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ARCADIS of New York, Inc.
50 Fountain Plaza
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Transmittal Letter

To:
Mr. David Szymanski
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203

Copies:
Mike Goldstein, Ingersoll Rand
Matthew Forcucci, NYSDOH
Moh Mohiuddin, ARCADIS
Ben Girard, ARCADIS
File

From:
Todd Carignan, Ben Girard

Date:
June 12, 2015

Subject:
Site Management- Periodic Review Report

ARCADIS Project No.:
AY000220.0021

We are sending you:

☒ **Attached** ☐ **Under Separate Cover Via _________ the Following Items:**

☐ Shop Drawings ☐ Plans ☐ Specifications ☐ Change Order
☐ Prints ☐ Samples ☐ Copy of Letter ☒ Reports
☐ Other:

Copies	Date	Description	Action*
1	6/12/15	Site Management- Periodic Review Report (May 14, 2014 – May 15, 2015), ARO Corporation Site, Cheektowaga, New York (Site No. 915147)	AS

Action*

☐ A Approved ☐ CR Correct and Resubmit ☐ Resubmit _____ Copies
☐ AN Approved As Noted ☐ F File ☐ Return _____ Copies
☒ AS As Requested ☐ FA For Approval ☐ Review and Comment
☐ Other:

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Comments: Signed original IC/EC Certification Forms were mailed under seperate cover.

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ENVIRONMENT

Mr. David Szymanski
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203

Subject:
2014 - 2015 Site Management- Periodic Review Report, ARO Corporation Site, Cheektowaga, New York (Site No. 915147)

Date:
June 12, 2015

Contact:
Todd Carignan

Phone:
518.250.7352

Email:
todd.carignan@arcadis-us.com

Our ref:
AY000220.0021

Dear Mr. Szymanski:

On behalf of Ingersoll Rand Company, ARCADIS is submitting this cover letter and accompanying attachments to satisfy the request for the Annual Site Management-Periodic Review Report for ARO Corporation Site, covering the reporting period from May 14, 2014 through May 14, 2015, as requested by NYSDEC in a March 27, 2015 letter.

The following documents have been provided to satisfy the requirements of the Site Management- Periodic Review Report Enclosures 1 and 2:

1. NYSDEC Site Management Periodic Review Report Notice, Institutional Controls and Engineering Controls Certification Form. It should be noted that there were no changes in the way the site was managed during 2014.

2. Annual Monitoring Report, which covers the entire 2014 reporting period. This report summarizes the remedial system operation and performance, and results of the semi-annual groundwater monitoring program.

The First Quarter 2015 Status Report for Remedial Action covering the reporting period of January 1 through March 31, 2015 is provided under separate cover. The Second Quarter 2015 Status Report for Remedial Action covering the reporting period from April 1 through June 30, 2015 will be submitted under separate cover upon receipt of the final laboratory analytical reports.

If there are any questions or comments regarding this status report, please do not hesitate to contact us.

Sincerely,

ARCADIS of New York, Inc.

Todd Carignan
Project Engineer

Ben Girard
Project Manager

Attachments:

1. NYSDEC Site Management Periodic Review Report Notice, Institutional Controls and Engineering Controls Certification Form.
2. 2014 Annual Monitoring Report.

Copies:
Mike Goldstein, Ingersoll Rand
Matthew Forcucci, NYSDOH
Moh Mohiuddin, ARCADIS
File

Enclosure 2
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Site Management Periodic Review Report Notice
Institutional and Engineering Controls Certification Form

Site Details **Box 1**

Site No. **915147**

Site Name ARO Corporation

Site Address: 3695 Broadway Zip Code: 14227
City/Town: Cheektowaga
County: Erie
Site Acreage: 1.0

Reporting Period: May 14, 2014 to May 14, 2015

	YES	NO
1. Is the information above correct?	X	☐
If NO, include handwritten above or on a separate sheet.		
2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?	☐	X
3. Has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))?	☐	X
4. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?	☐	X
If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form.		
5. Is the site currently undergoing development?	☐	X

Box 2

	YES	NO
6. Is the current site use consistent with the use(s) listed below? Industrial	X	☐
7. Are all ICs/ECs in place and functioning as designed?	X	☐

IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

NA
____ __________________
Signature of Owner, Remedial Party or Designated Representative Date

SITE NO. 915147 **Box 3**

Description of Institutional Controls

Parcel	Owner	Institutional Control
103.17-1-17	Ingersoll Rand Company	

A long term Operation, Monitoring and Maintenance Plan is in place in accordance with the March 1995 Record of Decision (ROD). The OM and M Plan includes periodic sampling of the groundwater and monitoring of the Vacuum Enhanced Recovery System (Extraction System, Vapor Treatment System, and Liquid Treatment System).

103.17-1-18 Ingersoll Rand Company

A long term Operation, Monitoring and Maintenance Plan is in place in accordance with the March 1995 Record of Decision (ROD). The OM and M Plan includes periodic sampling of the groundwater and monitoring of the Vacuum Enhanced Recovery System (Extraction System, Vapor Treatment System, and Liquid Treatment System).

103.17-1-19 Ingersoll Rand Company

A long term Operation, Monitoring and Maintenance Plan is in place in accordance with the March 1995 Record of Decision (ROD). The OM and M Plan includes periodic sampling of the groundwater and monitoring of the Vacuum Enhanced Recovery System (Extraction System, Vapor Treatment System, and Liquid Treatment System).

Box 4

Description of Engineering Controls

Parcel	Engineering Control
103.17-1-17	Groundwater Treatment System Vapor Mitigation
103.17-1-18	Groundwater Treatment System Vapor Mitigation
103.17-1-19	Groundwater Treatment System Vapor Mitigation

Box 5

Periodic Review Report (PRR) Certification Statements

1. I certify by checking "YES" below that:

   a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

   b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and compete.

YES	NO
X	☐

2. If this site has an IC/EC Plan (or equivalent as required in the Decision Document), for each Institutional or Engineering control listed in Boxes 3 and/or 4, I certify by checking "YES" below that all of the following statements are true:

   (a) the Institutional Control and/or Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

   (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

   (c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

   (d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

   (e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

YES	NO
X	☐

IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

NA
____ _______________
Signature of Owner, Remedial Party or Designated Representative Date

IC CERTIFICATIONS
SITE NO. 915147

Box 6

SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE

I certify that all information and statements in Boxes 1,2, and 3 are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Todd Carignan at ARCADIS 855 Route 146, Suite 210, Clifton Park, NY 12065,
print name / print business address

am certifying as ARCADIS of New York, Inc. (Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

T. Carignan 6/12/15

Signature of Owner, Remedial Party, or Designated Representative Rendering Certification

Date

IC/EC CERTIFICATIONS

Box 7

Professional Engineer Signature

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Moh Mohiuddin at ARCADIS Raritan Center, Plaza III, 105 Fieldcrest Ave, Suite 203, Edison, NJ 08837,

print name — print business address

am certifying as a Professional Engineer for the ARCADIS of New York, Inc.

(Owner or Remedial Party)

STATE OF NEW YORK
MOH MOHIUDDIN
074527
LICENSED PROFESSIONAL ENGINEER

06/09/2015

Signature of Professional Engineer, for the Owner or Remedial Party, Rendering Certification

Stamp (Required for PE)

Date

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2014 Annual Monitoring Report

ARO Corporation Site

Cheektowaga, New York

Site# 915147

June 2015

Todd Carignan
Project Engineer

Ben Girard
Project Manager

Moh Mohiuddin, Ph.D., P.E., BCEE
Principal Engineer
NY PE License #074527

2014 Annual Monitoring Report

ARO Corporation Site,
Cheektowaga, New York
NYSDEC Site Code 915147

Prepared for:
Ingersoll Rand

Prepared by:
ARCADIS of New York, Inc.
50 Fountain Plaza
Suite 600
Buffalo
New York 14202
Tel 716 667 0900
Fax 716 667 0279

Our Ref.:
AY000220.0021

Date:
June 12, 2015

Tables

Figures

Acronyms

cfm - cubic feet per minute

DCE - dichloroethene

COC - Constituents of Concern

EC/BSA - Erie County/Buffalo Sewer Authority

gpm - gallons per minute

HDPE - high density polyethylene

in.Hg - inches of mercury

in.W.C. - inches of water column

lbs - pounds

LPGAC - liquid phase granular activated carbon

LRP - liquid ring pump

NYSDEC - New York State Department of Environmental Conservation

O&M - Operation and Maintenance

PF - pneumatic fracturing

PID - photoionization detector

ppm - parts per million

PVC - polyvinyl chloride

SCH - schedule

SDR - standard dimension ratio

TCE - Trichloroethene

µg/L - micrograms per liter

$\mu g/m^3$ - micrograms per cubic meter

USEPA - United States Environmental Protection Agency

VC - Vinyl Chloride

VER Vacuum-Enhanced Recovery

VOCs - Volatile Organic Compounds

VPGAC - vapor phase granular activated carbon

1. Introduction

ARCADIS of New York, Inc. (ARCADIS) has prepared this *2014 Annual Monitoring Report* on behalf of the Ingersoll Rand Company to summarize the operational and performance monitoring data generated during 2014 for the remedial program at the ARO Corporation site (NYSDEC Site Code 915147, referred to hereafter as the Site) in Cheektowaga, New York (Figure 1). In accordance with the *Remedial Design/Remedial Action Work Plan* (Geraghty & Miller 1997), a vacuum-enhanced recovery (VER) system (Figure 2) was installed to recover chlorinated volatile organic compounds (VOCs) present in the dissolved, adsorbed, and vapor phases in the subsurface at the Site. The main constituents of concern (COC) at the Site are trichloroethene (TCE), Dichloroethene (DCE), and vinyl chloride (VC).

The basis of this report is to satisfy the requirements set forth in the Site Management Periodic Review Report request and provides supporting documentation for the Institutional and Engineering Controls Certification. It should be noted that no substantial changes were made in regards to site management in 2014. Additionally, no changes are being proposed to the remedial program in 2015.

1.1 Site Location and Background

The ARO Corporation site is located on Broadway Street (Route 130) in the Town of Cheektowaga, Erie County, New York (Figure 1). The property consists of the former ARO Corporation parcel and two parcels formerly owned by Richard J. Zydel located adjacent and to the west of the ARO parcel. The area surrounding the Site is zoned as light industrial/residential. The Site is listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as Site Number 915147. The Site is designated as a Class “4” site, which means the Site was properly closed and requires continued management or continuation of operation and maintenance activities.

The former ARO main facility building, which was demolished in December 1997, covered approximately 69,000 square feet of the property. The floor slab of the former main facility building was left in place and not demolished. A separate maintenance and storage building, approximately 4,800 square feet in size, was not demolished and is located south of the west side of the main facility building (Figure 2). The maintenance building currently houses the onsite remedial system. Other property areas include a paved area north of the former main facility building, and a larger, paved parking lot area south of the former building. Areas south and west of the parking lot are open fields. The former Zydel properties included former residences and a garage that were demolished in late November 1998.

A storm water drainage ditch extends southward along the east property boundary and westward along the southern property boundary. Another drainage ditch begins at a backfilled culvert on the south side of the parking lot. Surface water runoff within this ditch flows south to the west-flowing portion of the storm water drainage ditch located along the perimeter of the property.

Pneumatic fracturing (PF) has been conducted at several select areas of the Site in 2004, 2006, and 2009. Pneumatic fracturing is a process by which air is injected at high pressures into the subsurface to create fractures in the geological formation to promote increased hydraulic and pneumatic conductivity, thereby improving the mass recovery potential for site recovery wells. Pneumatic fracturing was conducted at pneumatic fracturing wells PF-1 through PF-4 in 2004, PF-5 through PF-9 in 2006, and PF-10 through PF-13 in 2009 (Figure 2).

1.2 Supplemental Remedial Enhancements

As part of an overall remedial strategy to reduce the remedial life-cycle at the Site, eight (8) additional recovery wells were brought online and cycled on/off during the 2014 reporting period (*Supplemental Remedial Enhancement Work Plan* ([ARCADIS 2013]). The remedial goals for the enhancements were to increase the radius of influence of the existing system within the source areas, thereby providing additional extraction of the higher concentration VOC mass from these impacted areas of the Site.

Performance results, which include the operation of the additional recovery wells are summarized in Section 6.

2. Vacuum Enhanced Recovery System

The VER system currently comprises nineteen recovery wells. It should be noted that eight new recovery wells were added to the recovery well network during the fourth quarter of 2013. The new recovery wells included the conversion of eight (8) existing monitoring wells (i.e., former pneumatic fracturing wells).

The table below summarizes the converted recovery wells:

Previous Well ID	New Recovery Well ID
PF-1	RW-1A
PF-2	RW-1B
PF-4	RW-10A
PF-6	RW-3A
PF-8	RW-9A
PF-10	RW-4A
PF-12	RW-11B
PF-13	RW-11A

The new recovery well locations are shown on Figure 2.

The above grade process and treatment equipment include the following; a liquid ring pump (LRP), a knockout tank (i.e., air/water separator), and liquid phase treatment components. The system equipment and instrumentation are interlocked to a programmable logic controller (PLC), which regulates system operation in automatic mode and will activate a system shutdown and alarm callout in the event of a system malfunction. A system layout showing the location of recovery wells and the treatment system is provided on Figure 2.

Vacuum is applied to the recovery wells by the LRP unit via below-grade vacuum process piping. The LRP removes both groundwater and subsurface vapor (i.e., dual-phase) from the recovery wells. The LRP is similar to a conventional vacuum blower, except that it is able to generate much higher levels of vacuum [28 inches of mercury (in.Hg)].

The recovered groundwater and vapor from each recovery well are directed from a common manifold to the knockout tank. The knockout tank is designed to separate the liquid and vapor process streams from one another. Groundwater is transferred using two (2) progressive cavity transfer pumps through a bag filter vessel which removes particulates larger than 25 microns in diameter. The final treatment for groundwater consists of two 1,000-pound (lb) liquid phase granular activated carbon (LPGAC) vessels. The average and cumulative extracted groundwater flows are monitored and data logged via a flow transmitter and paddlewheel flow sensor. The extracted vapor phase flows are monitored and recorded utilizing a pitot tube which converts differential pressure to volumetric flow. Additionally, vapor flow rates are verified with a hand held anemometer.

Downstream from the knockout tank, the vapor stream passes through a particulate filter, the LRP, and through a secondary knockout tank prior to being released to the atmosphere.

The liquid phase treatment vessels are equipped with a manifold which can be valved for series, parallel, or isolated operating configurations, allowing flexibility in treatment operation during non-routine maintenance activities. Sample collection valves and individual pressure indicators are located on the inlet and discharge side of each vessel.

The LPGAC vessels are designed to remove VOCs from the liquid process stream prior to discharge. Treated groundwater is discharged to an on-site sanitary sewer connection under an industrial wastewater discharge permit. The vapor is vented directly to the atmosphere approximately 4 feet above the building roofline.

3. System Operation & Maintenance

The VER system operated continuously from January to December during the 2014 reporting period with only brief shutdown periods due to scheduled operation and maintenance (O&M) activities, and the occurrence of alarm conditions.

A combination of recovery wells were operated during 2014, ranging from four to eleven recovery wells operating on a monthly to month basis. Wells that were operated during the 2014 period include RW-1, RW-1A, RW-1B, RW-3, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-9A, RW-10, RW-10A, RW-11, RW-11A, and RW-11B. Recovery well RW-2 was offline during the 2014 reporting period due to cleanup goals being achieved for the groundwater in adjacent monitoring well MW-26.

The eight recovery wells added to the system during the 2013 fourth quarter (RW-1A, RW-1B, RW-3A, RW-4A, RW-9A, RW-10A, RW-11A, and RW-11B) were on a more consistent basis during 2014 in an effort to expand the systems range of influence.

Monthly O&M site visits consist of system inspection, recording of operating parameters, influent and effluent system sampling, and investigation of any alarms that may have occurred. The O&M data generated during each monthly visit are summarized in quarterly progress reports as required by the Consent Order for remediation. O&M related to each of the major system components (extraction system, liquid and vapor treatment) are discussed in the following subsections.

3.1 Extraction System O&M

The following O&M tasks were performed monthly on the VER system (LRP, transfer pump, and related equipment):

- Checked and recorded overall system operation and alarm status
- Recorded vacuum gauge readings at the knockout tank and LRP to confirm applied vacuum operational setpoints
- Checked LRP seal oil level, filter pressure, and temperature to ensure that the LRP was operating within the allowable ranges as recommended by the manfacturer
- Recorded total volume of groundwater recovered and average groundwater recovery flow rates
- Recorded extracted air flow rate
- Recorded vacuum level readings at individual recovery well gauges (both at interior valve manifold and recovery wellhead locations).

Monitoring data for 2014 were recorded on ARCADIS O&M checklists and submitted along with the quarterly progress reports to the NYSDEC (ARCADIS 2014 and 2015).

3.2 Vapor Treatment System O&M

The following O&M tasks were performed monthly with regards to the vapor phase portion of the system:

- Recorded the post-LRP/inlet temperature of the secondary knockout tank
- Recorded the vapor flow rate using a handheld anemometer
- Inspected all pipes and fittings for potential leaks
- Collected effluent vapor samples for laboratory analysis.

The vapor sampling results are also used to estimate the VOC removal from the vapor extraction portion of the system. Vapor phase mass removal estimates are summarized in Section 4.2.2.

3.3 Liquid Treatment System O&M

The following O&M tasks were performed monthly with regards to the liquid phase treatment portion of the system.

- Recorded pressure level readings at the inlet and outlet pressure gauges for each of the two LPGAC vessels
- Recorded the pre- and post-sediment filter pressure readings
- Replaced liquid phase bag filters as needed
- Inspected all pipes and fittings for potential leaks
- Inspected liquid and vapor phase flow meters to ensure proper operation
- Collected influent (pre-LPGAC vessel #1), midpoint (post-LPGAC vessel #1), and effluent (post-LPGAC vessel #2) system groundwater samples and submitted for laboratory analysis
- Cleaned out knockout tank and y-strainer as needed
- Maintained the LRP and progressive pumps
- Cleaned and maintained flowmeter to ensure continuous flow monitoring, as required by the Erie County/Buffalo Sewer Authority (EC/BSA) industrial wastewater discharge permit.

As outlined above, influent, midpoint, and effluent liquid samples are submitted for laboratory analysis on a monthly basis. The analytical results are used to determine if the LPGAC media is spent; a condition which can be indicated by the breakthrough of VOCs downstream from the first and/or second LPGAC vessel. Pressure differentials across LPGAC vessels are also used to determine if head losses across vessels are high as a result of the carbon being spent due to adsorption sites being utilized or inorganic fouling (e.g., silt or scale). The system influent groundwater sampling results are used to estimate the VOC removal from the liquid extraction portion of the system. The system effluent groundwater sampling results are used to track the performance of the treatment system in order to meet the permit requirements set forth by the BSA. The BSA permit requires compliance sampling and reporting on a quarterly basis.

3.4 System Repairs and Non-Routine O&M

During the 2014 reporting period, the following system repairs and non-routine O&M activities were performed in addition to the remedial enhancements implemented:

- On January 27, 28, and 29, 2014 the newly installed recovery wells (RW-1A, RW-1B, RW-3A, and RW-4A) were re-developed and brought online.

- On January 31, 2014, the pitless adapter on RW-4A and RW-9A were replaced due to faulty connections.

- On February 5, 2015, the low liquid level float in the knockout tank was malfunctioning. The level switch was removed, cleaned, and tested and reinstalled. A new level switch assembly was specified and ordered.

- On February 10 and 11, 2015, the newly installed recovery wells (RW-9A, RW-10A, RW-11A, and RW-11B) were re-developed and brought online.

- On February 28, 2014, a thermometer was installed between the LRP and the secondary knockout drum to monitor condensate generation in the effluent vapor pipe.

- On March 14, 2014, spent carbon was transported and disposed offsite at Waste Management's Model City Facility.

- On March 14, 2014, a water leak was observed from the transfer pump (P-220) drive shaft. The pump was temporarily taken offline to be repaired.

- The On April 22, 2014, the knockout tank liquid level float switches and site gauge were replaced.

- On May 6, 2014, transfer pump 210 was taken offline due to repeated blown fuses. The pump motor was diagnosed and repaired and by the local pump manufacturer representative.

- On September 26, 2014, the LRP oil and oil filter were changed out.

3.5 Objectives of Monitoring

During operation of the VER system, various data were collected and analyzed to evaluate the overall performance and effectiveness of the system. This performance monitoring is intended to achieve the following objectives:

- Evaluate total VOC recovery in the liquid and vapor phases during the operational period
- Evaluate performance of the groundwater treatment system
- Determine if any modifications to the system are required to enhance and maximize system performance
- Ultimately determine when remedial endpoints have been achieved.

Data generated from the system performance monitoring activities are outlined below.

3.6 System Operational Data

The VER system operational data for 2014 are summarized in Table 1. These data include the total applied vacuum to the system, extracted vapor and groundwater flow rates, and extraction wellhead vacuums.

3.6.1 Applied Vacuum/Extracted Vapor Flow Rate

The observed applied vacuum at the system knockout tank generated by the LRP ranged from 15 in.Hg to 26 in.Hg during the 2014 reporting period. The extracted vapor flow rate ranged from about 35 to 105 cubic feet per minute (cfm) during the 2014 reporting period. The average monthly system vapor flow rates are included in Table 1.

3.6.2 Groundwater Recovery Rates

Total groundwater flow readings were taken from the totalizing flow meter installed on the liquid discharge of the VER system. The average monthly system groundwater flow rates are included in Table 1. A cumulative total of 14,437,179 gallons of groundwater has been recovered by the VER system as of December 30, 2014. A total of 959,882 gallons of water were treated by the VER system in the 2014 reporting period (Table 2). This total flow corresponds to an average recovery rate of approximately 1.8 gallons per minute (gpm) over the entire 2014 reporting period.

3.7 System Liquid Phase Analytical Results

As outlined, groundwater samples were collected on a monthly basis from the influent of the treatment system, the midpoint between the two LPGAC units, and from the effluent (prior to discharging to the sewer under the EC/BSA discharge permit). All samples were submitted to Accutest Laboratories located in Marlborough, Massachusetts for analysis. The 2014 system liquid phase sampling laboratory analytical results have been provided with the quarterly progress reports submitted to the NYSDEC (ARCADIS 2014 and 2015). The laboratory analytical data has been submitted to NYSDEC's EIMS Administrator in the required EQuIS Electronic Data Deliverable (EDD) format.

3.7.1 System Influent Liquid Phase Analytical Results

Monthly system influent liquid phase samples were analyzed for VOCs using United States Environmental Protection Agency (USEPA) Method 8260. The influent sample concentrations were used to estimate the total VOC mass removal from the subsurface and to evaluate the relative changes in the mass removal rate over time. The mass removal estimate is generated using the monthly influent sample analytical data and the cumulative groundwater flow totals.

Dissolved phase concentrations of TCE, DCE (total), and VC in the influent, midpoint, and effluent liquid samples are provided in Table 3. The monthly influent concentrations of TCE, DCE (total) and VC in samples collected during the 2014 reporting period are illustrated graphically on Figure 3.

Monthly liquid phase influent concentrations during 2014 ranged from 28.3 to 7,400 micrograms per liter (μg/L) for TCE, 16.9 to 1,138 μg/L for DCE (total), and non-detect to 45.4 μg/L for VC.

The following table summarizes the recovery wells online during the monthly system influent sampling events during the 2014 reporting period:

Sample Date	Recovery Wells Online
1/31/2014	RW-1, RW-1A, RW-1B, RW-3A, and RW-11
2/28/2014	RW-1, RW-4, RW-9, RW-9A, RW-10, RW-10A, RW-11, RW-11A, RW-11B
3/31/2014	RW-9A, RW-10A, RW-11A and RW-11B
4/30/2014	RW-5, RW-10A, RW11, RW-11A and RW-11B
5/30/2014	RW-1, RW-4, RW-5, RW-9A, RW-11A and RW-11B
6/24/0214	RW-1, RW-4, RW-4A, RW-5, RW-10A, RW-11A and RW-11B
7/30/2014	RW-1, RW-3A, RW-4, RW-4A, RW-5, RW-6, RW-9A, and RW-10A
8/25/2014	RW-4A, RW-9, RW-9A, and RW-10A
9/26/2014	RW-4, RW-4A, RW-9, RW-10A, RW-11, RW-11A and RW-11B
10/30/2014	RW-3, RW-4, RW-6, and RW-9
12/2/2014	RW-10A, RW-11, RW-11A and RW-11B
12/30/2014	RW-1, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-10A, RW-11, RW-11A, RW-11B

Monthly influent concentrations should be expected to vary based on which recovery wells are online at the time of the sampling and other factors such as extraction rates and groundwater yield/recharge conditions.

3.7.2 System Midpoint Liquid Phase Analytical Results

Monthly system liquid phase samples were collected from the midpoint location between the two LPGAC units and analyzed for VOCs using USEPA Method 8260. Liquid phase midpoint samples were collected to monitor the performance of the lead LPGAC unit and to help determine when a carbon media change is warranted. As noted previously, dissolved phase concentrations of TCE, DCE (total) and VC in the influent, midpoint, and effluent samples have been provided in Table 3.

3.7.3 System Effluent Treated Liquid Phase Analytical Results

Pursuant to the effluent standards set forth by the Erie County/Buffalo Pollutant Discharge Elimination System Permit # 10-10-E1017, an effluent sampling event was conducted on a quarterly basis which consists of a 24-hour composite sample (via an automatic sampler) for laboratory analysis of total extractable hydrocarbons and the collection of four grab samples over an 8 hour period for analysis of VOCs. Additionally, a monthly effluent liquid phase grab sample is collected and analyzed for VOCs. VOCs and total extractable hydrocarbons were analyzed using USEPA Methods 8260 and 1664, respectively.

During 2014, the monitoring parameters were either non-detect or reported at quantities below the permitted effluent limits. These system effluent results indicate that the LPGAC treatment system removed in excess of 99% of the VOCs in the extracted groundwater. The effluent sample results for TCE, DCE (total), and VC are provided in Table 3.

3.8 Vapor Discharge Sampling & Analytical Results

Effluent vapor samples were collected on a monthly basis from the vapor discharge side of the LRP, and submitted for laboratory analysis of VOCs by Method AM 4.02 by Microseeps, Inc. in Pittsburgh, Pennsylvania. As with the extracted groundwater sampling, the purpose of the vapor sampling is to estimate the total VOC mass removal from the subsurface, and to evaluate the relative changes in vapor phase mass removal rate over time as a result of the system operation. The mass removal estimate is generated using the vapor sample analytical data and the air flow rate estimates recorded at the time of sampling. The monthly system vapor sample laboratory analytical results have been provided with the quarterly progress reports submitted to the NYSDEC (ARCADIS 2014 and 2015). The laboratory analytical data has been submitted to NYSDEC's EIMS Administrator in the required EDD format.

The monthly vapor concentrations of TCE, DCE (total) and VC are presented in Table 4, with time-concentration data for 2013 and 2014 depicted graphically on Figure 4. The two predominant compounds detected in the vapor samples have historically been TCE and DEC (total). During 2014, concentrations of TCE in the vapor samples ranged from 2,148 microgram per cubic meter ($\mu g/m^3$) to 64,440 $\mu g/m^3$. Vapor concentrations of DCE (total) ranged from 1,585 $\mu g/m^3$ to 14,794 $\mu g/m^3$. Vinyl chloride remained below the detection limits during 2014.

3.9 Semi-Annual Groundwater Monitoring

Semi-annual groundwater monitoring activities were conducted in June and December 2014. Groundwater monitoring consisted of the collection of groundwater samples from monitoring wells, former pneumatic fracturing locations, and recovery wells, as well as the measurement of water levels in monitoring wells to evaluate the hydraulic influence of the VER system. The VER system was operating with recovery wells RW-1, RW-4A, RW-9A, RW-11A and RW-11B online during the June sampling event and RW-1, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-10, RW-10A, RW-11, RW-11A, and RW-11B online for the December sampling event. Sampling of the following fourteen wells was conducted to monitor groundwater concentrations during active remediation and evaluate the VER system effectiveness:

Monitoring Wells

- MW-2 (located adjacent to RW-8)
- MW-6 (adjacent to RW-1)
- MW-11 (adjacent to RW-3)
- MW-13 (adjacent to RW-3)
- MW-20 (adjacent to RW-5)
- MW-22 (adjacent to RW-4)
- MW-23 (adjacent to RW-6)
- MW-24 (adjacent to RW-7)
- MW-29 (adjacent to RW-9)
- OW-101 (adjacent to RW-3)
- VEROW-1 (adjacent to RW-1)
- PF-9 (adjacent to RW-5)

Recovery Wells

- RW-11
- RW-11A (former PF-13)

All groundwater samples were collected and submitted for analysis of VOCs using USEPA Method 8260 at Accutest Laboratories in Marlborough, Massachusetts.

Concentrations of TCE, DCE (total), and VC for the 2014 groundwater samples are shown in Table 5. Historical concentration trends of TCE and DCE (total) detected in each of the monitoring wells and select recovery wells are shown on Figures 5A, 5B, 6A, and 6B. Copies of the laboratory analytical results of the semi-annual groundwater samples have been provided in the quarterly progress reports submitted to the NYSDEC (ARCADIS 2014 and 2015).

4. System Performance Evaluation

The following sections provide evaluation of the remedial system performance monitoring data from 2014, and since the start of remedial system operations.

4.1 System Extraction Rates

4.1.1 Liquid Phase Extraction

As discussed in Section 3.6.2, the total recovered groundwater flows correspond to an average recovery rate of approximately 1.8 gpm over the 2014 reporting period. This is relatively consistent with the annual average groundwater recovery rates from 2009, 2010, 2011, 2012, and 2013 of 1.7, 2.2, 2.3, 2.8, and 1.7 gpm respectively.

4.1.2 Vapor Phase Extraction

As discussed in Section 3.6.1, the extracted vapor flow rate ranged from 35 to 105 cfm during the 2014 reporting period. It should be noted that the measured flow rate is solely from the recovery well network online during the sampling event, and does not include any makeup (i.e., dilution) air.

4.2 Dissolved and Vapor Phase Mass Removal

The estimated annual and total mass removed by the VER system was calculated using the influent VOC sampling results and system groundwater and vapor extraction flow rates.

4.2.1 Groundwater

Influent groundwater sampling results were used to estimate VOC recovery rates. As shown in Table 2, influent VOC levels and groundwater recovery rates were used to calculate the estimated overall mass of VOCs recovered in the dissolved phase. As indicated in Table 2, a total estimated approximate mass of 4.66 kilograms (10 lbs) of VOCs were recovered in the dissolved phase during the 2014 reporting period.

As the data in Table 2 and on Figure 7 indicate, the monthly dissolved phase mass recovery estimates ranged from 1 to 76 grams per day. The fluctuation in dissolved phase VOC recovery at the time of sampling is due to variability in the influent mass concentrations in the extracted groundwater depending on which recovery wells are online, extraction rate, and precipitation recharge to the groundwater system.

4.2.2 Vapor

Influent vapor sampling results and total vapor extraction flow rates were utilized to estimate the vapor phase VOC mass removal rate for 2014. These data are presented in Table 6. As the data in Table 6 and on Figure 4 indicate, the monthly vapor phase mass removal rate ranged from 20 to 160 grams per day. As with dissolved phase mass recovery, the fluctuation in vapor phase recovery rate can be attributed to variability in influent vapor mass concentrations due to recovery well configuration and precipitation recharge influences. A total estimated mass of 27.4 kilograms (60 lbs) of VOCs were recovered in the vapor phase during 2014.

As expected, the mass transfer of VOCs from soil to vapor is predominantly limited to desorption and diffusion processes, as noted above for the dissolved phase. Therefore, mass removal rates in the vapor phase should be expected to decline over time as the Site is remediated.

4.3 Total Mass Removal Trend

The VER system has recovered a cumulative total of approximately 54.7 kilograms (121 lbs) and 500.3 kilograms (1,103 lbs) of dissolved and vapor phase VOCs, respectively, during the period of operation from startup in 1998 through December 2014 (Table 7). The mass removal rate had generally declined for both the liquid and vapor phase VOC mass removed during each year of the operation from 1998 through 2003. As indicated in previous reports, the rate of recovery is expected to decrease as the mass removal becomes more dependent on desorption and diffusion processes rather advective movement and capture of VOCs. However, the dissolved and vapor phase mass removal rates have increased significantly following implementation of several pneumatic fracturing events at the Site in 2004 through 2009. This mass recovered is a direct indication that the pneumatic fracturing program has been effective at increasing the advective movement and capture of VOCs, and substantially enhancing the efficiency of the remediation system. This was accomplished by further increasing the bulk permeability of the dense glacial till formation in each of the recovery well areas, thereby allowing additional VOC mass recovery via physical desorption and diffusion processes. .

VOCs in the vapor phase accounted for greater than 95% of the total mass recovered in 2014. However, a percentage of the dissolved phase mass is transferred to the vapor phase due to the nature of VER system operation via in-situ stripping within the capillary fringe, recovery well, and through the extraction piping network. Thus, the vapor-phase influent data reflect, in part, the contribution of dissolved phase VOCs in groundwater.

As presented in Table 7, the dissolved and vapor phase mass recovered during 2014 is estimated at 4.66 and 27.4 kg, respectively. Figure 7 also depicts annual mass recovery through 2014 for both the dissolved and vapor phases. This corresponds to a combined vapor and dissolved phase mass recovery of 32.1 kg (71 lbs) during the 2014 reporting period. The estimated combined VOC mass recovered during the 2014 reporting period remains higher than annual VOC mass recovery estimates prior to 2004.

5. Groundwater Monitoring Program

5.1 Water Level Conditions under System Operation (Vacuum Conditions)

Water level measurements were collected in each of the onsite monitoring wells during June and December 2014. These measurements were collected to monitor groundwater levels in response to operation of the VER system, which provides an indication of the hydraulic influence in the vicinity of the recovery wells under pumping conditions.

Water level data are summarized in Table 8 and the corresponding groundwater contour maps for June 4 and December 15, 2014 are presented on Figures 8 and 9, respectively. The contour map representing groundwater elevations from June 4, 2014 were with recovery wells RW-1, RW-4A, RW-9A, RW-11A and RW-11B operating. The contour map representing groundwater elevations on December 15, 2014 were with recovery wells RW-1, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-10, RW-10A, RW-11, RW-11A, and RW-11B operating. The groundwater contours generally reflect the hydraulic influence and cones of depression induced by recovery wells that are online. The radius of hydraulic influence, which vary with each recovery well based on local hydrogeologic conditions including any effect from pneumatic fracturing, indicate that the system is maintaining hydraulic control of the groundwater in the vicinity of operating recovery wells. The manner in which recovery wells were operated during 2014 has been discussed in Section 3.

5.2 Semi-Annual Groundwater Monitoring

Both groundwater sampling events during the 2014 reporting period included groundwater collection from the same fourteen (14) wells to monitor VOC concentrations and trends, and evaluate the performance of the VER system. TCE, DCE (total), and VC concentrations from the 2014 groundwater monitoring program are shown in Table 5. Historical TCE and DCE (total) concentration trends in groundwater for monitoring and recovery wells are depicted on Figures

5A, 5B, 6A, and 6B. The groundwater laboratory analytical data have been provided with quarterly progress reports submitted to the NYSDEC (ARCADIS 2014 and 2015).

The analytical results continue to show improvement in groundwater quality post-pneumatic fracturing. VOC concentrations in several of the monitoring wells have declined one to two orders of magnitude since implementing pneumatic fracturing at the Site, The following highlights the groundwater analytical data for specific monitoring wells at the site:

- MW-6: DCE (total) concentrations have fluctuated within the ranges observed post the initial 2004 pneumatic fracturing event in the area. TCE concentrations continue to remain stable and have not rebounded post the 2004 pneumatic fracturing event.

- MW-20: TCE concentrations have remained within ranges established since the 2006 pneumatic fracturing event, which is an order of magnitude less than pre-pneumatic fracturing levels. DCE (total) concentrations continue to indicate a decreasing trend.

- PF-9: TCE concentrations have continued to trend downward since implementing the 2009 pneumatic fracturing event, and DCE (total) concentrations have remained relatively stable.

- MW-22: DCE (total) was detected at the lowest concentration (74 µg/L) for December 2014 since 2009. TCE and DCE (total) concentrations generally remained consistent during both events in regards to the TCE and DCE (total) concentrations compared to the previous year (2013).

- MW-23: DCE (total) and TCE have continued to trend downward since implementing the additional recovery wells at the end of 2013 and were consistent with readings observed during the December 2013 event.

- MW-29: DCE (total) and TCE concentrations increased during the June 2014 groundwater monitoring event, 1,100 and 3,320, respectively, concentrations however decreasing during the December 2014 event, 25 and 281, respectively.

- OW-101: DCE (total) and TCE concentrations increased during the June 2014 groundwater monitoring event, 122 and 1,112, respectively, concentrations however decreasing during the December 2014 event, 35 and 21, respectively.

- VEROW-1: TCE and DCE (total) concentrations increased slightly from 2013 to 2014. The noted increase in concentration is most likely attributable to operation of recovery wells RW-1A and RW-1B, which were brought online in early 2014. The operation of these recovery wells has increased the influence of the system in that area and is liberating VOC mass in those areas.

- RW-11: DCE (total) concentrations continue to remain relatively. TCE concentration for the June 2014 groundwater monitoring event was the second lowest detected at this location. A decreasing trend in VOCs is expected at this location with the continued operation of recovery wells RW-11A and RW-11B, which were brought online in 2014.

- RW-11A: DCE (total) concentration for the December 2014 groundwater monitoring event was the historical lowest concentrations detected at this location. This can likely be attributed to the conversion of PF-13 into a recovery well (RW-11A) and its subsequent operation prior to sampling. TCE concentrations remained relatively stable during 2014.

- VOC concentrations in monitoring wells MW-2 and MW-24 have remained relatively stable as compared the cyclic trends observed in the past several years.

- VOC concentrations at MW-11 and MW-13 have remained relatively stable as compared the cyclic trends observed in the past several years.

VOC concentrations in the other site monitoring wells have also fluctuated somewhat in response to changes in pumping cycles or seasonal water table fluctuations, but have remained relatively stable.

6. Conclusions and Recommendations

The following sections summarize the overall system operation, remedial progress, and OM&M goals for the next reporting period.

6.1 VER System Summary

The VER system has been effective at removing dissolved, adsorbed, and vapor phase VOC mass. Since startup of the VER system, groundwater quality at the Site has improved substantially in most areas. The groundwater monitoring analytical results discussed in Section 5.2, are consistent with the decrease in mass removal estimates based on VER system influent groundwater and vapor phase results presented in Section 4.2. As the available VOC mass decreases, as indicated by groundwater monitoring results, the VOC mass extracted by the VER system will decrease.

The effectiveness of the system is summarized below with the following performance metrics:

- Groundwater monitoring data following the pneumatic fracturing events have continued to indicate substantial improvement in groundwater quality in response to operation of the VER system. This includes the reduction of VOC concentrations by several orders of magnitude at 7 of the 15 wells monitored on a semi-annual basis. These reductions are depicted on Figures 5A, 5B, 6A, and 6B, and have been summarized below:
  - MW-6: TCE concentrations in groundwater have declined from 38,000 µg/L to 2,490 µg/L.
  - MW-20: TCE and DCE concentrations in groundwater have declined from 16,000 µg/L to 28 µg/L and 3,300 µg/L to 61 µg/L, respectively.
  - MW-29: TCE and DCE concentrations in groundwater have declined from 150,000 µg/L to 281 µg/L and 16,000 µg/L to 25 µg/L, respectively.
  - OW-101: TCE and DCE concentrations in groundwater have declined from 25,000 µg/L to 35 µg/L and 10,000 µg/L to 21 µg/L, respectively.
  - MW-3/RW-11: TCE and DCE concentrations in groundwater have declined from 1,600,000 µg/L to 26,700 µg/L and 4,000 µg/L to 356 µg/L, respectively.
  - PF-9: TCE and DCE concentrations in groundwater have declined from 490 µg/L to 54 µg/L and 2,000 µg/L to 125 µg/L, respectively.
  - PF-13/RW-11A: TCE concentrations in groundwater have declined from 43,500 µg/L to 8,720 µg/L.

- System dissolved and vapor phase influent VOC concentrations increased during the first several months of cyclic operation in 2014. The observed increase in influent VOC concentrations is attributable to operation of the eight new recovery wells; the increase in influent VOC mass is depicted on Figure 7. A decreased in system influent VOC concentrations was noted in the fourth quarter of 2014, this can be attributed to the Site being remediated and mass removal becoming more dependent on diffusion and desorption processes.

- Performance monitoring data (i.e., groundwater drawdown) have indicated that the VER system has been effective at dewatering the formation and making more adsorbed VOC mass available below the groundwater table and within the capillary fringe for vapor extraction and in-situ stripping.

- The extent of the groundwater plume has remained stable although VOC concentrations have declined at a number of monitoring well locations due to operation of the VER system and enhanced VOC mass recovery created by the pneumatic fracturing program.

Groundwater concentration trends also indicate a cyclical, fluctuating pattern at some of the monitoring wells.

- Performance monitoring data have indicated that the VER system has been effective at vapor extraction of adsorbed VOC mass and also creating a significant negative pressure zone (i.e., differential pressure) in the subsurface soil vapor environment.

- The advective movement and capture of dissolved phase VOCs were most notable during the first several months of cycling the eight new recovery wells. Groundwater quality changes are expected to occur over a longer timeframe due to the low permeability of the site geology. The advective movement and capture of dissolved phase VOCs will remain an important mechanism in the mitigation and reduction of VOC impacts, but is expected to decline with continued pumping as VOC mass removal becomes more influenced by slower diffusion processes.

- The liquid phase treatment system has been effective at removing over 99% of the dissolved phase influent VOC mass recovered by the VER system.

- As of December 30, 2014, the VER system has removed an estimated 503 kg (1,109 lbs) of vapor phase VOC mass and 55 kg (121 lbs) of dissolved phase VOC mass.

- As of December 30, 2014, the VER system has treated an estimated 14,437,179 gallons of groundwater.

6.2 Goals for the 2015 - 2016 Operation

System operation and performance monitoring will continue to focus on optimizing mass removal rates through cycled operation of recovery wells, evaluating individual recovery well mass removal rates, and continued operation and maintenance of the VER system equipment and components.

The goals for system operational activities during the next several months of operation in 2015 will be as follows:

- Conduct water level measurements at all monitoring wells to monitor hydraulic influence of the system and demonstrate continued hydraulic control of the groundwater plume

- Continue to collect groundwater samples on a semi-annual basis in accordance with the existing monitoring program. Collect groundwater samples from other selected monitoring wells and recovery wells to track changes in groundwater quality and support remedial decisions

- Collect quarterly system effluent samples as required by the EC/BSA Industrial Wastewater Discharge Permit

- Continue to monitor the LPGAC treatment system for VOC breakthrough based on laboratory analysis of samples collected from the system influent, midpoint, and effluent locations

- Collect monthly influent samples to monitor the liquid and vapor phase treatment system for mass removal efficiency based on laboratory analysis of samples collected from the system influent

- Continue operation of the system while performing the required vacuum adjustments at each of the recovery wells to optimize system performance, efficiency, and maximize contaminant mass removal rates.

Based on the results of the 2014 remedial program including the field and laboratory data, the projected remedial program for 2015 - 2016 will remain similar to 2014. As noted above, the groundwater monitoring program will remain relatively the same.

7. References

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ARCADIS. 2013. *Supplemental Remedial Enhancement Work Plan*, Aro Corporation Site, Cheektowaga, New York

ARCADIS G&M, Inc. and GM Consulting Engineers, P.C. 1998. *Engineering Report, Vacuum Enhanced Recovery System*. Aro Corporation Site. Cheektowaga, New York

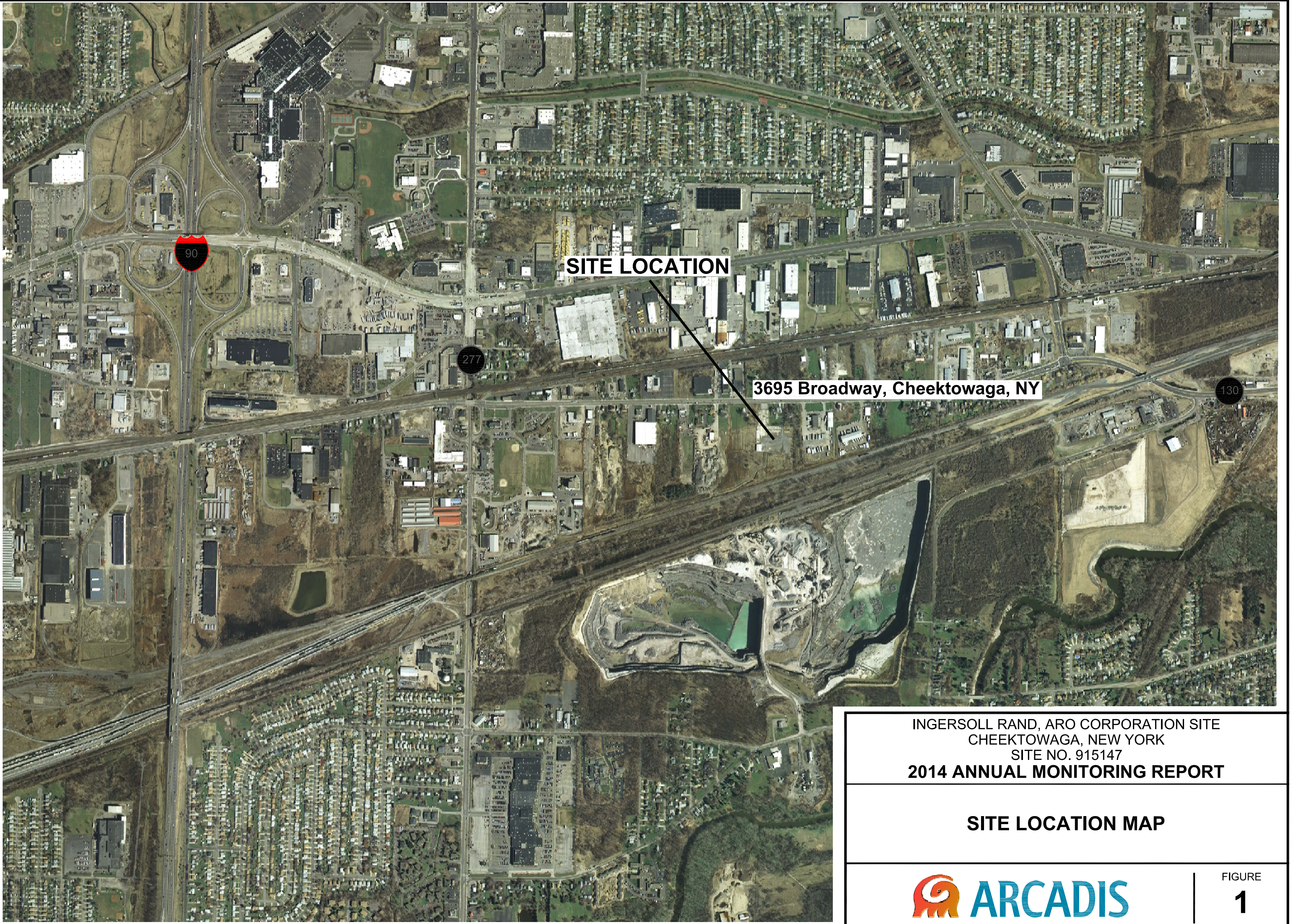
ARCADIS G&M, Inc. and GM Consulting Engineers, P.C. 1998. *Operation and Maintenance Plan, Vacuum Enhanced Recovery System*. Aro Corporation Site. Cheektowaga, New York

ARCADIS

Attachments

ARCADIS

Figures



INGERSOLL RAND, ARO CORPORATION SITE
CHEEKTOWAGA, NEW YORK
SITE NO. 915147

2014 ANNUAL MONITORING REPORT

SITE LOCATION MAP

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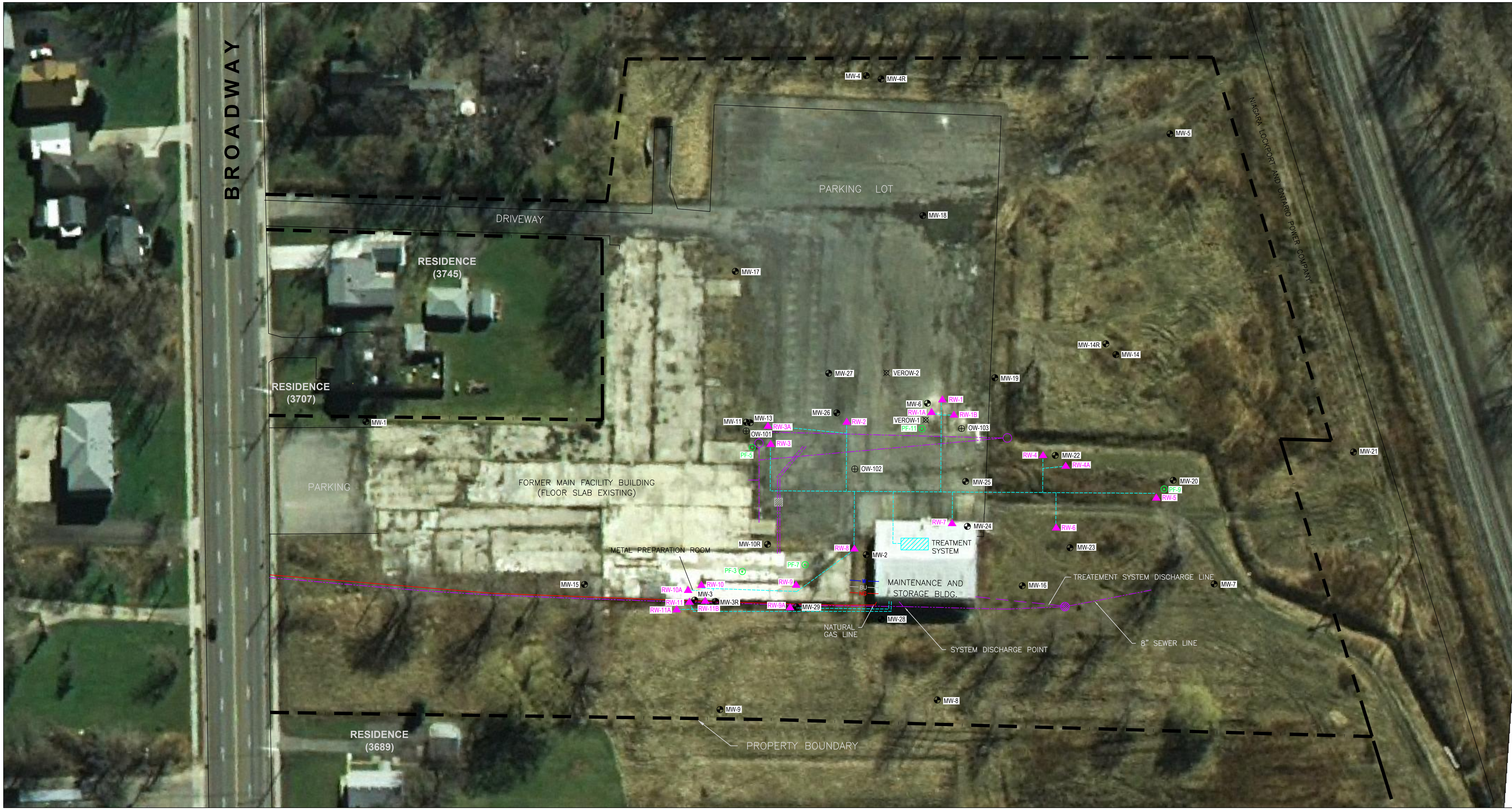
FIGURE
1



SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997

LEGEND

MW-17	MONITORING WELL	RW-2	RECOVERY WELL
OW-101	OBSERVATION WELL	VEROW-2	MONITORING WELL
PF-3	PNEUMATIC FRACTURING WELL		RECOVERY SYSTEM TRENCH/PIPING

PROPERTY BOUNDARY

SYSTEM TREATMENT DISCHARGE LINE

N

0 80 FT

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SITE PLAN AND RECOVERY SYSTEM LAYOUT

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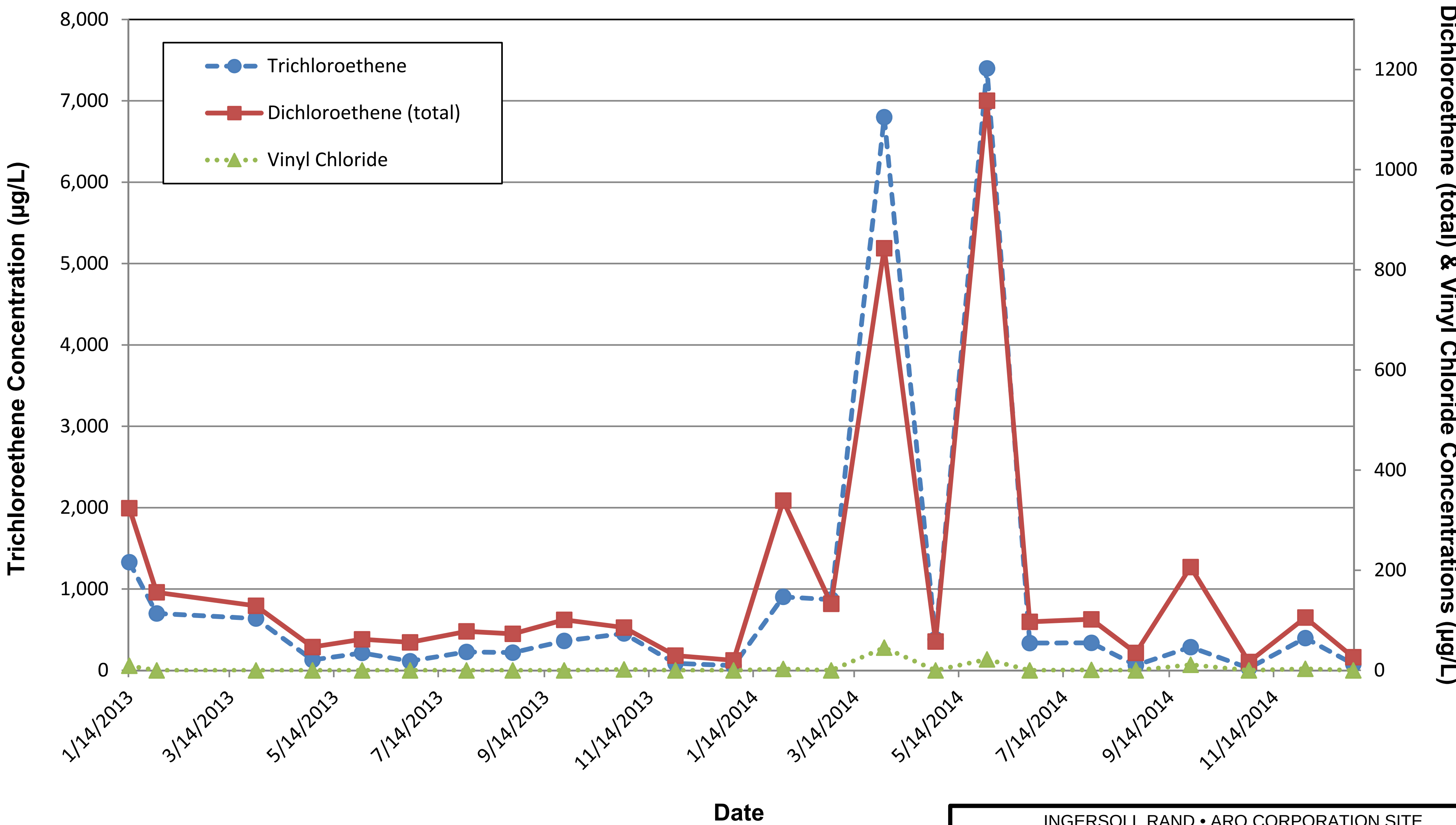
FIGURE
2

CITY:(KNOXVILLE) DIV/GROUP:(ENVCAD) DB:(B.ALTOM) LD:(B.ALTOM) PIC:(M.SANFORD) PM:(M.SANFORD) TM:(C.DAVERN)
G:\ENVCAD\Knoxville\ACT\AY000220\0017\00003\DWG\AY220_SITE PLAN REM SYS.dwg LAYOUT: 2 SAVED: 12/4/2014 7:53 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: TN1_STANDARD.CTB PLOTTED: 12/4/2014 7:55 AM BY: ALTOM, BRENDA
XREFS: xref_AY220_bs IMAGES: AY220_NYGIS_ARO.jpg



Notes:

1) µg/L – micrograms per liter
2) Dichloroethene (total) is the sum of 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene.

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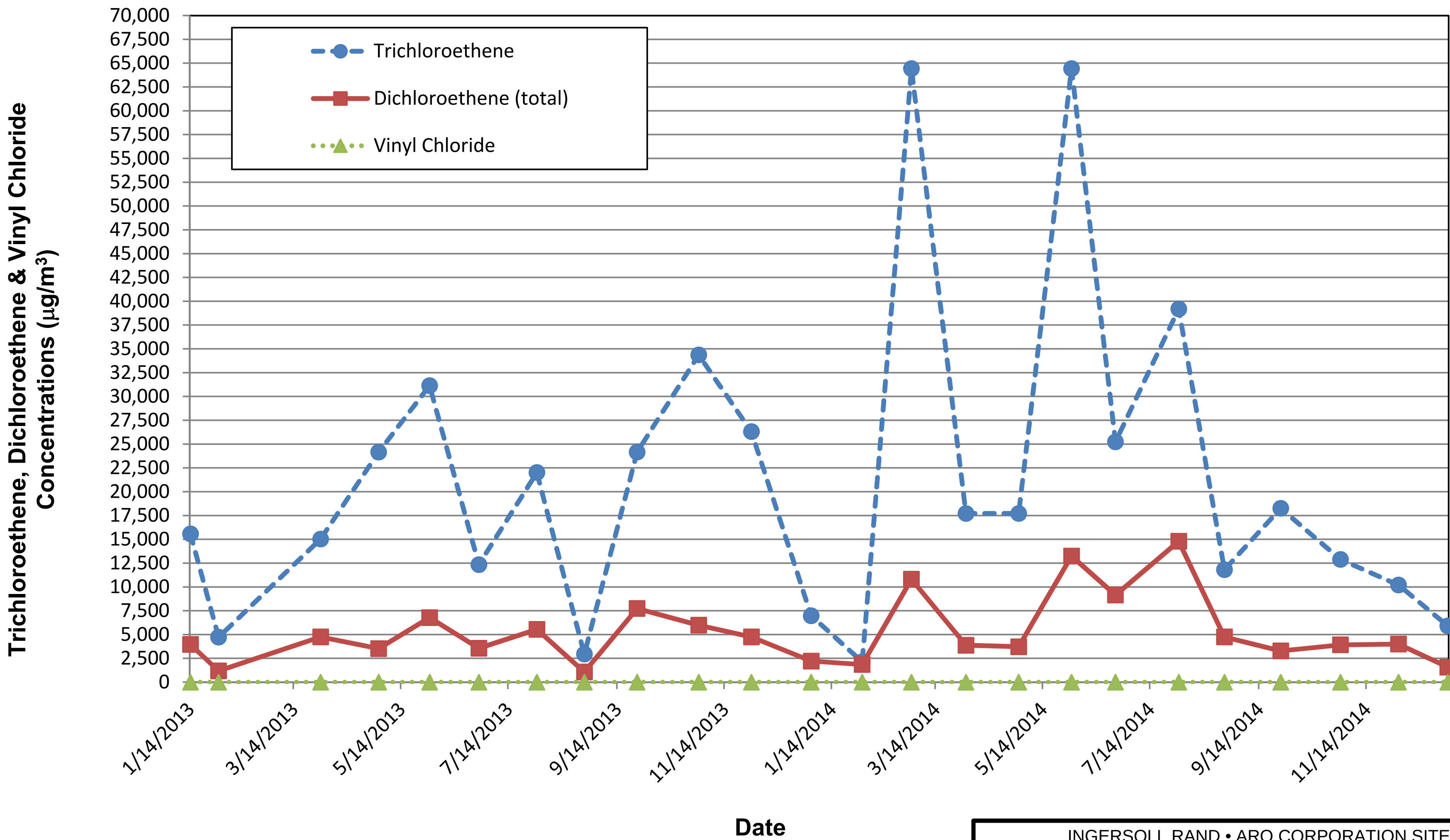
Monthly Influent Dissolved Phase Trichloroethene, Dichloroethene and Vinyl Chloride, 2013 & 2014

ARCADIS

FIGURE
3



Notes:

1) µg/m³ – micrograms per cubic meter
2) Dichloroethene (total) includes the sum of 1,1-dichloroethene, cis-1,2-dichloroethene, and trans-1,2-dichloroethene.

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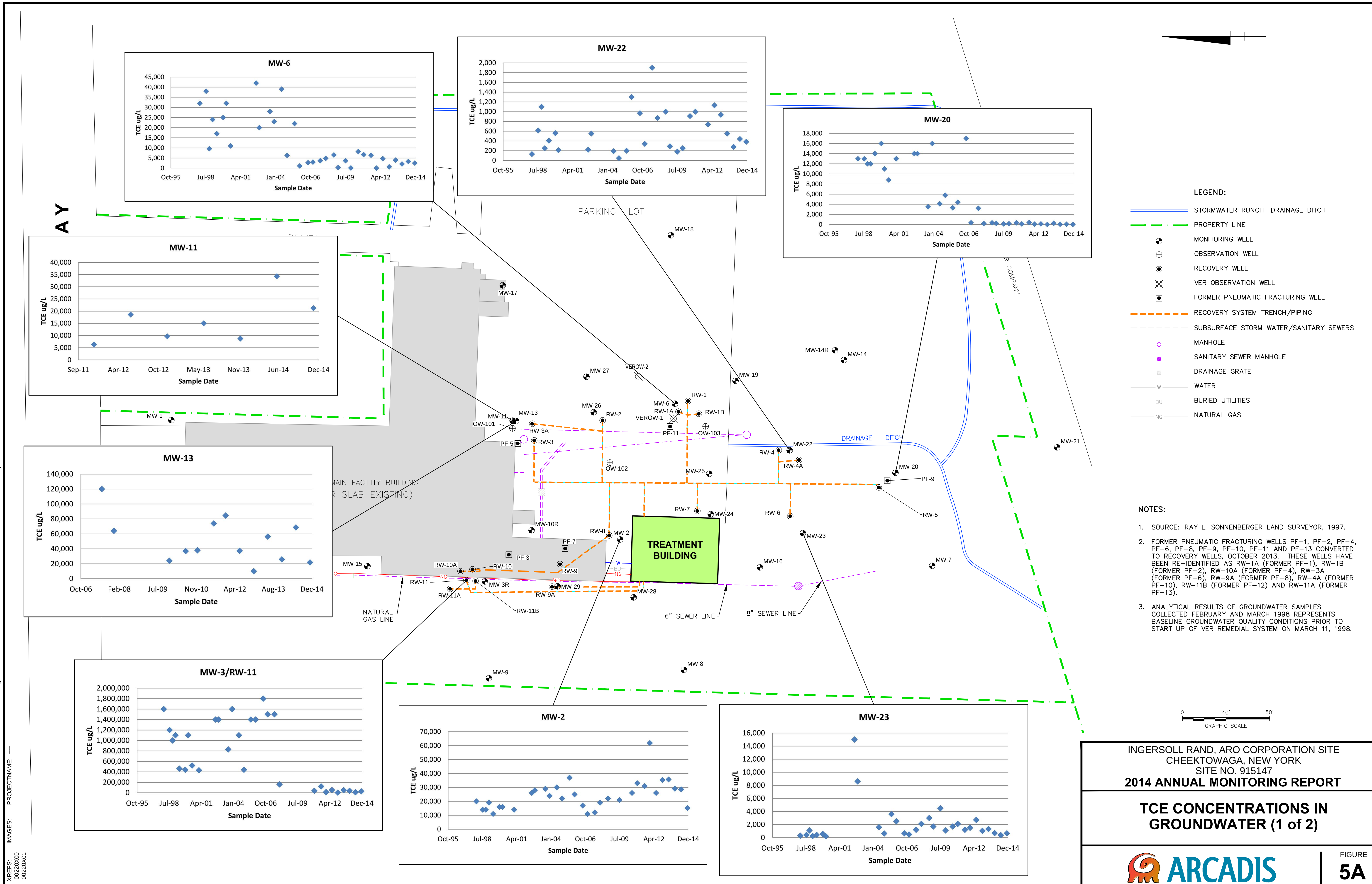
2014 ANNUAL MONITORING REPORT

Monthly Influent Vapor Phase Trichloroethene, Dichloroethene and Vinyl Chloride, 2013 & 2014

ARCADIS

FIGURE

4



NOTES:

1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF-1, PF-2, PF-4, PF-6, PF-8, PF-10, PF-11 AND PF-13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE-IDENTIFIED AS RW-1A (FORMER PF-1), RW-1B (FORMER PF-2), RW-10A (FORMER PF-4), RW-3A (FORMER PF-6), RW-9A (FORMER PF-8), RW-4A (FORMER PF-10), RW-11B (FORMER PF-12) AND RW-11A (FORMER PF-13).
3. ANALYTICAL RESULTS OF GROUNDWATER SAMPLES COLLECTED FEBRUARY AND MARCH 1998 REPRESENTS BASELINE GROUNDWATER QUALITY CONDITIONS PRIOR TO START UP OF VER REMEDIAL SYSTEM ON MARCH 11, 1998.

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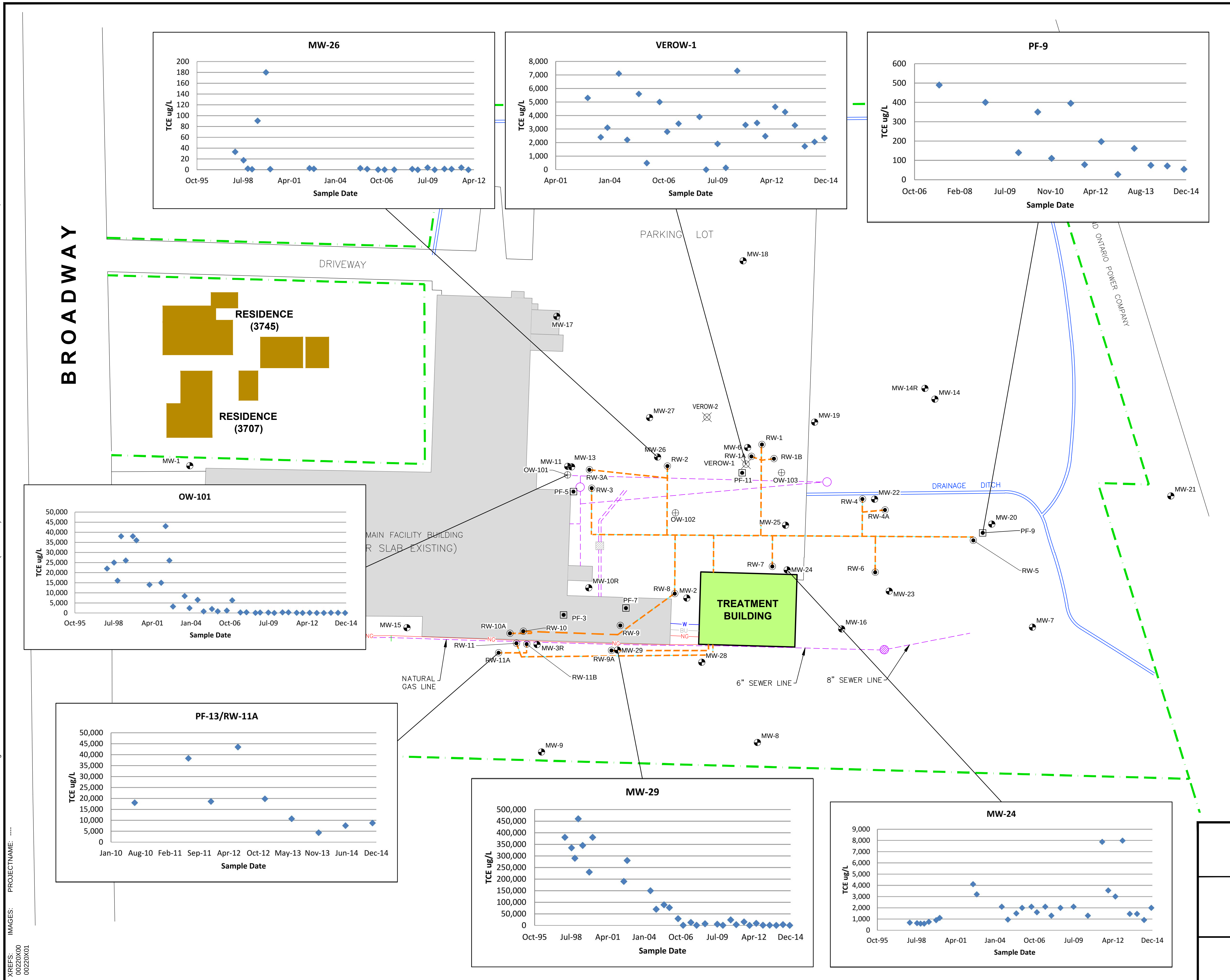
TCE CONCENTRATIONS IN GROUNDWATER (1 of 2)

ARCADIS

FIGURE **5A**



LEGEND:

- STORMWATER RUNOFF DRAINAGE DITCH
- PROPERTY LINE
- MONITORING WELL
- OBSERVATION WELL
- RECOVERY WELL
- VER OBSERVATION WELL
- FORMER PNEUMATIC FRACTURING WELL
- RECOVERY SYSTEM TRENCH/PIPING
- SUBSURFACE STORM WATER/SANITARY SEWERS
- MANHOLE
- SANITARY SEWER MANHOLE
- DRAINAGE GRATE
- WATER
- BURIED UTILITIES
- NATURAL GAS

NOTES:

1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF–1, PF–2, PF–4, PF–6, PF–8, PF–9, PF–10, PF–11 AND PF–13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE–IDENTIFIED AS RW–1A (FORMER PF–1), RW–1B (FORMER PF–2), RW–10A (FORMER PF–4), RW–3A (FORMER PF–6), RW–9A (FORMER PF–8), RW–4A (FORMER PF–10), RW–11B (FORMER PF–12) AND RW–11A (FORMER PF–13).
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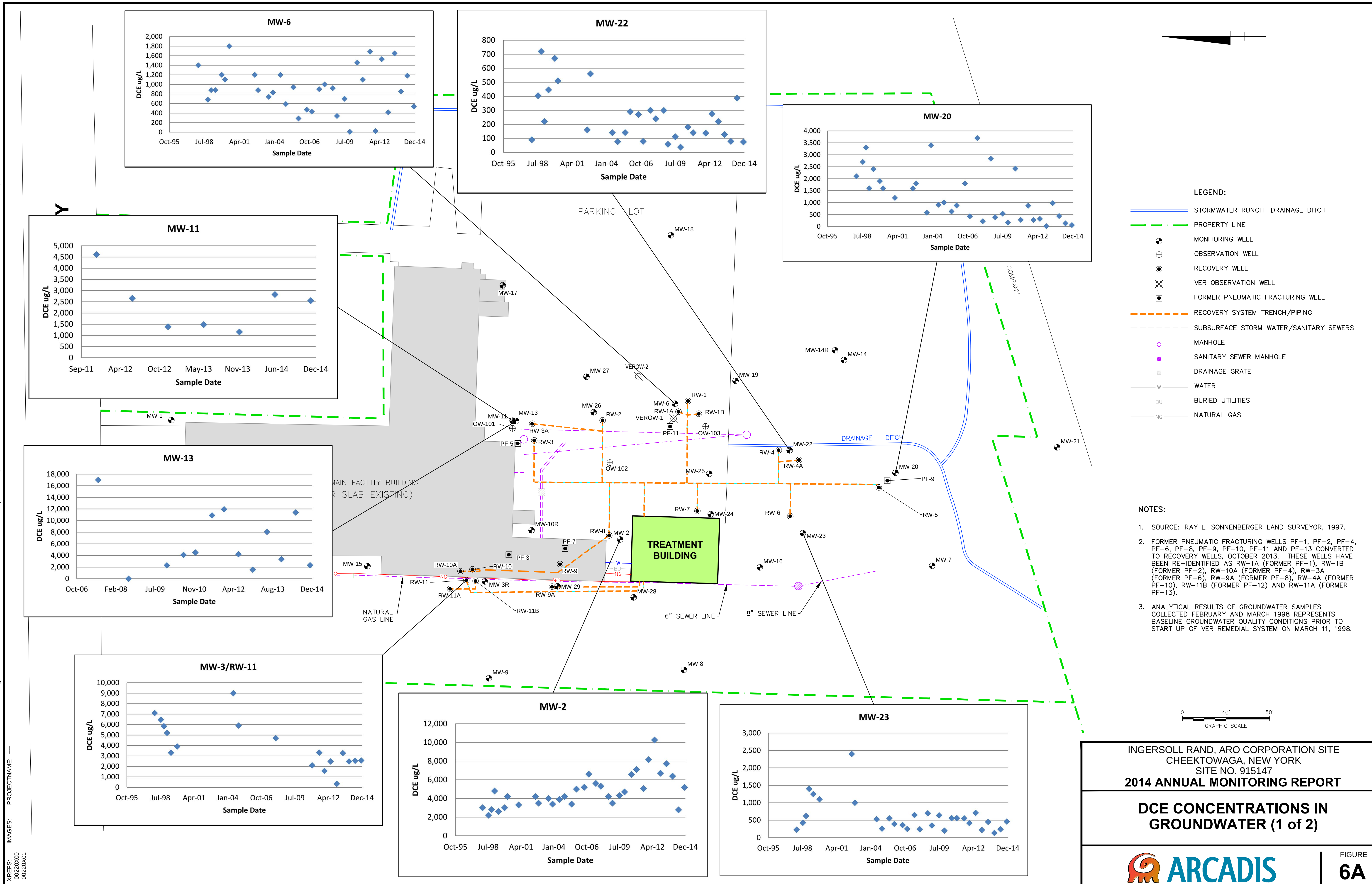
SITE NO. 915147

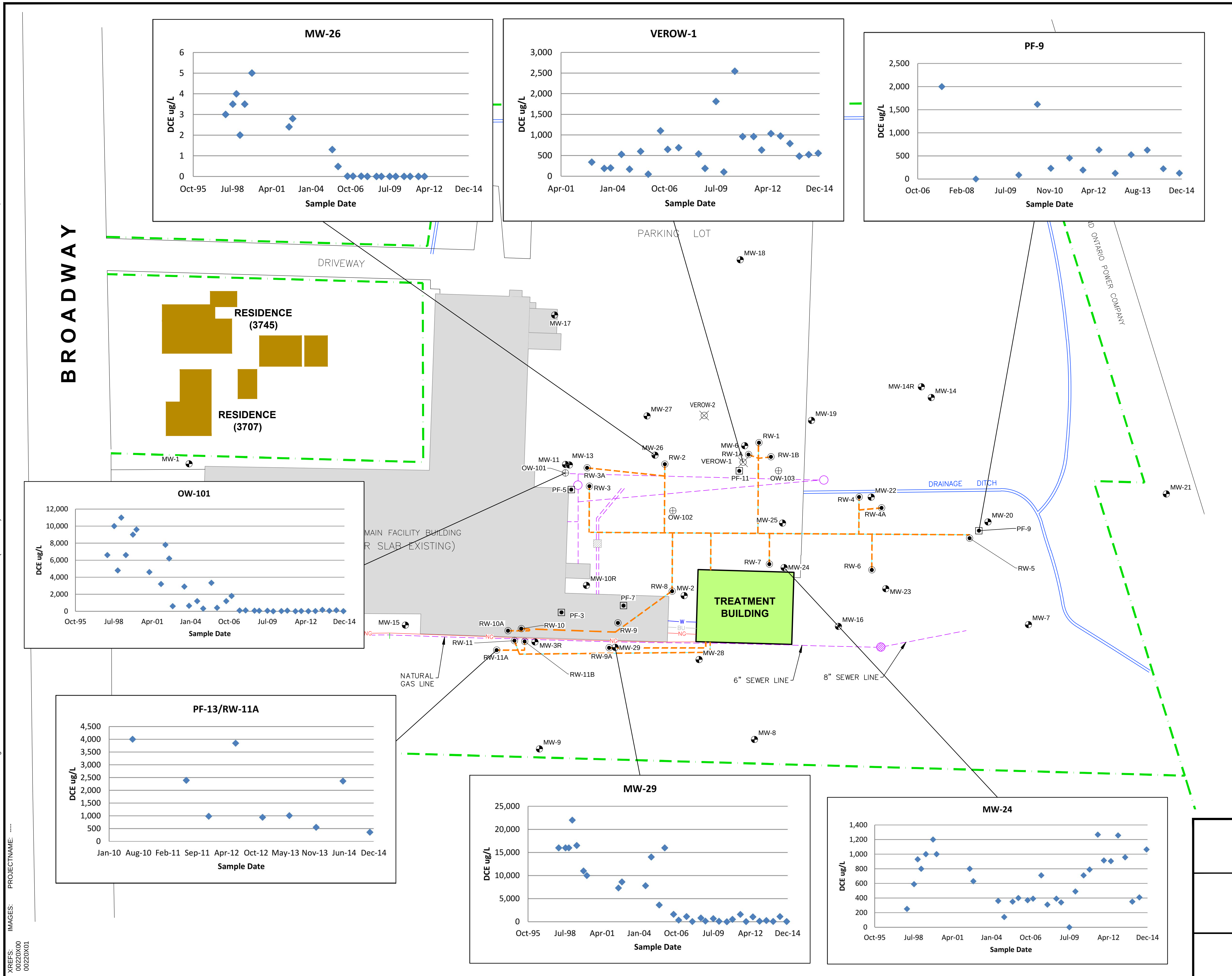
2014 ANNUAL MONITORING REPORT

TCE CONCENTRATIONS IN GROUNDWATER (2 of 2)

ARCADIS

FIGURE **5B**


MW-6
MW-22
MW-20
MW-11
MW-13
MW-3/RW-11
MW-2
MW-23
DCE ug/L
Sample Date
PARKING LOT
MAIN FACILITY BUILDING
TREATMENT BUILDING
DRAINAGE DITCH
6" SEWER LINE
8" SEWER LINE
NATURAL GAS LINE
LEGEND:
STORMWATER RUNOFF DRAINAGE DITCH
PROPERTY LINE
MONITORING WELL
OBSERVATION WELL
RECOVERY WELL
VER OBSERVATION WELL
FORMER PNEUMATIC FRACTURING WELL
RECOVERY SYSTEM TRENCH/PIPING
SUBSURFACE STORM WATER/SANITARY SEWERS
MANHOLE
SANITARY SEWER MANHOLE
DRAINAGE GRATE
WATER
BURIED UTILITIES
NATURAL GAS
NOTES:
1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF-1, PF-2, PF-4, PF-6, PF-8, PF-9, PF-10, PF-11 AND PF-13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE-IDENTIFIED AS RW-1A (FORMER PF-1), RW-1B (FORMER PF-2), RW-10A (FORMER PF-4), RW-3A (FORMER PF-6), RW-9A (FORMER PF-8), RW-4A (FORMER PF-10), RW-11B (FORMER PF-12) AND RW-11A (FORMER PF-13).
3. ANALYTICAL RESULTS OF GROUNDWATER SAMPLES COLLECTED FEBRUARY AND MARCH 1998 REPRESENTS BASELINE GROUNDWATER QUALITY CONDITIONS PRIOR TO START UP OF VER REMEDIAL SYSTEM ON MARCH 11, 1998.
GRAPHIC SCALE
INGERSOLL RAND, ARO CORPORATION SITE
CHEEKTOWAGA, NEW YORK
SITE NO. 915147
2014 ANNUAL MONITORING REPORT
DCE CONCENTRATIONS IN GROUNDWATER (1 of 2)
ARCADIS
FIGURE
6A



LEGEND:

- STORMWATER RUNOFF DRAINAGE DITCH
- PROPERTY LINE
- MONITORING WELL
- OBSERVATION WELL
- RECOVERY WELL
- VER OBSERVATION WELL
- FORMER PNEUMATIC FRACTURING WELL
- RECOVERY SYSTEM TRENCH/PIPING
- SUBSURFACE STORM WATER/SANITARY SEWERS
- MANHOLE
- SANITARY SEWER MANHOLE
- DRAINAGE GRATE
- WATER
- BURIED UTILITIES
- NATURAL GAS

NOTES:

1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF–1, PF–2, PF–4, PF–6, PF–8, PF–9, PF–10, PF–11 AND PF–13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE–IDENTIFIED AS RW–1A (FORMER PF–1), RW–1B (FORMER PF–2), RW–10A (FORMER PF–4), RW–3A (FORMER PF–6), RW–9A (FORMER PF–8), RW–4A (FORMER PF–10), RW–11B (FORMER PF–12) AND RW–11A (FORMER PF–13).
3. ANALYTICAL RESULTS OF GROUNDWATER SAMPLES COLLECTED FEBRUARY AND MARCH 1998 REPRESENTS BASELINE GROUNDWATER QUALITY CONDITIONS PRIOR TO START UP OF VER REMEDIAL SYSTEM ON MARCH 11, 1998.

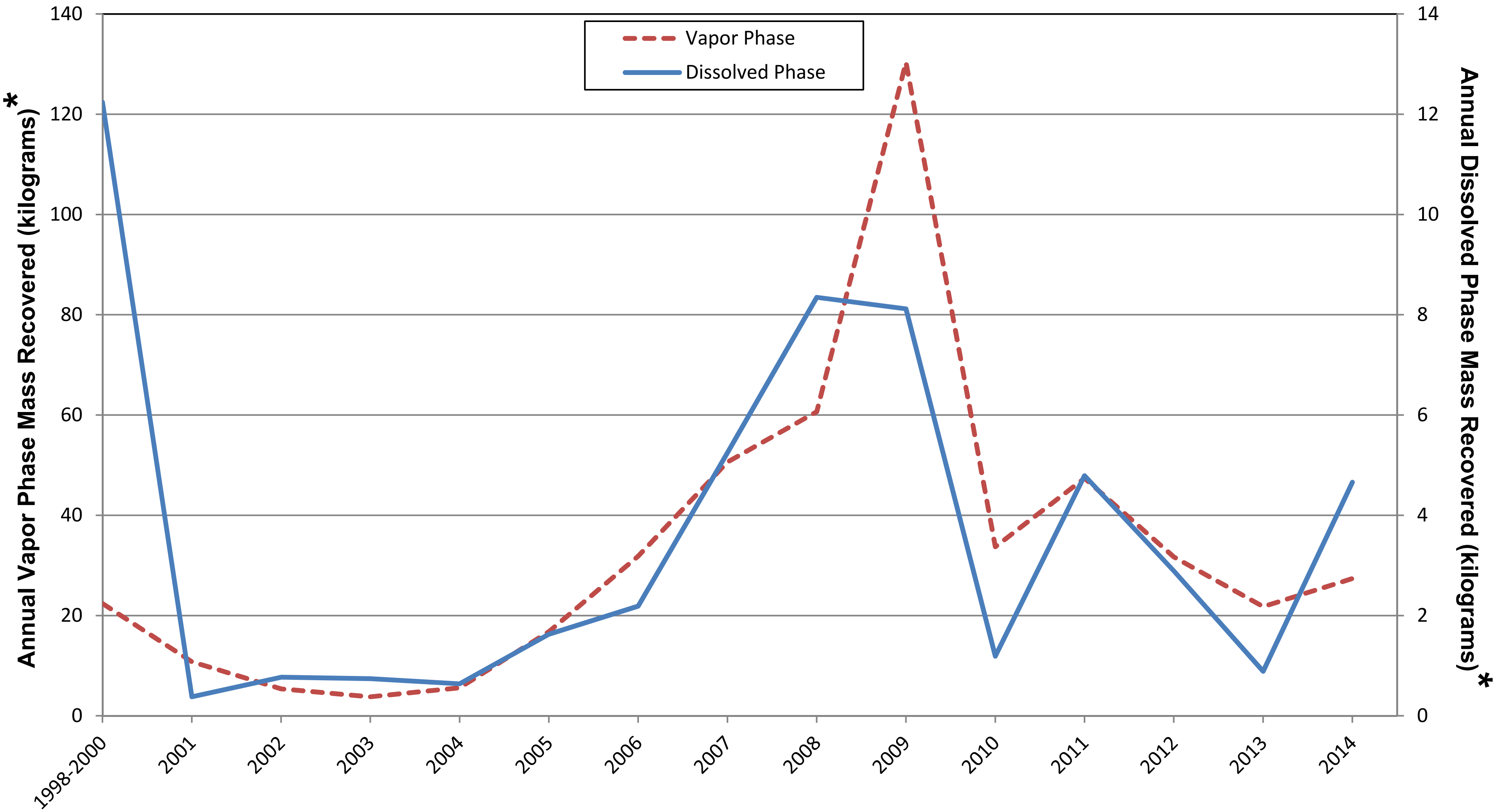
0 40' 80'
GRAPHIC SCALE

INGERSOLL RAND, ARO CORPORATION SITE
CHEEKTOWAGA, NEW YORK
SITE NO. 915147
2014 ANNUAL MONITORING REPORT

DCE CONCENTRATIONS IN GROUNDWATER (2 of 2)

ARCADIS

FIGURE
6B



* Mass recovered includes sum of Trichloroethene, Dichloroethene & Vinyl Chloride

INGERSOLL RAND • ARO CORPORATION SITE
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SITE NO. 915147

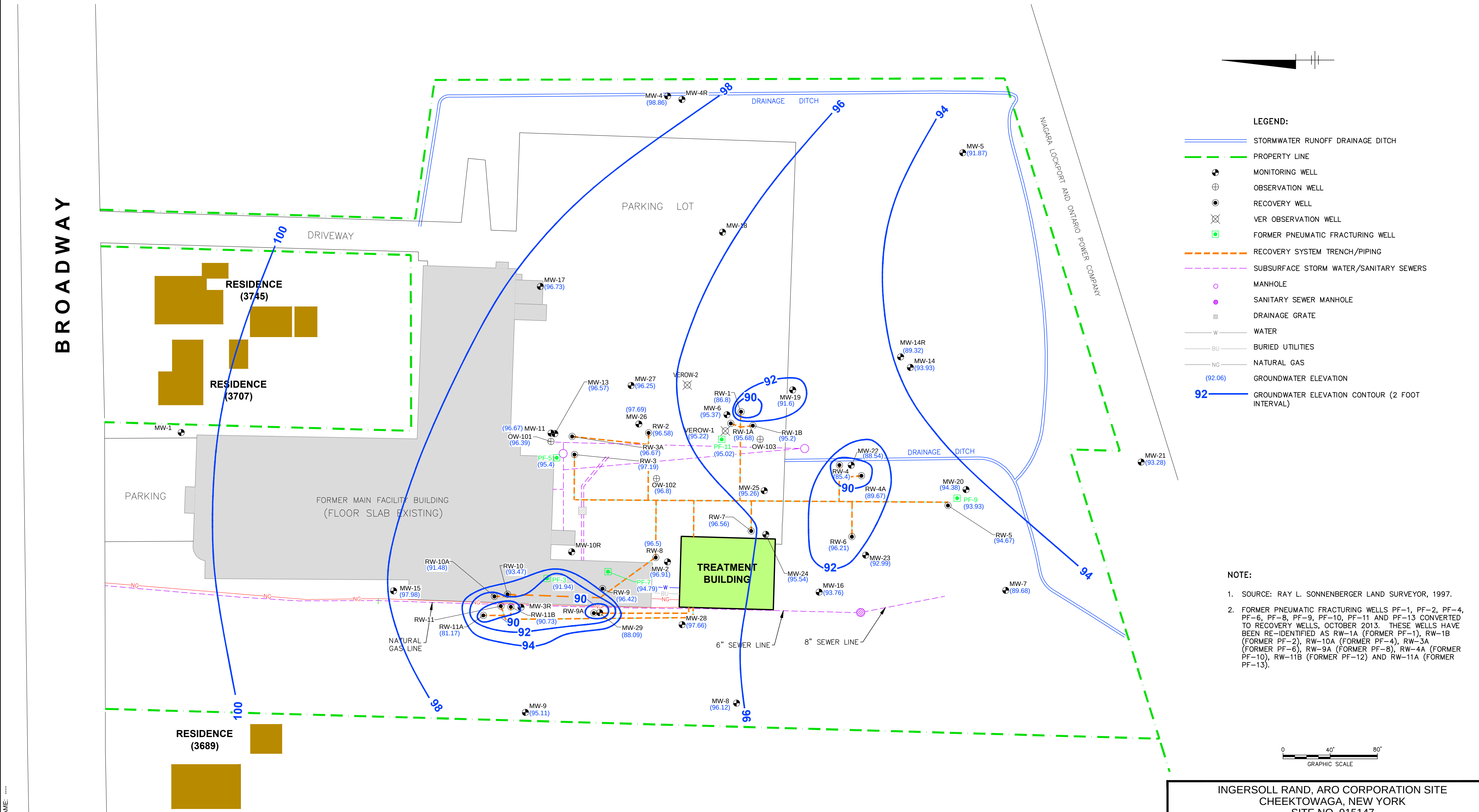
2014 ANNUAL MONITORING REPORT

Annual Dissolved and Vapor Phase Mass Recovered

ARCADIS

FIGURE

7



NOTE:

1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF-1, PF-2, PF-4, PF-6, PF-8, PF-9, PF-10, PF-11 AND PF-13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE-IDENTIFIED AS RW-1A (FORMER PF-1), RW-1B (FORMER PF-2), RW-10A (FORMER PF-4), RW-3A (FORMER PF-6), RW-9A (FORMER PF-8), RW-4A (FORMER PF-10), RW-11B (FORMER PF-12) AND RW-11A (FORMER PF-13).

INGERSOLL RAND, ARO CORPORATION SITE
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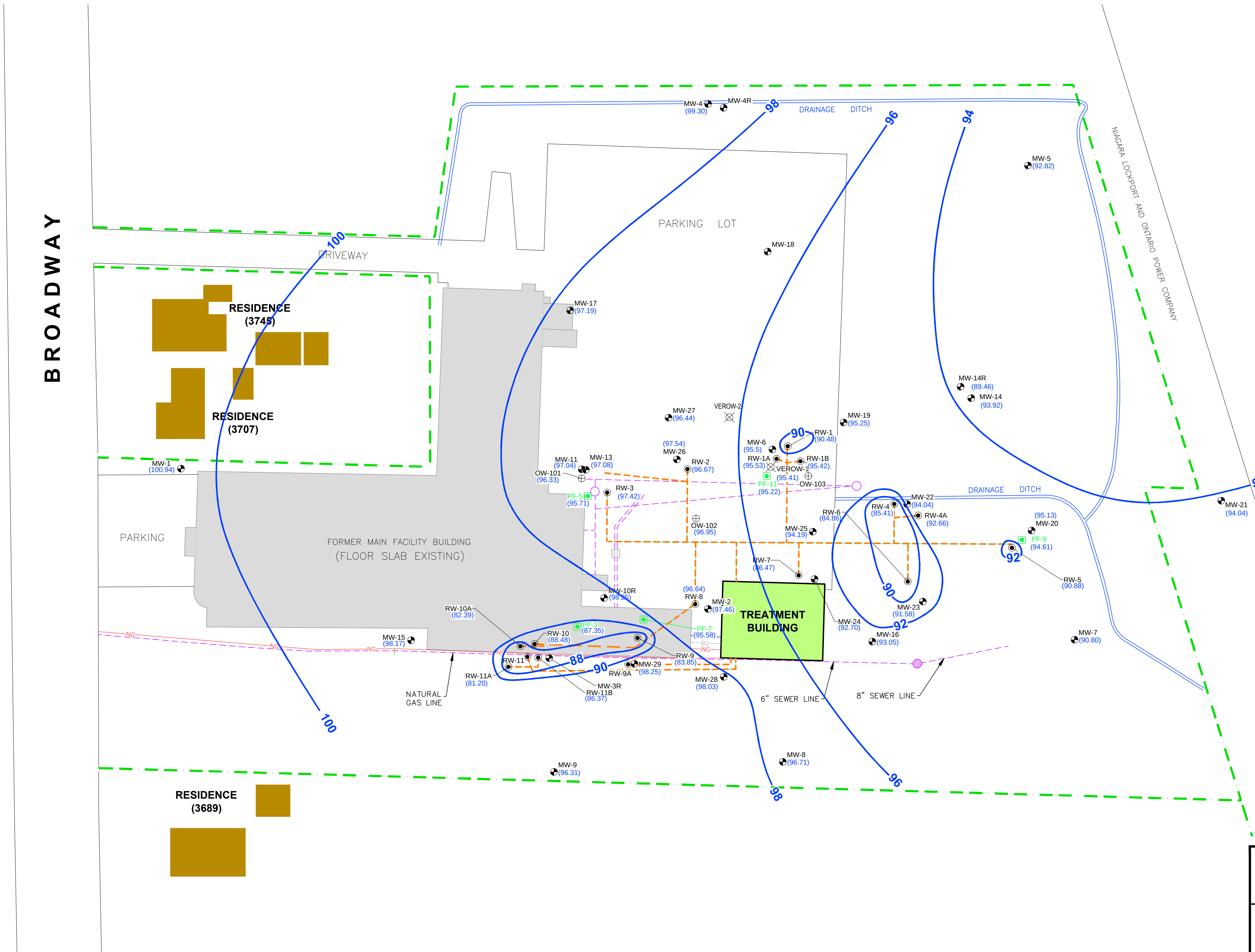
GROUNDWATER CONTOUR MAP (RW-1, RW-4A, RW-9A, RW-11A AND RW-11B ONLINE) JUNE 4, 2014

ARCADIS

FIGURE 8



LEGEND:

- STORMWATER RUNOFF DRAINAGE DITCH
- PROPERTY LINE
- MONITORING WELL
- OBSERVATION WELL
- RECOVERY WELL
- VER OBSERVATION WELL
- FORMER PNEUMATIC FRACTURING WELL
- RECOVERY SYSTEM TRENCH/PIPING
- SUBSURFACE STORM WATER/SANITARY SEWERS
- MANHOLE
- SANITARY SEWER MANHOLE
- DRAINAGE GRATE
- WATER
- BURIED UTILITIES
- NATURAL GAS
- (92.06) GROUNDWATER ELEVATION
- 92 GROUNDWATER ELEVATION CONTOUR (2 FOOT INTERVAL)

NOTE:

1. SOURCE: RAY L. SONNENBERGER LAND SURVEYOR, 1997.
2. FORMER PNEUMATIC FRACTURING WELLS PF-1, PF-2, PF-4, PF-6, PF-8, PF-9, PF-10, PF-11 AND PF-13 CONVERTED TO RECOVERY WELLS, OCTOBER 2013. THESE WELLS HAVE BEEN RE-IDENTIFIED AS RW-1A (FORMER PF-1), RW-1B (FORMER PF-2), RW-10A (FORMER PF-4), RW-3A (FORMER PF-6), RW-9A (FORMER PF-8), RW-4A (FORMER PF-10), RW-11B (FORMER PF-12) AND RW-11A (FORMER PF-13).

INGERSOLL RAND, ARO CORPORATION SITE
CHEEKTOWAGA, NEW YORK
SITE NO. 915147

2014 ANNUAL MONITORING REPORT

GROUNDWATER CONTOUR MAP (RW-1, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-10, RW-10A, RW-11, RW-11A AND RW-11B ONLINE) DECEMBER 15, 2014

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FIGURE 9

Tables

ARCADIS

Table 1. 2014 VER System Operational Data, Aro Corporation Site, Cheektowaga, New York.

System Parameter		Date											
		1/31/14	2/28/14	3/27/14	4/30/14	5/30/14	6/24/14	7/30/14	8/25/14	9/26/14	10/30/14	12/2/14	12/30/14
Knock-out Tank Vacuum (in.Hg)		23	22	26	19.5	23.5	17.8	22	17	20	20	24	15
Vapor Extraction Flowrate (cfm)		61	35	83	55	48	61	61	79	105	61	44	87
Monthly System Flow (gallons)		72,639	241,847	6,500	18,148	134,910	2,239	75,221	34,724	37,079	88,019	75,920	93,616
Monthly System Influent (gpm)		3.15	6.00	0.17	0.37	3.12	0.06	1.45	0.93	0.80	1.80	0.79	1.07
Recovery Well [1]	Monitoring Location	Applied Vacuum (in.Hg unless otherwise noted)											
RW-1	Well	15.0	--	--	--	11.0	8.9	12.0	--	--	--	--	12.0
	Manifold	22.0	20.0	--	--	20.0	12.0	20.0	--	--	--	--	12.0
RW-1A	Well	14.0	--	--	--	--	--	--	--	--	--	--	--
	Manifold	22.0	--	--	--	--	--	--	--	--	--	--	--
RW-1B	Well	6.0	--	--	--	--	--	--	--	--	--	--	--
	Manifold	22.0	--	--	--	--	--	--	--	--	--	--	--
RW-2	Well	--	--	--	--	--	--	--	--	--	--	--	--
	Manifold	--	--	--	--	--	--	--	--	--	--	--	--
RW-3	Well	--	--	--	--	--	--	--	--	--	14.0	--	--
	Manifold	--	--	--	--	--	--	--	--	--	19.0	--	--
RW-3A	Well	15.0	--	--		--	--	--	--	--	--	--	--
	Manifold	20.0	--	--		--	--	17.0	--	--	--	--	--
RW-4	Well	--	--	--	--	9.0	4.2	8.0	--	9.0	13.0	--	11.0
	Manifold	--	20.0	--	--	22.0	13.9	19.0	--	18.0	19.0	--	14.0
RW-4A	Well	--	--	--	--	--	3.2	7.0	9.0	5.0	--	--	11.0
	Manifold	--	--	--	--	--	13.9	19.0	14.0	12.0	--	--	14.0
RW-5	Well	--	--	--	7.1	7.0	9.1	--	--	--	--	--	10.0
	Manifold	--	--	--	13.5	22.0	10.0	15.0	--	--	--	--	11.0
RW-6	Well	--	--	--	--	--	--	--	--	--	15.0	--	10.0
	Manifold	--	--	--	--	--	--	15.0	--	--	16.0	--	12.0
RW-7	Well	--	--	--	--	--	--	--	--	--	--	--	10.0
	Manifold	--	--	--	--	--	--	--	--	--	--	--	11.0
RW-8	Well	--	--	--	--	--	--	--	--	--	--	--	--
	Manifold	--	--	--	--	--	--	--	--	--	--	--	--
RW-9	Well	--	15.0	--	--	--	--	--	9.0	11.0	10.0	--	9.0
	Manifold	--	21.0	--	--	--	--	--	14.0	12.0	19.0	--	14.0
RW-9A	Well	--	--	10.0		10.0	--	12.0	7.0	5" WC	--	--	--
	Manifold	--	16.0	12.0		17.0	--	17.0	12.0	12.0	--	--	--
RW-10	Well	--	--	--	--	--	--	--	--	--	--	--	--
	Manifold	--	21.0	--	--	--	--	--	--	--	--	--	--
RW-10A	Well	--	4.0	11.0	32" WC	--	24.5" WC	10.0	10.0	15" WC	--	8.0	9.0
	Manifold	--	15.0	14.0	15.5	--	12.5	18.0	13.0	11.0	--	17.0	13.0
RW-11	Well	15.0	4.0	--	3.9	--	--	--	--	16" WC	--	42" WC	64" WC
	Manifold	22.0	21.0	--	17.8	--	--	--	--	16.0	--	20.0	14.0
RW-11A	Well	--	<1.0	12.0	4.3	10.0	37" WC	--	--	9" WC	--	30" WC	6.0
	Manifold	--	19.0	14.0	17.0	20.0	14.5	--	--	18.0	--	18.0	15.0
RW-11B	Well	--	<1.0	12.0	9" WC	17.0	1" WC	--	--	12" WC	--	22" WC	8.0
	Manifold	--	19.0	14.0	17.0	20.0	14.5	--	--	18.0	--	18.0	15.0

1. Recovery well statuses shown are only those present at the time of the monthly system sampling event. Recovery well configurations different than those shown may have occurred between monthly sampling events.

2. Recovery well RW-2 was offline during the 2014 reporting period due to cleanup goals being achieved for the groundwater in adjacent monitoring well MW-26.

Definitions:

cfm - cubic feet per minute

gpm - gallons per minute

in.Hg - inches of mercury

in.W.C. - inches of water column

NR - Indicates recovery well online but vacuum not recorded

-- - Indicates recovery well offline

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Table 2. Dissolved Phase VOC Recovery, Aro Corporation Site, Cheektowaga, New York.

Date	Dissolved Phase Influent VOC Concentrations (µg/L)			Total Cumulative Flow (gal)(1)	Monthly Reporting Period Flow (L)	Estimated Mass Recovered Per(2) Reporting Period (kg)				2014 Cumulative VOC Recovery (kg)	Cumulative Days Operating	Estimated VOC Recovery Rate Per Reporting Period (kg/day)	Dissolved Phase Effluent VOC Concentrations (µg/L)			Estimated VOC Mass(2) Discharged Per Reporting Period (g)			Estimated VOC(3) Mass Adsorbed Per Reporting Period (%)
	TCE	DCE (tot)	VC			TCE	DCE (tot)	VC	Total				TCE	DCE (tot)	VC	TCE	DCE (tot)	VC	
1/31/14	904	339	3	13,553,572	288,731	0.139	0.052	0.000	0.191	0.19	29	0.007	ND	ND	ND	0.332	0.000	0.000	99.8
2/28/14	871	133	ND	13,795,419	915,488	0.812	0.216	0.000	1.028	1.22	57	0.037	ND	ND	ND	1.053	0.000	0.000	99.9
3/27/14	6800	843	45	13,801,919	24,605	0.094	0.012	0.000	0.106	1.33	84	0.004	1.6	ND	ND	0.000	0.000	0.000	100.0
4/30/14	383	58	ND	13,820,067	68,697	0.247	0.031	0.000	0.278	1.60	118	0.008	ND	ND	ND	0.000	0.000	0.000	100.0
5/30/14	7400	1138	22	13,954,977	510,688	1.987	0.305	0.000	2.293	3.90	148	0.076	ND	ND	ND	0.000	0.000	0.000	100.0
6/23/14	336	97	ND	13,957,216	8,476	0.033	0.005	0.000	0.038	3.93	172	0.002	ND	ND	ND	0.000	0.000	0.000	100.0
7/30/14	399	102	1	14,032,437	284,742	0.105	0.028	0.000	0.133	4.07	209	0.004	ND	ND	ND	0.000	0.000	0.000	100.0
8/25/14	63	35	ND	14,067,161	131,444	0.030	0.009	0.000	0.039	4.11	235	0.002	ND	ND	ND	0.000	0.000	0.000	100.0
9/26/14	286	206	11	14,104,240	140,359	0.024	0.017	0.001	0.042	4.15	267	0.001	0.320	ND	ND	0.000	0.000	0.000	100.0
10/30/14	28	17	ND	14,192,259	473,546	0.060	0.041	0.002	0.102	4.25	301	0.002	0.310	0.490	ND	0.000	0.000	0.000	100.0
12/2/14	398	105	3	14,268,179	620,575	0.147	0.068	0.002	0.218	4.47	334	0.005	0.400	ND	ND	0.000	0.000	0.000	100.0
12/30/14	77	26	ND	14,437,179	639,733	0.152	0.042	0.000	0.194	**4.66**	362	0.007	1.100	0.580	ND	0.000	0.000	0.000	100.0
Groundwater Recovered in 2014 (gal)				**959,882**			Cumulative VOC Recovery Rate in 2014 (kg/day):					**0.013**		Cumulative VOC Adsorption Rate in 2014					**100.0**
Average Groundwater Recovery Rate (gpm)				**2.0**															

Notes:

1. Total cumulative flows indicated are estimated values based on flowmeter FQI-210.
2. Estimated mass recovered/discharged per reporting period calculated using influent/effluent water VOC concentrations and groundwater flow for that reporting period, respectively. VOC concentrations used for calculation are averages of those obtained from previous monthly sampling event and those obtained from current monthly sampling event.
3. Adsorption rates calculated using estimated VOC mass recovered and estimated VOC mass discharged per reporting period.

Definitions:

DCE (tot) - Dichloroethene (sum of 1,1-DCE, cis-1,2-DCE, and trans-1,2-DCE)
g - grams
gal - gallons
gpm - gallons per minute
kg - kilograms
L - Liters
ND - Non-Detect
TCE - Trichloroethene
tot - total
µg/L - micrograms per liter
VC - Vinyl chloride
VOC - Volatile Organic Compounds

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Table 3. Dissolved Phase TCE, DCE (total), and Vinyl Chloride Concentrations in System Liquid Phase Samples, Aro Corporation Site, Cheektowaga, New York.

Sample Date	Sample Point	TCE	DCE (total)	VC
1/31/2014	Influent	904	339	3
	Mid-Point	1.5	ND	ND
	Effluent	ND	ND	ND
2/28/2014	Influent	871	133	ND
	Mid-Point	3.2	ND	ND
	Effluent	ND	ND	ND
3/31/2014	Influent	6800	843	45.4
	Mid-Point	15.8	ND	ND
	Effluent	1.6	ND	ND
4/30/2014	Influent	383	57.8	ND
	Mid-Point	1.9	ND	ND
	Effluent	ND	ND	ND
5/30/2014	Influent	7400	1138	22
	Mid-Point	4.5	ND	ND
	Effluent	ND	ND	ND
6/24/2014	Influent	336	97	ND
	Mid-Point	ND	ND	ND
	Effluent	ND	ND	ND
7/30/2014	Influent	339	102	1.1
	Mid-Point	1.8	ND	ND
	Effluent	ND	ND	ND
8/25/2014	Influent	63	35	ND
	Mid-Point	1.1	0.81	0.36
	Effluent	0.75	0.43	ND
9/26/2014	Influent	286	206.42	11.3
	Mid-Point	0.63	1.5	0.37
	Effluent	ND	0.32	ND
10/30/2014	Influent	28.3	16.9	ND
	Mid-Point	0.43	1.7	0.34
	Effluent	0.31	0.49	ND
12/2/2014	Influent	398	105.54	3.2
	Mid-Point	7	4.9	0.55
	Effluent	0.4	ND	ND
12/30/2014	Influent	76.9	26.4	ND
	Mid-Point	1.1	3.3	ND
	Effluent	1.1	0.58	ND

Notes:

1. All concentrations in µg/L.
2. Samples analyzed using USEPA method 8260B.

Definitions:

DCE (total) - Dichloroethene (sum of 1,1-DCE, cis-1,2-DCE, and trans-1,2-DCE)

J - Indicates an estimated value

ND - Non-Detect, below the laboratory detection limits

TCE - Trichloroethene

VC - Vinyl Chloride

µg/L - micrograms per liter

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Table 4. Vapor Phase TCE, DCE (total), and Vinyl Chloride Concentrations in System Effluent Vapor Phase Samples, Aro Corporation Site, Cheektowaga, New York.

Sample Date	TCE		DCE (total)		VC	
	ppmv	µg/m^3	ppmv	µg/m^3	ppmv	µg/m^3
1/31/2014	0.400	2,148	0.470	1,862	ND	NA
2/28/2014	12.000	64,440	2.729	10,812	ND	NA
3/31/2014	3.300	17,721	0.979	3,879	ND	NA
4/30/2014	3.300	17,721	0.940	3,724	ND	NA
5/30/2014	12.000	64,440	3.340	13,247	ND	NA
6/24/2014	4.700	25,239	2.310	9,152	ND	NA
7/30/2014	7.300	39,201	3.730	14,794	ND	NA
8/25/2014	2.200	11,814	1.200	4,754	ND	NA
9/26/2014	3.400	18,258	0.830	3,288	ND	NA
10/30/2014	2.400	12,888	0.990	3,922	ND	NA
12/2/2014	1.900	10,203	1.010	4,002	ND	NA
12/30/2014	1.100	5,907	0.400	1,585	ND	NA

Notes:

Samples analyzed by Microseeps Laboratory using their in-house analytical method AM 4.02.

Definitions:

DCE (total) - Dichloroethene (sum of 1,1-DCE, cis-1,2-DCE, and trans-1,2-DCE)
µg/m^3 - micrograms per cubic meter
ND - Non-Detect, below the laboratory detection limits
ppmv - parts per million by volume
TCE - Trichloroethene
VC - Vinyl Chloride

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Table 5. TCE, DCE (total), and Vinyl Chloride Concentrations in Groundwater Samples Collected in 2014, Aro Corporation Site, Cheektowaga, New York.

Well ID	Sample Date	TCE	DCE (total)	VC
MW-2	Jun. 5	28,600	2,780	ND
	Dec. 16	15,200	5,190	ND
MW-6	Jun. 4	3,290	1,183	33.2
	Dec. 15	2,490	538	12.3
MW-11	Jun. 4	34,300	2,825	50.1
	Dec. 15	21,200	2,550	ND
MW-13	Jun. 4	68,600	11,400	ND
	Dec. 15	21,800	2,320	ND
MW-20	Jun. 5	57	131	1.2
	Dec. 16	27.7	61.29	0.87
MW-22	Jun. 5	440	387	3.5
	Dec. 16	382	74	ND
MW-23	Jun. 5	378	241	6.8
	Dec. 16	670	462	3.5
MW-24	Jun. 5	909	409	5.4
	Dec. 15	2,000	1,064	6.5
MW-29	Jun. 5	3,320	1,100	59.5
	Dec. 16	281	25	ND
OW-101	Jun. 4	112	122	ND
	Dec. 15	35.2	21	ND
VEROW-1	Jun. 5	2,050	524	12.1
	Dec. 15	2,330	556	11.4
RW-11	Jun. 5	9,930	2,540	257
	Dec. 16	26,700	2,570	260
PF-9	Jun. 5	71	221	12.1
	Dec. 16	54	125	3.7
PF-13/ RW-11A	Jun. 5	7,540	2,361	415
	Dec. 16	8,720	386	ND

Notes:

All concentrations in µg/L.

Definitions:

DCE (total) - Dichloroethene (sum of 1,1-DCE, cis-1,2-DCE, and trans-1,2-DCE)

ND - Non-Detect, below laboratory detection limits

TCE - Trichloroethene

VC - Vinyl Chloride

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Table 6. Vapor Phase VOC Recovery, Aro Corporation Site, Cheektowaga, New York.

Date	Influent Vapor VOC[1] Concentrations (ppmv)			Influent Vapor VOC[2] Concentrations (μg/m^3)			Influent Vapor VOC[3] Concentrations (µg/L)			Vapor Extraction Flowrate (cfm)	Reporting[4] Period Volume of Air (L)	Mass Recovered Per[2] Reporting Period (kg)			2014 Cumulative Mass Recovered (kg)			Estimated Cumulative 2014 VOC Recovery (kg)	2014 Cumulative Operating Days	Estimated VOC Recovery Rate Per Reporting Period (kg/day)
	TCE	DCE (tot)	VC	TCE	DCE (tot)	VC	TCE	DCE (tot)	VC			TCE	DCE (tot)	VC	TCE	DCE (tot)	VC			
1/31/14	0.400	0.470	ND	2,148	1,862	0.0	2.1	1.9	0.0	61	72,141,235	0.3	0.1	0.0	0.3	0.1	0.0	0.5	29	0.02
2/28/14	12.000	2.729	ND	64,440	10,812	0.0	64.4	10.8	0.0	35	39,965,184	1.3	0.3	0.0	1.7	0.4	0.0	2.1	57	0.06
3/27/14	3.300	0.979	ND	17,721	3,879	0.0	17.7	3.9	0.0	83	91,389,773	3.8	0.7	0.0	5.4	1.1	0.0	6.5	84	0.16
4/30/14	3.300	0.940	ND	17,721	3,724	0.0	17.7	3.7	0.0	55	76,260,096	1.4	0.3	0.0	6.8	1.4	0.0	8.1	118	0.05
5/30/14	12.000	3.343	ND	64,440	13,247	0.0	64.4	13.2	0.0	48	58,724,352	2.4	0.5	0.0	9.2	1.9	0.0	11.0	148	0.10
6/23/14	4.700	2.310	ND	25,239	9,152	0.0	25.2	9.2	0.0	61	59,703,091	2.7	0.7	0.0	11.9	2.5	0.0	14.4	172	0.14
7/30/14	7.300	3.734	ND	39,201	14,794	0.0	39.2	14.8	0.0	87	131,273,395	4.2	1.6	0.0	16.1	4.1	0.0	20.2	209	0.16
8/25/14	2.200	1.200	ND	11,814	4,754	0.0	11.8	4.8	0.0	74	78,462,259	2.0	0.8	0.0	18.1	4.9	0.0	23.0	235	0.11
9/26/14	3.400	0.830	ND	18,258	3,288	0.0	0.0	0.0	0.0	75	97,873,920	0.6	0.2	0.0	18.7	5.1	0.0	23.8	267	0.03
10/30/14	2.400	0.990	ND	12,888	3,922	0.0	12.9	3.9	0.0	70	188,407,296	1.6	0.5	0.0	19.6	5.4	0.0	25.0	301	0.03
12/2/14	1.900	1.010	ND	10,203	4,002	0.0	10.2	4.0	0.0	61	82,091,750	0.9	0.3	0.0	20.6	5.7	0.0	26.3	334	0.04
12/30/14	1.100	0.400	ND	5,907	1,585	0.0	5.9	1.6	0.0	87	99,342,029	0.8	0.3	0.0	21.4	6.0	0.0	**27.4**	362	0.04
															2014 Cumulative VOC Recovery Rate (kg/day):					**0.08**

Notes:

1. Samples analyzedby Microseeps Laboratory using their in-house analytical method AM 4.02.
2. Vapor results were converted to μg/m^3 and μg/L using Microseeps unit conversion factors, assuming a temperature of 25 C (+ 273.15 K), and gas constant, 0.08206 l*atm/(mol*K).
3. Estimated mass recovered per reporting period calculated based on monthly influent vapor concentrations and estimated volume of air treated for that reporting period. Influent vapor concentration used for calculation is average of influent vapor concentrations obtained from current and previous monthly vapor sampling event.
4. Volumes of air treated are estimated values based on flowmeter FIT-200.

Definitions:

cfm - cubic feet per minute
DCE (total) - Dichloroethene (sum of 1,1-DCE, cis-1,2-DCE, and trans-1,2-DCE)
kg - kilograms
L - Liters
ND - Non-Detect
ppmv - parts per million by volume
TCE - Trichloroethene
tot - total
µg/L - micrograms per liter
µg/m^3 - micrograms per cubic meter
VC - Vinyl chloride
VOC - Volatile Organic Compounds

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Table 7. Cumulative VOC Recovery, Aro Corporation Site, Cheektowaga, New York.

Year(s)	Dissolved Phase		Vapor Phase	
	Estimated Annual VOC Recovery (kg)	Cumulative VOC Recovery (kg)	Estimated Annual VOC Recovery (kg)	Cumulative VOC Recovery (kg)
1998-2000	-	12.2	-	22.4
2001	0.38	12.6	10.8	33.2
2002	0.77	13.4	5.4	38.6
2003	0.74	14.1	3.8	42.4
2004	0.64	14.8	5.6	48.0
2005	1.63	16.4	16.8	64.8
2006	2.19	18.6	31.9	96.7
2007	5.25	23.8	50.6	147.3
2008	8.35	32.2	60.7	208.0
2009	8.12	40.3	130.3	338.3
2010	1.19	41.5	33.7	372.0
2011	4.79	46.3	47.4	419.4
2012	2.89	49.2	31.7	451.1
2013	0.89	50.1	21.8	472.9
2014	4.66	54.7	27.4	500.3

Definitions:

kg - kilograms

VOC - Volatile Organic Compounds

Table 8. 2014 Groundwater Elevation Data, Aro Corporation Site, Cheektowaga, New York.

Well	Measuring Point Elevation (ft amsl)	Date			
		6/4/2014[1]		12/15/2014[2]	
		DTW (ft)	GW Elev. (ft amsl)	DTW (ft)	GW Elev. (ft amsl)
MW-1	104.12	3.27	100.85	3.18	100.94
MW-2	101.33	4.42	96.91	3.87	97.46
MW-3R	-	23.12	-	23.55	-
MW-4[3]	103.52	4.66	98.86	4.22	99.30
MW-4R	100.98	30.60	70.38	30.79	70.19
MW-5[3]	103.31	11.44	91.87	10.49	92.82
MW-6	98.50	3.13	95.37	3.00	95.50
MW-7[3]	102.16	12.48	89.68	11.36	90.80
MW-8	99.49	3.37	96.12	2.78	96.71
MW-9	100.29	5.18	95.11	3.98	96.31
MW-10R	98.94	--	--	0.69	98.25
MW-11[3]	99.82	3.15	96.67	2.78	97.04
MW-13	99.86	3.29	96.57	2.78	97.08
MW-14	103.14	9.21	93.93	9.22	93.92
MW-14R	101.80	12.48	89.32	12.34	89.46
MW-15	103.16	5.18	97.98	4.99	98.17
MW-16	99.70	5.94	93.76	6.65	93.05
MW-17	99.92	3.19	96.73	2.73	97.19
MW-18	98.56	--	--	--	--
MW-19	100.52	8.92	91.60	5.27	95.25
MW-20	101.70	7.32	94.38	6.57	95.13
MW-21	100.34	7.06	93.28	6.30	94.04
MW-22	101.39	12.85	88.54	7.35	94.04
MW-23	100.25	7.26	92.99	8.67	91.58
MW-24	98.22	2.68	95.54	5.52	92.70
MW-25	97.80	2.54	95.26	3.61	94.19
MW-26	98.76	1.07	97.69	1.22	97.54
MW-27	98.80	2.55	96.25	2.36	96.44
MW-28	101.04	3.38	97.66	3.01	98.03
MW-29	101.01	12.92	88.09	2.76	98.25
OW-101	99.84	3.45	96.39	3.51	96.33
OW-102	98.60	1.80	96.80	1.65	96.95
VEROW-1	98.44	3.22	95.22	3.03	95.41
VEROW-2	98.58	2.78	95.80	--	--

Notes:

1) Groundwater measurements collected on June 4, 2014 with the following recovery wells operating: RW-1, RW-4A, RW-9A, RW-11A and RW-11B.
2) Groundwater measurements collected on December 15, 2014 with the following recovery wells operating: RW-1, RW-4, RW-4A, RW-5, RW-6, RW-7, RW-9, RW-10, RW-10A, RW-11, RW-11A and RW-11B.
3) Monitoring wells MW-4, MW-5, MW-7, and MW-11 underwent repairs in September 2008 which altered their measuring points. This table uses the previous measuring point elevations, as the repairs did not result in significant elevation changes.

Definitions:

"-" - data not available/recorded.
DTW - Depth To Water
ft amsl - feet above mean sea level
GW - Groundwater