FEASIBILITY STUDY

Former Canada Dry Bottling Facility
2 and 7 Badger Avenue
Endicott, New York

NYSDEC SITE CODE # 704050
WORK ASSIGNMENT NUMBER D006130-17

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Submitted: January 2013

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Former Canada Dry Bottling Facility
2 and 7 Badger Avenue
Endicott, New York

(Site Code # 704050)
(WA # D006130-17)

CERTIFICATION

I, Nancy Garry, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Feasibility Study 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.

Nancy Garry

Nancy Garry, PE
Project Manager

FEASIBILITY STUDY

Former Canada Dry Bottling Facility
2 and 7 Badger Avenue
Endicott, New York

1.0 INTRODUCTION

This report presents a Feasibility Study (FS) for remediation prepared by HRP Engineering, P.C. (HRP) in connection with the Former Canada Dry Bottling Facility at 2 and 7 Badger Avenue and the abutting paved areas located at 2 Badger Avenue in the Village of Endicott, Broome County, New York (Site # 704050), referred to herein as the Site (Figure 1).

A Remedial Investigation (RI) Report was completed for the New York State Department of Environmental Conservation (NYSDEC) pursuant to the NYSDEC Engineering Services Standby Contract Work Assignment (WA) D006130-17. The RI was carried out during the period of December 2009 through January 2013. Tasks included installation and analysis of passive soil samples, the installation of groundwater monitoring wells, two rounds of groundwater monitoring including on-site and off-site monitoring well locations, soil vapor points and the completion of RI Report.

This report summarizes the findings of the RI report, discusses the current and probable future use of the Site, and presents and compares potential remedial alternatives for remediation of the Site.

2.0 SITE DESCRIPTION AND HISTORY

The purpose of the RI was to characterize the source(s) of contamination and define the extent of hazardous substances located on the Site and surrounding areas. The purpose of this Engineering Services Standby Contract WA was to conduct a RI to characterize on-site and off-site media potentially impacted by historic activities at the Former Canada Dry Bottling Facility Site (Figure 2). The Site is located at 2 and 7 Badger Avenue, Village of Endicott, Broome County, New York (Figure 1). The Site encompasses all of 2 Badger Avenue and the northwest corner of 7 Badger Avenue. The surrounding properties consist of a mix of industrial, commercial, and residential use properties. The Site and surrounding area is generally flat and without feature. The Site was first investigated in the early 1990's.

The Site is improved by a one-story building that is approximately 11,610-ft^2 in size, constructed primarily of concrete block with a concrete slab floor. A small, paved loading area is located between the 2 and 7 Badger Avenue buildings and to the south of 2 Badger Avenue. However, the northern most portion of the Site is unpaved and is covered with top soil.

In order to identify the nature and extent of contamination at the Site, during the RI, HRP collected thirty-nine (39) Beacon® passive soil gas samplers, nine (9) subsurface soil samples from eight (8) soil borings that were converted to permanent groundwater monitoring wells, thirty-eight groundwater samples sampled in June 2011 and again in October 2011, five (5) sub-slab soil vapor samples, two (2) indoor air vapor samples and one (1) ambient air sample from the Site. The RI evaluated a broad range of parameters including target compound list (TCL) volatile organic compounds (VOCs), nitrate, sulfate, sulfide, iron (II), methane, pH, total organic carbon (TOC), alkalinity, chloride, carbon dioxide ($C0_2$), hydrogen, and TO-15. Additionally, four (4) microbial colony census samples were analyzed.

In December 2012 and in January 2013, an Interim Remedial Measure (IRM) occurred to eliminate receptor exposure to contaminants. Surface and subsurface soil were removed from the dry well located in the east basement of 7 Badger Avenue. The IRM work completed, including soil sample results and soil disposal information is included in the Construction Completion Report, which was submitted to the NYSDEC as a separate document from the FS.

3.0 SUMMARY OF REMEDIAL INVESTIGATION AND EXPOSURE ASSESSMENT

3.1 Summary of Remedial Investigation

Compounds detected in the various media tested during this RI were compared to the following New York State guidance documents and standards:

- Groundwater: NYSDEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1); Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations dated October 1993; Revised June 1998; ERRATA Sheet dated January 1999; and Addendum dated April 2000 (NYSDEC Class GA).

- NYSDEC Regulation, 6 NYCRR Subpart 375-6: "Remedial Program Soil Cleanup Objectives" which applies to the development and implementation of the remedial programs for soil and other media set forth in subparts 375-2 through 375-4 [Inactive Hazardous Waste Disposal Site Remedial Program, Brownfield Cleanup Program, and Environmental Restoration Program] and includes the soil cleanup objective tables developed pursuant to ECL 27-1415(6).

- NYSDOH Guidance, Soil Vapor: Guidance for Evaluating Soil Vapor Intrusion in the State of New York dated October 2006 prepared by New York State Department of Health, Center of Environmental Health, Bureau of Environmental Exposure Investigation.

Based on Site investigation findings, the nature and extent of the contamination on-site and off-site in the area encompassing 2 Badger Avenue is include trichloroethylene and its breakdown products. These chemicals are in the groundwater and soil throughout the Site and abutting areas. Based on the results of the RI, the groundwater has been impacted on-site due to past operations. The nature and extent of contamination on-site and RI activities can be summarized by the following:

On-site (2 Badger Avenue)

- Based on the findings to date, of the nine (9) subsurface soils analyzed for VOCs, only two (2) exceedances (methylene chloride and 1,2,4-Trimethylbenzene) were detected at HRP-MW-11 and reported above Unrestricted Subpart 375-6 SCOs. These two VOCs are not present above Residential values listed for Subpart 375-6 SCOs and therefore meet the proposed SCO's for the area and the use definitions in DER-10.

- During the installation of HRP-MW-11 significant staining, odor, and elevated PID readings were observed in soil samples between depths of 18 to 19 feet below ground surface (bgs). In addition, elevated PID readings were observed from 18 to 19 feet bgs in the same boring. Based on the sheen noted on the groundwater in the boring location and the analytical results from the soil samples, there is evidence of petroleum products at this location.

- Based on the soil boring installations on-site, the analytical soil sample results from the saturated zone at HRP-MW-11 (inside the building at 2 Badger Avenue, between the two [2] former floor drains), exceed Part 375 SCO for Protection of Public Heath, unrestricted use for methylene chloride (11-15 feet bgs) and 1,2,4-trimethylbenzene (18-19 feet bgs).

- Three (3) volatile organic compounds (VOCs) (cis-1,2-Dichloroethylene, vinyl chloride, and trichloroethylene) were detected among the three (3) groundwater samples analyzed from the on-site groundwater monitoring wells. The concentrations of VOCs in the aqueous samples located in the western portion of off-site marginally exceed the TOGS value for these parameters; however the results from the wells to the east of the Site are within TOGS values for submitted groundwater samples.

- One (1) groundwater sample was selected and submitted for analysis of TAL metals and miscellaneous parameters. There were no exceedances above the TOGS values in submitted groundwater sample.

- A passive soil gas survey was completed. The samples were analyzed for the VOC target compound list by EPA method 8260B. Trichloroethane (TCE) was detected in thirty-one (31) of the thirty-nine (39) passive soil gas samples. Detection limits ranged from HRP-PSV-13 (26 ng [nanograms]) located at the northern portion of the paved area between the two buildings to HRP-PSV-28 (94,933 ng) located in to the eastern area of the main storage room in 2 Badger Avenue.

- Based on the data generated from the Site investigation, there are two (2) source areas at the Site that appear to have historically contributed to the current on-site contamination. These source areas are the two (2) former on-site floor drains and associated sumps within 2 Badger Avenue.

Off-site (7 Badger Avenue)

- Based on the findings to date, of the seven (7) subsurface soils analyzed for VOCs, with no exceedances reported above 375-6 Unrestricted SCO - Protection of Public Health, and therefore meet the proposed SCO's for the area, and the use definitions in DER-10.
- Based on the soil sample, approximately two feet below the sump located in the eastern basement of 7 Badger Avenue, metals (total chromium, lead, and manganese) and PCBs were detected above Subpart 375-6 SCOs for Protection of Public Heath, restricted residential use, but did not exceed Commercial use. It should be noted that one (1) metal (Cadmium) did exceed Subpart Part 375 SCO for Protection of Public Heath, commercial use, but not industrial use standards. However, an IRM (Interim Remedial Measure) was conducted at the sump at 7 Badger Avenue to remove soil and the cinder blocks in the sump area. Confirmatory soil sampling was conducted from the IRM area and the levels of metals were below Part 375-6 SCOs for Restricted Residential limits.
- Eight (8) ground water samples were selected and submitted for analysis of TAL metals and miscellaneous parameters. There were no exceedances above the TOGS values in submitted groundwater samples.
- The results of the soil vapor sample analysis showed that there were a total of twenty-nine (29) VOC compounds detected across the five (5) soil vapor (SV), two (2) indoor air (AA), and one (1) outdoor air (OA) sampling locations. Of these analyzed samples, TCE and methyl chloride were noted in all of the nine (9) soil vapor samples. As a whole, low levels of chlorinated compounds (commonly associated with solvent degreasing and dry cleaning), and non-chlorinated compounds (commonly associated with petroleum products) were detected. Based on all the results from the soil vapor investigation, chlorinated compounds and non-chlorinated compounds were detected at low levels to the west and east of the Site.
- Based on analytical results of the soil vapor, the concentrations of soil vapor and indoor air for TCE were compared to the NYSDOH guidance for soil vapor intrusion, soil vapor/indoor air matrix 1 for TCE. Based on this matrix and from the January 2013 IRM soil sampling results, the action recommended by the NYSDEC and NYSDOH regulations is to take no further action at all the sampling locations in 7 Badger Avenue and to monitor 2 Badger Avenue.

3.2 Summary of Potential Human Exposure Pathways

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from the Site. As defined by the NYSDEC, an exposure pathway has five elements: 1) a contaminant source, 2) contaminant release and transport mechanisms, 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 exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future. An exposure assessment including potential migration routes by which chemicals in the environment may be able to reach human receptors was conducted during the RI. Potential points of human contact with contaminated media and exposure pathways were identified for the Site and abutting areas

- <u>Overburden Groundwater</u>

  There is currently no direct exposure pathway to overburden groundwater. At the time of investigation, the Site and the surrounding vicinity utilized municipal water for drinking water. Therefore, a threat of exposure could occur during future development or utility repair upon the Site should excavation and dewatering occurs, exposing workers to groundwater. A second threat of exposure could occur if visitors or trespassers were to come on-site during future development and be exposed to the groundwater. Since groundwater is not used as a drinking water supply and the likelihood for these exposure scenarios to occur is considered low due to the depth of groundwater, ingestion, dermal contact and inhalation of vapors are considered a minimal threat.

- <u>Surface Water</u>

  There is currently no direct exposure pathway to Surface water as it is not present on the Site. Exposure to surface water is feasible during temporary ponding subsequent to a rainfall or snowmelt event. Population receptors could include trespassers, site visitors, or future site workers. The overall likelihood for exposure to surface water is considered minimal at the Site.

- <u>Potential Exposure to Volatile Vapors</u>

  When volatile organics are detected within soil gas, soils and/or groundwater it creates a potential exposure to building occupants when vapors accumulate beneath structures with the ability to migrate into air, negatively impacting indoor air quality within a structure.

  The majority of the Site is currently developed with building in the northeast corner of the Site and the remaining areas are paved with blacktop with the one exception being the small top soil area at the northern most corner of the Site. The receptor population at this time includes workers, clients, and site visitors. The present exposure to chlorinated compounds (commonly associated with solvent degreasing), and non-chlorinated compounds (commonly associated with petroleum products) were detected during the soil vapor investigation as discussed in the RI. Chlorinated compounds and non-chlorinated compounds were detected at low levels to the west and east of the Site. Based on analytical results of the soil vapor; the concentrations of soil vapor and indoor air for TCE were compared to the NYSDOH guidance for soil vapor intrusion, soil vapor/indoor air matrix 1 for TCE. Based on this matrix, the action recommended by the NYSDOH regulation is to take no further action at all the sampling locations in 7 Badger Avenue and to monitor 2 Badger Avenue.

There is a potential exposure to volatile vapors to site visitors, workers and trespassers during future development in the undeveloped areas of the Site. If the Site is developed in the future, vapors could possibly accumulate in enclosed areas such as basements, crawl spaces, etc. In addition, there is the potential for contaminants in soil vapor to migrate off-site and into off-site structures through soil vapor intrusion. However, soil vapor will be addressed through the forthcoming remediation actions that will address contamination at the Site as per DER-10.

- Subsurface and Surface Soils

Potential routes of exposure to contaminants in subsurface and surface soils include dermal contact, ingestion and inhalation of soil particulates. Exposure to surface soils is possible for Site visitors, trespassers or future site workers. Exposure through dermal contact and ingestion is moderate to low due to the cover over the majority of the soils. Exposure through inhalation is considered low since no intrusive activities occur on-site that disturb soils and generate inhalable dust. At present, the exposure to subsurface soils is minimal since the Site is developed and the use is not changing.

During development, specifically disturbance of soils, the potential for exposures to soils would increase for on-site workers, utility workers, and visitors.

4.0 REMEIDAL GOALS AND REMEDIAL ACTION OBJECTIVES

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous substances disposed at the Site through the proper application of scientific and engineering principles.

The remediation goals for this Site are to eliminate or reduce to the extent practicable:

- exposures of persons both on-site and off-site to subsurface or surface soils and groundwater that contains elevated levels of cis-1,2-Dichloroethylene, diethyl ether, methylene chloride, and trichloroethylene in the contaminated media;
- prevent migration of contaminants that would result in groundwater contamination; and
- limit the possibility of the release of contaminants from subsurface or surface soils into potential indoor air and/or ambient air through soil vapor via remediation.

The remedial action objectives (RAO) for the Site are:

- Subsurface soils to achieve the soil cleanup objectives for the protection of public health for commercial use, set forth in 6 NYCRR, subpart 375-1.8 (g)(2)(iii) and presented in the protection of public health-commercial use column of Table 375-6.8(b); and

- Groundwater on-site to achieve the New York State Ambient water quality standards and guidance values listed in NYSDEC, Division of Water Technical and Operational Guidance Services (TOGS 1.1.1) and addendums.

- In compliance with NYSDOH Guidance for evaluating soil vapor intrusion in the Stateof New York, dated October 2006.

5.0 IDENTIFICATION AND SCREENING OF ALTERNATIVES

This section of the report provides an overview of potential remedial alternatives for the Site section of, which are screened for possible detailed consideration.

- **Alternative No. 1**: No Further Action
- **Alternative No. 2:** No Further Action with Site Management Plan
- **Alternative No. 3**: Soil Vapor Extraction System
- **Alternative No. 4**: Enhanced Intrinsic Bioremediation with Monitored Natural Attenuation
- **Alternative No. 5**: Electrical Resistance Heating

5.1 Alternative No. 1: No Further Action

The No Further Action Alternative recognizes the remediation of the site completed by the IRM(s). This alternative leaves the site in its present condition and does not provide any additional protection of the environment. The No Further Action alternative would not involve any surface soil, subsurface soil, groundwater, or soil vapor remedial activity. In addition, the No Further Action alternative would not place any institutional or engineering controls on the Site property, such as future land use restrictions, groundwater use limitations, and/or remediation through soil vapor extraction.

Present Worth: $0
Capital Cost:..$0
Annual Costs (Years 0-30):...$0

5.2 Alternative No. 2: No Further Action with Site Management Plan

The No Further Action with Site Management Alternative recognizes the remediation of the site completed by the IRM(s) and Site Management and Institutional Controls and Engineering Controls are necessary to confirm the effectiveness of the IRM. This alternative maintains engineering controls which were part of the IRM and includes institutional controls, in the form of and environmental easement and site management plan, necessary to protect public health and the environment from contamination remaining at the site after the IRMs. This alternative would include the abandonment of the on-site monitoring wells according to NYSDEC guidance documents, including removal of screens and risers when possible and backfilling with a bentonite slurry.

Present Worth: $58,985
Capital Cost:..$0
Annual Costs (Years 0-30): $2,500

5.3 Alternative No. 3: Soil Vapor Extraction System

Soil Vapor Extraction (SVE) system technology has been evaluated as an alternative to remediate impacted soil and groundwater at the Site (Figure 3). Soil vapor extraction technology is an in-situ method of remediation which requires the removal of contaminant air from the unsaturated zone. By applying a vacuum and removing vapors from the extraction wells, vapor flow through the unsaturated soil zone is induced. These vapor phase compounds volatilize from the soil matrix and then pass out of the groundwater and into the void spaces between soil particles and are carried by the air flow to the extraction wells for removal. The three main factors that control the performance of a venting operation are the chemical composition of each compound, vapor flow rates through the unsaturated zone and the flowpath of carrier vapors relative to the location of the compounds. The extracted vapors will be treated with an off-gas treatment which consists of passing through activated carbon if necessary.

The effectiveness of SVE increases with an increased depth to static groundwater, and becomes more efficient in non-stratified, highly impermeable geologic formations. To ensure that soil vapor extraction is a feasible and effective method for reducing concentrations of compounds present within soil pore spaces above the water table (vadose zone) and also dissolved in groundwater beneath the Site, a pilot test will be preformed. SVE pilot testing will be performed in order to evaluate the air permeability of the vadose zone beneath the Site. The data obtained from the pilot testing will be used calculate a radius of influence for a single extraction point and to develop a design and layout of an SVE system for the Site.

The SVE system would be designed to extract interstitial soil gases containing contamination from the unsaturated soils underlying the Site. The SVE system will be housed in 2 Badger Avenue in a room in the northeast corner of the building that held the former air sparge and SVE system. Operation and maintenance of the SVE system would require monthly site visits and system checks for the entirety of SVE life cycle to monitor the decreasing contamination and to ensure that the SVE is operating at its highest efficiency. Based on the levels of contamination on-site, the SVE system would have to be operated for 2 to 5 years to remediate the subsurface to RAOs.

Present Worth: $322,895
Capital Cost: $130,770
Annual Costs: (0-30 years) $12,500

5.4 Alternative No. 4: Enhanced Reductive Dechlorination with Monitored Natural Attenuation

Enhanced Reductive Dechlorination with monitored Natural Attenuation (MNA) would utilize two alternatives to spot treat primarily groundwater to shorten the lifetime of monitored natural attenuation needed. The combination of the two alternatives would lower the monitoring time by remediating the contamination faster than just MNA. Intrinsic bioremediation of VOCs depends upon natural processes such as aerobic and anaerobic biodegradation, dispersion, and volatilization to dissipate these compounds. As an overall-decreasing trend in TCE concentrations has been observed within the groundwater at the Site, enhanced intrinsic bioremediation is being pursued to remediate groundwater impact at the Site.

Enhanced reductive dechlorination (EDR) is an anaerobic biodegredation practice of adding hydrogen (an electron donor) to groundwater and/or soil to increase the number and vitality of indigenous microorganisms performing anaerobic bioremediation (reductive dechlorination) on any anaerobically degradeable compound or chlorinated contaminant. The most commonly targeted chlorinated groundwater contaminants are primarily used in industry as degreasing agents and include: perchloroethylene (PCE), trichloroethylene (TCE), dichloroethylene (DCE), and vinyl chloride (VC). EDR utilizes organic lading that directs aquifer microbial consortia into a low-redox behavior such as reduction and methanogenesis. Hydrogen Release Compound (HRC®), or a similar product, would be used as a onetime injection into the subsurface. HRC is a controlled release, electron donor material, that when hydrated is specifically designed to produce a controlled release of lactic acid. The newly available lactic acid is critical for the production of hydrogen to fuel anaerobic biodegradation processes in soil and groundwater.

HRC® is typically applied using direct-injection techniques. This process enables the viscous HRC® material to be pressure injected into the zone of contamination and moved out into the aquifer media. Once in the subsurface, HRC® can reside within the soil matrix fueling reductive dechlorination and promoting reducing aquifer conditions for periods of up to 24 months or longer through the controlled release of lactic acid (when in contact with water) and subsequent hydrogen production. HRC® is supplied as a viscous liquid for direct injection into contaminated groundwater and saturated soils. This newly available source of lactic acid is then metabolized by microbes to produce hydrogen which is then used in a naturally occurring process known as anaerobic reductive dechlorination.

Up to two injections would occur in the 2 Badger Avenue building and in surrounding Site areas. Groundwater monitoring for natural attenuation would continue for two to five additional years after the HRC injections occurred to monitor the decreasing contamination.

Present Worth: $300,525
Capital Cost:...$147,440
Annual Costs (Years 0-30): $9,960

5.5 Alternative No. 5: Electrical Resistance Heating

Electrical resistance heating (ERH) is an in-situ thermal treatment for soil remediation that can reduce the time to clean up volatile organic compounds (VOCs) from years to months. The ability of the technology to remediate soil and groundwater impacted by chlorinated solvents and petroleum hydrocarbons regardless of lithology proves to be beneficial over conventional in situ technologies that are dependent on advective flow.

Electrical resistance heating passes an electrical current through the contaminated soil. Resistance to this flow of electrical current warms the soil and then boils a portion of the soil moisture into steam. This *in-situ* steam generation occurs in all soil types, regardless of permeability. Electrical energy evaporates the target contaminant and provides steam as a carrier gas to sweep volatile organic compounds (VOCs) to vapor recovery (VR) wells. After the steam is condensed and the extracted air is cooled to ambient conditions, the VOC vapors are treated using conventional methods, including granular activated carbon (GAC) or oxidation. Electrodes are usually placed in the subsurface throughout the remediation area using standard drilling techniques.

The electrodes, which are in electrical contact but out of phase with each other, pass the electrical current through the soils between them. The natural resistance of the subsurface to this flow of electrical current creates uniform heating throughout the treatment area, regardless of whether it is saturated or unsaturated (vadose). Moisture present in the vadose and saturated zones conducts the electricity in the target treatment interval. The low volatility organic contaminants have a short hydrolysis half life and hydrolysis can be the primary form of remediation. This results in a rapid degradation of the contaminant that remediates that degrades the majority of the mass of the primary contaminant to a by-product.

The contamination within the shallow water bearing aquifer and soils, is being proposed to remediate utilizing ERH to treat impacted groundwater and subsurface soil at the Site. ERH application would require 2 months to a year to remediate the Site and would require confirmatory sampling prior to the completion of Environmental Easement to address any potential remaining groundwater contamination.

Present Worth: $3,391,090
Capital Cost:...$3,391,090
Annual Costs (Years 0-30): $0

6.0 DETAILED ANALYSIS AND COMPARISON OF ALTERNATIVES TO PROTECTION CRITERIA

Alternative selected for detailed analysis include:

- **Alternative No. 1**: No Further Action
- **Alternative No. 2**: No Further Action with Site Management Plan
- **Alternative No. 3**: Soil Vapor Extraction System
- **Alternative No. 4**: Enhanced Intrinsic Bioremediation with Monitored Natural Attenuation
- **Alternative No. 5**: Electrical Resistance Heating

These alternatives are developed in sufficient detail to allow an analysis of their effectiveness and implementability under applicable criteria for the ERP program, DER - 10 Technical Guidance for Site Investigation and Remediation, which require consideration of the following criteria:

- Overall Protection of Public Health and Environment
- Compliance with Standards, Criteria, and Guidance (SCGs)
- Long Term Effectiveness and Permanence
- Reduction in Toxicity and Mobility
- Short Term Effectiveness
- Implementability
- Cost effectiveness

6.1 Alternative No. 1 - No Further Action

- **Overall Protection of Public Health and Environment** – This alternative does not provide sufficient protection to human health and the environment. Residual public health risks would be high in consideration of: 1) the future use of the off-site, contaminated groundwater for drinking water or other purposes, 2) actions are needed to address potential exposures related to soil vapor intrusion and 3) exposure to subsurface soil that exhibit levels of contamination over SCGs. This alternative would not achieve Site RAO's.

- **Compliance with SCGs** – This alternative will not comply with SCGs since known contaminants exist in subsurface soils and the use of the Site groundwater for any purpose would be allowable without the implementation of institutional and engineering controls.

- **Long Term Effectiveness and Permanence** – This alternative will not constitute an effective long term solution because the lack of any remedial action or set controls would result in public health and environmental impacts and possible exposures.

- **Reduction in Toxicity and Mobility** – This alternative will not reduce the toxicity or mobility of the known contaminants on-site since no remedial action is proposed.

- **Short Term Effectiveness** – This alternative will not provide any benefits in the short term except for zero cost associated with no action and the time to implement the remedy. Potential human exposure, adverse environmental impacts and nuisance conditions at the Site resulting from this alternative are not anticipated.

- **Implementability** – This alternative could be easily implemented.

- **Cost** – No cost.

- **Land Use** – This alternative will not comply with the future commercial zoned use of the Site or the revitalization plans of the area and could possibly affect the general public that utilize the adjacent properties.

Although the No Further Action alternative would be the least expensive alternative, it would represent the greatest risk to public health and environment and to any future development of the Site property. As a result of the known contamination of the subsurface soil and groundwater, the No Further Action alternative is an impractical remedial action. This alternative poses the greatest public health and environmental risk and represents the greatest risk to the Site's viability for any future development or inhabitation. In addition, the No Further Action alternative may result in an unknown amount of future costs related to public health and/or future remedial action costs.

6.2 Alternative No. 2 - No Further Action with Site Management Plan

- **Overall Protection of Public Health and Environment** – This alternative will provide protection to human health and the environment through the use of a Site Management Plan and an environmental easement. This alternative would not achieve Site RAO's.

- **Compliance with SCGs** – This alternative will not comply with SCGs since known contaminants exist in subsurface soils.

- **Long Term Effectiveness and Permanence** – This alternative will not constitute an effective long term solution because the lack of any remedial action or set controls would result in public health and environmental impacts and possible exposures.

- **Reduction in Toxicity and Mobility** – This alternative will not reduce the toxicity or mobility of the known contaminants on-site since no remedial action is proposed.

- **Short Term Effectiveness** – This alternative will not provide any benefits in the short term except for minimal cost associated with alternative and the time to implement the remedy. Potential human exposure, adverse environmental impacts and nuisance conditions at the Site resulting from this alternative are not anticipated.

- **Implementability** – This alternative could be easily implemented.

- **Cost** – The initial cost to implement this alternative would include costs to decommission the existing on-site groundwater monitoring wells, complete an ALTA survey, and complete an environmental easement associated with the Site and development of a Site Management Plan. Future costs, however, may arise if the Site is developed and public health and environment exposure increases. See Table 1 for cost estimates.

- **Land Use** – This alternative would comply with the future commercial zoned use of the Site.

Although the No Further Action with Site Management Plan alternative would be the least expensive alternative, it would still have a risk to public health and environment and to any future development of the Site property. However, it would restrict the use of groundwater on-site and also the activities that can be completed on–site as part of any future development or changes to the subsurface. In addition, the No Further Action with Site Management Plan alternative may result in an unknown amount of future costs related to public health and/or future remedial action costs.

6.3 Alternative No. 3 - Soil Vapor Extraction System

- **Overall Protection of Public Health and Environment** – This alternative provides sufficient protection to both public health and the environment by eliminating exposure to subsurface contaminated soils and groundwater. This alternative would achieve the Site RAO's.

- **Compliance with SCGs** – This alternative complies with the SCGs regarding surface and subsurface soils as a result of contamination removal through the operation of the SVE system and the future use of the on-site groundwater due to implementation of engineering controls.

- **Long Term Effectiveness and Permanence** – The SVE system alternative will constitute an effective long term solution, as a result of 1) current Site conditions indicating highly permeable subsurface conditions based on soil types 2) with the exception of the area to the northern section of the Site, the Site has an impervious layer of black top, and 3) continued remediation of the subsurface soil and groundwater contamination.

- **Reduction in Toxicity and Mobility** – This alternative will reduce the toxicity and mobility of contaminants in the soils and groundwater through the operation of the SVE system and by monitoring remediation activities.

- **Short Term Effectiveness** – This alternative will provide limited benefits in the short term, including immediate reduction in the potential for soil vapor intrusion.

- **Implementability** –This alternative, Soil Vapor Extraction System, will result in the remediation of the Site. This alternative is easily implementable within several months of a pilot test, injection well installation, remedial system design and build, and system installation through the use of available contractors under the supervision and oversight of qualified field personnel. Such activities are performed frequently with high rates of success. The time to perform the job can be completed over two to five years.

- **Cost** – The cost to implement this alternative would be moderate due to the remedial steps involved: pilot test and the design, construction, and operation and maintenance. Costs would include the annual operation and maintenance costs to maintain the SVE system, the preparation of an environmental easement associated with the Site and the periodic certification required by an easement. See Table 2 for cost estimates.

- **Land Use** – This alternative would not interfere with Site land uses, however this alternative would utilize the currently vacant storage room in the northeast corner of 2 Badger Avenue. The future land use under this alternative would be consistent with current zoning and surrounding land use.

This alternative would yield a low risk to public health and environment because of low exposure to any residual contamination. Soil vapor extraction has already been implemented at the Site, and has been successful. A previously operated SVE system was used to successfully remediate petroleum contamination in the 1990's in the area of 2 and 7 Badger Avenue.

6.4 Alternative No. 4 – Enhanced Intrinsic Bioremediation with Monitored Natural Attenuation

- **Overall Protection of Public Health and Environment** – This alternative provides moderate protection to both public health and the environment by reducing the threat of exposure to surface and subsurface contaminated soils as well as treating in groundwater. However, unsaturated soils and surface soils would not be reduced by using this alternative. This alternative would achieve the Site RAO's.

- **Compliance with SCGs** – SCGs are satisfied under this remedial alternative. Contaminants in the subsurface soil would remain on-site, and the concentrations would be below the Commercial SCOs of Part 375. Groundwater compliance with Site RAO's is expected to be achieved within five to seven years after this alternative is implemented.

- **Long Term Effectiveness and Permanence** – This alternative will constitute an effective long term solution, as a result of 1) contamination source being addressed through injections 2) restricting the use of the off-site groundwater, and 3) the effects of biodegradation will be enhanced causing the contaminant breakdown to be accelerated. Biodegradation is accomplished through the activity of indigenous (native) microorganisms whereby the hydrocarbons are utilized as growth substrates and the groundwater contamination levels will be monitored over time along with continued monitoring of site conditions.

- **Reduction in Toxicity and Mobility** – This alternative will significantly decrease the toxicity of the contaminants in the saturated soils of 2 Badger Avenue. The mass volume of the contaminants will be addressed in the specific areas where the levels of subsurface and groundwater contamination are the highest. Enhanced intrinsic bioremediation coupled with natural attenuation will enhance natural processes such as aerobic and anaerobic biodegradation, dispersion and volatilization to naturally degrade dissolved petroleum compounds encountered within the saturated zone. The possibility of contamination rebound (i.e. an increase in the contamination concentration due to the increased mobility due to contaminate mobility after remediation of the compounds after remediation) exists.

- **Short Term Effectiveness** – This alternative will provide benefits in the short term. Enhanced reductive dechlorination (EDR) is accomplished through an anaerobic biodegredation practice of degrading compound or chlorinated contaminant from the soils in the saturated zone to non-toxic form and the contamination will be monitored over time. Potential human exposure, adverse environmental impacts and nuisance conditions at the Site resulting from this alternative are anticipated to be for a period of two days during Site work.

- **Implementability** – This alternative is easily implementable through the injection of material and use of available contractors under the supervision and oversight of a qualified field personnel. Such activities are performed frequently with high rates of success. The time to coordinate the work, advance the injection points, and apply treatment can be completed over several days. The MNA portion of this alternative would require additional years of monitoring to ensure that the treatment was working and that subsurface contamination did not worsen.

- **Cost** – The cost to implement this alternative would be the least expensive alternative after the "No action" alternative. Costs would include design, injection events and the continued monitoring of subsurface soil and groundwater conditions at the Site until concentrations decrease to acceptable levels. Confirmatory closure samples would also be required. See Table 3 for cost estimates.

- **Land Use** –The current on-site buildings could remain in place and uninterrupted use of the Site would be possible. The future land use under this alternative would be consistent with current zoning and surrounding land use.

This alternative provides adequate protection of public health and environment. The risk of exposure to remaining soil contamination is very low because there are no completed pathways through which the public may be exposed to contaminated subsurface soil. This alternative would provide the effective public health and environment protection and would be meet SCGs faster than Alternative 1 due to the enhanced intrinsic bioremediation. Because no long term operation and maintenance activities are involved, it would be more cost effective than Alternative 2, however, an additional two to five years of groundwater monitoring would be recommended.

6.5 Alternative No. 5 – Electrical Resistance Heating

- **Overall Protection of Public Health and Environment** – Upon completion, this alternative provides a sufficient level of protection to both public health and the environment by remediating contaminated groundwater and subsurface soils. Because the contamination would be removed from the Site, there would be no residual public health or environmental risks remaining after remediation. The Site would be restored to predisposal conditions. This alternative would achieve the Site RAO's.

- **Compliance with SCGs** - This alternative will comply with the SCGs regarding groundwater and subsurface soil requirements.

- **Long Term Effectiveness and Permanence** - This alternative will constitute an effective long term solution, as a result of 1) contamination source being addressed through ERH and 2) the effects of ERH will be enhanced causing the contaminant breakdown of groundwater and subsurface soils on the Site to be accelerated. There would be no residual risks since the source(s) of the contamination in the subsurface soil and the groundwater in the immediate area surrounding the application ERH would be remediated.

- **Reduction in Toxicity and Mobility** - This alternative will significantly decrease the toxicity of the contaminants in the soils. Full reduction in toxicity and mobility will be achieved via electrical resistance heating.

- **Short Term Effectiveness** - This alternative will provide significant benefits in the short term, notably the destruction of contaminants in the subsurface soil and groundwater. Potential human exposure, adverse environmental impacts and nuisance conditions at the Site resulting from this alternative are anticipated for the time period during which the alternative is active.

- **Implementability** - This alternative will result in the remediation of the Site. This alternative is implementable through the installation of ERH soil probes and associated extraction equipment, and use of available contractors under the supervision and oversight of qualified field personnel to install and maintain the ERH probes. The time to install the ERH can be completed over several days with the ERH system projected to be in operation for several weeks to months.

- **Cost** - The cost to implement this alternative would be the most expensive alternative. Costs would include design, preparation, excavation, project oversight and installation, and a long term electrical power source would be required. See Table 4 for cost estimates.

- **Land Use** Once the work was completed, uninterrupted use of the Site would be possible. The future land use under this alternative would be consistent with current zoning and surrounding land use. Land use would be significantly impacted during this alternatives implementation.

This alternative is the most expensive remedial alternative, although it would restore the Site to Unrestricted SCOs and thus be the protective alternative to public health and environment. Also, this alternative would not consist of any future land use or groundwater use restrictions and will meet the Site's RAOs. This alternative would provide the most public protection and would be effective faster than Alternatives 2, 3 and, 4, however, more expensive.

7.0 SUMMARY OF PROPOSED REMEDY

The following is a summary of the advantages and disadvantages for each of the four alternatives:

Alternative No. 1 - No Further Action

The No Further Action alternative represents the greatest risk to public health and environment and to any future development of the Site property. As a result of the known contamination of the saturated soil and groundwater, the No Further Action alternative is an impractical remedial action. In addition, the No Further Action alternative may result in an unknown amount of future costs related to public health and/or future remedial action costs.

Alternative No. 2 - No Further Action with Site Management Plan

The No Further Action with Site Management Plan alternative would be the least expensive alternative financially; it would represent a greater risk to public health and environment than Alternative 3, 4, and 5. As a result of the known contamination of the saturated soil and groundwater, the No Further Action with Site Management Plan alternative would restrict site use and access during current and future site use.

Alternative No. 3 - Soil Vapor Extraction System

This alternative would yield a low risk to public health and environment because once the contaminated soil and groundwater had been remediated; the public would have low exposure to any residual on-site contamination. In addition, this alternative would allow for the future proposed use of the Site in an approximately six month timeframe. However, because this alternative involves a SVE extraction system to be designed, built, and operated and maintained to complete the remedial process, it is more expensive than Alternative 3 providing similar protection and effectiveness.

Alternative No. 4 -Enhanced Intrinsic Bioremediation with Monitored Natural Attenuation

This alternative is the second least expensive remedial alternative, it has the potential to restore the Site to pre-disposal conditions and thus meet the Sites RAOs. Also, this alternative would consist of groundwater use restrictions and a moderate risk to public health and environment, and to any future on-site development during implementation of the remedy. Although this alternative allows for the future proposed use of the Site, it would take the most amount of time (five to seven years) to complete.

Alternative No. 5 – Electrical Resistance Heating

This alternative is the most expensive remedial alternative, it would restore the Site to pre-disposal conditions and would meet the sites RAOs. This alternative would not consist of any future land use or groundwater use restrictions and would yield the lowest risk to public health and environment, and to any future on-site development. However, the cost for this alternative is expensive due to the costs of a design, building, installing, and operation and maintenance of the system. There is a long time frame associated with this remedial alternative, it would take the second least amount of time (several weeks to months) to complete with confirmatory sampling upon remediation completion.

After considering the current and potential future uses of the Site, as well as reviewing and comparing the four alternatives for the Site, Alternative No. 3- “Soil Vapor Extraction System” would be the best alternative for the remediation of the Site. Alternative 3 was found to be protective of human health and the environment, fulfills the RAO’s for the site, and eliminates potential exposure to contaminants in groundwater and soil on-site. Therefore, the Soil Vapor Extraction System is suggested as the proposed remedy.

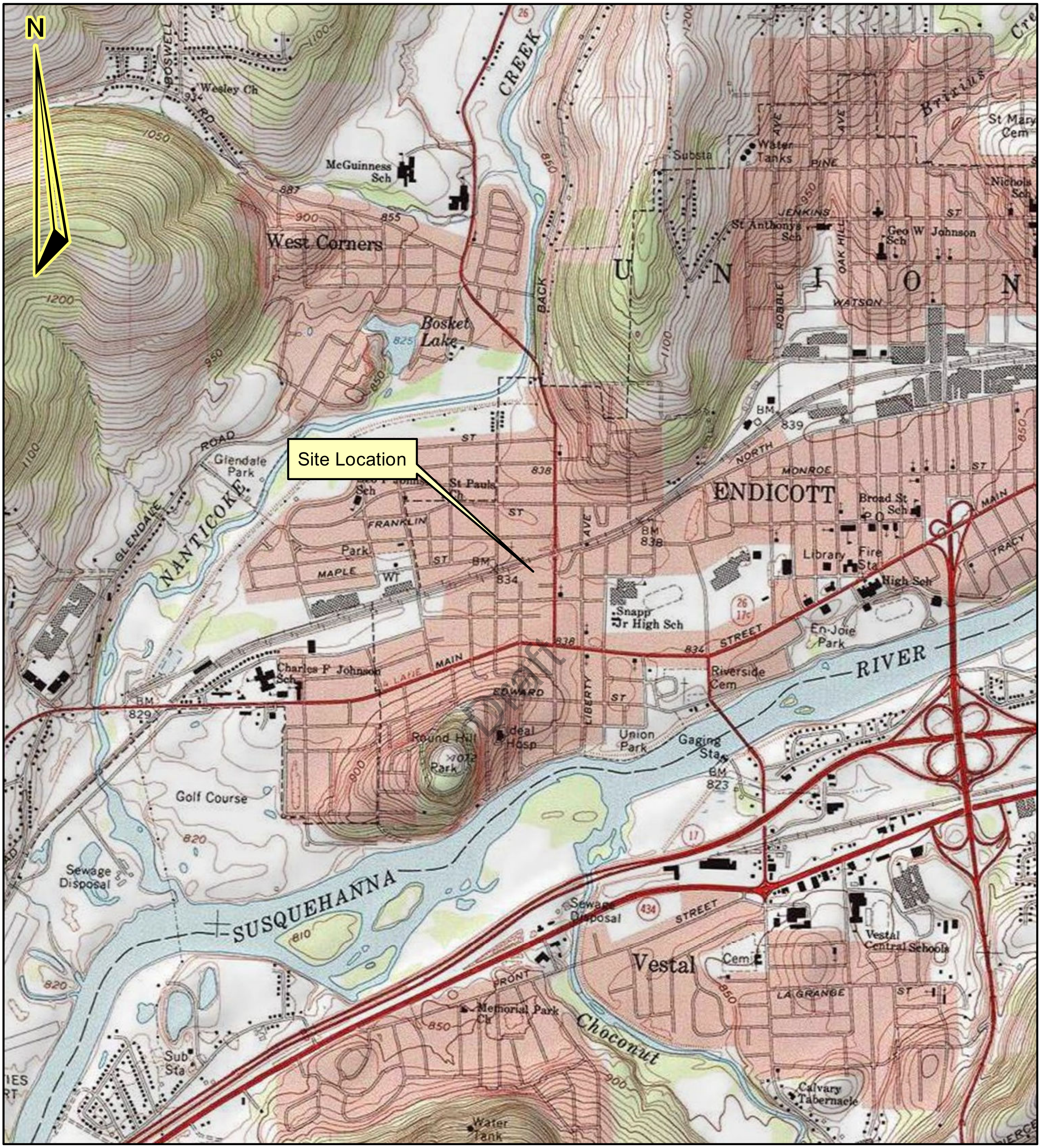
TABLE 1 Alternative No. 2- No Further Action with Site Management Plan		
Description	**Quantity**	**Cost (estimated)**
Subcontractor Costs (well abandonment only)	2 day	$5,470
Staff prep time ($100/hr)	4 hours	$400
Staff on-site labor ($100/hr)	16 hours	$1,600
Senior staff oversight ($130/hr)	3 hours	$390
PID, ($50/day)	2 day	$100
Field Equipment/PPE	2 day	$100
Prepare Environmental Easement	1 plan	$3,000
Site ALTA Survey for environmental easement	1 event	$5,500
SMP Development	1 event	$4,000
TOTAL		**$20,560**
Annual Cost	0-30 years	$2,500

TABLE 2 Alternative No. 3- Soil Vapor Extraction System		
Description	**Quantity**	**Cost (estimated)**
Subcontractor Costs (well abandonment only)	2 days	$5,470
Staff prep time ($100/hr)	4 hours	$400
Staff on-site labor ($100/hr)	80 hours	$8,000
Senior staff oversight ($130/hr)	25 hours	$3,250
PID ($200/wk)	2 weeks	$400
Field Equipment/PPE ($200/week)	2 weeks	$400
SVE Pilot Test	Per cost estimate	$11,050
SVE System Design and Construction	Per cost estimate	$89,300
Site ALTA Survey for environmental easement	1 event	$5,500
Prepare Environmental Easement	1 plan	$3,000
Site Management Plan	1 plan	$4,000
Total		**$130,770**
Years 0-30		
Annual Cost	0-30 years	$12,500

TABLE 3
Alternative No. 4- Enhanced Intrinsic Bioremediation with Monitored Natural Attenuation

Description	Quantity	Cost (estimated)
Well Abandonment	2 day	$5,470
Staff prep time ($100/hr)	4 hours	$400
Staff on-site labor ($100/hr)	40 hours	$4,000
Senior staff oversight ($130/hr)	3 hours	$390
Enhanced Intrinsic Bioremediation injections	lump sum	$80,000
Injection activities	2 days	$7,000
PID ($200/week)	1 week	$200
Field Equipment/PPE	1 week	$200
Confirmatory groundwater monitoring samples (1 event x 14 samples - $190/sample)	Estimated 14 samples per event (8 events)	$21,280
Semi-annual reports	8	$16,000
Site ALTA Survey for environmental easement	1 event	$5,500
Prepare Environmental Easement	1 plan	$3,000
Site Management Plan	1 plan	$4,000
Total		**$147,440**
Annual Cost	0-30 years	$9,960

TABLE 4 Alternative No. 5- Electrical Resistance Heating		
Description	**Quantity**	**Cost (estimated)**
Well Abandonment	2 day	$5,470
Staff prep time ($100/hr)	6 hours	$600
Staff on-site labor ($100/hr)	80 hours	$8,000
Senior staff oversight ($130/hr)	15 hours	$1,950
Electrical Resistance Heating, including the placement of 98 ERH probes and power source leasing	lump sum (6 month lease)	$3,366,230
Field Equipment/PPE	1 week	$200
Confirmatory soil samples from MW wells (VOCs plus QAQC 11 wells - $90/sample)	Estimated 8 sample events	$8,640
TOTAL	0-30 years	**$3,391,090**



USGS Quadrangle Information
Quad ID: 42076-A1
Name: Endicott, New York
Date Rev: 1969
Date Pub: 1972

1 inch = 2,000 feet

0 1,000 2,000 4,000

Figure 1
Site Location
2 & 7 Badger Avenue
Endicott, New York
Work Assignment# D006130-17
HRP # NEW9616.P2
Scale 1" = 2,000'

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Path: S:\Data\NNEWEN - NY STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\CANADA DRY PLANT, 2&7 BADGER AVENUE, ENDICOTT, NY\NEW9616P2\GIS\Site Location.mxd

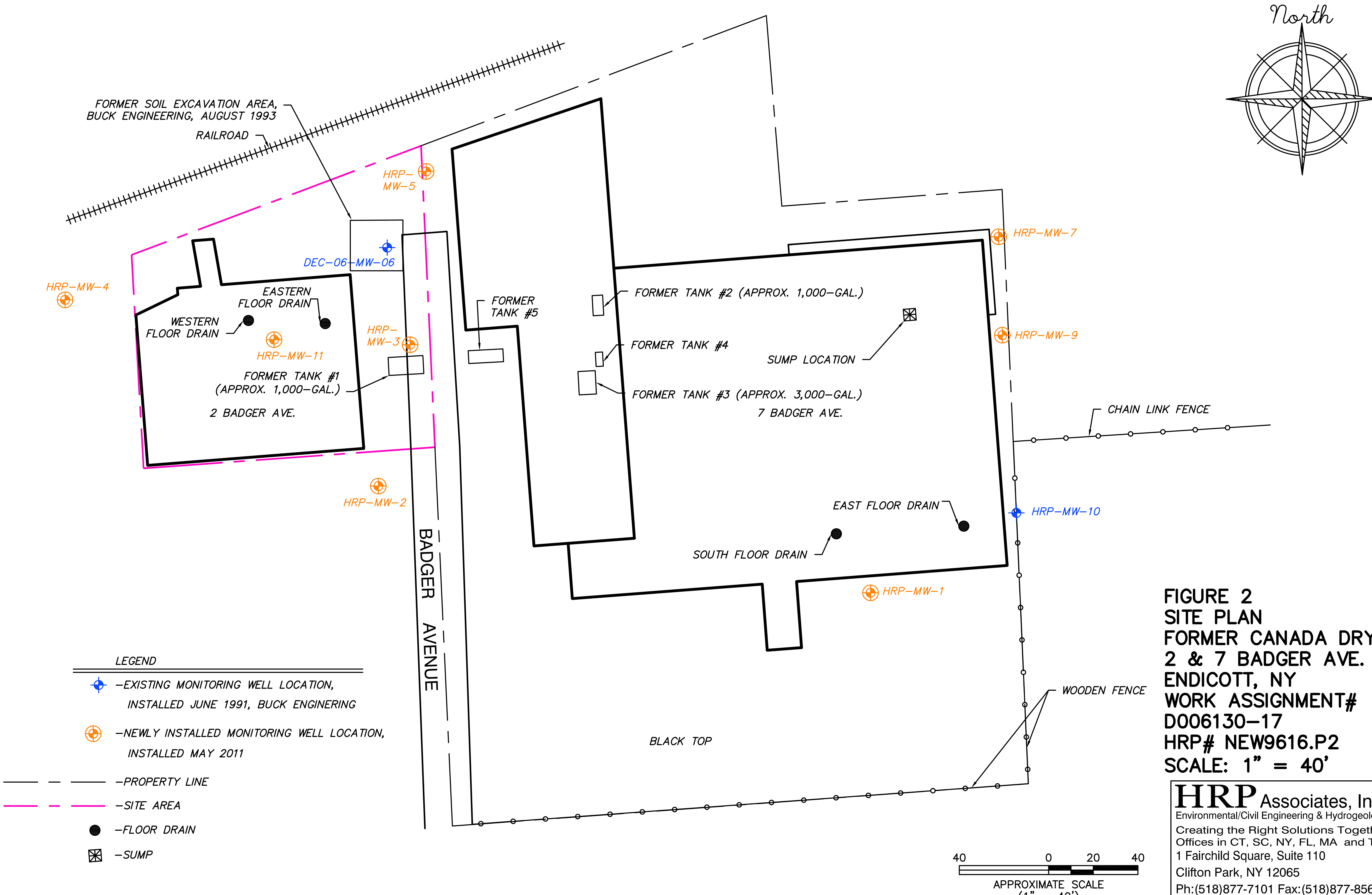

FIGURE 2
SITE PLAN
FORMER CANADA DRY
2 & 7 BADGER AVE.
ENDICOTT, NY
WORK ASSIGNMENT#
D006130-17
HRP# NEW9616.P2
SCALE: 1" = 40'

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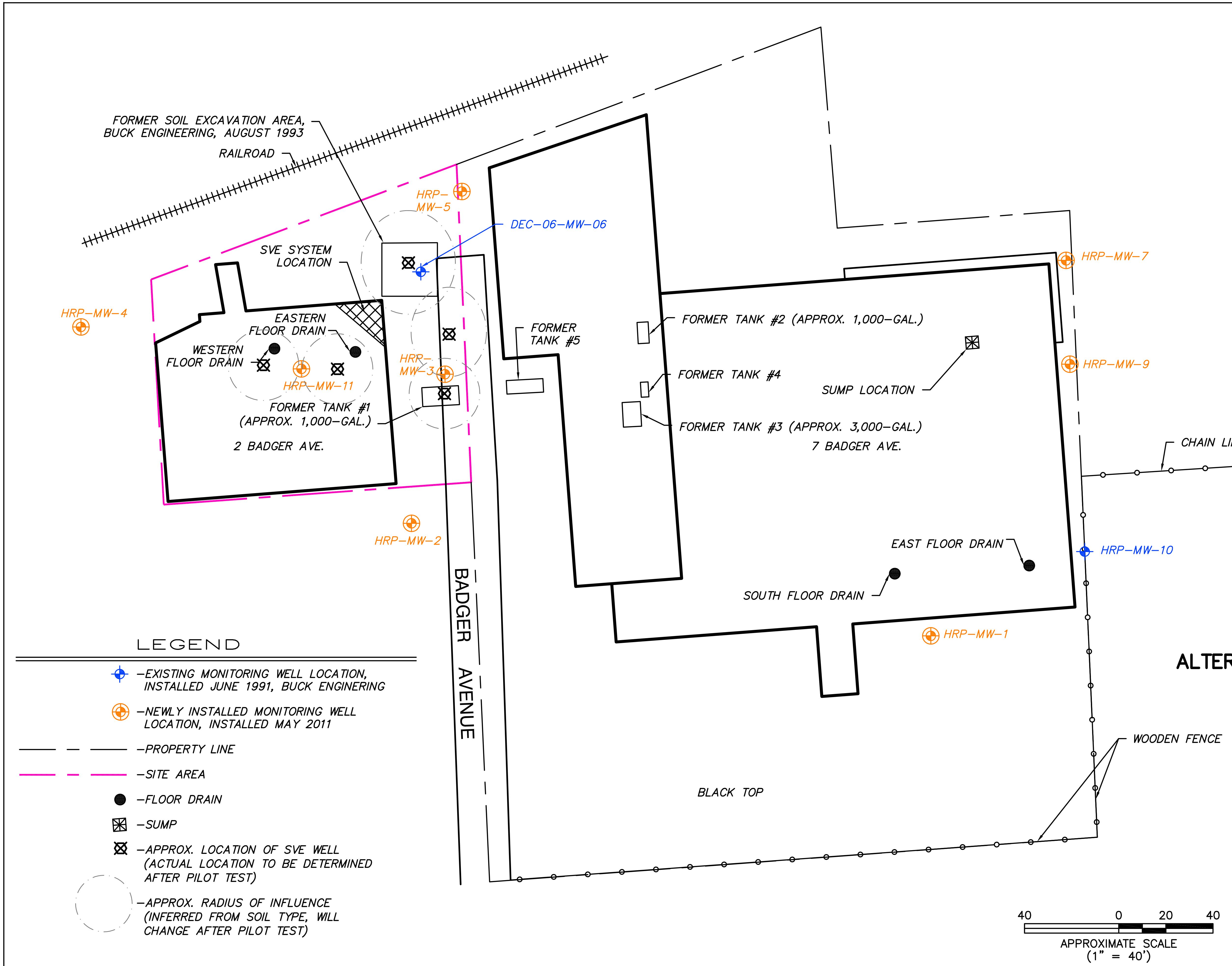

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FEASIBILITY STUDY
ALTERNATIVE 2: SOIL VAPOR EXTRACTION SYSTEM
FORMER CANADA DRY
2 BADGER AVENUE
ENDICOTT, NEW YORK
WORK ASSIGNMENT# D006130-17
SCALE: 1" = 40'

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