Groundwater
& Environmental Services, Inc.

2142 Priest Bridge Court • Suite 1 • Crofton, Maryland 21114 • (800) 220-3606 • FAX (410) 721-3733

September 9, 2010

Ms. Susan Bull
Maryland Department of the Environment - Oil Control Program
1800 Washington Street
Baltimore, Maryland 21230

Re: In Situ Chemical Oxidation Pilot Test Work Plan
Monrovia BP / Former Green Valley Citgo
MDE Case # 2005-0834-FR

Dear Ms. Bull:

Groundwater & Environmental Services, Inc. (GES) is pleased to submit the attached I*n Situ* Chemical Oxidation (ISCO) Pilot Scale Study Work Plan to the Maryland Department of the Environment (MDE) for consideration / approval at the above referenced Site. The work plan was prepared with the goal of determining the feasibility of using ISCO technology to reduce the dissolved–phase hydrocarbon mass present in the bedrock aquifer at this Site. GES has extensive experience with ISCO as we have utilized our ISCO technologies at over 250 sites across the United States (US) since 2003 with a total in excess of 1,000 long term and short term ISCO injection events.

Chemical oxidation using hydrogen peroxide and ozone has been proven to be an effective remediation technology for the oxidation of organic contaminants in subsurface soils and groundwater. Petroleum hydrocarbons, as are present at this Site, are amenable to remediation by this technology due to their ability to be directly oxidized by hydrogen peroxide and ozone, oxidized via free radicals, and also through subsequent increased aerobic biological activity. The oxidation process breaks down the organic contaminants into naturally occurring compounds. Hydrogen peroxide reacts with ozone and/or iron in the subsurface to form the hydroxyl radical (OH•). The dissolved and adsorbed hydrocarbons present have relatively high reaction rate constants with the hydroxyl radical and are readily susceptible to breakdown through this process.

GES has a patented process to inject oxidants to optimize the hydroxyl radical formation and enhance distribution in the subsurface. Gas (air/oxygen/ozone) injected under pressure acts as a carrier which aids in distributing the oxidant into the formation, greatly increasing the effective radius of influence (ROI). It also provides agitation which facilitates greater contact of the contaminants and the oxidant.

To implement this process, GES has fabricated and operates a mobile chemical oxidation system that can direct relatively high flow rates of hydrogen peroxide and air into injection points to remediate dissolved organic compounds. In addition, the system includes a small ozone generator (two pounds per day) to enhance the overall process. Based on our review of the Site information, GES recommends performing an initial pilot test at the Site to determine the feasibility of a full-scale implementation of a chemical oxidation program. The objective of the ISCO pilot test is to identify what volumes of fluid the aquifer can accept and what injection rates pressures and radius of influence (ROI) can be achieved. During the ISCO pilot study a limited quantity of peroxide will be injected, not to exceed approximately 110 gallons of 16 to 18 percent peroxide.

The attached work plan presents the following information to demonstrate that ISCO can safely and effectively be pilot tested as a viable remedial option for Site cleanup:

- ✓ Overview of Proposed Pilot Scale Test
- ✓ Test Objectives
- ✓ Proposed Test Location
- ✓ Procedures for Pilot Testing

As was discussed at our August 10, 2010 meeting, GES has experience with ISCO implementation in fractured rock aquifers and we believe that we can safely implement an effective program to eradicate MTBE from the bedrock aquifer system. We welcome a dialogue with the MDE and involved stakeholders related to the merits of this proposal and look forward to your response. A US Environmental Protection Agency (EPA) "Citizens Guide to Chemical Oxidation" has been attached to this cover letter for your use in ongoing MDE public outreach efforts.

Sincerely,
Groundwater & Environmental Services, Inc.

Steven M. Slatnick
Sr. Project Manager /
Site Operations Manager

Richard Evans, PE
Director of Engineering

Christopher Mulry, PG
VP Major Projects

Enclosures

c: Herb Meade, Carroll

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5102G)

EPA 542-F-01-013
April 2001
www.epa.gov/superfund/sites
www.cluin.org

A Citizen's Guide to Chemical Oxidation

The Citizen's Guide Series

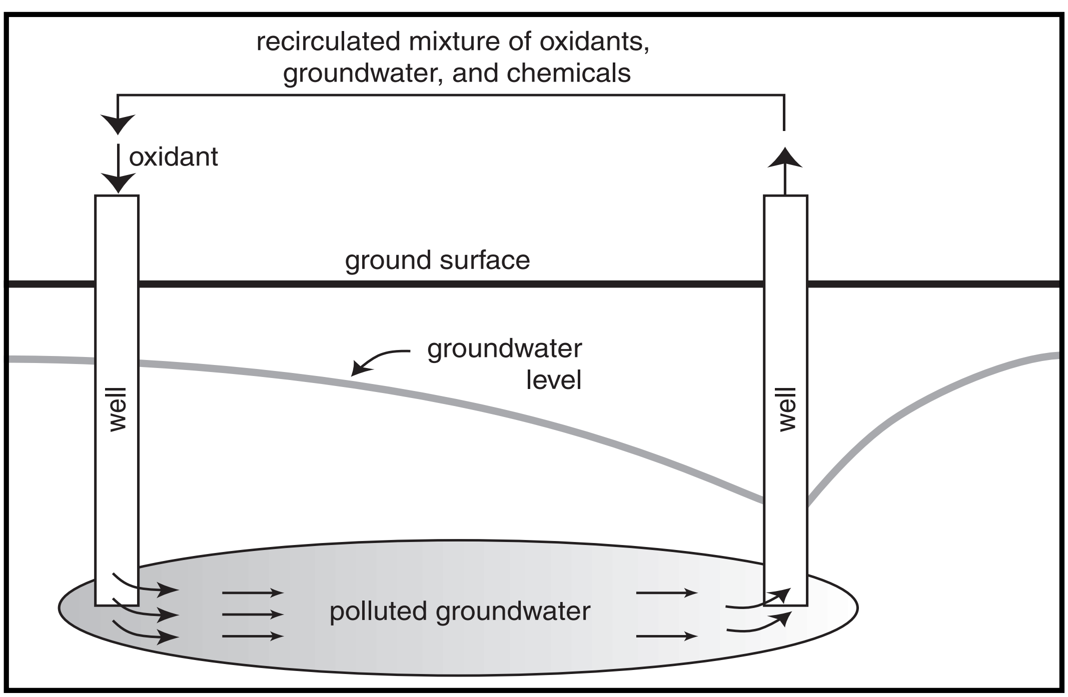
EPA uses many methods to clean up pollution at Superfund and other sites. Some, like chemical oxidation, are considered new or *innovative*. Such methods can be quicker and cheaper than more common methods. If you live, work, or go to school near a Superfund site, you may want to learn more about cleanup methods. Perhaps they are being used or are proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a series to help answer your questions.

What is chemical oxidation?

Chemical oxidation uses chemicals called *oxidants* to destroy pollution in soil and groundwater. Oxidants help change harmful chemicals into harmless ones, like water and carbon dioxide. Chemical oxidation can destroy many types of chemicals like fuels, solvents, and pesticides.

How does it work?

Chemical oxidation does not involve digging up polluted soil or groundwater. Instead, wells are drilled at different depths in the polluted area. The wells pump the oxidant into the ground. The oxidant mixes with the harmful chemicals and causes them to break down. When the process is complete, only water and other harmless chemicals are left behind.



To clean up a site faster, oxidants can be pumped in one well and out another well. This approach helps mix the oxidant with the harmful chemicals in the groundwater and soil. After the mixture is pumped out, it is pumped back (*recirculated*) down the first well. As pumping and mixing continues, more polluted soil and groundwater are cleaned up.

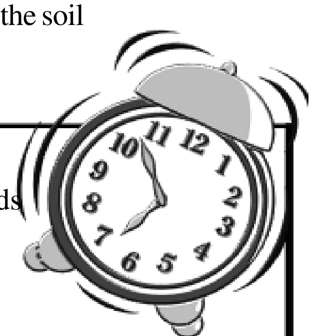
It can be hard to pump oxidants to the right spots in the ground. So before drilling starts, EPA must study the conditions underground by testing the soil and groundwater. Where is the pollution? How will the oxidant spread through the soil and groundwater to reach it?

The most common oxidant to clean up pollution is *hydrogen peroxide*. Another is *potassium permanganate*, which is cheaper. Both oxidants are pumped as liquids. And both have advantages depending on the site. Ozone is another strong oxidant, but because it is a gas, it can be difficult to use.

At some sites, a *catalyst* is used with the oxidant. A catalyst is a chemical that increases the strength or speed of a process. For instance, if hydrogen peroxide is mixed with an iron catalyst, it produces a strong chemical called a *free radical*. Free radicals can destroy more harmful chemicals than hydrogen peroxide alone.

Chemical oxidation can create enough heat to boil water. The heat can cause the chemicals underground to *evaporate*, or change into gases. The gases rise through the soil to the ground surface where they are captured and cleaned up.

How long will it take ?



The time it takes for chemical oxidation to clean up a site depends on several factors:

- size and depth of the polluted area
- type of soil and conditions present
- how groundwater flows through the soil (How fast? Along what path?)

In general, chemical oxidation offers rapid cleanup times compared to other methods. Cleanup times can be measured in months, rather than years.

Is chemical oxidation safe?

Chemical oxidation can be quite safe to use, but there are potential hazards. Oxidants are *corrosive*, which means they can wear away certain materials and can burn the skin. People who work with oxidants must wear protective clothing. Some oxidants can explode if used under the wrong conditions. Explosions can be prevented, however, through proper design of the chemical oxidation system. EPA makes sure that the system is properly designed. Workers also test the soil, groundwater, and air after chemical oxidation to make sure the site is cleaned up.

Why use chemical oxidation?

Chemical oxidation is being used at hundreds of sites across the country. It destroys pollution underground without having to dig it up or pump it out for transport to a treatment system. This saves time and money. Often chemical oxidation is used to clean up pollution that other methods can't reach, like pollution deep within the groundwater. Chemical oxidiation can be used to clean up the source of pollution. Most other methods that are used to remove the source are very slow and more expensive.

NOTE: This fact sheet is intended solely as general guidance and information to the public. It is not intended, nor can it be relied upon, to create any rights enforceable by any party in litigation with the United States, or to endorse the use of products or services provided by specific vendors. The Agency also reserves the right to change this fact sheet at any time without public notice.

For more information

write the Technology Innovation Office at:

U.S. EPA (5102G)
1200 Pennsylvania Ave., NW
Washington, DC 20460

or call them at (703) 603-9910.

Further information also can be obtained at **www.cluin.org** or **www.epa.gov/superfund/sites**.

Pilot Scale Study Work Plan

Monrovia BP / Former Green Valley Citgo
11791 Fingerboard Road
Monrovia, Maryland
MDE Case # 2005-0834-FR

Carroll Independent Fuel Company

Herb Meade
Environmental, Health and Safety Director
2700 Loch Raven Road
Baltimore, Maryland 21218

Groundwater & Environmental Services, Inc.
2142 Priest Bridge Court
Suite #1
Crofton, Maryland 21114

September 9, 2010

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1.0 Overview of Proposed Pilot Scale Test

This pilot scale study work plan has been prepared by Groundwater & Environmental Services, Inc. (GES) on behalf of Carroll Independent Fuel Company (CIFC) and the Probable Responsible Party Group (PRP Group) for the Monrovia BP / Former Green Valley Citgo project (Site) located in Monrovia, Frederick County, Maryland. This work plan is being submitted to the Maryland Department of the Environment (MDE) for review and approval.

GES is proposing to implement an in-situ chemical oxidation (ISCO) pilot test within the Green Valley Plaza shopping center area of the Site; Local Area Map attached as **Figure 1**. The pilot study area on-site has been selected for the following reasons:

- Proximity to highest dissolved Methyl Tertiary Butyl Ether (MTBE) concentrations (MW-13 and MW-7) from recent sampling events
- Existence of a dense network of downgradient (along strike of bedrock structural fabric) monitoring wells to allow for monitoring of test results and hydraulic control if necessary to prevent migration of oxidants
- Existence of a significant lateral distance (buffer) along bedrock fabric strike to nearest potable well receptors

A two-day long pilot test is proposed to determine the efficacy and feasibility of advanced chemical oxidation remediation techniques on the existing dissolved phase MTBE plume present in the bedrock aquifer in the Site vicinity. GES' patented Max-Ox family of ISCO technologies utilize combinations of liquid and gas oxidants (ozone, oxygen, atmospheric air, hydrogen peroxide, and other oxidants and amendments) to oxidize (chemically degrade) volatile organic compounds (VOCs) into naturally occurring compounds including carbon dioxide and water. Hydrogen peroxide reacts with ozone and/or iron in the subsurface to form the hydroxyl radical (OH•). The dissolved and adsorbed hydrocarbons present have relatively high reaction rate constants with the hydroxyl radical and are readily susceptible to breakdown through this process.

Based on site conditions, GES' HypeAir™ (short-term ISCO injection) and HypeAir-EX (continuously operating ISCO injection) are potentially viable remedies for this Site and have been successfully applied in fractured bedrock settings. Both HypeAir processes use specialized injection wells to inject liquid and gaseous oxidants into the subsurface while enhancing mixing and the radius-of-influence (ROI) of oxidant distribution through the dual phase injection process. The two-day pilot test will be designed to simulate the HypeAir-EX process which uses less hydrogen peroxide than the short-term injection process as the continuous injection process appears to be a better option based on the current site conceptual model. However, the data obtained during the pilot test can be used to design an effective process for either a short-term or extended duration injection approach.

The proposed pilot study will progress in the following manner:

- obtain property access and any necessary permission and permits to complete the contemplated work
- injection well/monitoring well installation
- baseline sample collection/characterization events
- pilot study field injection and response monitoring
- post-test groundwater characterization
- pilot test report and corrective action plan (CAP) preparation

All pilot study activities will be performed in accordance with local and state regulations and will follow established GES procedures to ensure that safety and technical objectives are met.

1.1 Health and Safety Protocol

GES will prepare a site-specific health and safety plan (HASP) for this Site. The HASP outlines the required monitoring equipment, protective clothing, action levels and emergency response procedures for the Site. Safety documents associated with conducting specific job tasks (Job Safety Analyses [JSAs]) will also be prepared based on the work being conducted. The HASP will be reviewed and signed by all GES personnel and subcontractors prior to performing work at the Site, and applicable JSAs will be reviewed and modified based on site conditions. All GES personnel and subcontractors will have successfully completed 40-hour Occupational Safety and Health Administration (OSHA) training in accordance with 29 CFR 1910.120. Applicable JSAs and a copy of the HASP will be present during all on-site activities. A copy of the HASP can be provided upon request.

Additionally, vapor extraction will be a component of the pilot test. Vapor extraction will be conducted in the vicinity of the building as a mitigation method for potential fugitive emissions from the oxidation process. Indoor air monitoring will also be conducted. Further details of fugitive emissions monitoring and mitigation are provided later in this work plan.

2.0 Test Objectives

The objectives of the pilot test are to:

- evaluate site-wide groundwater chemistry prior and subsequent to ISCO injections;
- determine the radius or zone of influence for the injection wells to establish appropriate spacing for a full-scale ISCO design;
- evaluate the effectiveness of the proposed ISCO technology to reduce dissolved-phase MTBE within the targeted treatment area (since pilot tests typically use only a percentage of the amount of oxidant needed to effectively remediate the area, reductions in MTBE may be limited after the pilot test);
- obtain operational and performance data to design a full-scale ISCO application, including injection flow rates and pressures, oxidant demand, appropriate monitoring actions and other design parameters; and
- evaluate the need for fugitive emissions recovery or other monitoring and safety contingencies appropriate to site conditions.

GES will use a combination of pre-test baseline analytical sampling, regularly collected field data during the test, and post-test analytical sampling to assess system performance. Pre-test data will be used as a baseline when determining overall contaminant reductions at the conclusion of pilot test activities. During the test, groundwater data, including groundwater elevation, monitoring well head space readings, dissolved oxygen (DO) content, oxidation reduction potential (ORP), temperature, and pH will be collected at proximal monitoring wells to determine the ROI of the injection wells. System information including injection flow rates and pressures will be recorded throughout injection activities to ensure these parameters are optimized during full-scale implementation.

3.0 Proposed Test Location

The pilot test will be conducted utilizing a series of three newly installed injection well clusters located to the south of the existing tank field and northeast of monitoring well MW-7 at the Site.

An additional nested observation well (MW-18N) is also proposed for installation approximately 10 to 15 feet southwest of the injection well area. Refer to **Figure 2** for the proposed pilot test injection and observation well locations.

For pilot testing purposes, the short-term HypeAir process and mobile injection platform will be used. GES' mobile chemical oxidation truck will be mobilized to the Site to provide the system components. GES will operate all equipment via an on-board generator. GES staff selected for the test completion are fully trained and experienced with this work. Quick-connect hoses will be utilized to connect the proposed injection wells and existing monitoring wells to the HypeAir truck. The HypeAir truck will be demobilized from the Site at the end of each day of testing. One 55-gallon drum of 31% hydrogen peroxide will be used. It will be stored in a secured containment area during the test. Totes of water will also be stored at the Site for chemical mixing and as a safety measure in the event of a surface spill of hydrogen peroxide (for dilution).

4.0 Procedures for Pilot Testing

4.1 Well Installation and Development

This planned scope of work includes the installation of three (3) nested injection points (IW-1, IW-2 and IW-3), one nested observation well (MW-18N) and one vapor extraction well (VE1) as indicated on **Figure 2.**

GES will provide a qualified geologist to perform oversight during the installation of the three injection wells. GES personnel will identify potential conflicts (i.e., subsurface utilities, overhead restrictions, facility features, etc.) with the proposed well locations. The final well locations may be adjusted during field activities. In accordance with GES health and safety requirements for drilling operations, each boring location will be hand-cleared using an air knife to a depth of at least five feet below ground surface (bgs). The proposed injection well depths, diameters and screen intervals are shown in **Table 1** below**.**

Injection Wells
Each of the three (3) nested injection wells will be utilized to simultaneously inject hydrogen peroxide liquid and ozone/oxygen gas to maximize oxidant distribution within the targeted saturated bedrock zones. Each nested pair of injection wells will be installed in a single 8-inch diameter borehole. Borehole advancement will be performed using air rotary or rotary sonic drilling techniques.

During drilling, samples will be collected from the retrieved core cuttings at five-foot increments. These samples will be sealed in airtight bags to allow volatilization and subsequently screened for VOCs with a hand-held Photoionization Detector (PID) with 10.6-eV bulb strength. A qualified GES geologist will characterize soil/rock composition during well installation efforts and record any VOC response from core screening.

GES' Max-Ox injection points will be fabricated and used for the injection wells. The Max-Ox injection points will be constructed of stainless steel screen and riser for oxidant compatibility (ozone is not compatible with PVC). Three discrete zones will be targeted with nested injection well pairs. The target zones are approximately 63-73 feet bgs in IW-1, 93-103 feet bgs in IW-2, and 123-133 feet bgs in IW-3. Sand pack will be placed surrounding the screen and at least 6 inches above the screen. Hydrated bentonite and a grout seal will be installed between screen intervals to prevent short-circuiting between the intervals. After the last screen interval, the borehole will be filled with concrete grout to the surface. Each well will be finished in a flush mount 10- or 12-inch diameter manhole. Each injection well will be capped with a threaded plug. A cross section illustrating a typical Max-Ox injection well is depicted on **Figure 4.**

In order to ensure compatibility with the oxidants to be injected, the injection wells will be constructed using stainless steel well screen and riser. Each of the injection wells will be constructed by installing two (2) ¾" diameter stainless steel Max-Ox points (each point will be constructed to allow for injection of ozone/oxygen and hydrogen peroxide) into an 8-inch diameter borehole. The designed screen lengths for each injection point will be three feet in length. Sand pack will be placed surrounding the screen and to a depth of at least one foot above the top of the screen. A 2-foot bentonite seal will be placed above the sand pack surrounding the stainless steel screen to prevent short-circuiting.

The injection well depths and screen intervals are shown in **Table 1** below.

TABLE 1. Proposed Injection Well Details (dual nested points for Peroxide and Ozone)

WELL ID	USE	TOTAL WELL DEPTH (FEET)[1]	INJECTION PT. DIAMETER (INCHES)	INJECTION PT. SCREEN INTERVAL (FEET, BGS)
IW-1	H_2O_2 Injection	67	0.75	63 - 67
	O_3 Injection	73	0.75	69 - 73
IW-2	H_2O_2 Injection	97	0.75	93 – 97
	O_3 Injection	103	0.75	99 -103
IW-3	H_2O_2 Injection	127	0.75	123 – 127
	O_3 Injection	133	0.75	129 - 133

Vapor Extraction Well

One 4-inch diameter soil vapor extraction (SVE) well will be installed proximal to the building in the vicinity of the injection wells. The purpose of the vapor extraction well is to monitor for potential fugitive emissions near the building and for use to extract/mitigate vapor streams containing ozone or VOC concentrations above 50 parts per million (ppm) should they be detected. The well will be installed to an approximate depth of 20-25 feet with 5 feet of casing and 15-20 feet of screen. Actual construction details will be field-determined, but the well will be constructed to provide open screen through the interface between saprolite and competent rock with the screen interval extending to within approximately 8 feet of the surface. This vapor extraction well, also shown on **Figure 2**, will likewise be installed using the air rotary or rotary sonic drilling techniques. The well will be placed a minimum distance of 15 feet from any injection point and as close as possible to the sidewalk serving the Green Valley Shopping Center.

Observation Well

A nested monitoring well pair is proposed to be installed approximately 15 feet southwest of the injection well cluster to allow for monitoring of shallow and deep aquifer response to injection activities. These wells are proposed to be installed with 2-inch diameter screened intervals from 45-70 feet for shallow groundwater monitoring and 120-130 feet for deep zone monitoring. GES proposes to install both wells in the same bore hole using air rotary or rotary sonic drilling technique to advance the bore. We believe this construction will provide for adequate separation between the screened intervals to ensure well integrity as well as provide a mechanism to evaluate vertical head gradients and provide a window in close proximity to the injection points for monitoring of injection effects. This proposed nested well is identified on **Figure 2** as MW-18N.

Well Development
Following installation of the vapor extraction and observation wells, GES will complete well development activities using a surge and pump method to establish connectivity with the aquifer and to ensure that samples subsequently collected from these locations are representative of aquifer conditions.

For the three nested injection wells, an air-lifting technique will be utilized to complete the development. Surging with compressed air is done by injecting a sudden charge of compressed air into the well so that water is forced through the well screen and gravel pack. Well development will utilize an air compressor and ¾-inch wellhead connection which will allow the air hose to be advanced into the well. Air lifting will start at the top of the screened interval and move downward until the sand pack throughout the screened interval is developed. Once the air lifting is initiated, air flow rates will be adjusted as needed to facilitate the removal of fines, and until the discharged water is sediment-free. In general, well development procedures will continue for each well until (1) the development water becomes visually clear of suspended sediment, and (2) a minimum of three to five calculated well volumes of the initial standing water column has been purged.

Standard well development procedures will be used for the vapor extraction and observation wells to establish connectivity with the aquifer. Purge water will be containerized and disposed on-site through granular activated carbon (GAC).

The scope also includes the use of eleven (11) existing monitoring wells (MW-6, MW-7, MW-8, MW-9, MW-10, MW-13, MW-14S, MW-14D, MW-15D, MW-16 and MW-17) for use in monitoring aquifer response to oxidant injection.

4.2 Baseline Groundwater Characterization

Groundwater
One baseline groundwater sampling event will be conducted prior to the pilot test. The baseline sampling event will include measurement of field chemistry parameters and laboratory analytical samples. The proposed sampling and analyses are summarized in **Table 2** below. Injection well samples would be collected from only one of the two nested intervals in each of the three injection point couplets.

TABLE 2. Baseline Groundwater Sampling Plan

Well ID	Field Chemistry Parameters					Laboratory Analytical Parameters						
	DO	ORP	pH	Cond	Temp	VOCs	TOC	COD	Diss. Iron	Total Iron	Cr	TDS /TSS
MW-7	X	X	X	X	X	X	X	X	X	X	X	X
MW-14D	X	X	X	X	X	X	X	X	X	X	X	X
MW-15D	X	X	X	X	X	X	X	X	X	X	X	X
MW-17	X	X	X	X	X	X	X	X	X	X	X	X
MW-18N	X	X	X	X	X	X	X	X	X	X	X	X

DO – Dissolved Oxygen
ORP – Oxidation Reduction Potential
VOCs – Volatile Organic Compounds
TOC/TSS – Total Organic Carbon/ Total Suspended Solids

COD – Chemical Oxygen Demand
TDS – Total Dissolved Solid
Cr – Chromium

4.3 Feasibility Testing

The proposed injection event will be conducted on a pilot basis using one 55-gallon drum of 31% hydrogen peroxide. The two-day pilot test will be used to determine how much oxidant (liquid and gas) can actually be injected for designing subsequent full-scale injection events. DO, ORP, groundwater temperature, hydrogen peroxide and pH data will be collected from the monitoring wells before, during (after one hour and every two hours thereafter), and after the injection to help determine the ROI, as well as headspace readings of ozone, oxygen, LEL, and hydrocarbons at observation wells.

4.4 Post-Pilot Test Groundwater Analysis

Groundwater
Post-injection groundwater sampling will be conducted to evaluate the effects of the injection event of target organic and inorganic analytes. One event will be conducted approximately one week after the pilot test and a second will be conducted approximately four weeks after the injection event. The proposed analytical suite is summarized in **Table 3** below.

TABLE 3. Post-Pilot Test Groundwater Sampling Plan

Well ID	Field Chemistry Parameters						Laboratory Analytical Parameters						
	DO	ORP	pH	Cond.	Temp	H_2O_2	VOCs	TOC	COD	Diss. Iron	Total Iron	TDS/ TSS	Cr
MW-7	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-14D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-15D	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-17	X	X	X	X	X	X	X	X	X	X	X	X	X
MW-18N	X	X	X	X	X	X	X	X	X	X	X	X	X

Note that hydrogen peroxide, TOC, COD, TDS, and sulfate will only be analyzed during the first post-injection sampling event. In addition, this analytical suite may be modified based upon the baseline sampling results.

5.0 Pilot Test Monitoring and Contingency Plans

The following steps have been included in the pilot test program, in addition to standard and baseline monitoring as an additional means of adding redundant monitoring, contingency action plans and other potential safeguards:

- collect liquid level, DO and ORP data from all wells on site prior to initiation of injection
- monitor for the presence of peroxide in select monitoring wells including MW-7, MW-14D, MW-15D, MW-17 and proposed MW-18N after one hour and every two hours thereafter. If peroxide is detected in any well other than the MW-18N or if the liquid level in any well other than the closest MW-18N rises more than 1.5 feet, we would cease injection, activate groundwater extraction pumps in the well immediately downgradient of the affected well and increase monitoring to 30 minute intervals.
- pumps will be deployed and ready to go (generator and holding tank) in wells MW-17, MW-14D and MW-16. These pumps will be configured so they can be readily moved to

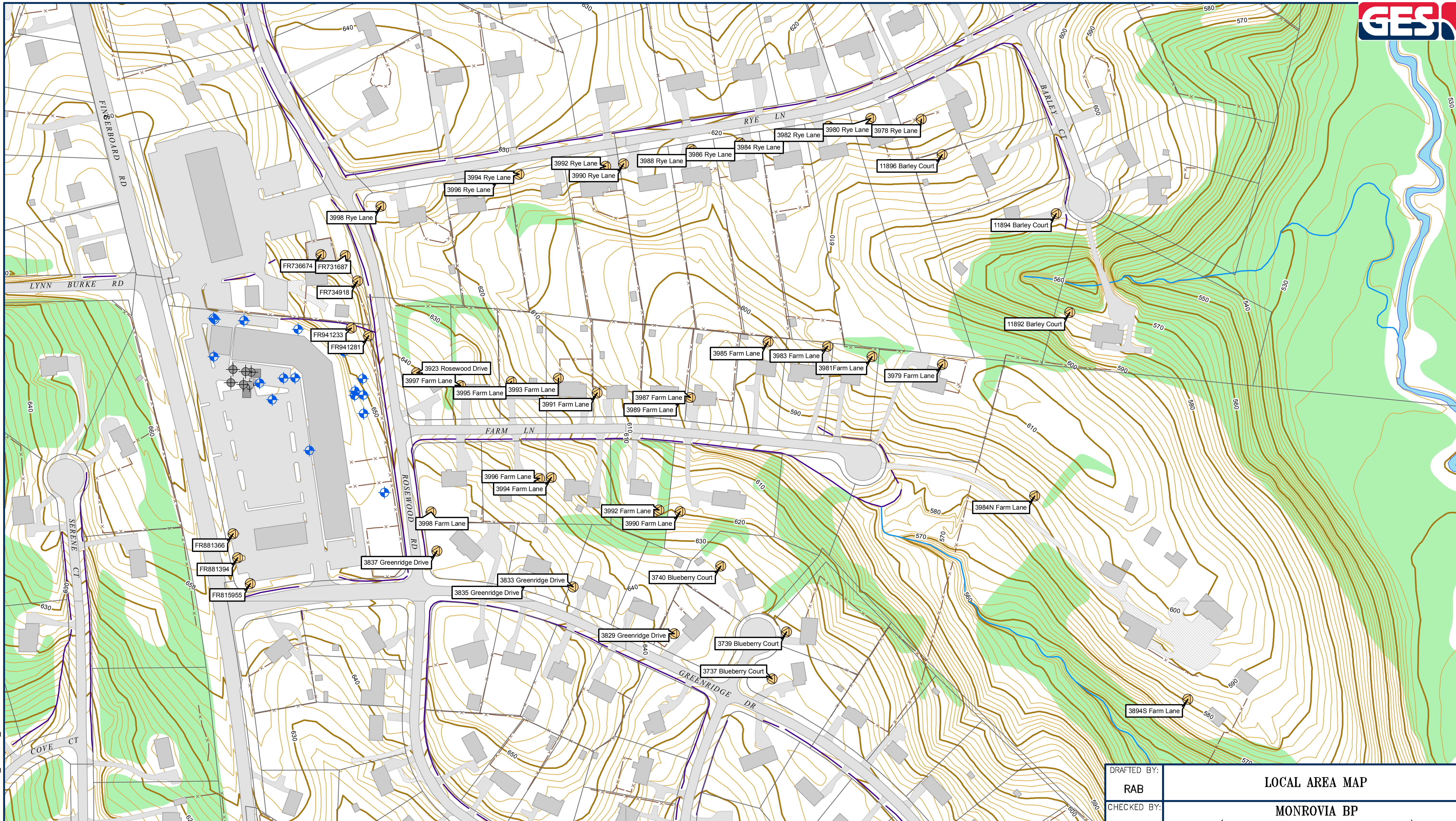
another location and GES personnel will be on hand to implement such activity if necessary.

- Vapor monitoring to include VOC and ozone analysis will take place at MW-18N and MW-15D, MW-7, MW-17 and MW-14D at one hour after injection initiation and every hour thereafter. Should ozone be detected in any well other than MW-18N, injection will cease and active SVE will begin at the affected well and monitoring frequency will increase to 30 minute intervals.
- Indoor air monitoring will be conducted before, during pilot testing and approximately one hour subsequent to the completion of daily ISCO events in each of the occupied spaces of the Green Valley Shopping Center. GES personnel will utilize a PID, Oxygen meter and an Ozone meter to monitor the air breathing zone. Should meters detect concentrations of concern above background levels or any ozone concentration, the ISCO pilot test will be immediately stopped and ventilation of the indoor spaces will be conducted using ventilation fans which will be maintained on standby during the test.

6.0 Pilot Study Summary Report and Corrective Action Plan

Following receipt and review of the post-remediation sampling analytical data, GES will prepare a summary report. The summary report will document the results of the chemical oxidation pilot test including the injection rates/quantities/pressures, groundwater and headspace monitoring data, estimated area of influence and overall feasibility of the ISCO technology to meet project objectives of MTBE reduction in the bedrock aquifer. The efficacy of monitoring and contingency steps will also be evaluated and discussed. The results, findings and conclusions will be incorporated into a revised Corrective Action Plan for the Site.

FIGURES



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Legend

Abandoned Well	Tank Field Well	Topographic Contour (10 ft)	Building	Stream	Wooded Area
Monitoring Well	Abandoned Soil Vapor Point	Intermediate Contour (2 ft)	Paved Road/Drive	Ditch	
Potable Well	Fence	Property Boundary	Unpaved Drive	Water Body	

Source:
Frederick County GIS

DRAFTED BY: RAB	LOCAL AREA MAP
CHECKED BY:	MONROVIA BP (FORMER GREEN VALLEY CITGO) 11791 FINGERBOARD ROAD MONROVIA, MARYLAND
REVIEWED BY: SMS	

Groundwater & Environmental Services, Inc.
2142 PRIEST BRIDGE COURT, SUITE 1, CROFTON, MD 21114

NORTH	SCALE IN FEET	DATE	FIGURE
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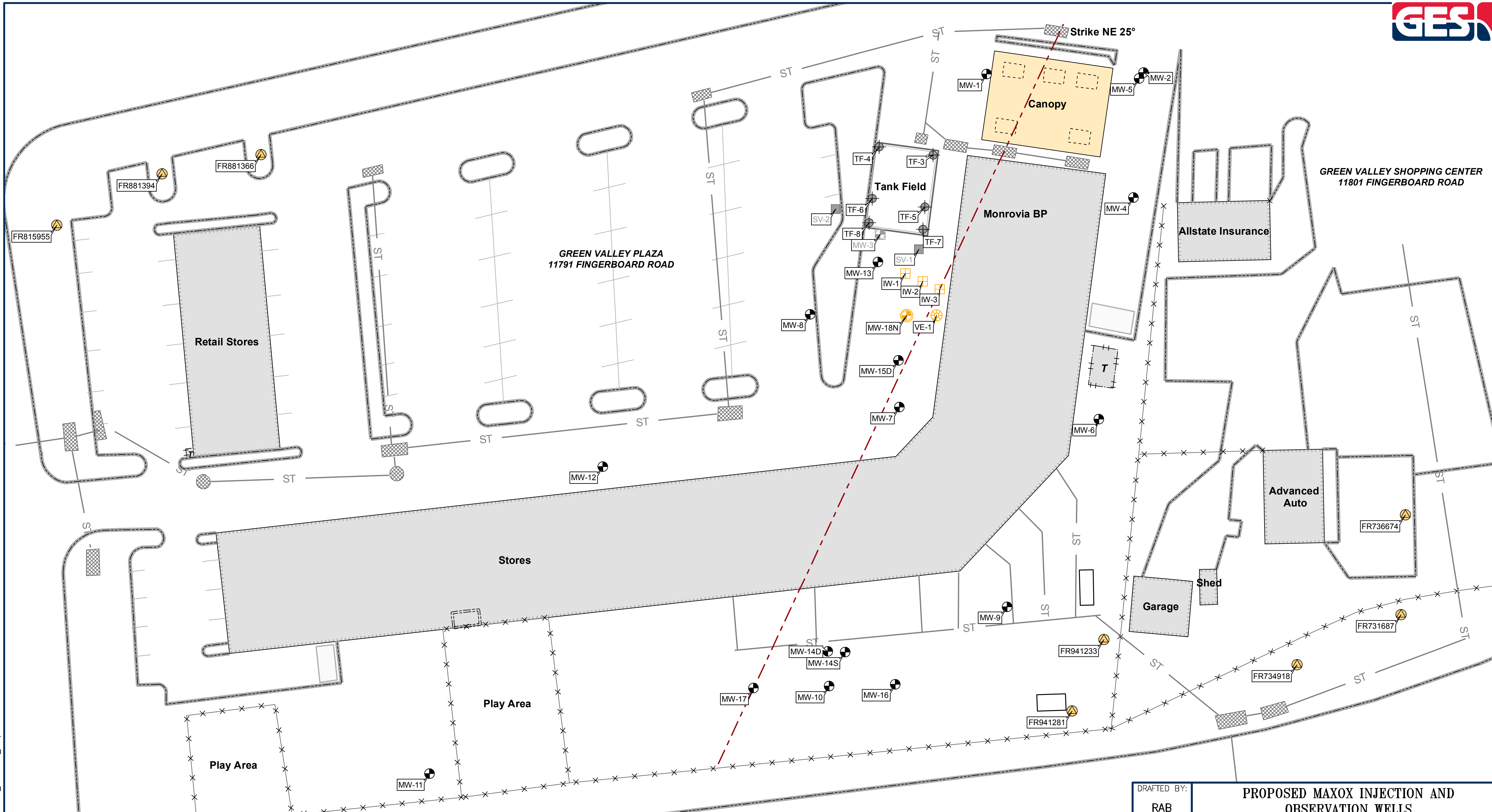

Legend

Abandoned Well	Abandoned Soil Vapor Point	Curbing	Building	Dispenser	Propane AST
Monitoring Well	Proposed Injection Well	Fence	Canopy	Dumpster	Pump Room Door
Potable Well	Proposed Nested Obs Well	Parking	Catch Basin	Tank Field	Transformer
Tank Field Well	Proposed SVE Well	— ST — Storm Sewer			

Source:
NAIP aerial photograph for Frederick Co.
Based on GIS data provided by
Environmental Alliance, Inc.

DRAFTED BY: RAB	PROPOSED MAXOX INJECTION AND OBSERVATION WELLS
CHECKED BY:	MONROVIA BP (FORMER GREEN VALLEY CITGO) 11791 FINGERBOARD ROAD MONROVIA, MARYLAND
REVIEWED BY: SMS	Groundwater & Environmental Services, Inc. 2142 PRIEST BRIDGE COURT, SUITE 1, CROFTON, MD 21114

NORTH	SCALE IN FEET 0 50	DATE	FIGURE
		8-30-10	2

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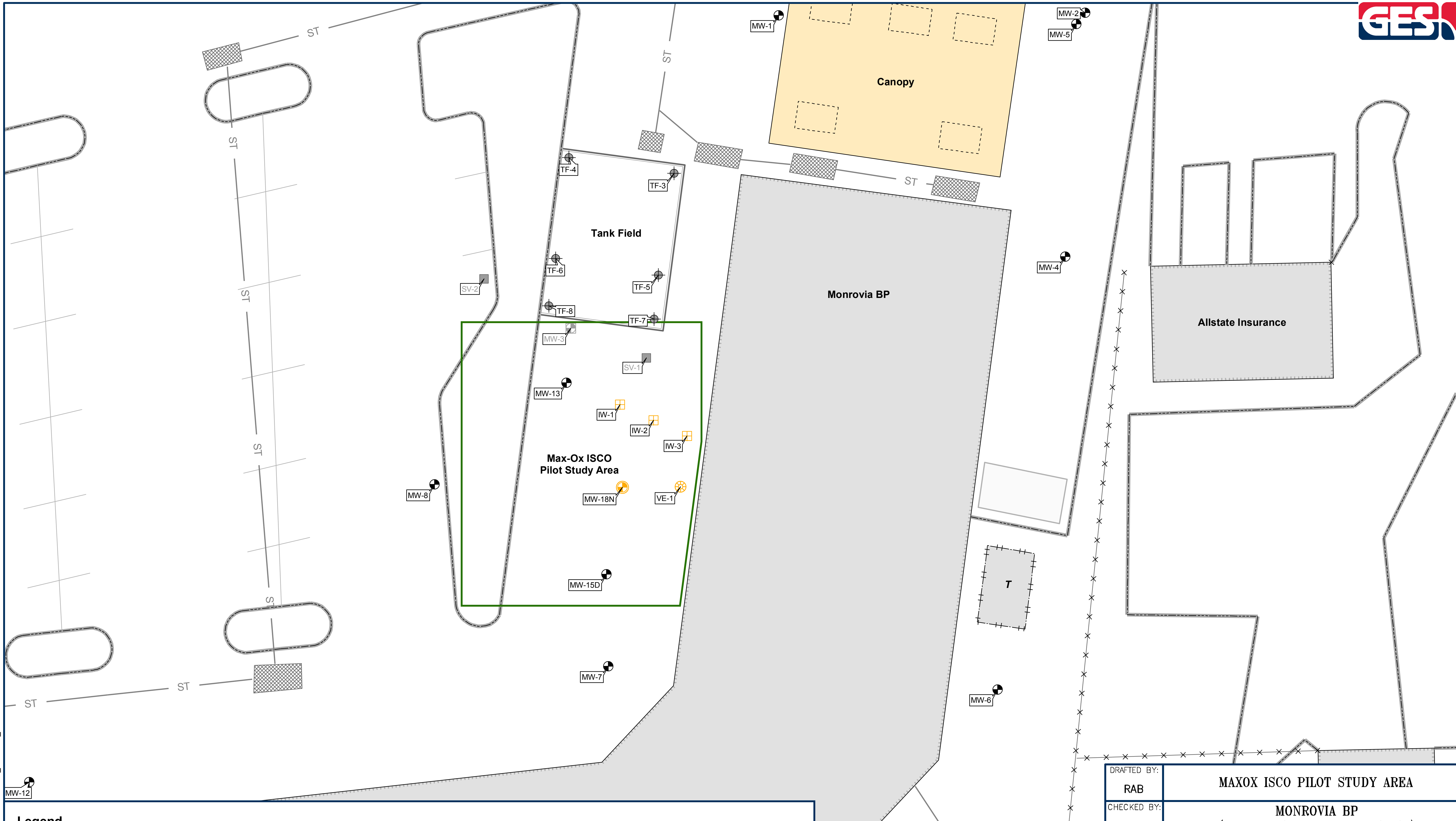

Legend

Abandoned Well	Abandoned Soil Vapor Point	Curbing	ISCO Pilot Study Area	Dispenser
Monitoring Well	Proposed Injection Well	Fence	Building	Dumpster
Potable Well	Proposed Nested Obs Well	Parking	Canopy	Tank Field
Tank Field Well	Proposed SVE Well	ST Storm Sewer	Catch Basin	T Transformer

Source:
NAIP aerial photograph for Frederick Co.
Based on GIS data provided by Environmental Alliance, Inc.

DRAFTED BY: RAB

CHECKED BY:

REVIEWED BY: SMS

NORTH

MAXOX ISCO PILOT STUDY AREA

MONROVIA BP
(FORMER GREEN VALLEY CITGO)
11791 FINGERBOARD ROAD
MONROVIA, MARYLAND

Groundwater & Environmental Services, Inc.
2142 PRIEST BRIDGE COURT, SUITE 1, CROFTON, MD 21114

SCALE IN FEET	DATE	FIGURE
0 25	8-30-10	3

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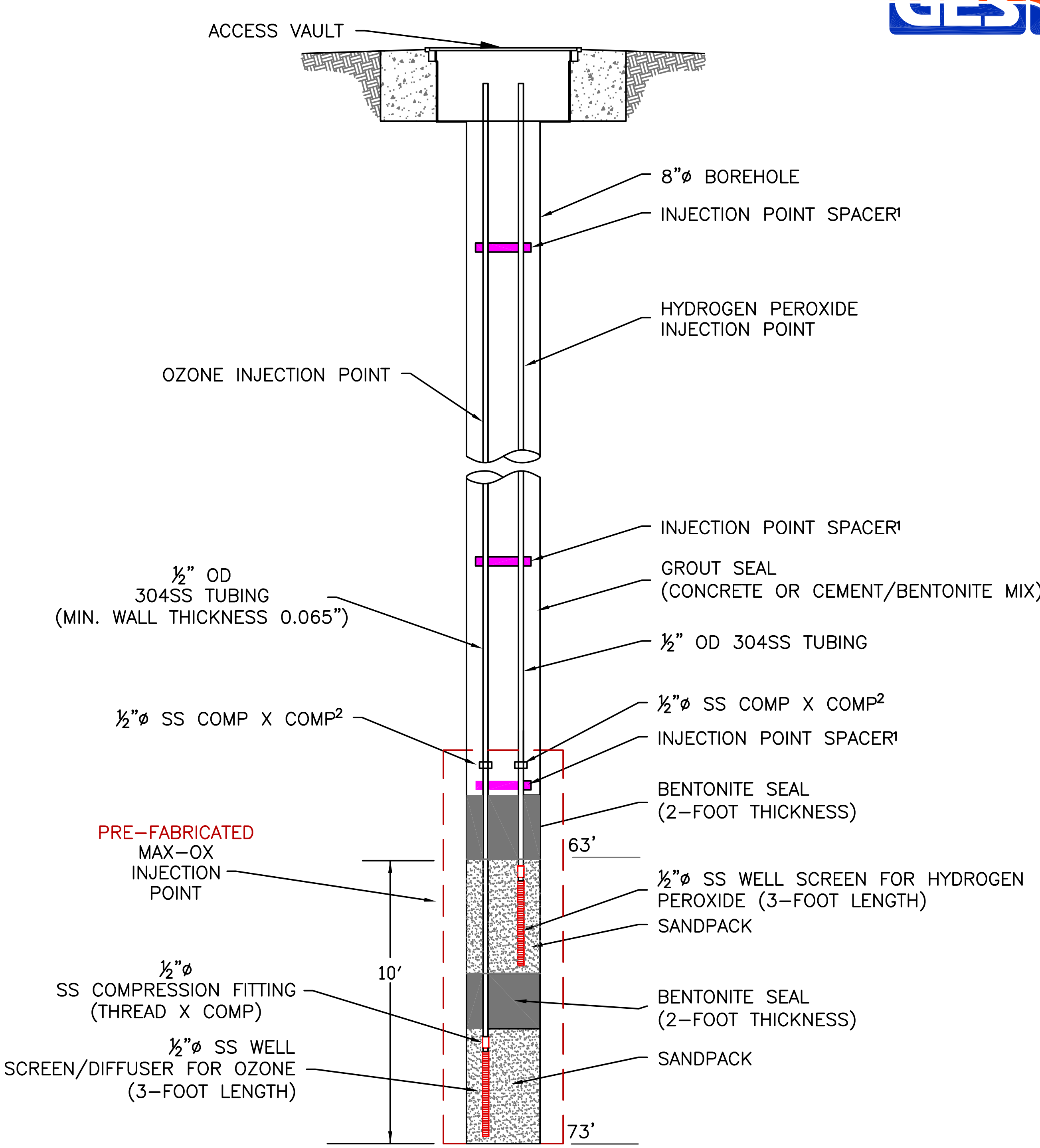

NOTES:

1) SPACERS MUST BE INSTALLED WITHIN GROUT SEAL. SPACERS SHOULD BE APPROX. EVERY TEN FEET.

2) EACH MAX–OX POINT WILL BE TERMINATED WITH A SS COMPRESSION BY COMPRESSION ON BOTH THE OZONE AND PEROXIDE POINTS TO CONNECT TO THE USER SUPPLIED SS TUBING. (APPROXIMATELY 1 FOOT ABOVE TOP WELL SCREEN).

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DRAFTED BY: RRF (CROFTON)

CHECKED BY: DNB

REVIEWED BY: CBW

TYPICAL MAX–OX INJECTION POINT

PULSEOX 100 POINT

Groundwater & Environmental Services, Inc.
440 CREAMERY WAY, SUITE 500, EXTON, PA 19341

NOT TO SCALE	DATE	FIGURE
	09–1–10	4