor air are within the

range of published background levels. As a result, the presence of these compounds in sub-slab vapor and indoor air may be attributed to background concentrations (e.g., from household and/or commercial products) and/or a non-Site related source.

1.7 Qualitative Exposure Assessment

An exposure pathway consists of five elements: (1) a contaminant source, (2) a contaminant release, and transport mechanism, (3) a point of exposure, (4) a route of exposure, and (5) a receptor population. An exposure pathway is complete when all five elements of an exposure pathway are complete.

Based on the findings of the RI and prior investigations by others, the principal contaminant of concern in the Site Investigation Area has been identified as PCE, primarily in groundwater. During prior investigations, PCE was additionally detected at elevated concentrations in subsurface soil beneath the exterior stairwell drain (west of the Gem Cleaners building); however, the impacted soils were excavated and transported off-Site for disposal, a new drain was installed, and the area was backfilled with clean sand in 1997. Additionally, PFAS were detected in groundwater and in the standing liquid in the interior drain inlet in the western portion of the basement of the Gem Cleaners building. A qualitative assessment was prepared to evaluate and document the potential for exposure to Site-related contaminants.

Dermal contact, ingestion of soil or groundwater, or inhalation of vapors or dust represent the potential routes of exposure. Potential receptors include construction workers during demolition and redevelopment, future on-Site occupants and visitors, future on-Site maintenance workers, and off-Site residents.

Considering the current conditions at the Site, the following exposure pathways are considered incomplete:

- **Groundwater ingestion:** Use of groundwater in the area of the Site is prohibited as a source of potable water; therefore, this exposure pathway is not complete for potential on-Site and off-Site visitors, building occupants and residents.
- **Soil dermal contact by Site visitors, building occupants and off-Site residents:** The majority of the Site and surrounding area is covered by buildings, asphalt pavement or landscaped areas, thereby minimizing the potential for exposure of occupants to the subsurface soil.
- **Inhalation of vapors by Site visitors, building occupants and off-Site residents:** Site contaminants of concern were detected in soil vapor and/or indoor air; however, based on comparison to the NYSDOH Vapor Intrusion Decision Matrices, vapor intrusion is not a concern in the four structures sampled. Note that non-Site related contaminants, including xylenes and ethylbenzene, were detected in sub-slab vapor and/or indoor air in the four structures sampled; however, there is no known source of these compounds in soil and groundwater and considering ethylbenzene, o-xylene and m,p-xylenes were not detected in groundwater and were either not detected or detected at low levels below the Unrestricted Use SCOs in

soil in the Site Investigation Area, the presence of these compounds in sub-slab vapor and indoor air may be attributed to background concentrations and/or a non-Site related source.

The following exposure pathways are considered potentially complete:

- **Dermal contact with soil by construction workers and maintenance workers:** Potential future construction and maintenance activities (e.g., utility repairs) could result in contact with Site impacted soil (i.e., historic sampling results showed limited SVOCs and metals above Unrestricted Use and/or Commercial Use SCOs in subsurface soil).
- **Dermal contact with groundwater or drain inlet liquid by construction workers and maintenance workers:** The groundwater table is at depths greater than 8 feet below the top of the basement slab (in the Gem Cleaners building) or 15 feet below ground surface in the Site Investigation Area, therefore contact with groundwater is generally unlikely. The potential for exposure of workers to contaminated groundwater via contact exists if soil excavation is required at depths below the water table. Additionally, there is potential for exposure to contaminated standing water in the drain inlet in the Gem Cleaners building. As noted above, remediation and closure of the drain inlet structure as part of an IRM is planned.
- **Inhalation of dust by construction workers and maintenance workers:** Potential future construction and maintenance activities (e.g., utility repairs) could result in the generation of and exposure to impacted dust (i.e., historic sampling results showed limited SVOCs and metals above Unrestricted Use and/or Commercial Use SCOs in subsurface soil).

2.0 IDENTIFICATION OF STANDARDS, CRITERIA, GUIDANCE AND REMEDIAL ACTION OBJECTIVES

2.1 Introduction

In order to identify and screen potential remedial technologies, an initial identification of remedial action objectives (RAOs) and preliminary remediation goals (PRGs) is required. RAOs provide a general description of the objectives of a cleanup action. Furthermore, RAOs provide the basis for developing numerical remediation goals (the PRGs), which are used to identify the appropriate extent of a cleanup action. Regulatory criteria and risk-based levels are considered in identifying PRGs. This section also describes the potential standards, criteria, and guidance (SCGs) that a remedial action must achieve.

Once RAOs and PRGs are developed, general response actions (GRAs) are identified which satisfy the objectives. An initial evaluation is made of the areas and volumes of media to which the GRAs will be applied.

The GRAs are then used to develop a list of potential remedial technologies for each environmental matrix to be remediated. An initial screening of the technologies is conducted based on the technical implementability of the various technologies and their applicability to the Site. Site-specific characteristics or waste characteristics limit the applicability of certain technologies and are considered in determining which technologies are not appropriate for further consideration.

For the technologies that pass the initial screening, the associated technology process options are evaluated in greater detail to allow the selection of one process option to represent each technology type. The representative process option provides a basis for developing performance specifications that are used in evaluating that technology type; however, the specific process actually used to implement the remedial action may not be selected until the remedial design phase. To select a representative process, each process option is evaluated on the basis of effectiveness, implementability, and cost, with the greatest focus on effectiveness factors.

2.2 Remedial Action Objectives

RAOs are developed in order to set objectives for protecting public health and the environment early in the remedial alternatives development process. The objectives should be as specific as possible but should not unduly limit the range of alternatives that can be developed. The COCs discussed in Section 1.6 represent the specific contaminants of interest and allowable exposures are defined based on the SCGs (discussed in more detail in Section 2.3). RAOs should specify (1) the contaminants of concern; (2) the exposure route(s) and receptor(s); and (3) an acceptable contaminant level (or range of levels) for each exposure route.

The Site RI has identified PCE at concentrations greater than regulatory criteria in Site overburden groundwater. The area of PCE-impacted groundwater is estimated to be approximately 3,000 square feet, as shown on **Figure 6.**

The RAOs for the Site were developed in consideration of current known Site conditions and include the following:

- Eliminate or mitigate significant threats to public health and the environment;
- Restore the Site to pre-disposal/pre-release conditions, to the extent practicable, with pre-disposal conditions defined as:
    - Groundwater: Class GA Values
    - Soil: 6 NYCRR Part 375 Commercial Use SCOs
- Prevent direct contact (dermal absorption, inhalation and incidental ingestion) with contaminated groundwater and soil in the event pre-disposal conditions cannot be achieved.

SVOCs and metals historically detected in subsurface soil at concentrations above Commercial Use SCOs will be addressed via Site Management consisting of Institutional Controls (i.e., environmental easement or similar) and Engineering Controls (i.e., existing site cover). Details regarding Site Management activities are discussed in Section 5.0. As such, this FFS Report does not include any further specific consideration of impacts to soil.

2.3 Potentially Applicable Standards, Criteria, Guidance (SCGs), and Preliminary Remediation Goals

SCGs are defined as follows:

> "Standards and criteria are cleanup standards, standards of control, and other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance."
>
> "Guidance are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as standards and criteria; however, remedial alternatives should consider guidance documents that, based on professional judgment, may be applicable to the project."

Chemical-specific SCGs are usually health- or risk-based restrictions on the amount or concentration of a chemical that may be found in or discharged to the environment. These SCGs control remedial activities involving the design or use of certain activities, or regulate discrete actions.

2.3.1 Chemical-Specific SCGs

2.3.1.1 Groundwater PRGs

The New York State groundwater classification for the Site is GA, which indicates waters that could be used as a source of potable water supply. Federal and state drinking water standards were considered as potential groundwater chemical-specific SCGs, based on the groundwater classification. State groundwater quality standards and guidance values were also considered. Potential federal and state chemical-specific SCGs include Maximum Contaminant Levels (MCLs) published under the Safe Drinking Water Act (40 CFR 141 and 141.61-64), New York MCLs (10 NYCRR 5-1.52), and New York Groundwater Quality Standards (6 NYCRR 703). Potential groundwater SCGs additionally include federal secondary MCLs and groundwater quality standards and guidance values established in the Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 based on the GA groundwater classification.

As identified in Section 1.6, PCE is the COC in groundwater. The Class GA Value for PCE in groundwater is shown in **Table 1**.

2.4 General Response Actions

GRAs are remedial actions that will satisfy the RAOs identified in Section 2.2.

Impacts to groundwater were considered in determining appropriate GRAs. For groundwater, GRAs are identified and an initial evaluation of the areas or volumes to which the GRAs may be applied was conducted, as described below. In determining the volumes/areas of media, consideration was given to Site conditions, the nature and extent of contamination, acceptable exposure levels, and potential exposure routes.

2.4.1 Groundwater

As indicated in **Table 2**, GRAs identified for groundwater impacts, are as follows:

- No Action
- Site Management
- Containment
- Extraction/Treatment/Discharge
- In-Situ Treatment

As described in the RI Report, PCE has been detected at concentrations greater than the applicable criterion in samples collected from several Site groundwater monitoring wells (refer to Figure 11 of the RI Report).

3.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

The GRAs are developed further through the identification and screening of remedial technologies which would potentially meet the RAOs and PRGs. Following a screening of the remedial technologies on the basis of technical implementability, the process options associated with each technology were screened based on effectiveness, implementability, and cost. Representative process options were chosen for inclusion in the comprehensive remedial alternatives developed for the Site.

3.1 Technology Screening

Technology screening was performed to evaluate technologies for the remediation of groundwater, as presented in **Table 2**. The table includes a brief description of individual technologies or process options, and presents comments on applicability of each to the Site. The implementation of containment technologies (e.g., sheet-piles, slurry walls, etc.) was determined to be impractical due to the density of Site development. The effectiveness of *ex-situ* technologies (e.g., extraction and treatment) is limited by the density of Site development, which would interfere with the routing of piping and siting of treatment equipment, and the mass transfer limitations of relying on groundwater as a transport medium to effectively remediate the low concentrations of PCE in groundwater. Therefore, the technology screening process results indicate with respect to groundwater that the focus should be on Site Management and *in-situ* treatment technologies. The technology options that do not pass the screening process on the basis of technical implementability are indicated in **Table 2** and will not be retained for further consideration.

3.2 Process Option Screening

After identification of technologies that are technically implementable, the process options were further evaluated to select representative process options. The process options were evaluated on the basis of effectiveness, implementability, and cost. The groundwater process option evaluation is presented in **Table 3**. As indicated in the table, No Action, Site Management (i.e., groundwater sampling), Natural Attenuation, and Enhanced Reductive Bioremediation were selected as the process options to be included among the alternatives described in Section 4.0.

4.0 IDENTIFICATION OF ALTERNATIVES

4.1 Introduction

This section describes the development of several remedial options to achieve the RAOs identified above. PCE in groundwater has been identified as the potential risk to protection of public health at the Site. As such, the focus of this section and the following sections of the FFS Report is evaluation of alternatives for PCE in groundwater.

In consultation with NYSDEC, focused review of remedial technologies and options for applicability and feasibility was completed, as documented in **Table 3**. The technologies and process options identified in Section 3.0 were combined to form a limited number of remedial alternatives, including a no action alternative.

The remedial alternatives developed in this FFS provide treatment and attain remedial goals within different restoration periods. Site Management elements are evaluated as individual components of remedial alternatives that would result in residual contamination at the Site following implementation. Due to low concentrations of PCE in groundwater, an alternative including an innovative technology (e.g., thermal remediation) was not developed.

Three alternatives have been developed for evaluation. These alternatives were selected in consideration of the RAOs and based on an evaluation of the results of environmental investigations and site-specific conditions, an analysis of technological implementability, effectiveness, cost, and professional judgment.

For the alternatives developed for the Site, general descriptions of the alternatives and associated technologies are provided in Sections 4.3 through 4.5. Detailed analysis of the remedial alternatives is presented in Section 5.0.

4.2 Development of Alternatives

The RAOs, as presented in Section 2.2, were used as a guide in the development of remedial alternatives.

The list of alternatives is as follows:

1. No Action;
2. Implementation of Engineering and Institutional Controls and Site Management; and
3. Enhanced *In-Situ* Bioremediation (EISB), Implementation of Engineering and Institutional Controls, and Site Management.

4.3 Alternative 1: No Action

No Action as an alternative is only an option at sites that could benefit from natural processes which would degrade the contamination to levels below the cleanup goals. This alternative is considered as a baseline for comparison as required by DER-10. This alternative would not involve periodic monitoring to evaluate natural attenuation, but would include periodic evaluation of Site conditions.

4.4 Alternative 2: Implementation of Engineering and Institutional Controls and Site Management

Alternative 2 consists of the implementation of an Engineering Control consisting of a Site-wide cover comprised of the existing buildings, asphalt pavement, and landscaped areas. Institutional Controls consisting of an environmental easement (or similar instrument), restricting use of the Site to commercial purposes and prohibiting extraction and use of Site groundwater, and a Site Management Plan (SMP) would also be prepared and implemented. Implementation of the SMP would include semi-annual inspections of the Site-wide cover system, long-term periodic groundwater sampling to monitor for potential contaminant migration and natural physical attenuation (e.g., volatilization, dispersion, etc.), and reporting.

Refer to **Figure 6** for estimated extents of PCE concentrations in groundwater. The area of PCE concentrations greater than 5 µg/L is estimated to be approximately 3,000 square feet. Groundwater samples would be collected from monitoring wells MW-2, MW-104, MW-106, MW-107, MW-108, MW-109, and 109M and analyzed for VOCs and monitored natural attenuation (MNA) parameters. Shallow monitoring wells and the intermediate depth monitoring well (MW-109M) are included in the sampling program and are within, upgradient, and cross-gradient of the PCE plume. Groundwater monitoring would be performed semi-annually for 5 years, at which time future groundwater monitoring requirements would be evaluated.

4.5 Alternative 3: Enhanced In-Situ Bioremediation (EISB), Implementation of Engineering and Institutional Controls, and Site Management

Alternative 3 primarily consists of active remediation of PCE in groundwater via EISB. The objective of Alternative 3 would be to reduce concentrations of PCE to below 5 µg/L in Site groundwater (refer to **Figure 6)**. However, the potential exists for residual groundwater contamination. Therefore, the Institutional and Engineering Controls and an SMP with elements of Site Management included in Alternative 2 are also included in Alternative 3.

Prior to implementation of EISB USEPA and NCDOH requirements for UIC Program permitting would be identified. UIC Program approval would be obtained, as necessary.

A temporary amendment mixing and staging area would be constructed at the Site and a carbon source (e.g., lactate) and bioaugmentation cultures (i.e., *Dehalococcoides spp*.) would be injected via direct-push techniques to promote biological reduction of chlorinated ethenes. Post-injection groundwater monitoring would be

performed to evaluate the effectiveness of the injection program. Additional injections would be performed, as necessary.

For the limited purposes of this FFS Report, a conceptual arrangement of EISB injection locations within the estimated area of groundwater with PCE concentrations greater than 5 µg/L is shown on **Figure 7**. It is preliminarily estimated that 13 EISB points would be installed on approximately 20-foot centers. For cost estimating purposes, two injections events (in Year 1 and Year 3) are included in this FFS Report.

5.0 DETAILED ANALYSIS OF ALTERNATIVES

5.1 Introduction

This section provides a detailed analysis of the remedial alternatives described in Section 4.0 of this FFS Report. Each alternative is evaluated with respect to technical applicability and ability to protect against risks to public health and the environment. Additionally, each alternative is described in detail and compared on the basis of environmental benefits and costs using criteria established in 6 NYCRR Part 375, DER-10, and DER-31. A total of three remedial alternatives (including a "No Action" alternative) are described in this section and evaluated with respect to the RAOs for groundwater for the Site.

5.1.1 Detailed Evaluation of Criteria

This section discusses the evaluation criteria against which each remedial alternative will be compared in accordance with 6 NYCRR Part 375 and Title 40 of the Code of Federal Regulations §300.430 (40 CFR §300.430, as required by DER-10). The evaluation criteria include the following:

- Overall protectiveness of public health and the environment
- Compliance with SCGs
- Short-term effectiveness and potential impacts during remediation
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility and volume of hazardous waste
- Implementation and technical reliability
- Cost
- Community acceptance
- Land use

When evaluating alternatives in terms of overall protectiveness of public health and the environment, consideration is given to the manner in which Site-related risks are eliminated, reduced, or controlled. Compliance with SCGs, long-term effectiveness and permanence, and short-term effectiveness are given major consideration in determining the overall protectiveness offered by each alternative.

The alternatives are assessed to determine whether they attain SCGs under applicable federal environmental laws and state environmental laws. The identification of SCGs is a site-specific process which is dependent on the specific hazardous substances, pollutants, and contaminants at a site, the physical characteristics and location of a site and the remedial actions under consideration at a site. Therefore, it is an iterative process that requires re-examination throughout the RI/FS process, until the Record of Decision (ROD) is issued.

Chemical-specific SCGs were previously discussed in Section 2.3. In the following alternative analyses, the individual remedial alternatives are evaluated in detail to determine compliance with SCGs that are applicable to the specific media being addressed by the alternative, and the potential impacts of SCGs on implementation of each alternative.

Selected remedial actions must meet the threshold criteria, and thereby be protective of public health and the environment. Effectiveness of an alternative is determined by evaluation with respect to the criteria listed above, including cost[4]. The result is a selected alternative that satisfies the threshold criteria and provides the best balance of the criteria, with an emphasis on long-term effectiveness and reduction of toxicity, mobility and volume.

Community acceptance is not evaluated in the following sections since the related criteria will be evaluated as part of future activities (e.g., future public participation events). Land use is not evaluated in detail in the following sections as land use will be consistent for all alternatives.

5.1.2 DER-31 Implementation

As part of the FFS process, TRC considered NYSDEC DER-31 implementation objectives. The NYSDEC DER's approach to remediating sites in the context of the larger environment is a concept referred to as "Green Remediation." The approach is intended to minimize overall environmental impacts by promoting the use of more sustainable practices and technologies. Green Remediation practices and technologies are less disruptive to the environment, generate less waste, increase reuse and recycling, and emit fewer pollutants, including greenhouse gases, to the atmosphere. Remedial alternatives and technologies were evaluated with respect to DER-31 throughout the FFS process as part of the overall protectiveness of public health and the environment evaluation criteria.

5.2 Remedial Alternatives

5.2.1 Alternative 1: No Action

5.2.1.1 Description

Alternative 1, the No Action Alternative, involves no remedial activities. NYSDEC 6 NYCRR Part 375 requires consideration of the No Action Alternative; at a minimum it provides a baseline for comparison with other alternatives. Natural attenuation would be the sole method of remediation. Because contaminants would remain at the Site above levels that would allow for unlimited use and unrestricted exposure, periodic reviews of the No Action decision would be required under 40 CFR 300.430(f)(4)(ii).

[4] For the purposes of this FFS, a discount rate of 7% was used in the present worth analyses.

Detailed Evaluation with Respect to Criteria

5.2.1.2 Overall Protectiveness of Public Health and the Environment

This alternative is not protective of public health and the environment since it does not adequately limit the potential for exposure to impacted groundwater. Natural attenuation (e.g., volatilization, dispersion, etc.) of PCE in groundwater is likely occurring at a limited rate. This alternative is not effective in the short-term, but may achieve RAOs in the long-term.

With respect to sustainability, Alternative 1 utilizes very few natural resources and does not include the disturbance of the existing landscape. The only consumption of resources would be associated with limited field and administrative work associated with periodic regulatory review.

5.2.1.3 Compliance with SCGs

Alternative 1 may meet chemical-specific SCGs if long-term natural attenuation processes eventually result in lower PCE concentrations in groundwater. However, Alternative 1 includes no monitoring for groundwater with respect to progress towards achieving chemical-specific SCGs.

5.2.1.4 Short-Term Impacts and Effectiveness

Alternative 1 would not result in any increased short-term risks, due to the lack of activities associated with its implementation. However, Alternative 1 does not include any Site use restrictions to prevent exposures to contamination. Therefore, no action does pose a short-term risk under the current Site conditions. RAOs would not be achieved over the short-term.

5.2.1.5 Long-Term Effectiveness and Permanence

Alternative 1 offers potential long-term effectiveness. Due to the low concentrations of PCE detected in groundwater and absence of a continuing source of contamination, it is likely that natural attenuation processes would achieve RAOs in the long-term. However, Alternative 1 does not include any long-term monitoring or Site use restrictions to prevent exposures to contamination. Due to the residual risk that would be associated with Alternative 1, five-year reviews of the no action decision would be required.

5.2.1.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 1 does not include any treatment methods other than naturally occurring attenuation processes. Therefore, the alternative offers no significant reductions in the toxicity, mobility, or volume of contamination through treatment.

5.2.1.7 Implementability

Alternative 1 would require no implementation other than the performance of periodic reviews. Its implementation would not limit the future implementation of additional remedial actions, if needed.

5.2.1.8 Cost

Costs associated with implementation of the Alternative 1 would involve the minimal costs associated with the performance of periodic reviews. A period of 10 years is used in the cost estimate as the period over which periodic reviews would be conducted for Alternative 1. The estimated present value of this alternative, including contingency, is approximately $8,500. A detailed cost estimate is presented in **Table 4**.

5.2.2 Alternative 2: Implementation of Engineering and Institutional Controls and Site Management

5.2.2.1 Description

Alternative 2 includes the following components:

- Utilization of existing site development as a site-wide cover system;
- Establishment of an Environmental Easement (or similar);
- Preparation and implementation of an SMP; and
- Groundwater Monitoring, and Periodic Review.

Alternative 2 includes the utilization of existing development as an Engineering Control consisting of a Site-wide cover system to prevent exposure to residual contamination. Additionally, Alternative 2 includes the establishment of Institutional Controls (e.g., environmental easement) limiting the use and future development of the Site to commercial uses, prohibiting the use of Site groundwater and requiring compliance with the SMP. The SMP developed for Alternative 2 would include requirements for notifications, soil management (if disturbed), periodic inspection and maintenance of cover, long-term groundwater monitoring for TCL VOCs, MNA parameters, and geochemical parameters, and record keeping and reporting.

Groundwater monitoring is included in the Site Management component of Alternative 2 to evaluate natural attenuation. The scope of the groundwater monitoring program used for development of cost estimates includes sampling of a network consisting of 7 existing wells (MW-2, MW-104, MW-106, MW-107, MW-108, MW-109, and 109M). The actual number and location of the wells included in the monitoring program would be determined as part of final remedy selection, subject to future revisions if the areal extent of groundwater impacts changes.

Groundwater monitoring under Alternative 2 would be performed on a semi-annual basis for 5 years. After 5 years the requirement for further groundwater monitoring would be evaluated. Estimated costs are based on analysis of groundwater samples for TCL VOCs, MNA parameters, and geochemical parameters. However, an alternative-specific groundwater monitoring program would be developed as part of the final remedy selection.

Semi-annual inspection of the Site would be performed to confirm the integrity of the Site-wide cover system and groundwater monitoring wells. Notifications would be required for proposed changes to Site conditions (e.g., building demolition and/or redevelopment) as well as related revisions to the SMP. Results of Site inspections and analytical data generated as part of Site Management activities would be reported to NYSDEC in semi-annual reports.

Detailed Evaluation with Respect to Criteria

5.2.2.2 Overall Protectiveness of Public Health and the Environment

Alternative 2 provides limited protectiveness to public health by providing evidence of groundwater plume stability and natural attenuation via groundwater monitoring and limiting potential for exposure to remaining contamination via Engineering and Institutional Controls. It is expected that the mobility and toxicity of groundwater contaminants would be reduced through natural attenuation. Alternative 2 is effective in the short- as achievement of SCGs for groundwater is estimated to be within 5 years. With respect to sustainability, Alternative 2 would consume a minimal amount of energy associated groundwater sampling.

5.2.2.3 Compliance with SCGs

Alternative 2 uses long-term groundwater monitoring to monitor changes in exceedances of chemical-specific SCGs in Site groundwater. Natural attenuation processes are expected to result in achievement of chemical-specific SCGs in Site groundwater, in the short-term.

5.2.2.4 Short-Term Impacts and Effectiveness

The implementation of a groundwater monitoring program is not effective in the short-term at minimizing the exposure risk associated with PCE in groundwater, other than providing evidence of groundwater plume stability. Implementation of groundwater monitoring poses minimal potential short-term risks to field sampling crews who may be exposed to contaminated groundwater. These risks would be mitigated by using appropriate personal protective equipment (PPE) and protocols. Implementation of Engineering and Institutional Controls would prevent exposure in the short-term.

5.2.2.5 Long-Term Effectiveness and Permanence

Alternative 2 offers long-term effectiveness. Due to the low concentrations of PCE detected in groundwater and absence of a continuing source of contamination, it is likely that natural attenuation processes would achieve remedial action objectives in a reasonable timeframe. The implementation of a groundwater monitoring program is not effective in minimizing the concentrations of PCE in groundwater but would provide evidence of groundwater plume stability and/or reduction. Implementation of groundwater monitoring poses minimal potential long-term risks to field sampling crews who may be exposed to contaminated groundwater. These risks would be mitigated by using appropriate PPE and protocols. Implementation of Engineering and Institutional Controls would prevent exposure in the long-term.

5.2.2.6 Reduction of Toxicity, Mobility, and Volume through Treatment

The primary elements of Alternative 2 are not intended to treat PCE in groundwater. Therefore, limited reduction of the toxicity, mobility, and volume of contaminants would be expected as a result of implementation of Alternative 2 at the Site.

5.2.2.7 Implementability

Alternative 2 requires the implementation of a groundwater monitoring program, Engineering Controls, Institutional Controls, and site inspections. All of the primary elements of Alternative 2 would utilize well-proven technologies, and vendors with the qualifications to implement the alternative are readily available.

5.2.2.8 Cost

The primary costs of Alternative 2 are those associated with long-term groundwater monitoring. As such, based on the use of existing monitoring wells, there is no direct capital cost for Alternative 2. The estimated indirect capital cost (i.e., preparation of the SMP) for Alternative 2 is $10,000. The estimated present value for groundwater monitoring is $123,200. Therefore, the estimated present value of Alternative 2, including contingency ($26,700), is $159,900. A detailed cost estimate is presented in **Table 5**.

5.2.3 Alternative 3: Enhanced In-Situ Bioremediation (EISB), Implementation of Engineering and Institutional Controls, and Site Management

The primary difference between Alternative 3 and Alternative 2 is the implementation of EISB to actively remediate PCE in groundwater.

5.2.3.1 Description

As part of Alternative 3, the groundwater monitoring program, Engineering Controls and Institutional Controls included in Alternative 2 would be implemented. Additionally, the objective of the EISB component of Alternative 3 would be to reduce concentrations of PCE in groundwater to below Class GA Values via the injection of bio-stimulating amendments, bio-augmentation cultures, and pH buffer into the aquifer. Installation of temporary direct-push EISB injection points within the footprint of the plume would be required. Existing data indicate that the PCE in the groundwater is not being naturally degraded under existing Site conditions. Therefore, amendments would be selected and employed to change these limiting conditions and promote a vigorous population of *Dehalococcoides spp*. (bacteria that completely dechlorinate chlorinated ethenes). It is anticipated that two rounds of EISB injections would be required to achieve RAOs.

For the limited purposes of this assessment, and utilizing data generated during RI, it is estimated that bio-stimulating amendments, bio-augmentation cultures, and pH buffer would be injected into the upper 20 feet of the aquifer at 13 direct push locations within an area of approximately 3,000 square feet. A conceptual layout of injection points is shown on **Figure 7**. However, the actual number and locations of injection points required

to remediate the plume would be established during remedial design. For the purpose of this assessment, it is estimated that a second, more limited injection event would be performed two years after completion of the first injection event.

Detailed Evaluation with Respect to Criteria

5.2.3.2 Overall Protectiveness of Public Health and the Environment

Alternative 3 provides protectiveness to public health and the environment through the injection of bio-stimulating amendments and bioaugmentation cultures to reduce concentrations of PCE in groundwater and limiting potential for exposure to remaining contamination via Engineering and Institutional Controls. Alternative 3 would be effective both in the short and long term, with achievement of SCGs for groundwater estimated to be 5 years or less. Alternative 3 would consume a minimal amount of energy with associated injection events and groundwater sampling.

5.2.3.3 Compliance with SCGs

Alternative 3 would use the injection of bio-stimulating amendments and bioaugmentation cultures to remediate groundwater contaminants above chemical-specific SCGs.

5.2.3.4 Short-Term Impacts and Effectiveness

The injection of bio-stimulating amendments and bioaugmentation cultures is expected to provide protection in the short term. Implementation of Engineering and Institutional Controls would minimize the potential for exposure in the short-term. Performance of injections and groundwater sampling could present minor increased short-term risks to workers and field sampling crews. These risks would be minimized through the use of proper PPE and protocols. No short-term adverse impacts to the surrounding community would result from implementation. Alternative 3 would be effective at achieving RAOs in the short-term.

5.2.3.5 Long-Term Effectiveness and Permanence

Alternative 3 would be effective in reducing the long-term risks associated with the presence of PCE in groundwater through the *in-situ* treatment of impacted groundwater. EISB would result in a permanent reduction in the toxicity of groundwater. Implementation of Engineering and Institutional Controls would minimize the potential for exposure in the long-term. Periodic reviews of the action would be required until RAOs are achieved.

5.2.3.6 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternative 3 would provide reductions in the toxicity of the groundwater contaminants through EISB of PCE to less toxic compounds.

5.2.3.7 Implementability

Alternative 3 requires the injection of bio-stimulating amendments, bioaugmentation cultures, and pH buffer utilizing direct push technology; implementation of a groundwater monitoring program; Engineering Controls, Institutional Controls; and site inspections. All of the primary elements of Alternative 3 would utilize well-proven technologies, and vendors with the qualifications to implement the alternative are readily available.

5.2.3.8 Cost

The principal costs of Alternative 3 are associated with preparing an SMP, performing direct-push injections, and groundwater monitoring. The direct capital cost of Alternative 3 is estimated at $50,000 and the estimated indirect capital cost is estimated at $37,500. The estimated present value for an additional injection event and groundwater monitoring is estimated at $172,100. Therefore, the estimated present value of this alternative, including contingency ($52,000), is $311,600. A detailed cost estimate is presented in **Table 6**.

6.0 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

6.1 Introduction

The comparative analysis presented in this section evaluates the relative performance of each alternative using the same criteria by which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in selecting an overall remedy for the Site.

The comparative analysis includes a narrative discussion of the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance, as applicable. The comparative analysis presented in this document uses a qualitative approach to comparison, with the exceptions of comparing estimated alternative costs and the required time to implement each alternative.

6.2 Comparison of Alternatives

Overall Protectiveness of Public Health and the Environment – Alternative 1 is the least protective of public health and the environment, and does not include evaluation or monitoring of existing exposure pathways. Since Alternative 2 does not include active groundwater remediation, potential for exposure would not be completely eliminated for several years. Alternative 3, which includes active groundwater remediation, provides greater protectiveness of public health and the environment than Alternative 2 since achievement of SCGs would be achieved with greater certainty, likely within a shorter timeframe.

Compliance with SCGs – Alternatives 1 and 2 would likely result in compliance with SCGs after an extended timeframe via natural attenuation. Alternative 3 is most likely to result in compliance with groundwater SCGs with the greatest certainty and possibly within the shortest timeframe.

Short-term Impacts and Effectiveness – Alternative 1 is not effective in the short-term and would have no impacts. The certainty of reducing PCE concentrations in groundwater in the short-term under Alternative 2 would be less than Alternative 3, but the short-term impacts of Alternative 2 would be less than Alternative 3 which would likely require two subsurface injection events.

Long-term Effectiveness and Permanence – Each alternative is expected to be effective and permanent in the long-term. However, Alternative 1 does not include any controls or monitoring to confirm the effectiveness of natural attenuation processes with respect to achieving RAOs.

Reduction of Toxicity, Mobility, and Volume by Treatment – Alternatives 1 and 2 provide no reduction of toxicity, mobility, or volume of contaminants other than through naturally occurring attenuation processes. Alternative 3 would reduce the toxicity, mobility, and volume of PCE in groundwater via EISB.

Implementability – Alternative 1 is the most easily implemented since it requires no action. Alternatives 2 and 3 are both readily implementable.

Cost-Effectiveness. Alternatives 1, 2, and 3, are progressively more expensive. A summary comparison of the estimated remedial alternative costs is presented in **Table 7**.

Land Use. Since the Site is currently zoned for commercial use and a county ordinance prohibits the use of Site groundwater, Alternatives 1, 2, and 3 are equal with respect to land use

Green Remediation (DER-31) – Alternative 3 rates lowest with respect to green remediation due to the amount of energy required to complete EISB injections. Alternative 2 rates higher than Alternative 3 with respect to green remediation since it would require less equipment, consumption of resources and waste disposal (limited primarily to only purge water). Alternative 1 rates highest with respect to green remediation since it does not require any consumption of resources or impacts to the environment.

7.0 RECOMMENDED REMEDIAL ALTERNATIVE

Results of the RI, presented in the August 2019 RI Report, indicate that concentrations of PCE are present in groundwater above Class GA Values. Alternatives 2 and 3 include the implementation of Institutional and Engineering Controls to limit the potential for exposure to contamination via a Site-wide cap consisting of existing buildings and ground surface coverings, restrict the use of the Site to commercial uses only and prohibit the use of Site groundwater. Alternative 2 includes groundwater monitoring to confirm plume stability or reduction and document natural attenuation of contaminants. Alternative 3 includes active remediation of PCE-impacted groundwater. Alternatives 2 and 3 are protective of human health and the environment and are expected to achieve chemical-specific SCGs within a reasonable timeframe. Since the estimated cost for Alternative 2 is less than Alternative 3, Alternative 2 is the recommended remedial action for the Site.

8.0 REFERENCES

1. 6 NYCRR 375, Remedial Program Requirements.
2. 6 NYCRR 703, Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations.
3. Bedrock Geologic Map of New York, Lower Hudson Sheet, New York State Museum, 1970, reprinted 1995.
4. Energy & Environmental Analysts, Inc. (EAA), Phase II Environmental Subsurface Investigation, 84 North Village Avenue, Rockville Centre, New York, May 1995.
5. General Consolidated Industries, Inc. (GCI), Phase II Subsurface Investigation of 84 North Village Avenue, Rockville Centre, New York, February 2018.
6. New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation, May 2010.
7. NYSDEC Division of Environmental Remediation (DER) Bureau of Program Management Work Assignment (WA) Notice to Proceed, May 1, 2017.
8. New York State Department of Health (NYSDOH), Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, as amended.
9. O'Brien & Gere Engineers, Inc., Draft Preliminary Site Characterization, Gem Cleaners, 84 North Village Avenue, Rockville Centre, New York, October 6, 2006.
10. P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. (PWGC), Site Assessment & Remediation Report, Gem Cleaners, 84 N. Village, Rockville Centre, NY, August 21, 1997.
11. Surficial Geologic Map of New York, Lower Hudson Sheet, New York State Museum, 1970.
12. TRC Engineers, Inc. Standby Engineering Contract Work Assignment (WA) No. D007620-19, NYSDEC-approved Scope of Work dated January 17, 2018.
13. TRC Engineers, Inc., "Data Usability Summary Reports (DUSRs) for Gem Cleaners, NYSDEC Site No. 130082", May 2018, June 2018, and August 2018.
14. TRC Engineers, Inc. "Remedial Investigation Report for Gem Cleaners, NYSDEC Site No. 130082", August 2018.

Tables

Table 1

New York State Department of Environmental Conservation

Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York

Focused Feasibility Study Report

Groundwater Contaminants of Concern and Chemical-Specific SCGs

Contaminants of Concern for Groundwater	Class GA Value[1] (ug/L)
Volatile Organic Compounds	
Tetrachloroethene	5

Notes

ug/L - Micrograms per liter

[1] - NYSDEC Ambient Water Quality Standards and Guidance Values for GA Water

Table 2
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Summary of Groundwater Remedial Technology Screening

Retained
Screened Out on Basis of Technical Implementability

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	Limited Applicability	COMMENTS
No Action	None	Not Applicable	No action.		Fulfills requirement for consideration of no action alternative.
Site Management	Groundwater Monitoring	Groundwater Sampling	Documents environmental conditions.		Well suited for Site conditions due to low contaminant concentrations, documented removal of historic source, and lack of existing source.
Containment	Capping	Impermeable Cap	An impermeable cap can minimize infiltration of precipitation and associated transport of contaminants.		Screened out since the extent of permeable ground surfaces at the Site and in the surrounding area is limited.
	Vertical Barriers	Slurry Wall	Barrier formed by backfilling a trench with a low permeability material.		Vertical barriers (both slurry walls and sheet piling) are not feasible alternatives due to existing structures, infrastructure, and other improvements in the area.
		Sheet Piling	Sheet piling is driven into the ground to form a barrier to groundwater migration.		
Extraction/ Treatment/Discharge	Extraction and On-Site Treatment	Pump and Treat System	Groundwater is extracted and treated using air stripping, granular activated carbon, and/or other unit operations. Treated groundwater is discharged to the sewer or surface water.		Technical practicability low due to mass transfer limitations at low concentrations that control the transfer of contaminants from the subsurface.
In-Situ Treatment	Biological Treatment	Enhanced Reductive Bioremediation	Addition of nutrients, microbes or other substances to the subsurface to enhance existing bioremediation processes.		Site data indicates that biological reductive dechlorination is not occurring at significant rates in the groundwater. Degradation conditions could be improved through the application of reductive bioremediation enhancements.
		Phytoremediation	The use of plants to remove, detoxify or immobilize environmental contaminants through natural biological, chemical or physical activities and processes.		Not a feasible alternative due to existing use and development in the area.
		Natural Attenuation	Involves relying on natural processes (physical, chemical and/or biological) to reduce contaminant concentrations over the long term.		Physical attenuation processes (e.g., volatilizatioin, dispersion, etc.) are well suited for Site conditions due to low contaminant concentrations.
		Biosparging	Injection of gas (e.g., air or compressed oxygen) in order to stimulate the aerobic bioremediation of VOCs; nutrients may be added to augment biodegradation.		Aerobic bioremediation is not considered effective for Site contaminants.

Table 2
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Summary of Groundwater Remedial Technology Screening

Retained
Screened Out on Basis of Technical Implementability
Limited Applicability

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	COMMENTS
In-Situ Treatment (cont.)	Physical/Chemical Treatment	Dual-Phase Extraction	Use of a high vacuum system in the subsurface to simultaneously remove various combinations of contaminated groundwater, separate-phase product, and vapor from the subsurface.	Limited applicability due to lack of separate phase product and mass transfer limitations at low concentrations that control the transfer of contaminants from the subsurface soil.
		Air Sparging with Soil Vapor Extraction	Removes volatile groundwater contaminants through injection of gas (e.g., air) into groundwater and simultaneous extraction of vapors.	Effective in treating contaminants with high Henry's Law Constant values.
		Chemical Oxidation	Introduction of an oxidizing agent into the subsurface to chemically oxidize contaminants, breaking contaminants down into non-toxic substances.	Chemical oxidizing agents would be effective at concentrations detected.
		Thermal Remediation	VOC removal enhanced by the addition of heat. Can include direct heating of the sub-surface or the injection of steam.	Heating of subsurface volatilizes VOCs. VOC-impacted soil vapor would be collected and treated on-Site. The limited available space, current active use, and development of the Site would not accommodate the necessary electrical and waste treatment infrastructure.
		Chemical Reduction	Introduction of a reducing agent into the subsurface to chemically reduce contaminants, breaking contaminants down into non-toxic substances.	A chemical reducing agent such as zero-valent iron would increase chemical reduction rates of VOCs in groundwater.
		In-Well Air Stripping	Air is injected into a double-screened well, lifting the water in the well and forcing it out an upper screen. Simultaneously, additional water is drawn in the lower screen. Once in the well, VOCs in the contaminated groundwater are transferred from the dissolved phase to the vapor phase by air bubbles. The contaminated air rises in the well to the water surface where vapors are drawn off and treated by a vapor extraction system.	Effective in treating contaminants with high Henry's Law Constant values or compounds that are readily biodegraded. Not practical due to limited available space, current active use, development of the Site, and resulting disturbances required for well construction, electrical, and infrastructure.

Table 3
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Groundwater Process Option Screening

Selected process option
Screened out process option

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
No Action	None	Not Applicable	Not effective in controlling contaminant migration.	No implementation required.	No cost other than regulatory administration.
Site Management	Groundwater Monitoring	Groundwater Sampling	Documents environmental conditions and requirements. Not effective in controlling contaminant migration.	Easily implemented.	Minimal or no capital; low OM&M.
In-Situ Treatment	Biological Treatment	Enhanced Reductive Bioremediation	Reductive dechlorination is not occurring at significant rates. Significant amendment volumes would be necessary to overcome oxidizing aquifer conditions.	Easily implemented.	Low capital; low OM&M.
		Natural Attenuation	Existing data indicates natural attenuation could be effective in addressing low-level residual contaminant concentrations.	Easily implemented.	Minimal or no capital; low OM&M.
	Physical/ Chemical Treatment	Air Sparging with Soil Vapor Extraction	Effective in stripping the contaminants of concern from groundwater. Screened out since not typically practical for remediation of low-level groundwater contamination.	Limited available space and active existing use in area of impact would complicate implementation.	Moderate capital; moderate OM&M.
		Chemical Oxidation	Effective in treating VOCs in groundwater. Screened out since not typically practical for remediation of low-level groundwater contamination.	Easily implemented.	Moderate capital; low OM&M.
		Chemical Reduction	Effective in treating VOCs in groundwater. Significant amendment volumes would be necessary to overcome oxidizing aquifer conditions. Screened out due to cost ineffectiveness.	Easily implemented.	Moderate capital; low OM&M.

Table 4
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Alternative 1 Cost Estimate
No Action

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
FUTURE ACTIONS						
Periodic Review ($5,000 each, annualized basis)	1	l.s.	$1,000	$1,000	10	$7,024
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$7,100
CONTINGENCY (20%)						$1,400
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 1						$8,500

Notes
1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.

Table 5
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Alternative 2 Cost Estimate
Implementation of Engineering and Institutional Controls and Site Management

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST. INDIRECT						
Engineering and Design						$10,000
TOTAL INDIRECT CAPITAL COSTS						$10,000
TOTAL CAPITAL COSTS						$10,000
FUTURE ACTIONS						
Semi-Annual Groundwater Sampling/Reporting	1	l.s. (per year)	$20,000	$20,000	5	$82,100
Semi-Annual Reviews	1	l.s. (per year)	$10,000	$10,000	5	$41,100
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$123,200
CONTINGENCY (20%)						$26,700
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 2						$159,900

Notes
1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.

Table 6
New York State Department of Environmental Conservation
Gem Cleaners Site - 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Alternative 3 Cost Estimate
Enhanced *In-Situ* Bioremediation, Implementation of Engineering and Institutional Controls, and Site Management

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Enhanced *In-Situ* Bioremediation (EISB)						
Direct-Push EISB Injection Event	1	l.s.	$50,000	$50,000	NA	$50,000
TOTAL DIRECT CAPITAL COSTS						$50,000
CAPITAL COST - INDIRECT						
Engineering and Design						$15,000
Construction Phase Engineering Services						$20,000
Permits and Plans						$2,500
TOTAL INDIRECT CAPITAL COSTS						$37,500
TOTAL CAPITAL COSTS						$87,500
Direct-Push EISB Injection Event (Year 3)	1	l.s. (per year)	$35,000	$35,000	1	$28,600
Semi-Annual Groundwater Sampling/Reporting	1	l.s. (per year)	$25,000	$25,000	5	$102,500
Semi-Annual Reviews	1	l.s. (per year)	$10,000	$10,000	5	$41,000
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$172,100
CONTINGENCY (20%)						$52,000
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 3						$311,600

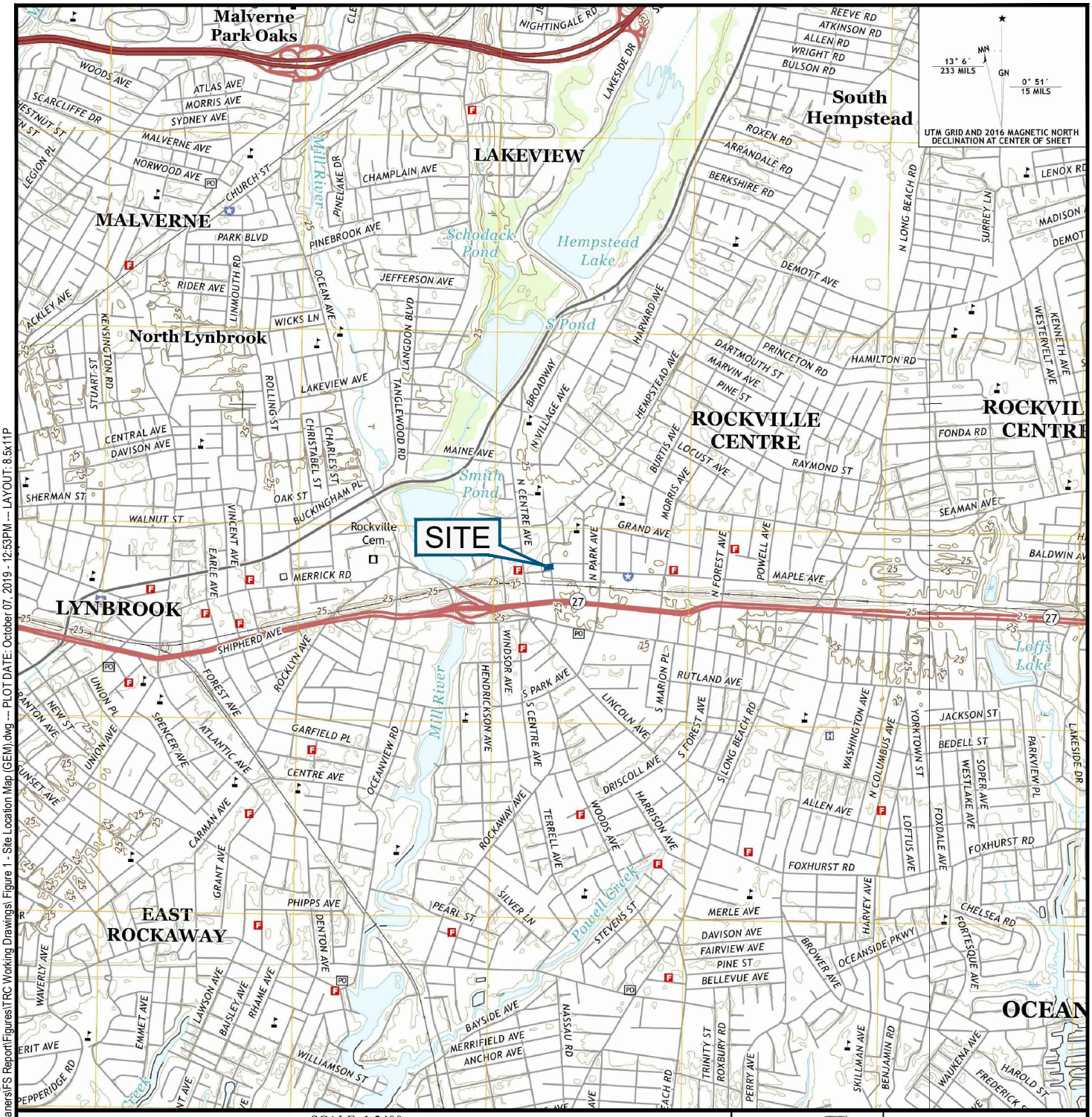
Notes
1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.

Table 7
New York State Department of Environmental Conservation
Gem Cleaners Site – 84 North Village Avenue, Rockville Centre, New York
Focused Feasibility Study Report
Comparison of Remedial Alternative Costs

Alternative	Total Capital Cost	Present Worth of Future Actions Cost	Total Present Worth[1]
Alternative 1 - No Action	$0	$7,100	$8,500
Alternative 2 – Implementation of Engineering and Institutional Controls and Site Management	$10,000	$123,200	$159,900
Alternative 3 – EISB, Implementation of Engineering and Institutional Controls, and Site Management	$87,500	$172,100	$311,600

Notes:
Estimated costs are rounded.
[1] Includes contingency.
EISB – Enhanced *In-Situ* Bioremediation

Figures



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1 0.5 0 KILOMETERS 1 2

1000 500 0 METERS 1000 2000

1 0.5 0 1

MILES

1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

FEET

QUADRANGLE LOCATION

MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):
TP, LYNBROOK, NY, 7.5-MINUTE, DATED 2016.
E, FREEPORT, NY, 7.5-MINUTE, DATED 2016.

MAP OBTAINED THROUGH USE OF TOPOVIEW WITH THE INTERFACE CREATED BY THE NATIONAL GEOLOGIC MAP DATABASE PROJECT (NGMDB), IN SUPPORT OF THE TOPOGRAPHIC MAPPING PROGRAM, MANAGED BY THE USGS NATIONAL GEOSPATIAL PROGRAM (NGP).

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PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

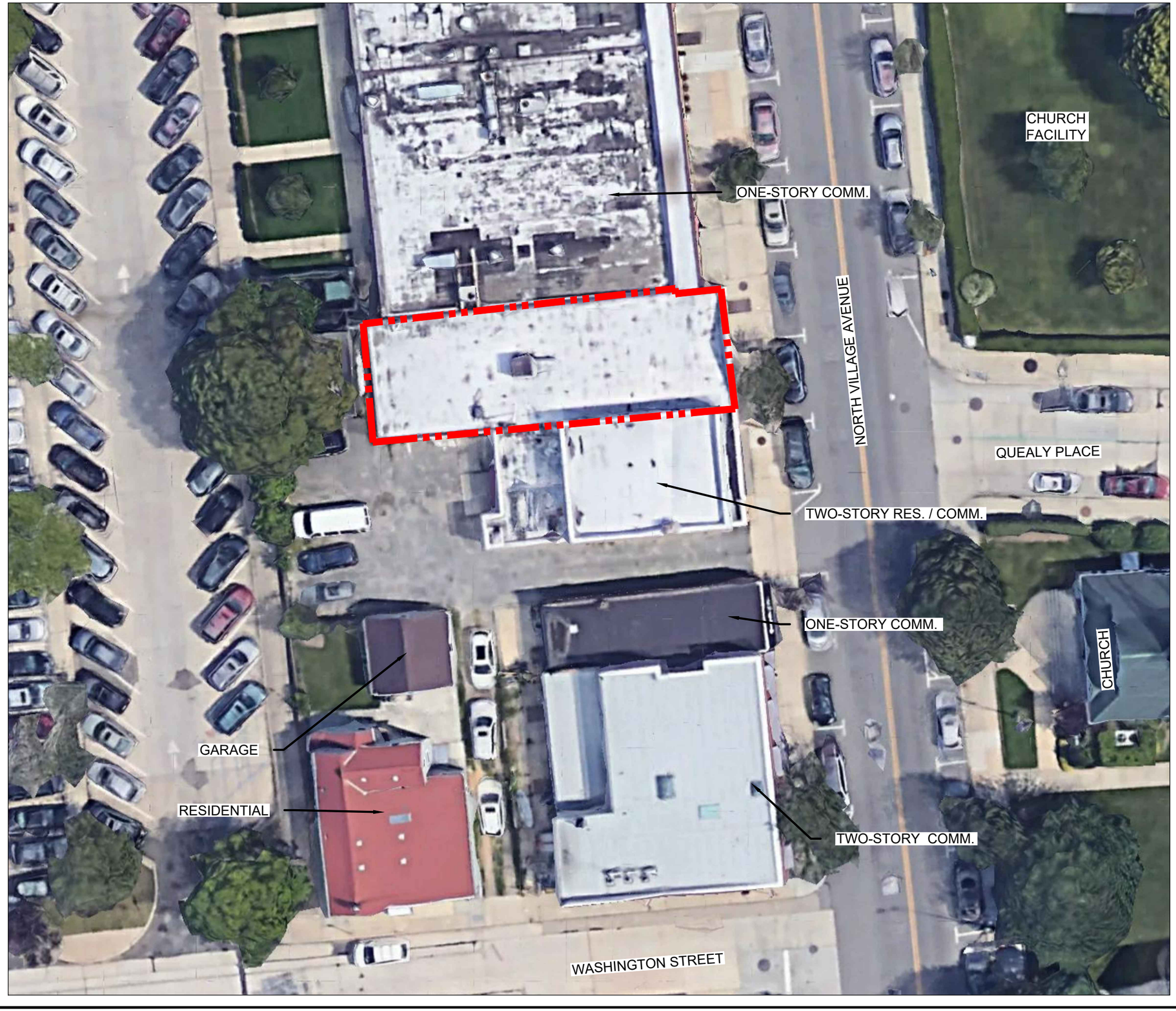
TITLE:

SITE LOCATION MAP

DRAWN BY:	H. DELGADO
CHECKED BY:	D. WARREN
APPROVED BY:	L. O'HARA
DATE:	OCTOBER 2019
PROJ. NO.:	279191
FILE:	Figure 1 - Site Location Map (GEM).dwg

FIGURE 1

8.5x11 --- ATTACHED IMAGES: NY_Freeport_20160824_TM; NY_Lynbrook_20160824_TM;
DRAWING NAME: I:\Projects\NYSDEC\Assignments\WA #36 - GEM Cleaners\FS Report\Figures\TRC Working Drawings\ Figure 1 - Site Location Map (GEM).dwg --- PLOT DATE: October 07, 2019 - 12:53PM --- LAYOUT: 8.5x11P



LEGEND (SYMBOLS NOT TO SCALE):

GEM CLEANERS BUILDING

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. AERIAL IMAGE FROM GOOGLE EARTH PRO DATED SEPTEMBER 17, 2017.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
SITE PLAN

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 2**
DATE:	OCTOBER 2019		

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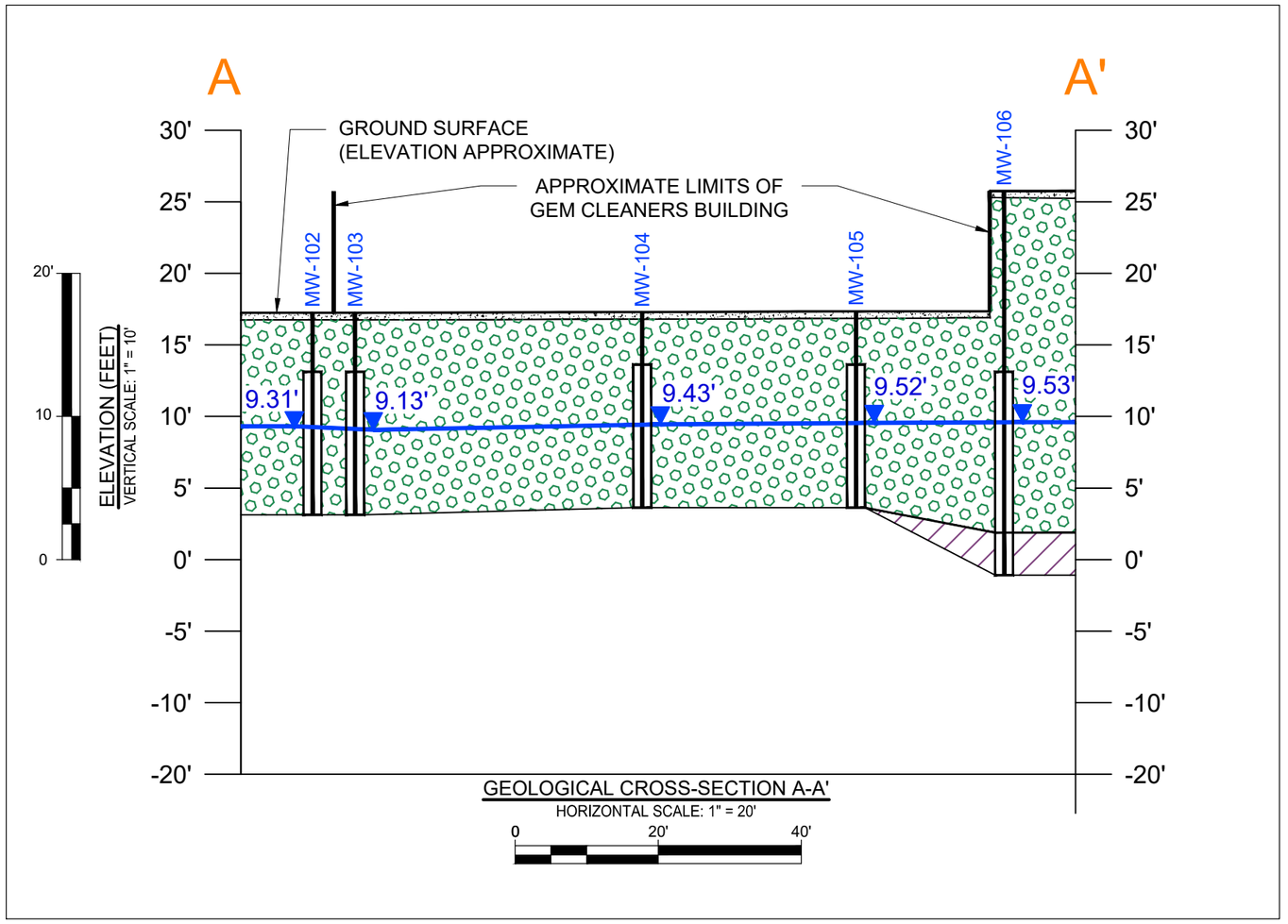
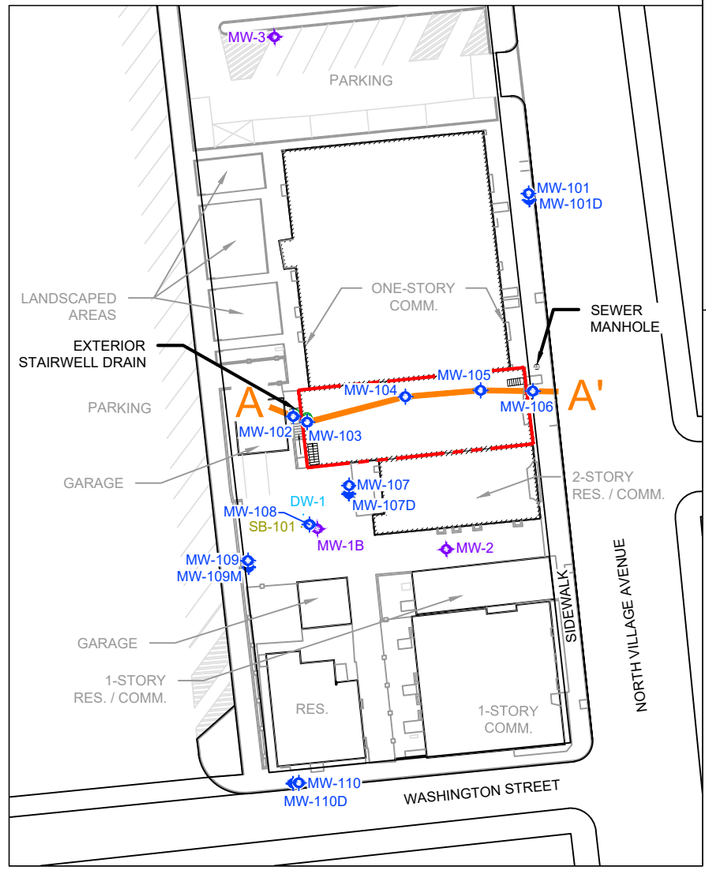
FILE NO.: Figure 2 - Site Plan.dwg



GEOLOGICAL CROSS-SECTION A-A'

HORIZONTAL SCALE: 1" = 20'

0 20' 40'



TRANSECT LOCATION MAP

0 60' 120'

SCALE: 1" = 60'

LEGEND (SYMBOLS NOT TO SCALE):

- GEM CLEANERS BUILDING
- DRAIN INLET
- DW-1 — DRYWELL LOCATION AND IDENTIFICATION NUMBER
- SB-XXX — SOIL BORING LOCATION AND IDENTIFICATION NUMBER
- MW-X/B — EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW-XXX — SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- MW-XXXD/M — SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- GEOLOGICAL CROSS-SECTION TRANSECT
- 9.31' — INFERRED GROUNDWATER SURFACE ELEVATION AND ELEVATION MEASUREMENT (SHALLOW WELLS - APRIL 2018)
- MONITORING WELL SCREEN
- CONCRETE
- SILT AND SAND
- SAND

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. DRAIN INLETS NOT SHOWN IN CROSS-SECTION.

SHEET SIZE: 11" BY 17"

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
GEOLOGICAL CROSS-SECTION A-A'

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 3A**
DATE:	OCTOBER 2019		

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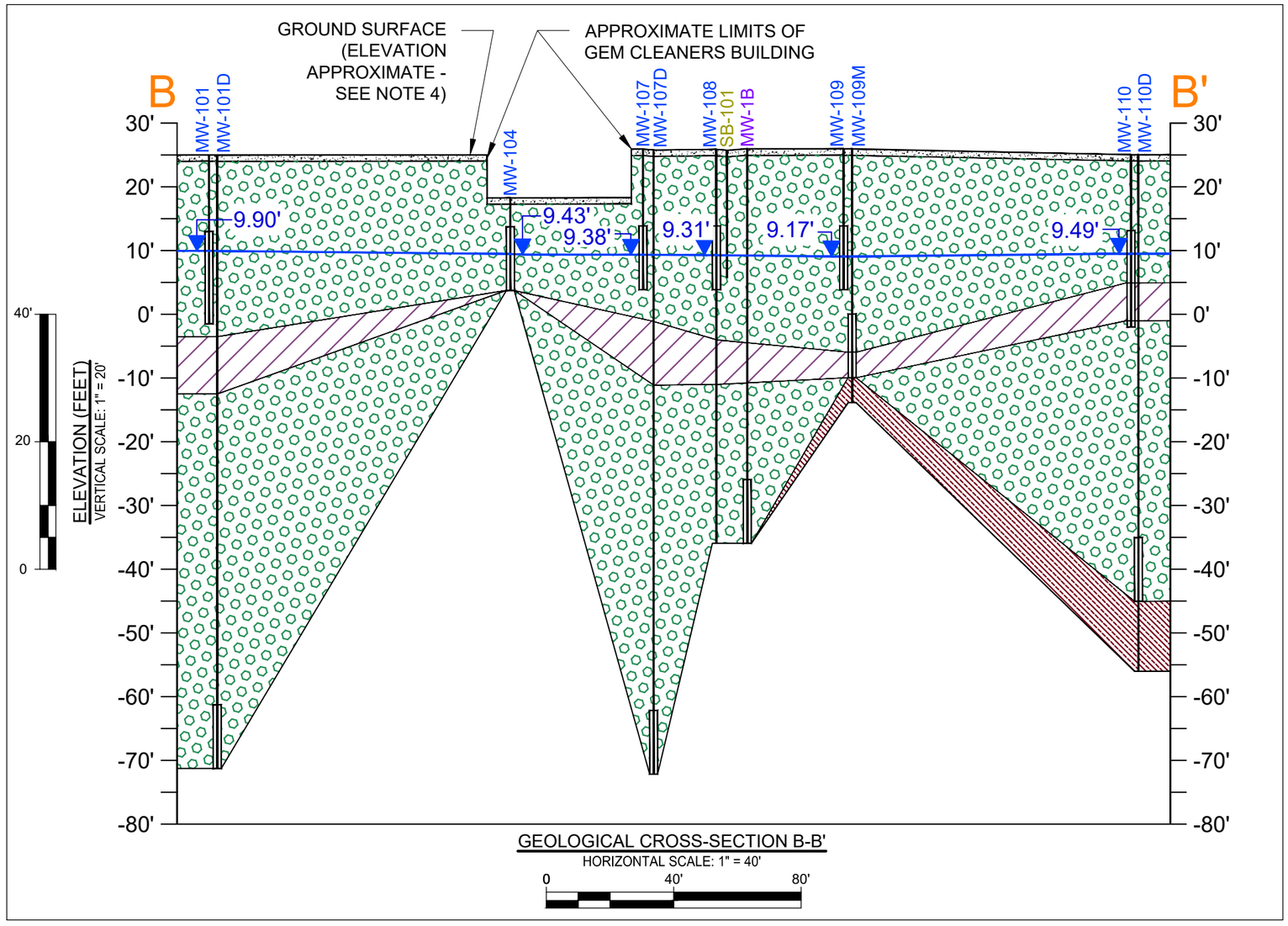
FILE NO.: Figure 3A-3B - Geological Cross-Sections.dwg



GEOLOGICAL CROSS-SECTION B-B'

HORIZONTAL SCALE: 1" = 40'

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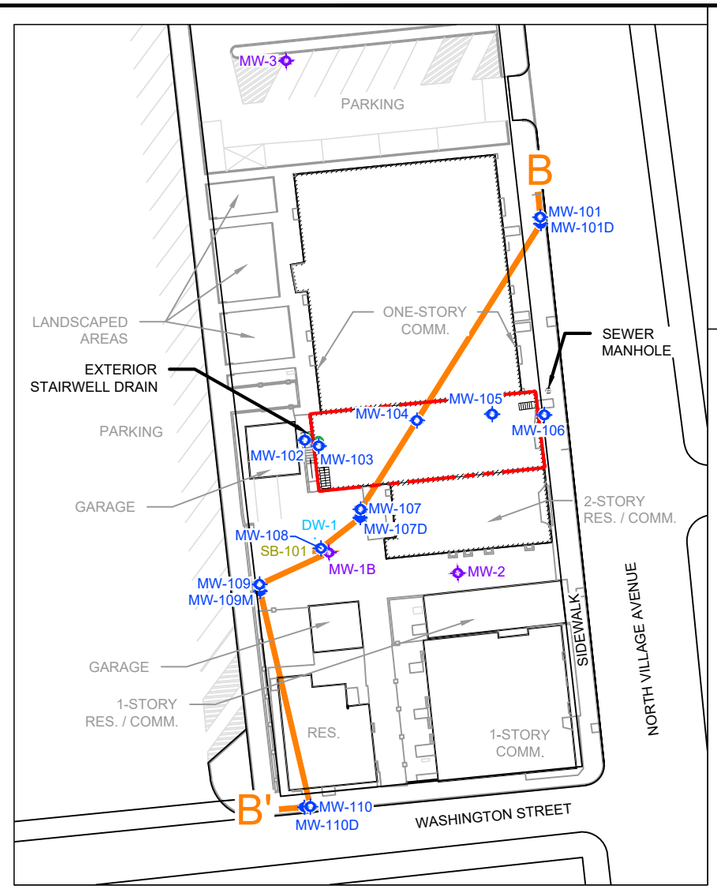

TRANSECT LOCATION MAP

0 60' 120'

SCALE: 1" = 60'

LEGEND (SYMBOLS NOT TO SCALE):

- GEM CLEANERS BUILDING
- DRAIN INLET
- DW-1 — DRYWELL LOCATION AND IDENTIFICATION NUMBER
- SB-XXX — SOIL BORING LOCATION AND IDENTIFICATION NUMBER
- MW-X/B — EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW-XXX — SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- MW-XXXD/M — SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- GEOLOGICAL CROSS-SECTION TRANSECT
- 9.31' — INFERRED GROUNDWATER SURFACE ELEVATION AND ELEVATION MEASUREMENT (SHALLOW WELLS - APRIL 2018)
- MONITORING WELL SCREEN
- CONCRETE / ASPHALT
- CLAY
- SILT AND SAND
- SAND

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. ELEVATIONS OF LOWEST LEVEL FLOOR SLABS OF ADJACENT BUILDINGS ARE NOT KNOWN.

SHEET SIZE: 11" BY 17"

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
GEOLOGICAL CROSS-SECTION B-B'

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 3B**
DATE:	OCTOBER 2019		

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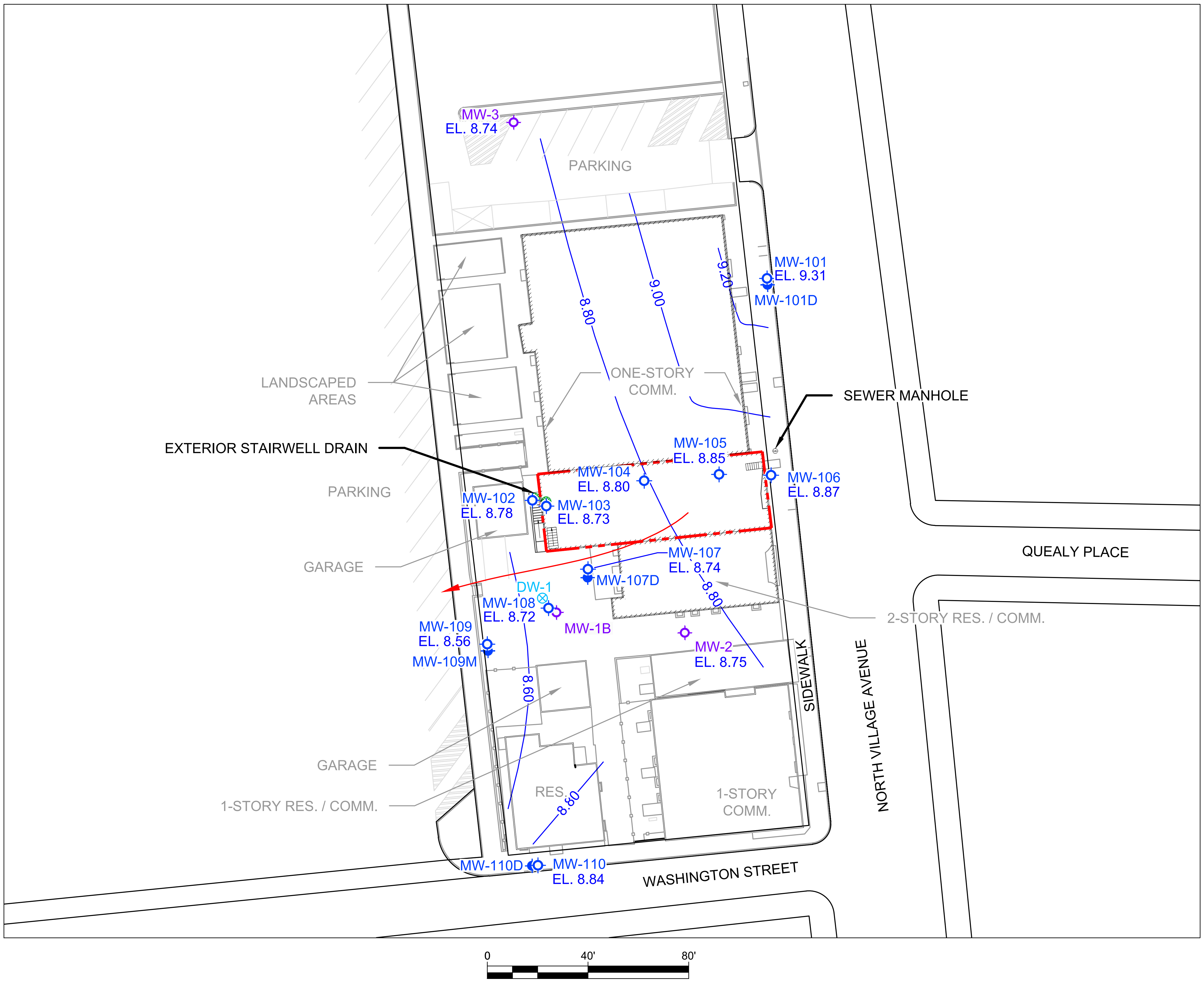
FILE NO.: Figure 3A-3B - Geological Cross-Sections.dwg



SCALE: 1" = 40'
SHEET SIZE: 11" BY 17"

LEGEND (SYMBOLS NOT TO SCALE):

(red dashed line)	GEM CLEANERS BUILDING
DW-1	DRYWELL LOCATION AND IDENTIFICATION NUMBER
	DRAIN INLET
COMM.	COMMERCIAL
RES.	RESIDENTIAL
MW-X/B	EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
MW-XXX	SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
MW-XXXD/M	SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
EL. 9.31	GROUNDWATER SURFACE ELEVATION (IN FEET)
9.30	INFERRED GROUNDWATER SURFACE ELEVATION CONTOUR (IN FEET)
(red arrow)	INFERRED GROUNDWATER FLOW DIRECTION

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE: **GROUNDWATER SURFACE ELEVATION CONTOUR MAP - SHALLOW OVERBURDEN (JULY 2018)**

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		**FIGURE 4A**
APPROVED BY:	L. O'HARA		
DATE:	OCTOBER 2019		

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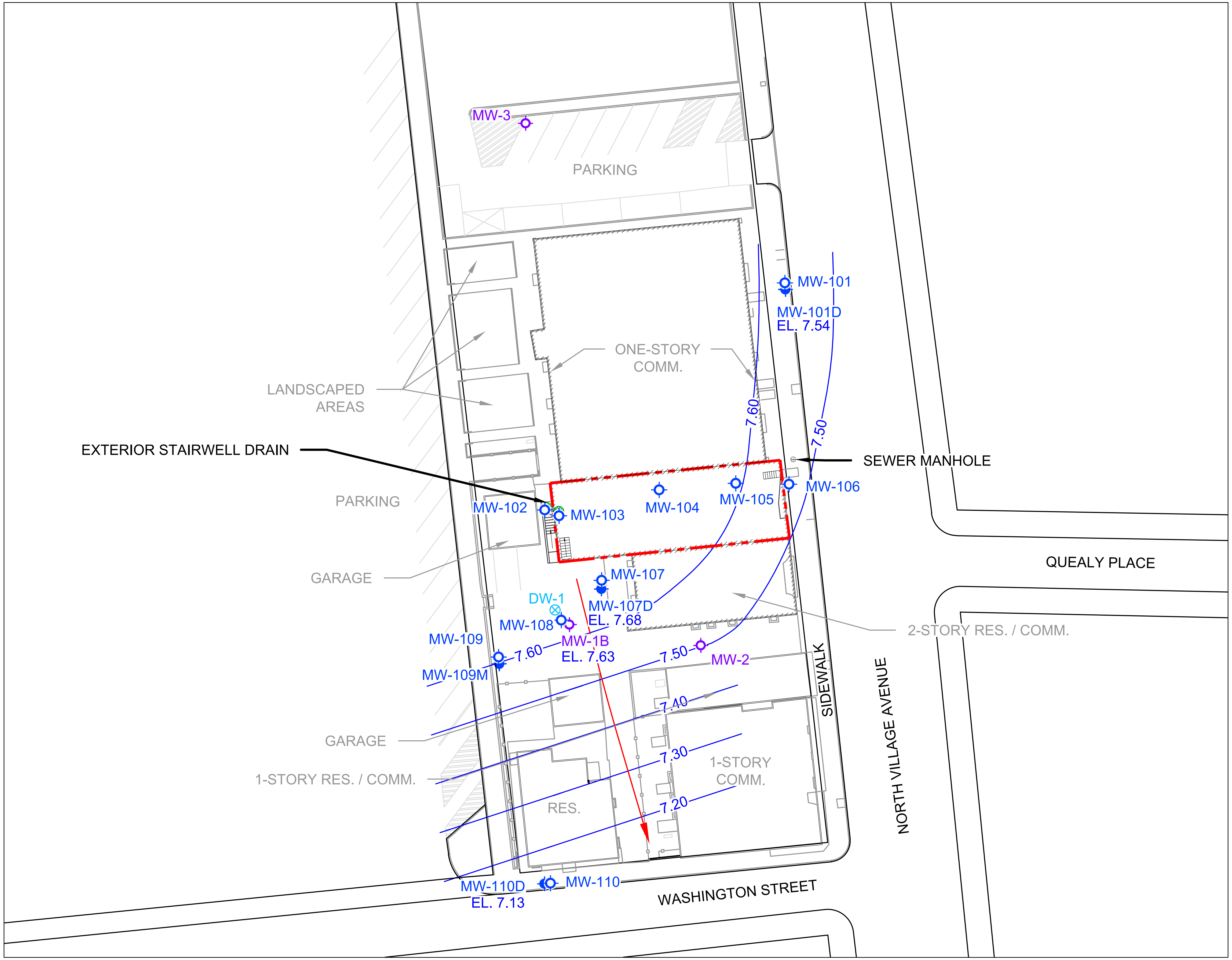
FILE NO.: Figure 4A - GW Surf. El. Cont. Map - Shallow OB (July 2018).dwg

11x17 --- ATTACHED XREF'S: N 38-153-1-MWemail-84 NORTH VILLAGE AVENUE; Shallow GW 07.24.18 (0.2 Ft. Intervals) V2 --- ATTACHED IMAGES: 06.11.18 FIGURE 3 MARKUP (ME); 84 North Village Road map_image; GEM_PROPLOCS Fig 2; GEPRO-1000 FT - grey toned V2; historic WELLS_Page_2;
DRAWING NAME: I:\Projects\NYSDEC\Assignments\WA #36 - GEM Cleaners\FS Report\Figures\TRC Working Drawings\ Figure 4A - GW Surf. El. Cont. Map - Shallow OB (July 2018).dwg --- PLOT DATE: October 22, 2019 - 9:50AM --- LAYOUT: 11x17L



0 40' 80'

SCALE: 1" = 40'
SHEET SIZE: 11" BY 17"

LEGEND (SYMBOLS NOT TO SCALE):

	GEM CLEANERS BUILDING
DW-1	DRYWELL LOCATION AND IDENTIFICATION NUMBER
	DRAIN INLET
COMM.	COMMERCIAL
RES.	RESIDENTIAL
MW-X/B	EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
MW-XXX	SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
MW-XXXD/M	SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
EL. 7.68	GROUNDWATER SURFACE ELEVATION (IN FEET)
7.50	INFERRED GROUNDWATER SURFACE ELEVATION CONTOUR (IN FEET)
	INFERRED GROUNDWATER FLOW DIRECTION

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
4. DUE TO THE LIMITED DATA SET AND LOCATIONS OF THE DEEP MONITORING WELLS, THERE IS LIMITED CERTAINTY REGARDING THE GROUNDWATER SURFACE ELEVATION CONTOURS SHOWN ON THIS FIGURE.

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE: **GROUNDWATER SURFACE ELEVATION CONTOUR MAP - DEEP OVERBURDEN (JULY 2018)**

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		**FIGURE 4B**
APPROVED BY:	L. O'HARA		
DATE:	OCTOBER 2019		

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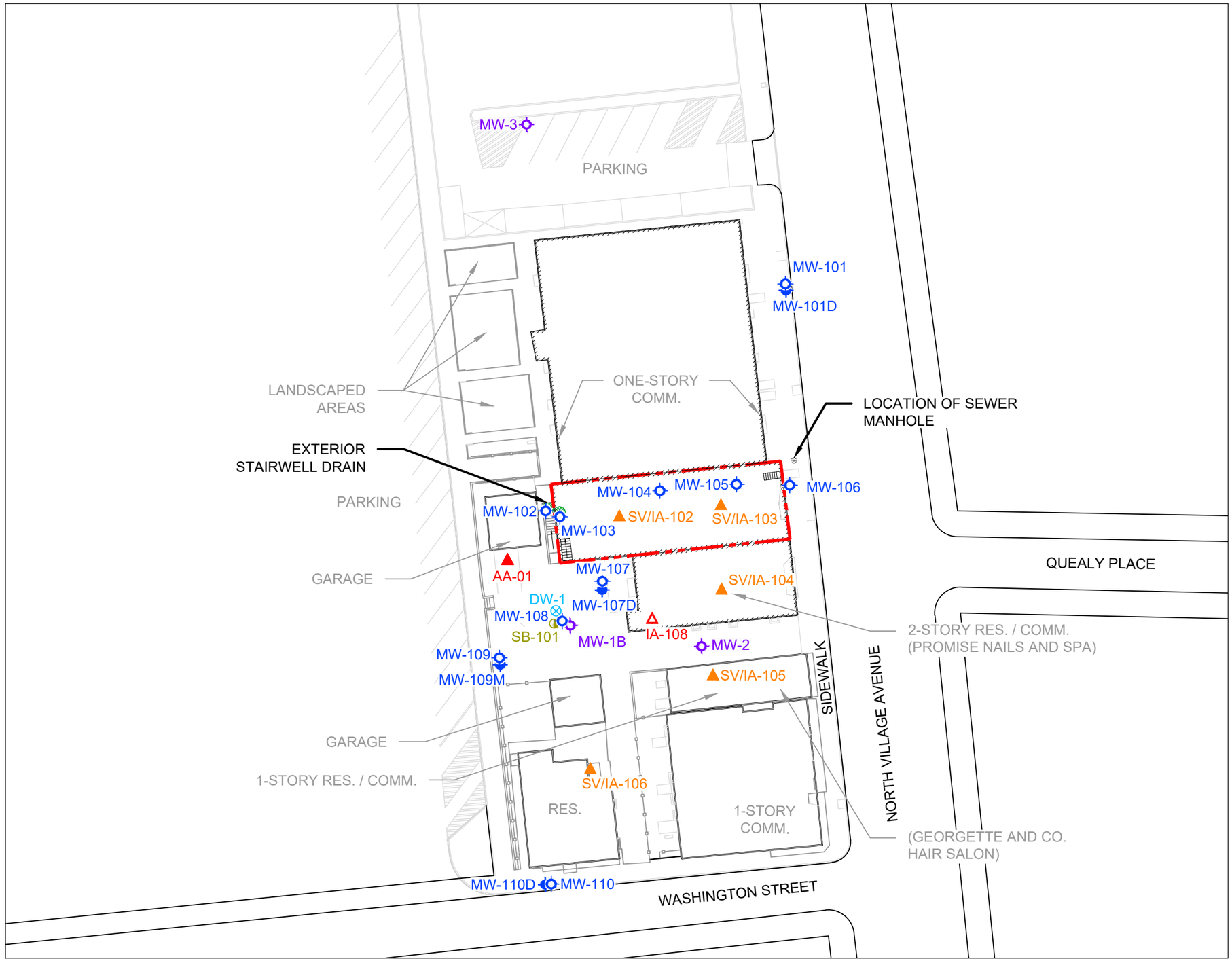
FILE NO.: Figure 4B - GW Surf. El. Cont. Map - Deep OB (July 2018).dwg



0 40' 80'

SCALE: 1" = 40'
SHEET SIZE: 11" BY 17"

LEGEND (SYMBOLS NOT TO SCALE):

- GEM CLEANERS BUILDING
- DRAIN INLET
- DW-1 — DRYWELL LOCATION AND IDENTIFICATION NUMBER
- SB-XXX — SOIL BORING LOCATION AND IDENTIFICATION NUMBER
- MW-X/B — EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
- MW-XXX — SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- MW-XXXD/M — SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
- SV/IA-XXX — SUB-SLAB VAPOR / INDOOR AIR SAMPLING LOCATION AND IDENTIFICATION NUMBER
- IA-XXX — INDOOR AIR SAMPLING LOCATION AND IDENTIFICATION NUMBER
- AA-XX — AMBIENT AIR SAMPLING LOCATION AND IDENTIFICATION NUMBER

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. SEDIMENT, STANDING WATER, AND GRAB SOIL SAMPLE LOCATIONS ARE NOT SHOWN ON THIS FIGURE.
4. VAPOR INTRUSION SAMPLING IN THE ONE-STORY COMMERCIAL BUILDING NORTH OF THE GEM CLEANERS SITE BUILDING AND IN THE ONE-STORY COMMERCIAL BUILDING SOUTH OF THE SITE AT THE NORTHWEST CORNER OF NORTH VILLAGE AVENUE AND WASHINGTON STREET WAS PROPOSED; HOWEVER, ACCESS TO THESE STRUCTURES WAS NOT GRANTED BY THE PROPERTY OWNERS.

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
REMEDIAL INVESTIGATION SAMPLING LOCATION PLAN

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 5**
DATE:	OCTOBER 2019		

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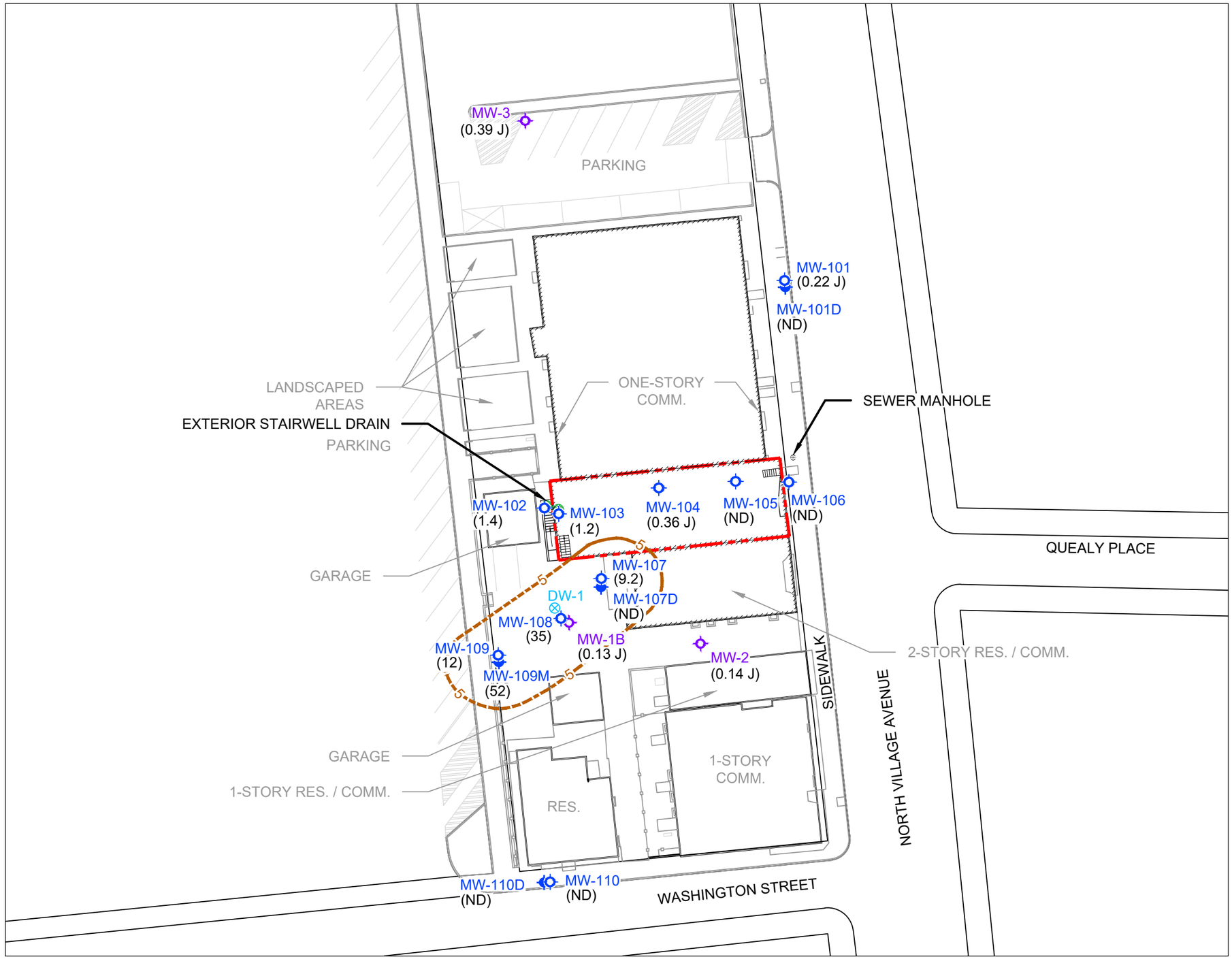
FILE NO.: Figure 5 - RI Samp. Loc. Plan.dwg



SCALE: 1" = 40'
SHEET SIZE: 11" BY 17"

LEGEND (SYMBOLS NOT TO SCALE):

	GEM CLEANERS BUILDING
DW-1	DRYWELL LOCATION AND IDENTIFICATION NUMBER
	DRAIN INLET
COMM.	COMMERCIAL
RES.	RESIDENTIAL
MW-X/B	EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
MW-XXX	SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
MW-XXXD/M	SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
(0.22 J)	PCE IN GROUNDWATER CONCENTRATION (µg/L)
5	PCE IN GROUNDWATER CONCENTRATION CONTOUR (µg/L, DASHED WHERE INFERRED)

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. DATA SHOWN IS THE HIGHER OF THE APRIL 2018 AND JULY 2018 SAMPLING EVENTS.
4. ND - NOT DETECTED.
5. PCE - TETRACHLOROETHENE.
6. J - ESTIMATED VALUE.
7. µg/L - MICROGRAMS PER LITER.

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
PCE CONCENTRATIONS IN GROUNDWATER

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 6**
DATE:	OCTOBER 2019		

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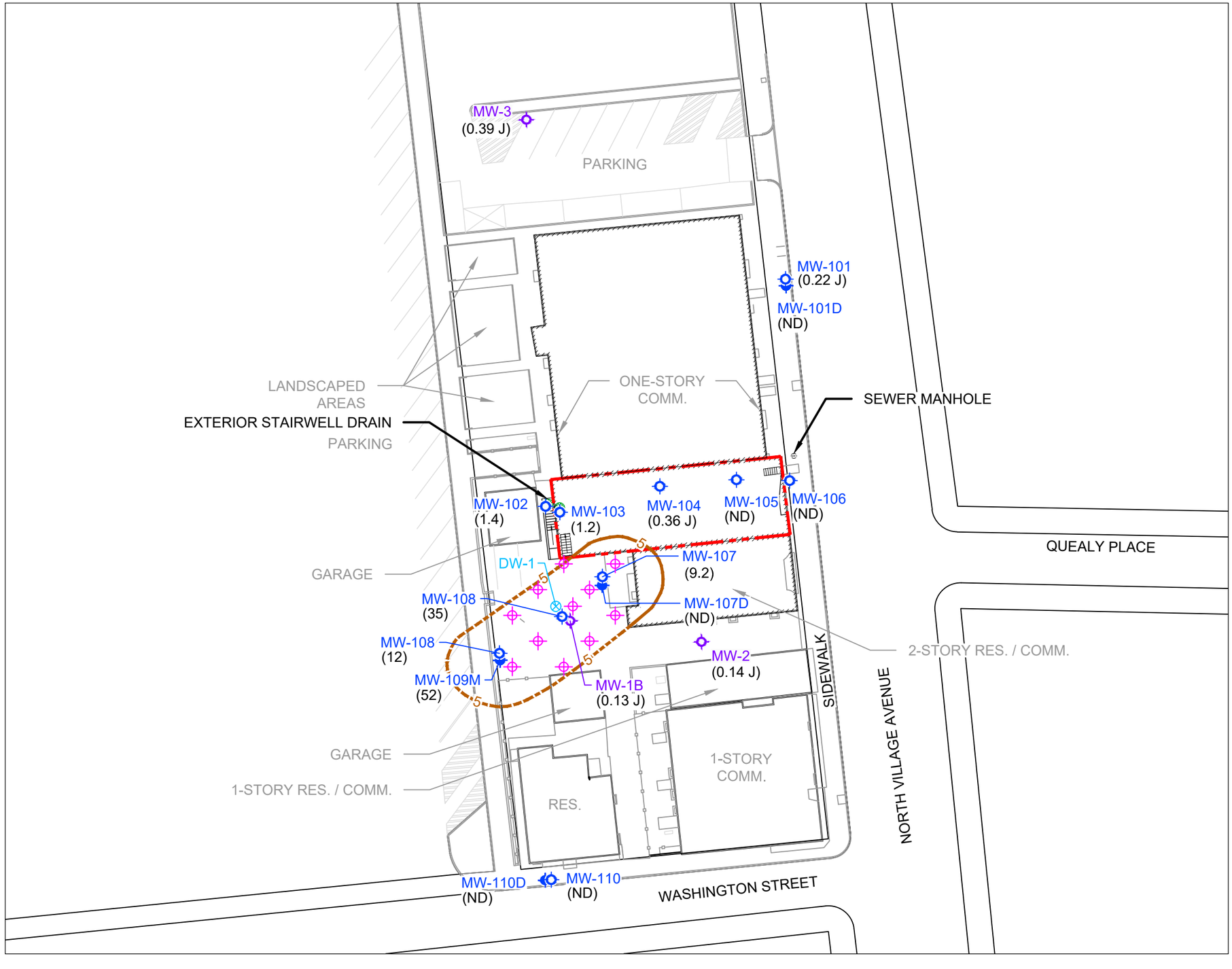
FILE NO.: Figure 6 - PCE Conc. in GW.dwg



SCALE: 1" = 40'
SHEET SIZE: 11" BY 17"

LEGEND (SYMBOLS NOT TO SCALE):

	GEM CLEANERS BUILDING
DW-1	DRYWELL LOCATION AND IDENTIFICATION NUMBER
	DRAIN INLET
COMM.	COMMERCIAL
RES.	RESIDENTIAL
MW-X/B	EXISTING MONITORING WELL LOCATION AND IDENTIFICATION NUMBER
MW-XXX	SOIL BORING AND SHALLOW MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
MW-XXXD/M	SOIL BORING AND DEEP / INTERMEDIATE MONITORING WELL LOCATION AND IDENTIFICATION NUMBER (INSTALLED MARCH/APRIL 2018)
(0.22 J)	PCE IN GROUNDWATER CONCENTRATION (µg/L)
5	PCE IN GROUNDWATER CONCENTRATION CONTOUR (µg/L, DASHED WHERE INFERRED)
	PROPOSED EISB INJECTION LOCATION

NOTES:

1. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES AND PROPERTY BOUNDARIES ARE APPROXIMATE.
2. DRAIN INLET, DRYWELL, SOIL BORING AND MONITORING WELL LOCATIONS SURVEYED BY PERFECT POINT LAND SURVEYING ON APRIL 17, 2018.
3. DATA SHOWN IS THE HIGHER OF THE APRIL 2018 AND JULY 2018 SAMPLING EVENTS.
4. ND - NOT DETECTED.
5. PCE - TETRACHLOROETHENE.
6. J - ESTIMATED VALUE.
7. µg/L - MICROGRAMS PER LITER.
8. EISB - ENHANCED IN-SITU BIOREMEDIATION.

PROJECT:
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
GEM CLEANERS - SITE NO. 130082
84 NORTH VILLAGE AVENUE
ROCKVILLE CENTRE, NY

TITLE:
CONCEPTUAL EISB INJECTION LOCATIONS

DRAWN BY:	H. DELGADO	PROJ NO.:	279191
CHECKED BY:	D. WARREN		
APPROVED BY:	L. O'HARA		**FIGURE 7**
DATE:	OCTOBER 2019		

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FILE NO.: Figure 7 - Concept. EISB Inj. Wells.dwg