



**Groundwater
& Environmental Services, Inc.**

495 Aero Drive, Suite 3 • Cheektowaga, New York 14225 • TEL (800) 287-7857 • Fax (866) 902-2187

July 7, 2014

Mr. Chad Staniszewski
NYSDEC Region 9
270 Michigan Avenue
Buffalo, New York 14203

**RE: Offsite In-Situ Chemical Oxidation (ISCO) Pilot Study Work Plan
Standard Portable
25 West Lake Road
Mayville, NY 14757
NYSDEC Site Number C907030A**

Dear Mr. Staniszewski:

Groundwater & Environmental Services, Inc. (GES) has prepared the enclosed *Offsite In-Situ Chemical Oxidation (ISCO) Pilot Study Work Plan* for the observed offsite impacts associated with the Standard Portable site at 25 West Lake Road in Mayville, New York. This work plan has been prepared at the request of the New York State Department of Environmental Conservation. The purpose of this work is to evaluate the potential benefit of supplementing the on-site ISCO program currently being conducted by the property owner with off-site application.

If you have any questions or comments, please do not hesitate to contact GES at your convenience.

Sincerely,

GROUNDWATER & ENVIRONMENTAL SERVICES, INC.

A handwritten signature in black ink, appearing to read 'N. Lindner'.

Nicole A. Lindner
Case Manager

A handwritten signature in black ink, appearing to read 'Eric Popken'.

Eric Popken
Project Manager

Enclosure



OFFSITE IN-SITU CHEMICAL OXIDATION WORK PLAN

**Standard Portable (Offsite)
25 West Lake Road
Mayville, New York 14757
NYSDEC Site Number C907030A**

Prepared for

**New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203**

Report Date

July 7, 2014

Prepared By:

Handwritten signature of Nicole A. Lindner in black ink.

**Nicole A. Lindner
Case Manager**

Reviewed By:

Handwritten signature of Eric Popken in black ink.

**Eric Popken
Project Manager**

Handwritten signature of Matthew Crance in black ink.

**Matthew Crance, PE
Staff Engineer**

**GROUNDWATER & ENVIRONMENTAL SERVICES, INC.
495 Aero Drive, Suite 3
Cheektowaga, New York 14225
1-800-287-7857**



TABLE OF CONTENTS

1.0	INTRODUCTION	4
1.1	<i>SITE HISTORY</i>	4
2.0	SITE BACKGROUND	5
2.1	<i>ON-SITE INTERIM REMEDIAL MEASURES</i>	5
2.2	<i>OFFSITE INVESTIGATION</i>	5
3.0	IN-SITU CHEMICAL OXIDATION SELECTION	6
4.0	IN-SITU CHEMICAL OXIDATION PILOT TEST WORK PLAN	8
4.1	<i>HEALTH AND SAFETY CONSIDERATIONS</i>	9
4.2	<i>WATER QUALITY PARAMETER MONITORING</i>	9
4.3	<i>SODIUM PERMANGANATE INJECTION</i>	10
4.4	<i>INJECTION EQUIPMENT DECONTAMINATION PROCEDURES</i>	10
4.5	<i>COORDINATION OF CURRENT ONSITE SYSTEM OPERATION</i>	10
4.6	<i>POST-INJECTION GROUNDWATER SAMPLING</i>	10
5.0	SCHEDULE AND REPORTING	11
6.0	IN-SITU CHEMICAL OXIDATION PILOT TEST COST ESTIMATES	11

FIGURES

Figure 1	Site Location Map
Figure 2	Site Map
Figure 3	TCE Concentration in GW
Figure 4	Total VOC Concentrations in GW

TABLES

Table 1	Groundwater Analytical Data – Full List 8206 (April 10, 2013 and July 18 to July 20, 2012)
Table 2	Soil Analytical Data Full List 8260

APPENDIX

Appendix A	USEPA periodate oxidation method #8034
------------	--



1.0 INTRODUCTION

This work plan has been prepared by Groundwater and Environmental Services, Inc. (GES) to develop a pilot test study to determine if *In-Situ* Chemical Oxidation (ISCO) is a viable method to treat observed offsite impacts related to the subject site, Standard Portable, located at 21 Valley Street in Mayville, New York. This work plan has been prepared at the request of New York State Department of Environmental Conservation (NYSDEC). The purpose of this work is to evaluate the potential benefit of supplementing the on-site ISCO program currently being conducted by the property owner to address off-site impacts to the soil and groundwater. The proposed pilot testing activities are based on a review of historical documentation provided to GES by NYSDEC as well as previous investigations completed by GES for NYSDEC. A site location map has been included as **Figure 1**. A site map illustrating the site layout, and adjacent property layout, has been included as **Figure 2**.

This work plan was prepared with the purpose of evaluating the feasibility of applying ISCO technologies in order to address the offsite chlorinated hydrocarbon compounds identified in subsurface soils and groundwater. ISCO via sodium permanganate has been selected as the remedial option for this site. The following sections in this work plan outline remedial technology selection, methodologies for design, and implementation of the ISCO pilot testing work scope. The proposed activities will be conducted in accordance with all applicable federal, state and local rules and regulations.

1.1 *Site History*

The Standard Portable Site is a NYSDEC Brownfield Site that is currently owned and operated by Jo Lyn Enterprises. The parcel is located at 21 Valley Street, and consists of 1.06 acres of land located directly west of Chautauqua Lake (across Route 394). The facility was formerly operated by Wappat Saw Company (Wappat), followed by then Standard Portable Products, Inc (Standard Portable). Both Wappat and Standard Portable performed various metalworking operations, which included the use of trichloroethylene (TCE) in a vapor degreasing unit. The spent TCE had reportedly been stored in an underground tank, which was adjacent to the building. On-site and off-site investigations have indicated that there is TCE contamination in soil and groundwater.

The off-site property is municipally owned land. Work associated with the offsite investigation reported here-in was conducted in the Mayville Lakeside Park (across Route 346, adjacent to Lake Chautauqua), on municipal land south of the site (undeveloped and provides access to the Nadine and Paul Webb Trail), and in the right-of-way (ROW) between Route 346 and the undeveloped municipal land.



2.0 SITE BACKGROUND

2.1 On-site Interim Remedial Measures

According to information provided by NYSDEC, Hazard Evaluations, Inc. (HEI) has conducted ongoing ISCO remediation at the site. HEI has conducted an ISCO feasibility study at the site, as outlined in the *Interim Remedial Measures Report and Work Plan* and the *Focused Feasibility Study for the Interim Remedial Measures*, both prepared by HEI and dated December 2006. An ISCO remedial system, designed and operated by HEI, exists on the site. The ISCO remedial system consists of an ISCO system and a dense non-aqueous phase liquid (DNAPL) recovery system. The chemical oxidant in use in the HEI ISCO system is potassium permanganate (KMNO₄). Additionally, a sub-slab vapor extraction system has also been installed in the existing building to mitigate potential soil vapor intrusion (SVI) impacts.

NYSDEC also provided a *Routine Progress Report* which was submitted by HEI on May 21, 2013. The progress report details the activities completed by HEI during April 2013. Of the activities completed in April 2013, 7,155 gallons of impacted water were extracted and carbon treated, a focused KMNO₄ injection at a rate of 0.5 gallons per minute was completed at EW14 and EW15, and 0.02 gallons of DNAPL were recovered. Groundwater samples were collected from select onsite monitoring wells on April 10, 2013, and analytical data has been tabulated in **Table 1**. As reported by HEI, historically 11,495 gallons of a 3% or less of potassium permanganate solution has been injected onsite.

2.2 Offsite Investigation

From June 6 through June 12, 2012, Trec Environmental, Inc. (Trec), under the supervision of Groundwater and Environmental Services, Inc. (GES) personnel, advanced eight soil borings (GMW-1 through GMW-8) using a Geoprobe 6620DT track-mounted direct push unit. Soil borings were advanced to depths of up to 14 feet (ft) below ground surface (bgs). Soil samples were collected in approximate two to four foot intervals via macro-core sampling. One soil sample was collected from each boring for laboratory analysis based on photoionization detector (PID) readings. In the absence of elevated PID readings, the sample collected at the interval observed in the soil/water interface was sent for laboratory analysis. Following the completion of soil sampling, each boring location (GMW-1 through GMW-8) was converted into a monitoring well, constructed with schedule 40 polyvinyl chloride (PVC) 2 inch diameter well casing from the ground surface top of screen, followed by ten feet of 0.010 inch slot well screen. Of the eight soil borings, only GMW-4 exhibited compounds exceeding unrestricted Soil Cleanup Objectives (SCOs) as defined in Title 6 New York Codes, Rules, and Regulations - Part 375-6 (6 NYCRR375-6). The compounds TCE, cis-1,2-dichloroethene and vinyl chloride were exceeded for unrestricted and protection of groundwater SCOs in soil samples collected from GMW-4. The soil boring analytical data from June 6 through June 12, 2012 has been tabulated in **Table 2**.

From July 16 through July 20, 2012, GES was onsite for monitoring well gauging, development, groundwater sampling, and well survey oversight of the newly installed



wells, and select existing monitoring wells. On July 16, 2012, all of the monitoring wells onsite and offsite were gauged. From July 17 through July 20, 2012, offsite monitoring wells (GPW-2, GPW-3, GPW-4, GPW-5, GPW-6, GPW-8, GPW-9, GPW-10, GPW-13, GPW-14, GPW-17, GPW-18, GPW-20, GMW-1, GMW2-, GMW-3, GMW-4, GMW-5, GMW-6, GMW-7, GMW-8) were developed and sampled. Of the wells sampled, individual concentrations of Full List volatile organic compounds (VOCs) in groundwater exceeded NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* in groundwater samples collected from GPW-2, GPW-3, GPW-4, GPW-5, GPW-6, GPW-14, GMW-5, GMW-5 and GMW-8. The groundwater analytical data from July 16 through July 20, 2012 has been included in **Table 1**.

Further details of the June and July 2012 subsurface investigation activities are reported in the *Offsite Subsurface Investigation Report* submitted by GES to NYSDEC on January 25, 2013.

3.0 IN-SITU CHEMICAL OXIDATION SELECTION

ISCO has been proven to be an effective remedial technology for the oxidation of VOCs in subsurface soils and groundwater. Strong oxidizers such as hydrogen peroxide, potassium permanganate and sodium permanganate can be injected into the subsurface to chemically oxidize a wide variety of VOCs, including chlorinated compounds such as tetrachloroethylene (PCE) and TCE, converting them into carbon dioxide and water.

When introduced into groundwater, hydrogen peroxide is unstable, and will readily react with organic contaminants and other subsurface organic materials. Injecting concentrations of hydrogen peroxide as low as 100 milligrams per liter (mg/L) can also cause oxygen concentrations in groundwater to exceed the solubility limit of oxygen in groundwater (typically 9-10 mg/L at atmospheric pressures and typical groundwater temperatures). When this occurs, oxygen gas is formed and is lost in the form of bubbles that rise through the saturated zone to the water table and into the unsaturated zone. Hydrogen peroxide alone is not capable of oxidizing VOCs; it typically requires a suitable catalyst in order to generate reactive hydroxyl radicals. The catalyst can be ozone, a metal catalyst such as ferrous iron, permanganate, or ultraviolet light. Hydrogen peroxide is particularly effective when it reacts with ferrous iron to produce Fenton's reagent. Ferrous iron may be naturally present in the subsurface soils and/or groundwater or can be enhanced through the addition of reagents such as ethylene diamene tetra acetic acid (EDTA) or iron salts such as ferric sulfate.

Catalyzed hydrogen peroxide (CHP) is a mixture of hydrogen peroxide (H₂O₂) and an iron catalyst such as iron-EDTA or acidified ferrous iron that can potentially oxidize a wide range of VOCs. The simplified reaction is presented below:



If iron is naturally occurring in groundwater or present in soil, then it may be possible to achieve the similar reactivity with H₂O₂ and EDTA, since the EDTA will chelate the iron and help keep it in solution. Iron can precipitate as Fe(OH)₃ at high pH and the



solid iron will catalytically decompose peroxide. Anecdotal evidence indicates that this occurs frequently during ISCO with H₂O₂ and iron. Chelating agents, such as EDTA, minimize the precipitation of iron and create favorable conditions for the catalytic production of hydroxyl radicals.

CHP is non-selective and may react not only with the target compounds, but also with soil particles and natural organic matter. In addition, the system is catalytic so it is not possible to write a stoichiometric reaction for the oxidation of a specific compound or to determine the amount of H₂O₂ and iron that will be needed to convert a specific contaminant to carbon dioxide and water.

Like all oxidants, CHP may potentially have long term or short term secondary effects such as oxidation of soil-bound metals or mobilization of metals due to the presence of a chelating agent or changes in pH. The magnitude and duration of any such changes are site-specific and may or may not be significant. Additionally, the CHP reaction rate can be accelerated due to magnesium oxides onsite from the current onsite ISCO injection system. This can lead to an uncontrolled reaction while using hydrogen peroxide.

Chlorinated VOCs may be oxidized via permanganate. Permanganate is commercially available as both potassium and sodium salts. Potassium permanganate is solid purple crystal that is typically applied as a 1 to 7% solution. Sodium permanganate is a dark purple solution that can be applied at concentrations ranging from 10% to 40%. Permanganate is a milder oxidant in comparison to hydrogen peroxide, and can rapidly convert a wide range of chlorinated VOCs to carbon dioxide, water, and chloride ions. The permanganate is reduced to insoluble manganese dioxide during the reaction. Permanganate oxidation involves a direct electron transfer unlike other oxidants, such as persulfate and hydrogen peroxide, which use a free radical process. Permanganate has a unique affinity for oxidizing organic compounds containing carbon-carbon double bonds, aldehyde groups or hydroxyl groups. As an electrophile, the permanganate ion is strongly attracted to the electrons in carbon-carbon double bonds found in chlorinated alkenes, borrowing electron density from these bonds to form a bridged, unstable oxygen compound known as the cyclic hypomanganate ester. This intermediate product further reacts by a number of mechanisms including hydroxylation, hydrolysis or cleavage. Under most naturally occurring subsurface pH and temperature conditions, the carbon-carbon double bond of alkenes is broken spontaneously and the unstable intermediates are converted to carbon dioxide through either hydrolysis or further oxidation by the permanganate ion.

Injection of sodium permanganate has been selected for this site. Hydrogen peroxide was eliminated from consideration due to the specialized injection wells required and the presence of magnesium oxides from the current onsite ISCO injection system. Sodium permanganate was selected over potassium permanganate due to the higher injection concentration available, thereby reducing the number of injection days and overall cost.



4.0 IN-SITU CHEMICAL OXIDATION PILOT TEST WORK PLAN

An isoconcentration map of TCE concentrations and total VOC concentrations in groundwater from the on-site groundwater sampling conducted on April 10, 2013, and the off-site groundwater sampling conducted from July 17 through July 20, 2012 is shown in **Figure 3** and **Figure 4** respectively.

Based on the on and off-site groundwater concentration and the off-site soil concentrations, it would be most prudent to focus injection activities on the onsite property in order to address offsite issues. In order to provide maximum benefit to the ISCO program outlined above, GES recommends installing permanent injection points, screened across the appropriate injection interval, as opposed to using existing monitoring wells; however the existing monitoring wells could be used for the purpose of a pilot test with the understanding that the groundwater VOC reduction results may not be optimum. Continued use of the existing monitoring wells for injection purposes will be evaluated during the pilot test. GES does recommend the installation of packers in the proposed injection wells to target the zone of impact more selectively during the injection process. EW7, EW19, GPW2, GPW3, SB-1, and SB-12 have been selected as the pilot test injection wells. While injecting in the above wells; Nearby wells, as selected in the field, will be used to estimate the radius of influence for the injection by observing for the presence of sodium permanganate. If daylighting occurs or other problems are encountered, such as no flow or low flow into a well, additional wells onsite may be used for injection purposes; however any additional well selected will need to be 20 feet away from utilities.

GES proposes an ISCO remediation pilot test event using an oxidant solution of 10% sodium permanganate. Sodium permanganate was chosen due to its higher solubility rate which would allow more oxidant to be injected per gallon. The proposed remediation activities are described below and will be conducted following approval of the work plan presented herein. During the ISCO event, groundwater quality parameters will be collected from select monitoring wells as outlined below.

Injection equipment and chemicals will be staged in the grassy field to the south of the Standard Portable Site. A total of 200-pounds of sodium thiosulfate (in solid form) will be stored onsite and will be used to prepare neutralizing solutions on an as needed basis. These solutions will be used to neutralize any permanganate spills that may occur. Material Safety Data Sheets (MSDS) will be available on-site for all the chemicals that are used for this application.

A total daily volume of approximately 3,000-gallons of pre-mixed 10% sodium permanganate solution will be delivered to the site in a bulk tanker. Secondary containment will be positioned underneath all piping connections. A 500-gallon tank will be used for storage of water that will be used for rinsing equipment and preparation of neutralizing solutions.

GES proposes to inject roughly 1,000 gallons into each well listed above over a 2 day period (approximately 10 hours onsite, 8 hours of injection time, per day). Alternatively, if cost is of concern, a 500 gallon injection per well over a 1 day period could be selected.



The required flow rate would be about 1 gpm per well in both scenarios. HEI has historically injected at around the .5 gpm per well range, so the 1 gpm per well estimate is not out of the range of feasibility. However, higher flow rates would be preferred during a full scale injection and during the pilot test a maximum flow rate will be investigated during the injection event. It is not anticipated that the flow rates will exceed 5 gpm per well but it is anticipated that the maximum flow rate will fall in the 2-3 gpm per well range.

4.1 Health and Safety Considerations

Due to the nature of the chemical oxidation reactions, potential safety risks may develop. Additionally, preferential flow paths to porous and/or non-native soils, and fill material may develop during the injection process. To manage these potential risks, GES will conduct the following activities during the injection event:

- A detailed account of specific health and safety precautions taken during implementation of this technology will be summarized in the site specific Health and Safety Plan (HASP), the Job Safety Analysis worksheets (JSAs), the Spill Contingency Plan, and the site-specific Contingency Plan, all of which will be available on-site during the execution of the proposed scope of work.
- Groundwater depth will periodically be monitored in selected monitoring wells to determine if excessive groundwater mounding develops during the injection procedure. Further details regarding data collection procedures and methods are provided in **Section 4.2**, below.

4.2 Water Quality Parameter Monitoring

Prior to initiating injection activities, GES will collect baseline parameters including dissolved oxygen (DO), oxidation/reduction potential (ORP), pH, temperature, and conductivity from each of the injection wells and all monitoring wells within 25 feet of the injection wells. These parameters will also be collected on a daily basis from selected wells before, during and immediately following the injection of the permanganate solution. An YSI 600 multi-parameter water quality meter/probe, with a minimum 25-foot long cable will be used to collect these parameters. The probe will be decontaminated between each measurement by rinsing it thoroughly with a solution of Liquidnox, followed by a de-ionized water rinse. These wells will also be field tested for Manganese using the Hach Pocket Colorimeter II Manganese HR System and USEPA periodate oxidation method #8034. A detailed description of this method is provided in **Appendix A**. Additional wells may be added to this monitoring program if the observed Radius of Influence is observed to be greater than 25 feet.

These water quality parameters will also be collected from all of the monitoring wells in the vicinity of the injection after approximately one week, two months, four months and nine months from the conclusion of the proposed injection activities. The water quality parameter data will be evaluated to assess overall distribution of the oxidant and determine an estimated decay rate of the sodium permanganate. This decay rate will be



used to co-ordinate the timing of the post-injection groundwater sampling event as outlined in **Section 4.6**.

4.3 Sodium Permanganate Injection

It is unknown the actual volume of 10% sodium permanganate solution necessary to address the off-site impacts. Additional soil data is required in order to develop an accurate estimation.

During the injection process, a stainless steel wellhead injection assembly (fitted with a flow control valve, check valve, and pressure gauge) will be used to connect to the top of each 2-inch injection well casing. The injection flow rate of the oxidant solution will initially be limited to 0.5 gallons per minute (gpm). The flow rate will then gradually be increased up to a maximum of 3 gpm, depending on the observed well pressures and other field observations. Flow rates will be decreased if well pressures are observed to exceed 15 pounds per square inch (psi), or if excessive groundwater mounding is observed in the surrounding monitoring wells. Groundwater mounding will be monitored periodically in the identified wells in order to adjust injection flow rates if necessary, and to ensure that the sodium permanganate solution does not break through to the surface.

4.4 Injection Equipment Decontamination Procedures

At the completion of injection activities, all oxidant injection process lines and wellheads will be rinsed by flushing each line with water. Any unused oxidant solution will be removed by the chemical vendor at the end of each day. Sodium permanganate will not be stored overnight on-site in any quantity.

4.5 Coordination of Current Onsite System Operation

In order to fully evaluate the effects of the above mentioned Pilot Test, It is recommended that the current groundwater extraction system be shut down for the duration of the pilot test. Coordination with the current system operators in order to protect equipment should be initiated prior to the start of the pilot test program. It is anticipated that the groundwater extraction system will need to remain off-line for a period of at least nine months. Once the lack of presence of sodium permanganate in the extraction well area is confirmed and follow-up groundwater samples are collected, GES and the NYSDEC will inform the property owners that the on-site groundwater extraction system can be reactivated. The current sub slab SVE system should remain operational during the pilot test program. The current ISCO Injection System could remain operational or could be deactivated at the owner's discretion during this pilot test study. It is not anticipated that the potassium permanganate injection would influence the injection area under study.

4.6 Pre-injection and Post-injection Groundwater Sampling

Pre-injection groundwater samples will be collected. Sampling will be conducted prior to mobilization for the injection activities. Post-injection groundwater samples will be collected from the monitoring wells after the permanganate has reacted and is not detected in the well. This is estimated to be between four and nine months following the



injection activities. This estimated time frame will be updated as described in **Section 4.2**, but will be confirmed prior to groundwater sampling. Additional monitoring events as described in **Section 4.2** may be required.

Sampling will consist of measuring depth to water and purging three well volumes from each well prior to sampling. Collected samples will be submitted for laboratory analysis for Full List VOC's via NYSDEC TOGS 1.1.1., and three wells will be selected in the field for analysis of Target Analyte List (TAL) Metals. The wells to be sampled for TAL Metals will be selected during the pre-injection sampling event. The same three wells will be sampled for TAL Metals during the final full round post-injection sampling event. Water quality parameters as described in **Section 4.2** will also be measured at each monitoring location during the groundwater sampling event. The pre-injection and final post-injection sample event will consist of a full round of sampling all offsite monitoring wells.

5.0 SCHEDULE AND REPORTING

The post-injection groundwater quality and parameter data will be used to assess the overall performance of the ISCO application. Upon completion of the first post injection groundwater sampling event, GES will prepare a detailed report summarizing all data collected during the pilot test and subsequent visits.

This report will include recommendations and costs for future remedial work for the site. Additional recommendations that may also be considered include the addition of monitoring wells, adjustments to the assumptions used to calculate oxidant volumes, and modifications to air monitoring and health and safety procedures.

GES is currently finalizing an implementation schedule for this work plan. Once completed, the schedule will be submitted to the NYSDEC under separate cover.

6.0 IN-SITU CHEMICAL OXIDATION PILOT TEST COST ESTIMATES

Presented below is an anticipated cost estimate for the completion of the ISCO application and associated coordination, sampling and reporting. Please note costs do not include applicable taxes.



The following table details costs which will apply regardless of sodium permanganate volume:

Permitting	\$500
Coordination and preparation of Environmental Protection Agency (EPA) Underground Injection Control Permit	
Coordination/Preparation	\$1,500
Preparation of a chemical management work plan, coordination with vendors and ISCO contractors, notification to municipality including fire department, site visit for analysis of wells for packer system, installation of packer system, etc.	
Pre and Post ISCO Full Round Sampling Events (Approximately 25 monitoring wells, 2 sampling events @ ~ \$3,000 each)	\$6,000
Post-ISCO Evaluation and Monitoring Well Sampling (6 sampling events @ ~ \$1,560 each)	\$9,360
Analytical Fees	\$2,200
Report	\$3,000
TOTAL ESTIMATED COST	\$22,560

The following table details the cost estimate for the ISCO application, with two values based on sodium permanganate volume:

6,000 Gallon ISCO Injection	\$67,000
Total cost for vendor fees, personnel, equipment, materials, etc. for 6,000 gallon injection of sodium permanganate.	
3,000 Gallon ISCO Injection	\$38,000
Total cost for vendor fees, personnel, equipment, materials, etc. for 3,000 gallon injection of sodium permanganate.	

Therefore the total anticipated cost estimate for a 6,000-gallon injection event is approximately \$89,560 and the total anticipated cost estimate for a 3,000-gallon event is approximately \$60,560.

GES is available to discuss the above presented costs.

FIGURES



SOURCE: USGS 7.5 MINUTE SERIES
 TOPOGRAPHIC QUADRANGLE 1979
 CHAUTAUQUA, NEW YORK
 CONTOUR INTERVAL = 10'



QUADRANGLE LOCATION

DRAFTED BY: E.M.E. (N.J.)	SITE LOCATION MAP					
CHECKED BY:				NYSDEC 25 WEST LAKE ROAD MAYVILLE, NEW YORK		
REVIEWED BY:						
NORTH 	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225					
	SCALE IN FEET 	DATE 10-13-12	FIGURE 1			



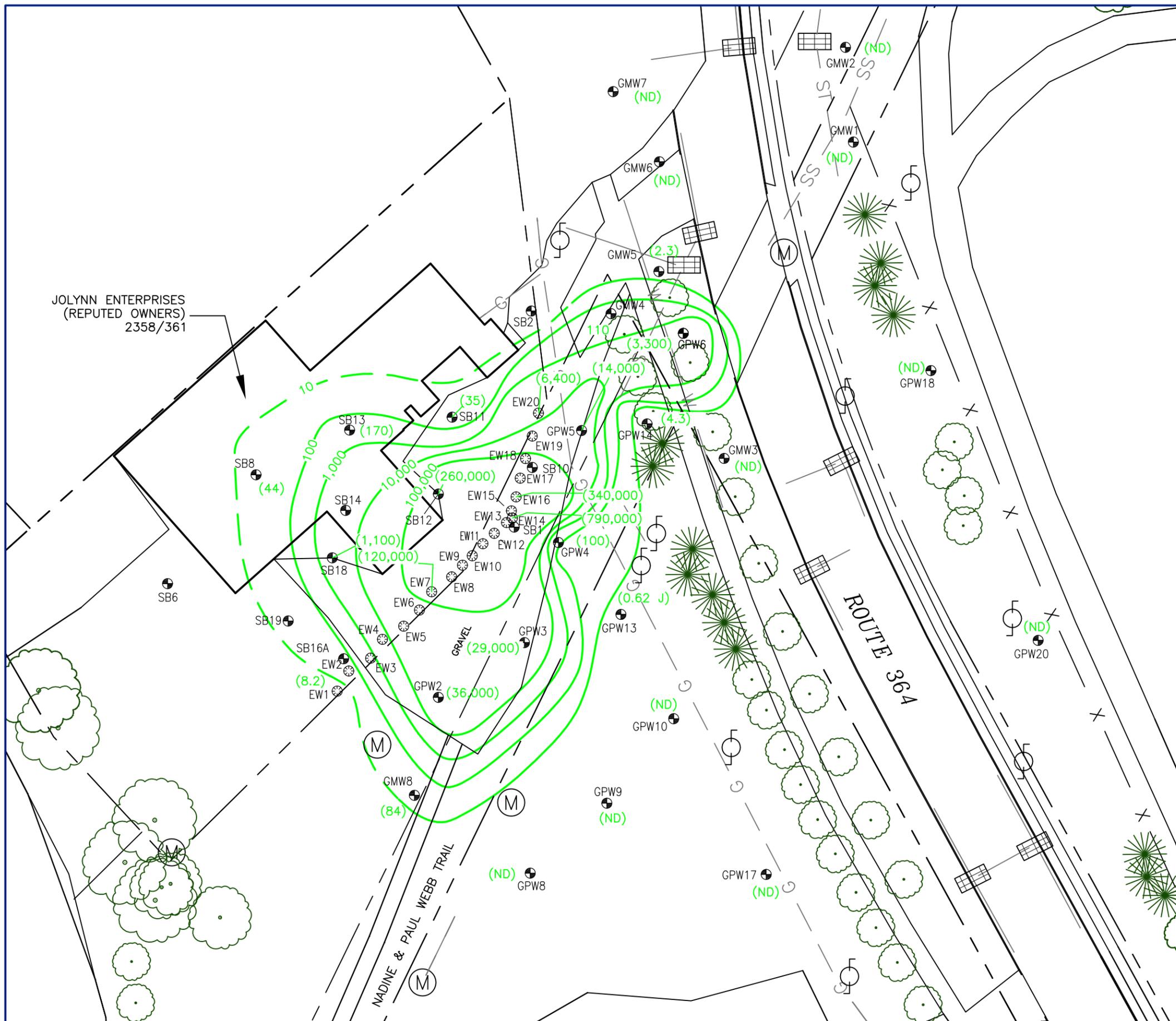
- LEGEND**
- PROPERTY BOUNDARY
 - x - FENCE
 - ⊕ STORM DRAIN
 - ▣ CATCH BASIN
 - ⊙ (M) UTILITY MANHOLE
 - ⊙ UTILITY POLE
 - ☀ LIGHT POLE
 - ⊕ FIRE HYDRANT
 - ⊕ MONITORING WELL
 - ⊕ SOIL VAPOR EXTRACTION WELL
 - SS - UNDERGROUND SANITARY SEWER LINE
 - ST - UNDERGROUND STORM SEWER LINE
 - W - UNDERGROUND WATER LINE
 - G - UNDERGROUND GAS LINE

JOLYNN ENTERPRISES
(REPUTED OWNERS)
2358/361

VILLAGE OF
MAYVILLE
(REPUTED OWNER)

VILLAGE OF
MAYVILLE
(REPUTED OWNER)
GRAVEL

DRAFTED BY: E.M.E. (N.J.)	SITE MAP		
CHECKED BY:			
REVIEWED BY:			
	NYSDEC 25 WEST LAKE ROAD MAYVILLE, NEW YORK		
NORTH 	Groundwater & Environmental Services, Inc. 495 AERO DRIVE, SUITE 3, CHEEKTOWAGA, NEW YORK 14225		
	SCALE IN FEET 0 APPROXIMATE 120	DATE 2-24-14	FIGURE 2



- LEGEND**
- PROPERTY BOUNDARY
 - x - FENCE
 - ⊕ STORM DRAIN
 - ⊞ CATCH BASIN
 - Ⓜ UTILITY MANHOLE
 - ⊙ UTILITY POLE
 - ⊙ LIGHT POLE
 - ⊙ FIRE HYDRANT
 - ⊙ MONITORING WELL
 - ⊙ SOIL VAPOR EXTRACTION WELL
 - SS - UNDERGROUND SANITARY SEWER LINE
 - ST - UNDERGROUND STORM SEWER LINE
 - W - UNDERGROUND WATER LINE
 - G - UNDERGROUND GAS LINE
 - (790,000) TCE CONCENTRATION (ug/L)
 - ~ TCE CONCENTRATION CONTOUR (ug/L)
 - TCE TRICHLOROETHENE
 - ug/L MICROGRAMS PER LITER
 - ND NOT DETECTED
 - J ESTIMATED CONCENTRATION

JOLYNN ENTERPRISES
(REPUTED OWNERS)
2358/361

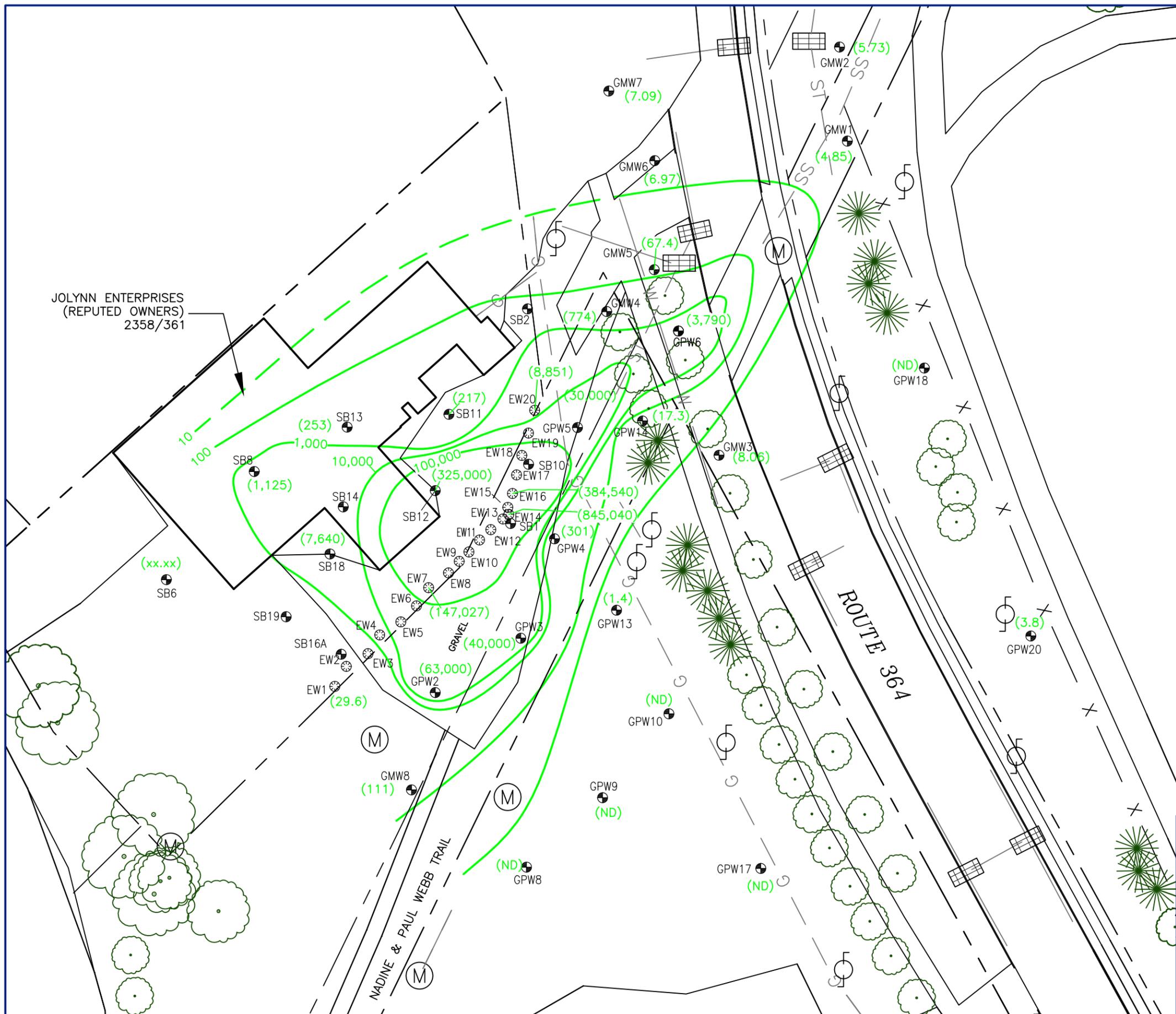
ROUTE 364

NADINE & PAUL WEBB TRAIL

DRAFTED BY: E.M.E. (N.J.)	TCE CONCENTRATION IN GROUNDWATER MAP	
CHECKED BY:	NYSDEC 25 WEST LAKE ROAD MAYVILLE, NEW YORK	
REVIEWED BY:		
NORTH	Groundwater & Environmental Services, Inc.	
	SCALE IN FEET	DATE
	0 APPROXIMATE 50	2-24-14
		FIGURE
		3

LEGEND

- PROPERTY BOUNDARY
- x - FENCE
- ⊕ STORM DRAIN
- ⊞ CATCH BASIN
- Ⓜ UTILITY MANHOLE
- ⊙ UTILITY POLE
- ⊙ LIGHT POLE
- ⊙ FIRE HYDRANT
- ⊙ MONITORING WELL
- ⊙ SOIL VAPOR EXTRACTION WELL
- SS - UNDERGROUND SANITARY SEWER LINE
- ST - UNDERGROUND STORM SEWER LINE
- W - UNDERGROUND WATER LINE
- G - UNDERGROUND GAS LINE
- (845,040) TOTAL VOC CONCENTRATION (ug/L)
- ~ TOTAL VOC CONCENTRATION CONTOUR (ug/L)
- VOC VOLATILE ORGANIC COMPOUNDS
- ug/L MICROGRAMS PER LITER
- ND NOT DETECTED



JOLYNN ENTERPRISES
(REPUTED OWNERS)
2358/361

DRAFTED BY: E.M.E. (N.J.)	TOTAL VOC CONCENTRATION IN GROUNDWATER MAP		
CHECKED BY:			
REVIEWED BY:			
NYSDEC 25 WEST LAKE ROAD MAYVILLE, NEW YORK			
Groundwater & Environmental Services, Inc.			
NORTH 	SCALE IN FEET	DATE	FIGURE
		2-24-14	4

TABLES

Table 2

Soil Analytical Data Full List 8260

25 West Lake Road
Mayville, New York
NYSDEC Site Number C907030A

Soil Sample ID	Part 375-6 (6 NYCRR-375-6) Soil Cleanup Objectives (SCOs)			GMW-1	GMW-2	GMW-3	GMW-4	GMW-5	GMW-6	GMW-7	GMW-8
				6/6/2012	6/6/2012	6/8/2012	6/8/2012	6/7/2012	6/7/2012	6/8/2012	6/8/2012
	Date	Unrestricted	Commercial	Protection of Groundwater	8-12'	8-10'	8-12'	8-10'	10-12'	8-12'	8-10'
Depth (ft)							0.0	0.0	350	0.0	0.0
PID (ppmv)											
1,1,1-Trichloroethane	680	500,000	680	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-trifluoroethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	270	240,000	270	ND	ND	ND	0.9	ND	ND	ND	ND
1,1-Dichloroethene	330	500,000	330	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-Chloropropane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	1,100	500,000	1,100	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	20	30,000	20	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	2,400	280,000	2,400	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	1,800	130,000	1,800	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	120	500,000	120	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone (MIBK)	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	50	500,000	50	8.3	ND	12	7.8	9.6	6.4	5.2	12
Benzene	60	44,000	60	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Bromoform	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	760	22,000	760	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	1,100	500,000	1,100	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	370	350,000	370	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	250	500,000	250	ND	ND	ND	670	ND	ND	ND	19
cis-1,3-Dichloropropene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorodifluoromethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	1,000	390,000	1,000	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert-butyl ether	930	500,000	930	ND	ND	ND	ND	ND	ND	ND	ND
Methylcyclohexane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	50	500,000	50	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1,300	150,000	1300	ND	ND	ND	4.6	ND	ND	ND	ND
Toluene	700	500,000	700	ND	ND	ND	ND	ND	ND	ND	ND
Trans-1,2-Dichloroethene	190	500,000	190	ND	ND	ND	5.4	ND	ND	ND	ND
Trans-1,3-Dichloropropene	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	470	200,000	470	ND	ND	ND	700	ND	ND	ND	190
Trichlorofluoromethane	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	20	13,000	20	ND	ND	ND	27	ND	ND	ND	ND
Xylenes, Total	26	500,000	1600	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	NA	NA	NA	8.3	ND	12	1,415.69	9.6	6.4	5.2	221

Notes:

ND = Not detected (below or equal to the method detection limit).

All units reported in µg/kg unless noted

Bold = Concentrations above guidance values or cleanup objectives used as noted.

* Limits reflect Title 6 New York Codes, Rules and Regulations Unrestricted, Commercial and Protection of Water Part 375-6 (6 NYCRR-375-6) Soil Cleanup Objectives (SCOs)

APPENDIX A
USEPA Periodate Oxidation Method #8034

USEPA¹ Periodate Oxidation Method²

Method 8034

HR (0.1 to 20.0 mg/L)

Powder Pillows

Scope and Application: For soluble manganese in water and wastewater¹ USEPA Approved for reporting wastewater analyses (digestion required). *Federal Register*, 44(116)34 193 (June 14, 1979)² Adapted from *Standard Methods for the Examination of Water and Wastewater*.

Test preparation

How to use instrument-specific information

The [Instrument-specific information](#) table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 1 Instrument-specific information

Instrument	Sample cell	Cell orientation
DR 5000	2495402	Fill line faces user
DR 3900	2495402	Fill line faces user
DR 3800, DR 2800, DR 2700	2495402	Fill line faces right

Before starting the test:

Digestion is required for reporting wastewater analyses.

If only dissolved manganese is to be determined, filter the sample before acid addition.

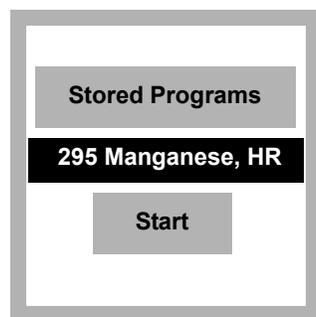
For more accurate results, determine a reagent blank value for each new lot of reagent. Follow the procedure using deionized water in place of the sample. Subtract the reagent blank value from the final results or perform a reagent blank adjust.

Collect the following items:

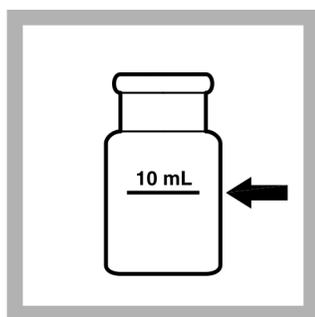
Description	Quantity
High Range Manganese Reagent Set	1
Sample Cells (see Instrument-specific information)	2

See [Consumables and replacement items](#) for reorder information.

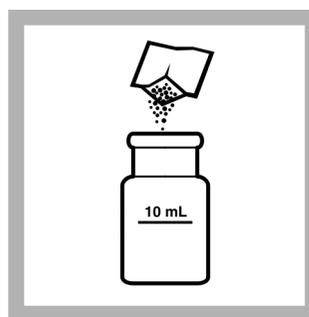
Periodate Oxidation method for powder pillows



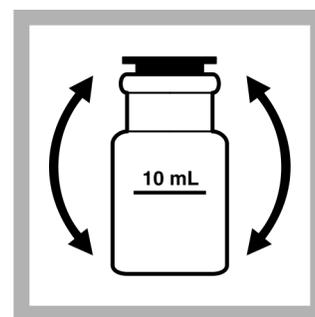
1. Select the test.
Insert an adapter if required (see [Instrument-specific information](#)).



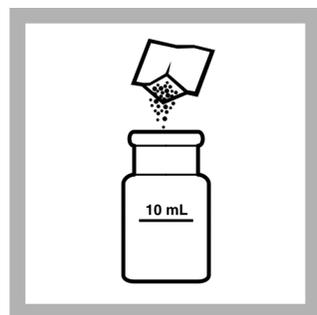
2. **Prepared Sample:**
Fill a sample cell with 10 mL of sample.



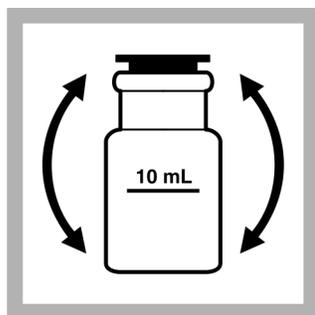
3. Add the contents of one Buffer Powder Pillow, Citrate Type for Manganese.



4. Stopper or cap and invert to mix.



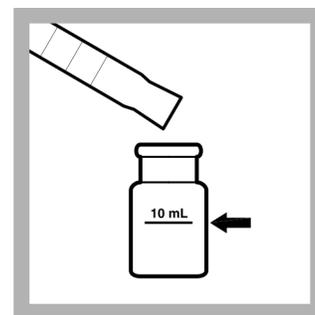
5. Add the contents of one Sodium Periodate Powder Pillow to the sample cell.



6. Stopper or cap and invert to mix.
A violet color will develop if manganese is present.



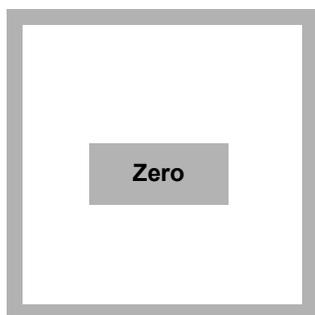
7. Start the instrument timer.
A two-minute reaction time will begin.



8. **Blank Preparation:**
Fill a second sample cell with 10 mL of sample.



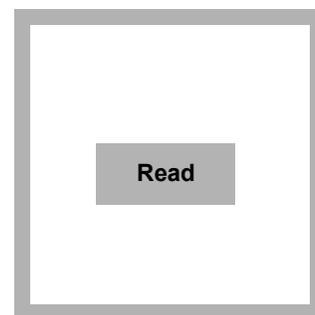
9. When the timer expires, insert the blank into the cell holder.



10. **ZERO** the instrument.
The display will show:
0.0 mg/L Mn



11. Within eight minutes after the timer expires, insert the sample into the cell holder



12. **READ** the results in mg/L Mn.

Interferences

Table 2 Interfering substances

Interfering substance	Interference level
Calcium	700 mg/L
Chloride	70,000 mg/L
Iron	5 mg/L
Magnesium	100,000 mg/L
pH	Highly buffered samples or extreme sample pH may exceed the buffering capacity of the reagents and require sample pretreatment.

Sample collection, preservation and storage

- Collect samples in acid-washed plastic bottles. Do not use glass containers due to possible adsorption of Mn to glass.
- If samples are acidified, adjust the pH to 4–5 with 5.0 N Sodium Hydroxide before analysis.
- Do not exceed pH 5, as manganese may precipitate.
- Correct the test result for volume additions.

Accuracy check

Standard additions method (sample spike)

Required for accuracy check:

- Manganese Voluette® Ampule Standard, 250 mg/L Mn
 - Ampule breaker
 - TenSette Pipet
1. After reading test results, leave the sample cell (unspiked sample) in the instrument.
 2. Select Options>More>Standard Additions from the instrument menu.
 3. Accept the default values for standard concentration, sample volume and spike volumes. After the values are accepted, the unspiked sample reading will appear in the top row. See the user manual for more information.
 4. Open the standard solution ampule.
 5. Use the TenSette Pipet to prepare spiked samples: add 0.1 mL, 0.2 mL and 0.3 mL of standard to three 10-mL portions of fresh sample. Mix thoroughly.
 6. Follow the [Periodate Oxidation method for powder pillows](#) test procedure for each of the spiked samples using the powder pillows, starting with the 0.1 mL sample spike. Measure each of the spiked samples in the instrument.
 7. Select **GRAPH** to view the results. Select **IDEAL LINE** (or best-fit) to compare the standard addition results to the theoretical 100% recovery.

Standard solution method

Note: Refer to the instrument user manual for specific software navigation instructions.

Required for accuracy check:

- Manganese Standard Solution, 1000 mg/L
- Deionized water

Manganese

- 1 L Class A volumetric flask
 - Class A volumetric pipet, 10 mL
 - Pipet filler, safety bulb
1. Prepare a 10.0 mg/L manganese standard solution as follows:
 - a. Pipet 10.0 mL of Manganese Standard, 1000 mg/L, into a 1000 mL (1 liter) volumetric flask.
 - b. Dilute to the mark with deionized water. Mix well. Prepare this solution daily.
 2. Use this solution in place of the sample. Follow the [Periodate Oxidation method for powder pillows](#) test procedure.
 3. To adjust the calibration curve using the reading obtained with the standard solution, select Options>More>Standard Adjust from the instrument menu.
 4. Turn on the Standard Adjust feature and accept the displayed concentration. If an alternate concentration is used, enter the concentration and adjust the curve to that value.

Method performance

Program	Standard	Precision 95% Confidence Limits of Distribution	Sensitivity Concentration change per 0.010 Abs change	
			Portion of Curve	Concentration
295	10.0 mg/L Mn	9.6–10.4 mg/L Mn	Entire curve	0.1 mg/L Mn

Summary of method

Manganese in the sample is oxidized to the purple permanganate state by sodium periodate, after buffering the sample with citrate. The purple color is directly proportional to the manganese concentration. Test results are measured at 525 nm.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Catalog number
Manganese Reagent Set, High Range (100 tests), includes:	—	—	2430000
Buffer Powder Pillows, citrate type for Manganese	1	100/pkg	2107669
Sodium Periodate Powder Pillows for Manganese	1	100/pkg	2107769

Required apparatus

Description	Quantity	Unit	Catalog number
Sample cell, 10 mL square, matched pair	2	2/pkg	2495402
Stopper, rubber	1	6/pkg	173106

Recommended standards

Description	Unit	Catalog number
Manganese Standard Solution, 1000 mg/L Mn	100 mL	1279142
Manganese Standard Solution, 250 mg/L Mn, 10-mL Voluette® ampule	16/pkg	1425810
Water, deionized	4 L	27256
Voluette Ampule breaker	each	2196800

Optional reagents and apparatus

Description	Unit	Catalog number
Manganese Standard Solution, 2 mL PourRite® Ampule, 25 mg/L	20/pkg	2112820
Manganese Standard Solution, 2 mL PourRite® Ampule, 10 mg/L	20/pkg	2605820
pH paper, 0–14	100/pkg	2601300
Pipe filler, safety bulb	each	1465100
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet Tips, for TenSette Pipet 1970001	50/pkg	2185696
Pipet Tips, for TenSette Pipet 1970001	1000/pkg	2185628
Pipet, TenSette, 1.0–10.0 mL	each	1970010
Pipet Tips, for TenSette Pipet 1970010	250/pkg	2199725
Pipet Tips, for TenSette Pipet 1970010	50/pkg	2199796
PourRite® Ampule breaker	each	2484600
Sodium Hydroxide, 5.0 N	100 mL	245032
Volumetric flask, Class A, 1000 mL	each	1457453
Volumetric pipet, Class A, 10 mL	each	1451538