

## **Operation, Maintenance and Monitoring Report**

### **Groundwater Interim Remedial Measure**

#### **October thru December 2009**

Operable Unit 3 (Former Grumman Settling Ponds),  
Bethpage, New York

NYSDEC ID # 1-30-003A

February 2010



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Our Ref.:  
NY001496.0910.00002

Date:  
February 2010

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<b>1. Introduction</b>	<b>1</b>
<b>2. Groundwater Interim Remedial Measure Objectives</b>	<b>2</b>
<b>3. Groundwater Interim Remedial Measure</b>	<b>2</b>
<b>4. Operation and Maintenance Activities</b>	<b>4</b>
<b>5. Treatment System Compliance and Performance Monitoring</b>	<b>5</b>
5.1 System Monitoring Activities	5
5.2 System Monitoring Results	7
5.3 Summary of OM&M Results	8
5.3.1 System Operation and Effectiveness	8
5.3.2 Regulatory Status of Discharges	9
5.3.2.1 Air Discharge	9
5.3.2.2 Water Discharge	10
5.4 Performance and Compliance Monitoring Conclusions	10
<b>6. Environmental Effectiveness Monitoring</b>	<b>11</b>
6.1 Hydraulic Monitoring	11
6.1.1 Activities	11
6.1.2 Results	11
6.2 Groundwater Quality Monitoring	11
6.2.1 Activities	11
6.2.2 Results	12
6.3 Environmental Effectiveness Monitoring Conclusions	12
<b>7. Groundwater IRM Recommendations</b>	<b>13</b>
<b>8. References</b>	<b>14</b>

## Tables

Table 1	Operational Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 2	Summary of Influent Water Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 3	Summary of Effluent Water Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 4	Summary of Influent Vapor Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 5	Summary of Effluent Vapor Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 6	Summary of System Parameters, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 7	Summary of Groundwater Recovered and TVOC Mass Removed, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 8	Air Emissions Model Output Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 9	Summary of Water-Level Elevations, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 10	Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.
Table 11	Concentrations of Metals in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

## Figures

- Figure 1 Site Location, Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 2 Site and Groundwater Interim Remedial Measure Layout, Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 3 Groundwater Treatment System Process Schematic, Process Flow Diagram and Monitoring Locations, Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 4 Groundwater Monitoring Program Well Network and Configuration of the Water Table and Groundwater Flow Direction (November 30, 2009), Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 5 Cumulative TVOC Mass Removed Through December 2009, Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 6 Influent TVOC Concentrations Through December 2009, Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.
- Figure 7 TVOC Mass Removal Rates Through December 2009 , Groundwater Interim Measure, Operable Unit 3 (Former Grumman Settling Ponds), Nothrop Grumman Systems Corporation, Bethpage, New York.

**Appendices**

- A Well Construction Information and Environmental Effectiveness Monitoring Program.
- B Compliance and Performance Program Elements, Water Sample Analytical Results, and Summary of pH Data
- C Vapor Sample Analytical Results
- D Air Discharge Quality Evaluation

## 1. Introduction

This Operable Unit 3 (OU3) Groundwater Interim Remedial Measure (Groundwater IRM) Operation, Maintenance and Monitoring (OM&M) Report was prepared by ARCADIS of New York, Inc. (ARCADIS) on behalf of Northrop Grumman Systems Corporation (Northrop Grumman). This report is submitted pursuant to the Order on Consent (Consent Order or CO) Index # W1-0018-04-01 that was executed by the New York State Department of Environmental Conservation (NYSDEC) and Northrop Grumman, effective July 4, 2005 (NYSDEC 2005). The present day Bethpage Community Park property (Park), which the NYSDEC has termed the “Former Grumman Settling Ponds Area” and designated as OU3, is referred to herein as the Site. A Site location map is provided on Figure 1.

Full-time operation (i.e., system start-up) of the Groundwater IRM began on July 21, 2009. This report summarizes the Groundwater IRM OM&M activities performed from October 1, 2009 through December 31, 2009 (referred to herein as the “reporting period”). Future OM&M interim reports will be submitted on a calendar quarterly basis. In accordance with the Draft DER-10 Technical Guidance Document (NYSDEC 2009c), the first annual report (or periodic review report (PRR)) will be submitted 90-days after December 31, 2010.

The Groundwater IRM was constructed in general accordance with NYSDEC-approved OU3 Groundwater IRM Final Design Report (ARCADIS 2008b). During this reporting period, the Remedial System and Environmental Effectiveness monitoring was completed in accordance with the OU3 Groundwater IRM System Start-up Workplan (ARCADIS 2009a), which was approved by the NYSDEC in a letter dated May 19, 2009 (NYSDEC 2009b).

As discussed in previous documents, e.g. the OU3 Site Area Remedial Investigation Report (ARCADIS 2008a), Northrop Grumman does not take responsibility for Freon 12 and Freon 22. Therefore, throughout this report, the Volatile Organic Compounds (VOCs) are discussed and presented as follows:

- “Project VOCs,” which are VOCs that may be related to former Grumman activities (specifically, for this report, Project VOCs include the VOCs listed on the Interim State Pollutant Elimination Discharge System (SPDES) permit equivalency (NYSDEC 2009a), plus Toluene, and Benzene).

- "Non-project VOCs:" which are VOCs, such as Freon 12 and Freon 22, that are not related to former Grumman activities but have been detected in various media at the site.

## 2. Groundwater Interim Remedial Measure Objectives

The remedial action objectives (RAOs) for the Groundwater IRM are as follows:

- Mitigate the off-site migration of project-related dissolved-phase VOCs. Specifically, the Groundwater IRM will address:
  - Groundwater that has total volatile organic compound (TVOC) concentrations greater than 5 micrograms per liter (ug/L) in the upper twenty feet of the surficial aquifer across the 1,200-foot wide lateral extent of the Site boundary.
  - Groundwater below the upper 20 feet of the surficial aquifer that has TVOC concentrations above 50 ug/L.
- Comply with applicable NYSDEC standards, criteria and guidance values (SCGs) for the various Groundwater IRM emissions (i.e. treated water and air emissions).

A secondary benefit of the Groundwater IRM is the creation of a clean-water front atop the downgradient groundwater, which acts to minimize the potential for vapor intrusion issues with groundwater downgradient of the site.

## 3. Groundwater Interim Remedial Measure

In general, the Groundwater IRM consists of a pump-and-treat system where groundwater is: (a) extracted from four remedial wells installed along the southern portion of the Northrop Grumman Former Plant 24 Access Road, (b) conveyed to a treatment plant at McKay Field, (c) treated via air stripping to reduce concentrations of project-specific VOCs, (d) filtered to remove oxidized metals, and (e) ultimately returned to the aquifer via a recharge basin located on the adjacent former Navy Weapons Industrial Reserve Plant (NWIRP) property. The treatment process also includes the vapor phase treatment of the air stripper off-gas emissions to reduce concentrations of project-specific VOCs. As described in the Draft Groundwater IRM OM&M Manual (OM&M Manual [ARCADIS 2009b]), a Groundwater Monitoring Network was installed and is periodically monitored to determine the environmental effectiveness of the Groundwater IRM.



The major components of the Groundwater IRM are described below; for additional detail please refer to the Final Design Report (ARCADIS 2008b) and the Draft OM&M Manual (ARCADIS 2009b). The Site features and Groundwater IRM system layout is shown on Figure 2, a schematic drawing of the Groundwater IRM system is provided on Figure 3, the approximate location of the Groundwater Monitoring Network is shown on Figure 4, and construction details for the remedial wells, monitoring wells, and piezometers is provided in Appendix A.

#### Groundwater Extraction and Conveyance System

Groundwater is extracted, at a constant, combined rate of approximately 210 gallons per minute (gpm), from four remedial wells (Remedial Wells RW-1 through RW-4) by submersible pumps, which are located in each of the remedial wells (i.e., two pumps are 3 hp and two pumps are 7.5 hp). The pumping rates for the four Remedial Wells, RW-1 through RW-4, are 35 gpm, 75, gpm, 75 gpm, and 35 gpm, respectively.

Extracted groundwater is conveyed to the treatment plant via four, underground influent pipelines (i.e., two 2-inch diameter high-density polyethylene (HDPE) and two 3-inch diameter HDPE pipelines).

#### Groundwater Treatment

VOCs in the extracted groundwater are removed via a low-profile air stripper equipped with a 40 hp blower.

Metals, such as iron, which are oxidized during the air stripping process, are filtered out of the air stripper effluent using two, parallel-configured bag filter units, each consisting of two bag filters.

#### Groundwater Discharge

The treated groundwater is pumped (using a 10 hp pump) from the air stripper to a stormwater manhole that discharges to a recharge basin on the adjacent, former NWIRP property, which is now owned by Nassau County.

#### Air Stripper Off-gas Treatment

The air stripper off-gas is treated to reduce VOC concentrations using two (2) 10,000 pound (lb), vapor phase granular activated carbon (VPGAC) emission control units

(ECUs) and two (2) 10,000 lb, potassium permanganate-impregnated zeolite (PPZ) ECUs.

#### Groundwater Monitoring Network

The Groundwater Monitoring Network consists of 35 monitoring locations (i.e., 17 groundwater monitoring wells, 4 remedial wells, and 14 piezometers). In accordance with the Groundwater IRM Environmental Effectiveness Monitoring Program (Draft OM&M Manual ARCADIS 2009b), groundwater quality samples and depth-to-water measurements are periodically collected from the Groundwater Monitoring Network to assess the effectiveness of the Groundwater IRM.

#### **4. Operation and Maintenance Activities**

Groundwater IRM operation and maintenance (O&M) activities conducted during the reporting period are summarized in Table 1. In general, the following OM&M activities were conducted during this reporting period:

- The Groundwater IRM treatment system operated 89 out of 92 days (97 percent uptime).
- The Supervisory Control and Data Acquisition (SCADA) system operated as designed, and when conditions warranted (see below) shut the system down automatically and instantaneously, and provided proper notification to plant operators of system advisories and alarms.
- The Groundwater IRM treatment system was generally monitored every business day either via a site visit or remotely via the wireless computer link-up.
- In general, the system shut down during this reporting period for the following alarm conditions; alarm conditions were appropriately responded to and the system was generally restarted on the same day or early the following day (see Table 1 for details):
  - High-high pressure alarms resulting from plugged bag filters. During this reporting period, the bag filter system was upgraded to address this maintenance problem.

- Low flow alarm in the RW-1 influent pipeline. On October 10, 2009 a low flow alarm condition briefly shut the IRM down. System was restarted without incident.
- An E-Stop alarm was accidentally triggered on October 26, 2009.
- In addition, the system was shut down intentionally for the following reasons (see Table 1 for details):
  - To collect samples of the potassium permanganate impregnated zeolite (PPZ) to assist with the profiling of the PPZ for off-site regeneration/disposal.
  - To upgrade the bag filter system to reduce the frequency of the bag filter changeouts and, in hopes of improving the effectiveness of the filtering system.
  - To replace the vapor phase granular activated carbon (VPGAC) in emission control units ECU-501 and 502. During this changeout, the amount of VPGAC in each ECU was increased from 6,000 pounds (lbs) to 8,000 lbs.
  - To replace the PPZ in emission control units ECU-601 and 602.
- Remedial Well RW-2 was taken offline and physical and chemical rehabilitated due to iron fouling issues at the remedial well.
- A bag filter optimization study was implemented and based on the data obtained, a bag filter upgrade was designed, coordinated, and implemented.

## **5. Treatment System Compliance and Performance Monitoring**

Groundwater IRM treatment system compliance and performance activities and monitoring results for the reporting period are discussed below.

### **5.1 System Monitoring Activities**

In accordance with the Draft OM&M Manual (ARCADIS 2009b), the following required compliance and performance monitoring events were performed during this reporting period (N.B., the required compliance and performance monitoring program elements are summarized in Appendix B, Table B-1):

- Three monthly water and air sampling events;
- Sixteen weekly site visits to monitor and record key system operational parameters and collect NYSDEC-required ph readings.
- Continuous monitoring of key system operational parameters by the SCADA system.

In addition to the required monitoring, the following additional, non-routine monitoring activities were also performed during this reporting period:

- The following additional water sampling was performed to help assess system performance:
  - October 9, November 10, and December 2 – air stripper effluent and treatment system effluent samples were analyzed for cadmium (Cd), Chromium (Cr), and Manganese (Mg), as well as the required iron (Fe) and mercury (Hg).
- pH was measured at other locations besides the system effluent to help assess system performance.
- The following additional vapor sampling was performed to help assess system performance:
  - The VPGAC ECU 501 effluent (VPGAC mid-train sample) was sampled during October and December sampling events.
  - The VPGAC ECU 502 effluent (mid-train sample) was sampled during the October sampling event.
  - The PPZ ECU 601 effluent (PPZ mid-train sample) was sampled during the November sampling event.
- System parameters were monitored and observed at numerous additional times during this reporting period.

Field and analytical data collected during these monitoring events were used to assess performance of the Groundwater IRM and whether the system discharges were

compliant with project objectives. System performance and compliance results are discussed in Sections 5.2 and 5.3, respectively, of this report.

## 5.2 System Monitoring Results

A summary of the Groundwater IRM treatment system operations and an assessment of the system performance and compliance are provided in, the following tables and figures:

- An Operational Summary, including monitoring events, system operational days, and noteworthy site activities (Table 1).
- Summary of Influent and Effluent Water Sample Analytical Results (Tables 2 and 3, respectively), including for Project VOCs, Freon 12, Freon 22, Iron, and Mercury. Table 3 also provides the Groundwater IRM treatment system removal efficiency. Complete validated Water Sample Analytical Result Summaries, per sample event, are included in Appendix B.
- Summary of pH data (Appendix B, Table B-5).
- Summary of Influent and Effluent Vapor Sample Analytical Results (Tables 4 and 5, respectively), including for Project VOCs, Freon 12, and Freon 22. Table 5 also provides the Groundwater IRM treatment system removal efficiency. Complete, validated Vapor Sample Analytical Results, per sample event, are included in Appendix C.
- System Parameters, including flow rates, line pressures, and temperatures (Table 6).
- Summary of Groundwater Recovered and TVOC Mass Removed (Table 7).
- Air Discharge Compliance Table (Table 8).
- Cumulative TVOC Mass Removed (Figure 6).
- Influent TVOC Concentrations (Figure 7).
- TVOC Mass Removal Rates (Figure 8).

### 5.3 Summary of OM&M Results

#### 5.3.1 System Operation and Effectiveness

Groundwater IRM OM&M results for the current reporting period (are presented below:

- Total volume of groundwater recovered and treated (Table 7):
  - During this reporting period: Approximately 23 million gallons.
  - Project total (since July 2009, including groundwater pumped/treated during the system testing/troubleshooting phase): Approximately 44 million gallons.
- Total mass of VOCs recovered and estimated mass removal rates for this reporting period (Table 7):
  - During this reporting period: Approximately 140 pounds (lbs) of VOCs were recovered at an average rate of 1.6 lbs per operational day.
  - Project total (since July 2009, including groundwater pumped/treated during the system testing/troubleshooting phase): Approximately 350 lbs of VOCs were recovered.
- Total mass of VOCs recovered and estimated mass removal rates for each well during this reporting period (Table 7):
  - RW-1: Approximately 0.19 lbs of VOCs recovered at an average rate of less than 0.01 lbs/day.
  - RW-2: Approximately 85 lbs of VOCs recovered at an average rate of 1.2 lbs/day.
  - RW-3: Approximately 42 lbs of VOCs recovered at an average rate of 0.49 lbs/day.
  - RW-4: Approximately 8.3 lbs of VOCs recovered at an average rate of 0.10 lbs/day.

- The TVOC influent concentration has decreased significantly since system start-up (Figure 6).
- The air stripper VOC removal efficiency was 99.9% or greater during this reporting period (Table 3).
- The air stripper off-gas emission control system's overall efficiency, calculated using Project and Non-Project VOCs, was between 55 and 69 percent. The system efficiency improved to 79 to 94 percent when calculated using only Project VOCs (Table 5).

### 5.3.2 Regulatory Status of Discharges

#### 5.3.2.1 Air Discharge

To determine the compliance status of air discharge from the Groundwater IRM treatment system, the system's effluent vapor concentrations were compared to NYSDEC Division of Air Resources Air Guide-1 (DAR-1) Model Short-term Guideline Concentrations (SGCs [NYSDEC 2007]) (Table 5) and the effluent vapor laboratory analytical results were compared to a site-specific modeled annual maximum allowable stack concentration (MASC). The annual MASC was calculated during each monitoring event for individual compounds using the output from the USEPA Screen 3 Model in conjunction with the NYSDEC DAR-1 AGCs (NYSDEC 2007). Specifically, a scaling factor was calculated using the Screen 3 model with site-specific physical layout information (e.g. building dimensions, stack height, terrain, etc.) and operating data (e.g. air flow rate, temperature, etc.) inputs for each monitoring event. The scaling factor was then used to adjust (scale) the NYSDEC DAR-1 AGC to a site-specific MASC. A summary of the instantaneous percent (e.g. not time weighted) of the site-specific annual MASC for Project VOCs, Freon 12, and Freon 22 is provided in Table 8. A summary of the cumulative annual percent (i.e. time weighted) of the site-specific MASC for detected compounds is also provided in Table 8. A summary of the model inputs, outputs, and backup calculations is provided in Appendix D.

The Groundwater IRM air effluent met NYSDEC requirements throughout the reporting period, as indicated by the following:

- The actual concentrations of individual VOCs in the vapor effluent during this reporting period did not exceed their respective SGCs (Table 5).

- The actual concentration of individual VOCs in the air discharge did not exceed their respective instantaneous MASCS, as calculated using the USEPA SCREEN 3 Model (Table 8). Similarly, the time-weighted rolling averages for the individual Project VOCs, Freon 12, and Freon 22 are currently below their respective MASCS.

#### 5.3.2.2 Water Discharge

The Groundwater IRM water effluent met NYSDEC requirements during this reporting period for VOCs, Mercury, and pH (Table 3 and Appendix B, Table B-5). The effluent iron concentration exceeded the allowable limit of 600 ug/L (Table 3) in two of three samples. The NYSDEC was verbally notified of the non-compliant iron analytical results prior to the issuance of this OM&M report. As discussed in this report, the bag filter system was upgraded in December 2009 to help address issues associated with non-compliance iron results.

### 5.4 Performance and Compliance Monitoring Conclusions

Based on the data collected, the following conclusions can be made about the system operation:

- The system operated within its normal operational parameters during this reporting period.
- The system controls and interlocks functioned correctly during this reporting period.
- The majority of the VOC mass removed (85 lbs of the 140 total lbs [61%]) came from Remedial Well 2 (Table 7).
- Project VOCs were not detected in Remedial RW-1 or RW-4 above their respective SGCs. The majority (97% or greater) of VOCs detected in Remedial Well RW-4 are from a non-project VOC (i.e., Freon 22) (Appendix B).
- The total influent VOC concentration (Figure 6, Table 2) and the respective VOC removal rates (Figure 7, Table 7) decreased during this reporting period compared to the first reporting period.
- Mercury was not detected in any sample collected.



- The system effluent pH measurements (Appendix B, Table B-5) were very consistent (i.e. did not fluctuate much) and ranged between 6.8 and 7.2 standard units (SU) which is well within the allowable range of 5.5 and 8.5 SU.
- The water discharge was compliant with project requirements except for the non-compliant iron concentration.
- The air emissions were compliant with project requirements.

## **6. Environmental Effectiveness Monitoring**

Groundwater IRM treatment system environmental effectiveness (i.e., hydraulic monitoring and groundwater quality monitoring) activities and results for this reporting period are discussed below. Environmental Effectiveness Monitoring was performed in accordance with Draft OM&M Manual (ARCADIS 2009b) requirements and procedures.

### **6.1 Hydraulic Monitoring**

#### **6.1.1 Activities**

During this reporting period, a quarterly round of hydraulic monitoring was performed. The monitoring event took place on November 30, 2009 and the depth-to-water was measured at 35 locations as outlined in the Draft OM&M Manual (ARCADIS 2009b), the locations of these wells and piezometers are shown on Figure 4.

#### **6.1.2 Results**

A summary of the Groundwater IRM groundwater elevation measurements are provided in Table 9. The configuration of the potentiometric surface on November 30, 2009 is shown on Figure 4, and indicates that the groundwater containment system has established a capture zone which encompasses the southern portion of the site.

### **6.2 Groundwater Quality Monitoring**

#### **6.2.1 Activities**

In accordance with the Draft OM&M Manual (ARCADIS 2009b), the 2009 Semi-Annual Groundwater IRM sampling event occurred during this reporting period. Groundwater

samples collected from 10 monitoring wells were analyzed for the Target Compound List (TCL) VOCs, plus Freon 12 and Freon 22 using NYSDEC Analytical Services Protocol (ASP) 2000 Method OLM 4.2, as specified in the Quality Assurance Project Plan (QAPP) (Appendix B of the 2006 RI/FS Work Plan; ARCADIS 2006).

#### 6.2.2 Results

Table 10 summarizes the results laboratory analysis of VOCs in groundwater samples collected from monitoring wells associated with the Groundwater IRM. The table includes the results of samples collected during this and previous reporting periods. In general, when the May 2009 results are compared to the December 2009 results, monitoring wells located upgradient and side-gradient of the recovery wells showed a decrease in total volatile organic compound (TVOC) concentration. Changes in VOC concentrations attributable to the Groundwater IRM are expected to be slow to occur.

Table 11 summarizes the results of laboratory analysis of metals in groundwater samples collected from monitoring wells associated with the Groundwater IRM. Per the NYSDEC-approved sampling plan, metals sampling was not conducted during this reporting period. However, the results of metals analysis from previous sampling rounds are presented, and the table will be updated when additional metals sampling is conducted in the future.

When an appropriate amount of data has been collected, trend graphs will be developed for select wells.

During this round of sampling, mercury was not detected in any of the groundwater samples.

### 6.3 Environmental Effectiveness Monitoring Conclusions

- As shown on Figure 4, ARCADIS has evaluated the operational hydraulic monitoring data and has concluded that the groundwater containment system is operating as expected and the associated capture zone has developed.
- A comparison of the Baseline Monitoring (May 2009) analytical results to the Semi-Annual (December 2009) results indicates that in general, VOC concentrations have declined. As changes in the groundwater quality over time are expected to be slow to occur the current data does not represent a trend (or indicate aquifer cleanup), it does support the conclusion that the groundwater containment system

is operating as expected, and has established a zone of hydraulic control along the southern portion of the site.

## **7. Groundwater IRM Recommendations**

The following recommendations are made based on the data and evaluations presented herein:

- Change the pH sampling frequency in the interim SPDES equivalency from weekly to monthly since the water discharge pH readings were very consistent and were well within the allowable range.
- Remove Mercury from the SPDES equivalency program since Mercury was not detected in any groundwater quality or system water sample.
- Continue operating, maintaining, and monitoring the system per the Groundwater Draft OM&M Manual (ARCADIS 2009b).

## 8. References

ARCADIS G&M, Inc. (ARCADIS) 2006. Remedial Investigation/Feasibility Work Plan, Former Grumman Settling Ponds (Operable Unit 3), Bethpage Community Park, Bethpage, New York. March 8, 2006.

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New York State Department of Environmental Conservation (NYSDEC), 2009b, System Start-up Work Plan Approval Letter, May 19, 2009.

New York State Department of Environmental Conservation (NYSDEC), 2009c, Draft DER-10 Technical Guidance for Site Investigation and Remediation, November, 2009.

Table 1. Operational Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

MONTH	DAY																															Days Operational (1)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
Jul-09																					(2)	#/b	b	#/**b	b	b	b	b	b	#	b	b		11
Aug-09	b	b	b	b	#/b	b	b			b	b	#/**b	b	b	b	b	b	b	b	#/b		b	b	b	b		b	b	b	b		b		30
Sep-09	#/b	b		b	b	b	b			b	#/**b	b	b	b	b		b	b	b		b	b		b	b		b	b		b				30
Oct-09	b			b	(2)b			(3)b	#/**	b			(5)b		b			(6)b	(7)	(8)b	(8)b	(8)b		b	b	(9)		b						31
Nov-09		(10)b			(11)b			b		#/**					(12)				C1,2						b		b				b			30
Dec-09		#/**			b		(13)			b					b						b/P1,2				b						b			28
2009 Totals																																160		
TOTAL																																160		

<b>Legend:</b>		Indicates system offline for at least the majority of the day.	C1	Indicates VPGAC ECU 501 media changeout.
		Indicates system online for at least the majority of the day.	C2	Indicates VPGAC ECU 502 media changeout.
		Indicates system operated with reduced flow rates.	P1	Indicates PPZ ECU 601 media changeout.
	#	Indicates water compliance samples were collected.	P2	Indicates PPZ ECU 602 media changeout.
	**	Indicates vapor compliance samples were collected.		
	b	Indicates filter bag unit changed over.		

#### Notes:

- (1) Days in which the system was operational for the majority of the day are counted as one day.
- (2) The OU3 GW IRM shut down for approximately 3 hours on October 5, 2009 due to clogged bag filters.
- (3) The OU3 GW IRM shut down for approximately 10 hours on October 8, 2009 due to clogged bag filters.
- (4) The OU3 GW IRM shut down briefly (less than 1 hour) on Saturday, 10/10/09 due to a low flow alarm condition at Remedial Well RW-1.
- (5) The OU3 GW IRM shut down for approximately 4 hours on October 13, 2009 due to clogged bag filters.
- (6) The OU3 GW IRM shut down for approximately 6 hours on October 18, 2009 due to clogged bag filters.
- (7) Remedial Well RW-2 was taken off-line on October 19, 2009 to inspect the well, pipe and pump for iron fouling. Remedial Well RW-2 was restarted on October 23, 2009. During the work, the check valve was removed from the pump.
- (8) From 10/20/09 to 10/22/09 Remedial Well RW-2 was operated only when an operator was present at the site (approximately 12 hours per day). The recently performed work on RW-2 resulted in an excessive amount of iron being pumped to the treatment system, which in turn, significantly increased the frequency of the bag filter changeouts, therefore, RW-2 was only operated when an operator was present at the site until the excessive iron condition ceased.
- (9) The OU3 GW IRM shut down briefly on October 26, 2009 when the onsite operator accidentally triggered the system E-Stop alarm during a routine site visit. The system was restarted with Remedial Wells RW-1, RW-3 and RW-4 online only. Remedial Well RW-2 was left offline overnight and restarted at approximately 11:00 AM on October 27, 2009.

Notes continued on next page.

Table 1. Operational Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

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**Notes Continued:**

- (10) The OU3 GW IRM was shut down on November 2, 2009 for approximately 2 hours to obtain a sample of PPZ for waste characterization purposes.
- (11) The OU3 GW IRM shut down for approximately 6 hours on November 5, 2009 due to clogged bag filters. The system was restarted with Remedial Wells RW-1, RW-3 and RW-4 only, Remedial Well RW-2 was brought on-line the following morning (November 6, 2009).
- (12) Remedial Well RW-2 was offline from November 15, 2009 to November 25 for rehabilitation activities.
- (13) The OU3 GW IRM was shut down from December 7, 2009 to December 10, 2009 for the planned filter bag filter system upgrade.

**Acronyms\Key:**

GW Groundwater.  
IRM Interim Remedial Measure.  
VPGAC Vapor phase granular activated carbon.  
PPZ Potassium permanganate impregnated zeolite.  
ECU Emission control unit.

Table 2. Summary of Influent Water Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

Compound <sup>(2)</sup>	08/12/09 (µg/L)	08/19/09 (µg/L)	09/01/09 (µg/L)	09/10/09 (µg/L)	10/09/09 (µg/L)	11/10/09 (µg/L)	12/02/09 (µg/L)
<b>Project VOCs</b>							
1,1,1 - Trichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1 - Dichloroethane	2.9	3.3	2.4	2.2	<b>1.9</b>	<b>1.9</b>	<b>1.7</b>
1,2 - Dichloroethane	ND	ND	ND	ND	ND	ND	ND
1,1 - Dichloroethene	ND	ND	1.1	ND	ND	<b>0.9</b>	<b>1.0</b>
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	18	17	<b>20</b>	<b>20</b>	<b>22</b>	<b>24</b>	<b>25</b>
Vinyl Chloride	<b>130</b>	<b>190</b>	<b>120</b>	<b>63</b>	<b>52</b>	<b>52</b>	<b>58</b>
cis 1,2-Dichloroethene	<b>570</b>	<b>630</b>	<b>460</b>	<b>300</b>	<b>250</b>	<b>260</b>	<b>260</b>
trans 1,2-Dichloroethene	<b>71</b>	16	4.4	<b>43</b>	<b>17</b>	<b>0.78</b>	<b>2.8</b>
Benzene	ND	ND	ND	ND	ND	ND	ND
Toluene	<b>28</b>	<b>55</b>	<b>63</b>	<b>34</b>	<b>28</b>	<b>53</b>	<b>43</b>
<b>Subtotal Project VOCs</b>	<b>820</b>	<b>911</b>	<b>671</b>	<b>462</b>	<b>371</b>	<b>393</b>	<b>391</b>
<b>Non-Project VOCs</b>							
Dichlorodifluoromethane (Freon 12)	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane (Freon 22)	<b>26</b>	<b>29</b>	<b>52</b>	<b>69</b>	<b>100</b>	<b>220</b>	<b>210</b>
<b>Subtotal Non-Project VOCs</b>	<b>26</b>	<b>29</b>	<b>52</b>	<b>69</b>	<b>100</b>	<b>220</b>	<b>210</b>
<b>Total VOCs <sup>(3)</sup></b>	<b>846</b>	<b>940</b>	<b>723</b>	<b>531</b>	<b>471</b>	<b>613</b>	<b>601</b>
<b>Inorganics</b>							
Total Iron	<b>1,220</b>	<b>1,620</b>	NA	<b>980</b>	<b>1,680</b>	<b>1,240</b>	<b>1,930</b>
Total Mercury	NA	NA	NA	NA	NA	NA	NA

**Notes:**

- (1) Water samples collected by ARCADIS on the dates shown and submitted to Columbia Analytical Services, Inc. for VOC analyses per NYSDEC ASP 2000, Method OLM 4.3, for iron analyses per EPA Method 6010 and for mercury analyses per EPA Method 7470. The VOC analyte list is provided in the Groundwater IRM OM&M Manual (ARCADIS 2009b). Influent water samples were collected from Water Sampling Port-5 (WSP-5); refer to Figure 3 of this OM&M Report for the location of WSP-5.
- (2) Only VOCs associated with the interim State Pollutant Discharge Elimination System (SPDES) equivalency program, plus Toluene, Benzene, non-project related Freon 12 and Freon 22, Mercury and Iron are included in this table. Complete VOC and inorganic data summary tables, including VOC TICs, are provided in Appendix B. Laboratory data qualifiers are included in the Appendix B tables.
- (3) "Total VOCs" represents the sum of individual concentrations of all compounds detected. The values used in calculations referenced in this report have not been rounded.

**Acronyms/Key:**

<b>700</b>	Bold data indicates that the analyte was detected at or above its reporting limit.
16	Data that is not bold indicates analyte detected but below its reporting limit; the value is estimated.
µg/L	Micrograms per liter.
ND	Analyte not detected at, or above its laboratory quantification limit.
NA	Not analyzed.
NYSDEC	New York State Department of Environmental Conservation.
EPA	Environmental Protection Agency.
TICs	Tentatively identified compounds.
VOC	Volatile organic compound.
IRM	Interim Remedial Measure.
OM&M	Operation, maintenance and monitoring.

Table 3. Summary of Effluent Water Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

Compound <sup>(2)</sup>	Discharge	08/12/09	08/19/09	09/01/09	09/10/09	10/09/09	11/10/09	12/02/09
	Limit <sup>(3)</sup>							
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Project VOCs								
1,1,1 - Trichloroethane	5	ND	ND	ND	ND	ND	ND	ND
1,1 - Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND
1,2 - Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND
1,1 - Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	5	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	5	ND	ND	ND	ND	ND	ND	ND
cis 1,2 Dichloroethene	5	0.67	0.64	0.44	ND	ND	ND	0.32
trans 1,2 Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND
Benzene	5	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND
Subtotal Project VOCs	NA	0.7	0.6	0.4	0.0	0.0	0.0	0.3
Non-Project VOCs								
Dichlorodifluoromethane (Freon 12)	5	ND	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane (Freon 22)	5	ND	ND	ND	ND	ND	ND	ND
Subtotal Non-Project VOCs	NA	0	0	0	0	0	0	0
Total VOCs <sup>(4)</sup>	NA	0.7	0.6	0.4	0.0	0.0	0.0	0.3
Treatment Efficiency <sup>(5)</sup>	NA	99.9%	99.9%	99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%
Inorganics								
Total Iron	600	1,480	1,870	NA	1,250	1,120	910	350
Total Mercury	250	ND	ND	NA	ND	ND	ND	ND

See notes on last page.



Table 3. Summary of Effluent Water Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

**Notes:**

- (1) Water samples collected by ARCADIS on the dates shown and submitted to Columbia Analytical Services, Inc. for VOC analyses per NYSDEC ASP 2000, Method OLM 4.3, for iron analyses per EPA Method 6010 and for mercury analyses per EPA Method 7470. The VOC analyte list is provided in the Groundwater IRM OM&M Manual (ARCADIS 2009b). Effluent water samples were collected from Water Sampling Port-7 (WSP-7); refer to Figure 3 of this OM&M Report for the location of WSP-7.
- (2) Only VOCs associated with the interim State Pollutant Discharge Elimination System (SPDES) equivalency program, including Toluene, Benzene, non-project related Freon 12 and Freon 22, Mercury and Iron are included in this table. Complete VOC and inorganic data summary tables, including VOC TICs, are provided in Appendix B. Laboratory data qualifiers are included in the Appendix B tables.
- (3) Discharge limits per the interim SPDES equivalency program or Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) Quality Standards and Guidance Values and Groundwater Effluent Limitations, if the compound is not part of the interim SPDES equivalency program.
- (4) Total VOCs" represents the sum of individual concentrations of all compounds detected. The values used in calculations referenced in this report have not been rounded.
- (5) Treatment efficiency was calculated by dividing the difference between the influent and effluent total VOC concentrations by the influent total VOC concentration.

**Acronyms\Key:**

<b>700</b>	Bold data indicates that the analyte was detected at or above its reporting limit.
16	Data that is not bold indicates analyte detected but below its reporting limit; the value is estimated.
<b>6</b>	Bold box indicates value is greater than discharge criterion.
µg/L	Micrograms per liter.
ND	Analyte not detected at, or above its laboratory quantification limit.
NA	Not analyzed.
NYSDEC	New York State Department of Environmental Conservation.
EPA	Environmental Protection Agency.
TICs	Tentatively identified compounds.
VOC	Volatile organic compound.
IRM	Interim remedial measure.
OM&M	Operation, maintenance and monitoring.
>	Greater than.

Table 4. Summary of Influent Vapor Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

Compound <sup>(2)</sup>	07/24/09 (µg/m <sup>3</sup> )	08/12/09 (µg/m <sup>3</sup> )	09/10/09 (µg/m <sup>3</sup> )	10/09/09 (µg/m <sup>3</sup> )	11/10/09 (µg/m <sup>3</sup> )	12/02/09 (µg/m <sup>3</sup> )
<b>Project VOCs</b>						
1,1,1, Trichloroethane	ND	ND	ND	ND	5.2	ND
1,1 - Dichloroethane	ND	ND	ND	ND	36	29
1,2 - Dichloroethane	ND	ND	ND	ND	ND	ND
1,1 - Dichloroethene	ND	ND	ND	ND	18	17
Tetrachloroethene	ND	ND	ND	ND	11	ND
Trichloroethene	480	300	360	330	400	420
Vinyl Chloride	1,200	3,000	1,500	1,200	1,200	800
cis 1,2-Dichloroethene	5,400	15,000	7,800	6,000	7,000	4,500
trans 1,2-Dichloroethene	ND	ND	ND	ND	9	ND
Benzene	ND	ND	ND	ND	5.5	ND
Toluene	ND	820	1,100	790	1200	770
<b>Subtotal Project VOCs</b>	<b>7,080</b>	<b>19,120</b>	<b>10,760</b>	<b>8,320</b>	<b>9,885</b>	<b>6,536</b>
<b>Non-Project VOCs</b>						
Dichlorodifluoromethane (Freon 12)	ND	ND	ND	ND	ND	ND
Chlorodifluoromethane (Freon 22) <sup>(3)</sup>	ND	ND	550	7.1	2,800	2,500
<b>Subtotal Non-Project VOCs</b>	<b>0</b>	<b>0</b>	<b>550</b>	<b>7.1</b>	<b>2,800</b>	<b>2,500</b>
<b>Total VOCs <sup>(4)</sup></b>	<b>7,080</b>	<b>19,120</b>	<b>11,310</b>	<b>8,327</b>	<b>12,685</b>	<b>9,036</b>

**Notes:**

- (1) Vapor samples collected by ARCADIS on the dates shown and submitted to Columbia Analytical Services, Inc. for VOC analyses per Modified EPA Method T0-15. A VOC analyte list is provided in the Groundwater IRM OM&M Manual (ARCADIS 2009b). Influent samples were collected at Vapor Sampling Port-1 (VSP-1); refer to Figure 3 of this OM&M Report for the location of VSP-1.
- (2) Only VOCs that are associated with the interim State Pollutant Discharge Elimination System (SPDES) equivalency program, Toluene, Benzene, and non-project related Freon 12 and Freon 22 are included in this table. Complete VOC summary tables, including VOC TICs, are provided in Appendix C. Laboratory data qualifiers are included in the Appendix C tables.
- (3) During this reporting period, samples were analyzed for Freon 22 as a TIC. Efforts are being made to contract a state-certified laboratory to analyze this compound as a target analyte.
- (4) Total VOCs" represents the sum of individual concentrations of all compounds detected. The values used in calculations referenced in this report have not been rounded.

**Acronyms/Key:**

<b>700</b>	Bold data indicates that the analyte was detected at or above its reporting limit.
µg/m <sup>3</sup>	Micrograms per cubic meter.
ND	Analyte not detected at or above its laboratory reporting limit.
EPA	Environmental Protection Agency.
TIC	Tentatively identified compound.
VOC	Volatile organic compound.
IRM	Interim remedial measure.
OM&M	Operation, maintenance and monitoring.

Table 5. Summary of Effluent Vapor Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

Compound <sup>(2)</sup>	Discharge						
	Limit <sup>(3)</sup> (µg/m <sup>3</sup> )	07/24/09 (µg/m <sup>3</sup> )	08/12/09 (µg/m <sup>3</sup> )	09/10/09 (µg/m <sup>3</sup> )	10/9/2009 <sup>(10)</sup> (µg/m <sup>3</sup> )	11/12/09 (µg/m <sup>3</sup> )	12/02/09 (µg/m <sup>3</sup> )
<b>Project VOCs</b>							
1,1,1 - Trichloroethane	68,000	<b>0.96</b>	ND	ND	--	ND	ND
1,1 - Dichloroethane	NS	<b>3.9</b>	<b>5.7</b>	<b>5.3</b>	--	<b>37</b>	<b>3.7</b>
1,2 - Dichloroethane	NS	ND	ND	ND	--	ND	ND
1,1 - Dichloroethene	380 <sup>(4)</sup>	ND	ND	ND	--	<b>5.8</b>	<b>1.4</b>
Tetrachloroethene	1,000	<b>0.64</b>	ND	ND	--	ND	ND
Trichloroethene	14,000	<b>9.3</b>	<b>4.7</b>	<b>8.8</b>	--	<b>15</b>	<b>30</b>
Vinyl Chloride	180,000	<b>54</b>	<b>260</b>	<b>160</b>	--	<b>200</b>	<b>52</b>
cis 1,2 Dichloroethene	190,000 <sup>(5)</sup>	<b>47</b>	<b>120</b>	<b>150</b>	--	<b>1,700</b>	<b>230</b>
trans 1,2 Dichloroethene	NS	ND	ND	ND	--	ND	ND
Benzene	1,300	<b>48</b>	<b>21</b>	<b>17</b>	--	<b>13</b>	<b>12</b>
Toluene	37,000	<b>1.5</b>	<b>110</b>	<b>120</b>	--	<b>87</b>	<b>90</b>
<b>Subtotal Project VOCs</b>	NA	<b>165.3</b>	<b>521</b>	<b>461</b>	--	<b>2,058</b>	<b>419</b>
<b>Non-Project VOCs</b>							
Dichlorodifluoromethane (Freon 12)	NS	<b>5.1</b>	ND	<b>10</b>	--	<b>61</b>	<b>2.4</b>
Chlorodifluoromethane (Freon 22) <sup>(6)</sup>	NS	ND	<b>220</b>	<b>540</b>	--	<b>3,600</b>	<b>2,400</b>
<b>Subtotal Non-Project VOCs</b>	NA	<b>5</b>	<b>220</b>	<b>550</b>	--	<b>3,661</b>	<b>2,402</b>
<b>Total VOCs <sup>(7)</sup></b>	NA	<b>170</b>	<b>741</b>	<b>1,011</b>	--	<b>5,719</b>	<b>2,822</b>
<b>Treatment Efficiency w/Freons <sup>(8)</sup></b>	NA	<b>97.6%</b>	<b>96.1%</b>	<b>91.1%</b>	--	<b>54.9%</b>	<b>68.8%</b>
<b>Treatment Efficiency w/o Freons <sup>(9)</sup></b>	NA	<b>97.7%</b>	<b>97.3%</b>	<b>95.7%</b>	--	<b>79.2%</b>	<b>93.6%</b>

See notes on last page.

Table 5. Summary of Effluent Vapor Sample Analytical Results, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1)</sup>

**Notes:**

- (1) Vapor samples collected by ARCADIS on the dates shown and submitted to Columbia Analytical Services, Inc. for VOC analyses per Modified EPA Method T0-15. A VOC analyte list is provided in the Groundwater IRM OM&M Manual (ARCADIS 2009b). Effluent samples were collected at Vapor Sampling Port-5 (VSP-5); refer to Figure 3 of this OM&M Report for the location of VSP-5.
- (2) Only VOCs that are associated with the interim State Pollutant Discharge Elimination System (SPDES) equivalency program, Toluene, Benzene, and non-project related Freon 12 and Freon 22 are included in this table. Complete VOC summary tables, including VOC TICs, are provided in Appendix C. Laboratory data qualifiers are included in the Appendix C tables.
- (3) Discharge limit is compound specific short-term guidance concentration (SGC) per the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007.
- (4) An SGC was not provided in the DAR-1 AGC/SGC Tables, dated September 10, 2007. An interim SGC was developed based on guidance of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1-dichloroethene, which is not defined as provided in Section IV.A.2.b.1 a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 1,600 µg/m<sup>3</sup> / 4.2 = approximately 380 µg/m<sup>3</sup>. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, dated September 10, 2007.
- (5) An SGC was not provided in the DAR-1 AGC/SGC Tables, dated September 10, 2007. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene, which is not defined as a high-toxicity compound, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 µg/m<sup>3</sup> / 4.2 = approximately 190,000 µg/m<sup>3</sup>. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, dated September 10, 2007.
- (6) During this reporting period, samples were analyzed for Freon 22 as a TIC. Efforts are being made to contract a state-certified laboratory to analyze this compound as a target analyte.
- (7) Total VOCs" represents the sum of individual concentrations of all compounds detected. The values used in calculations referenced in this report have not been rounded.
- (8) Treatment efficiency was calculated by dividing the difference between the influent and effluent total VOC concentrations by the influent total VOC concentration.
- (9) Treatment efficiency was calculated by dividing the difference between the influent and effluent total Project VOC concentrations by the influent total Project VOC concentration.
- (10) An effluent sample was not collected on date shown due to inadequate air pressure in sample container.

**Acronyms/Key:**

<b>700</b>	Bold data indicates that the analyte was detected at or above its reporting limit.
µg/m <sup>3</sup>	Micrograms per cubic meter.
ND	Analyte not detected at or above its laboratory reporting limit.
NA	Not applicable.
NYSDEC	New York State Department of Environmental Conservation.
EPA	Environmental Protection Agency.
TIC	Tentatively identified compound.
VOC	Volatile organic compound.
IRM	Interim remedial measure.
OM&M	Operation, maintenance and monitoring.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007. An interim SGC was not developed for these compounds because they have low toxicity ratings in the NYSDEC DAR-1 AGC/SGC tables revised September 10, 2007.
AGC	Annual guideline concentration.
--	Sample not collected.

Table 6. Summary of System Parameters, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Date <sup>(1)</sup>	Water Flow Rates <sup>(2)</sup>						Water Pressures <sup>(2)</sup>					Air Flow Rate <sup>(2)</sup>	Air Pressures <sup>(2)</sup>					Air Temp. <sup>(2)</sup>
	Remedial Well				Combined Influent	Effluent	Remedial Well Effluent <sup>(3)</sup>				Effluent	Effluent	ECU Influent		Intermediate		Effluent	Stack Temp.
	RW-1	RW-2	RW-3	RW-4			RW-1	RW-2	RW-3	RW-4			GAC-501	GAC-502	PPZ-601	PPZ-602		
	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(gpm)	(psi)	(psi)	(psi)	(psi)	(psi)	(scfm)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(inH <sub>2</sub> O)	(°R)
07/21/09	30.7	75.0	76.0	31.0	219	217	57.0	68.2	63.2	56.0	8.0	2,022	8.5	6.5	4.5	1.5	0.5	540
08/05/09	30.3	75.2	75.4	30.1	218	229	56.6	65.7	65.2	56.9	8.5	1,999	8.4	6.5	4.8	2.0	0.1	543
09/01/09	30.4	75.2	75.7	30.7	220	220	56.9	49.9	64.2	56.5	9.0	2,116	9.0	6.9	4.2	2.1	0.0	542
09/30/09	30.3	75.3	75.4	30.4	218	228	57.2	42.9	63.9	56.5	7.5	2,097	8.5	6.6	5.0	2.1	0.1	539
10/09/09	30.5	75.3	75.3	30.7	219	223	57.0	42.3	63.6	55.9	9.0	2,065	8.5	6.5	5.0	2.1	0.0	540
11/10/09 <sup>(4)</sup>	30.4	75.2	75.6	30.2	218	230	57.1	58.9	63.4	56.8	9.0	2,126	8.6	6.5	5.0	2.0	0.0	534 <sup>(5)</sup>
12/02/09	30.4	75.3	75.2	30.2	216	228	57.1	56.3	65.2	56.8	9.0	1,935	9.0	6.0	4.5	2.0	0.0	538 <sup>(5)</sup>
12/30/09	30.4	75.4	75.4	30.6	219	220	57.2	42.2	65.3	56.6	6.5	2,220	8.5	5.3	3.3	1.2	0.0	531 <sup>(5)</sup>

**Notes:**

- (1) Operational data collected by ARCADIS on days noted. Parameters listed were typically recorded during compliance monitoring events. Data in this table corresponds to approximately the past two quarters of system operation.
- (2) Instantaneous values from field-mounted instruments, except for the combined influent water-flow rate, which is the sum of individual well flow rates via the Supervisory Control and Data Acquisition (SCADA) System.
- (3) Remedial Well effluent pressure readings measured at the influent manifold within the treatment system building.
- (4) Parameters shown were recorded during the November 2, 2009 site visit and represent the conditions for this monitoring period.
- (5) Total effluent air temperature gauge (TI-601) malfunctioning; the value shown was measured at the mid-train air temperature gauge (TI-501).

**Acronyms/Key:**

°R	Degrees Rankine.
gpm	Gallons per minute.
inH <sub>2</sub> O	Inches of water column.
NM	Not measured.
psi	Pounds per square inch.
scfm	Standard cubic feet per minute.
Temp.	Temperature.

Table 7. Summary of Groundwater Recovered and TVOC Mass Removed, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Operating Period <sup>(1)</sup>	Volume of Groundwater Recovered (x1,000 gal) <sup>(2)</sup>					TVOC Mass Recovered (lbs) <sup>(3)</sup>					TVOC Mass Recovery Rate (lbs/day) <sup>(4)</sup>				
	RW-1	RW-2	RW-3	RW-4	Total	RW-1	RW-2	RW-3	RW-4	Total	RW-1	RW-2	RW-3	RW-4	Total
<b>System Pilot Test, Shakedown and Start Up Totals <sup>(5)</sup></b>															
	137	270	251	150	808	NA	NA	NA	NA	1.1	NA	NA	NA	NA	NA
<b>July 2009 through September 2009 Totals</b>															
<b>Subtotal July-Sept 09 <sup>(6)</sup></b>	2,921	7,237	7,335	2,914	20,407	0.22	190	12	5.0	208	<0.01	2.7	0.17	0.07	3.0
<b>October 2009 through December 2009 Totals</b>															
10/02/09 - 10/09/09	797	735	736	297	2,565	0.05	10	2.7	0.67	13	<0.01	1.4	0.39	0.10	1.9
10/09/09 - 11/16/09 <sup>(7)</sup>	1,105	2,434	3,983	1,600	9,122	0.06	35	14	3.6	53	<0.01	1.0	0.37	0.09	1.4
11/16/09 - 12/02/09 <sup>(7,8)</sup>	700	798	1,736	698	3,932	0.03	9.2	9.9	1.6	21	<0.01	1.3	0.62	0.10	1.3
12/02/09 - 12/30/09	1,069	2,634	2,655	1,065	7,423	0.05	31	15	2.4	48	<0.01	1.2	0.60	0.10	1.9
<b>Subtotal Oct-Dec 09 <sup>(9)</sup></b>	3,671	6,601	9,110	3,660	23,042	0.19	85	42	8.3	140	<0.01	1.2	0.49	0.10	1.6
<b>Subtotal 2009 <sup>(10)</sup></b>	6,592	13,838	16,445	6,574	43,449	0.41	280	54	13	350	<0.01	1.9	0.3	0.1	2.2
<b>Total <sup>(11)</sup></b>	6,730	14,110	16,700	6,720	44,260	0.41	280	54	13	350	NA	NA	NA	NA	NA

See notes on last page.

Table 7. Summary of Groundwater Recovered and TVOC Mass Removed, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

**Notes:**

- (1) Represents operating period between consecutive monitoring events.
- (2) Volume of groundwater recovered is based on individual local well totalized flow readings. Listed value is the difference between totalized flow values recorded between consecutive monitoring events. The total groundwater recovered during a given operating period is the sum of the individual well flow totals. Values shown have been rounded to the nearest gallon.
- (3) Mass recovered per well was calculated by multiplying the average concentrations of two consecutive sampling events by the number of gallons extracted between sampling events. The total amount recovered during a given operating period is the sum of masses recovered from each of the individual wells. Values shown have been rounded to include two significant figures to account for error associated with field measurements and analytical data.
- (4) Mass recovery rates were calculated by dividing the total mass recovered by the number of days the system operated during the respective operating period. Values shown have been rounded to include two significant figures to account for error associated with field measurements and analytical data.
- (5) Values based on operational data recorded prior to system startup on July 21, 2009.
- (6) The volume of groundwater recovered and mass recovered calculations represent the operational period between system start-up on July 21, 2009 and September 30, 2009.
- (7) Totalizer readings were not recorded during the November 10, 2009 compliance monitoring event. Values shown were recorded on November 16, 2009.
- (8) Remedial Well RW-2 was offline between November 16, 2009 and November 25, 2009 for redevelopment.
- (9) The volume of groundwater recovered and mass recovered calculations represent the operational period between October 2, 2009 and December 30, 2009.
- (10) "Subtotal 2009" refers to the amounts removed by the OU3 Groundwater IRM during 2009; mass recovery rates are averages and not totals.
- (11) "Total" refers to the amounts removed by the Operable Unit 3 Groundwater Interim Remedial Measure. Total volume of groundwater recovered reported is rounded to the nearest 10 gallons. Total mass recovered reported has been rounded to include two significant figures to account for error associated with field measurements and analytical data.

**Acronyms\Key:**

TVOC	Total Volatile Organic Compounds
gal	Gallons.
IRM	Interim remedial measure.
lbs	Pounds.
lbs/day	Pounds per day.
NA	Not applicable.
<	Less than.

Table 8. Air Emissions Model Output Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Compound <sup>(1)</sup>	AGC <sup>(2)</sup> (µg/m <sup>3</sup> )	Percent of MASC Per Event <sup>(3)</sup>					Cumulative % MASC <sup>(4)</sup>
		7/24/09	8/12/09	9/10/09	11/10/09	12/2/09	
1,1,1 - Trichloroethane	1,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1,1 - Dichloroethane	0.63	0.09%	0.14%	0.13%	0.90%	0.09%	0.25%
1,2 - Dichloroethane	0.038	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1,1 - Dichloroethene	70	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2-Butanone	5,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Acetone	28,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chloroform	0.043	0.00%	0.00%	0.00%	10.72%	2.05%	0.79%
Ethylbenzene	1,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Xylenes (o)	100	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Xylenes (m,p)	100	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chloromethane	90	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Methylene Chloride	2.1	0.00%	0.00%	0.00%	0.02%	0.00%	0.00%
Tetrachloroethene	1	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Trichloroethene	0.5	0.28%	0.14%	0.27%	0.46%	0.93%	0.35%
Vinyl Chloride	0.11	7.40%	35.78%	22.18%	27.94%	7.30%	22.59%
cis 1,2 Dichloroethene	63	0.01%	0.03%	0.04%	0.41%	0.06%	0.10%
trans 1,2 Dichloroethene	63	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Benzene	0.13	5.57%	2.45%	1.99%	1.54%	1.43%	2.09%
Toluene	5,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Trichlorofluoromethane (Freon 11)	1,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Dichlorodifluoromethane (Freon 12)	12,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Chlorodifluoromethane (Freon 22) <sup>(5)</sup>	50,000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

See notes on last page.



Table 8. Air Emissions Model Output Summary, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

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**Notes:**

- (1) Only VOCs that are associated with the interim State Pollutant Discharge Elimination System (SPDES) equivalency program, Toluene, Benzene, and non-project related Freon 12 and Freon 22 are included in this table.
- (2) AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised September 10, 2007. NYSDEC DAR-1 AGCs were scaled using the results of a site-specific annual USEPA SCREEN 3 model to calculate the annual maximum allowable stack concentration (MASC) per monitoring event.
- (3) Percent of AGC (or Percent MASC) was calculated by dividing the actual effluent concentration by the site-specific annual MASC. Detailed calculations are included in Appendix D.
- (4) Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event.
- (5) During this reporting period, samples were analyzed for Freon 22 as a tentatively identified compound (TIC). Efforts are being made to contract a state certified laboratory to analyze the compound directly.

**Acronyms/Key:**

µg/m <sup>3</sup>	Micrograms per cubic meter.
NYSDEC	New York State Department of Environmental Conservation.
USEPA	United States Environmental Protection Agency.
SGC	Short term guideline concentration.
AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
VOCs	Volatile organic compounds.



Table 9. Summary of Water-Level Elevations, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Well Identification	Well Casing Elevations (ft msl)	Event Date	Baseline 5/8/2009 (ft msl)		Start Up Round 7/10/2009 (ft msl)		Week 1, Day 2 07/22/09 (ft msl)		Week 1, Day5 07/25/09 (ft msl)		Week 2 7/27/09 (ft msl)		Week 3 08/05/09 (ft msl)		Week 6 08/27/09 (ft msl)		Week 7 09/01/09 (ft msl)		Week 8 09/11/09 (ft msl)		Week 9 09/17/09 (ft msl)		Week 10 09/23/09 (ft msl)		Week 20 11/30/09 (ft msl)
Recovery Wells																									
RW-1	125.18		69.75		72.98		71.53		NM		NM		NM		70.88		69.85		70.21		70.93		70.74		70.32
RW-2	124.48		72.27		72.76		65.94		65.66		67.57		65.60		63.42		63.16		63.27		61.51		61.30		63.07
RW-3	122.84		69.40		72.58		68.61		68.52		68.55		68.49		67.89		68.05		68.04		67.88		67.68		67.29
RW-4	121.25		69.25		72.39		71.11		71.21		71.21		71.23		70.55		69.40		70.12		70.77		70.37		70.01
Monitoring Wells																									
B24MW-2	126.96		74.31		74.79		74.71		74.75		74.92		75.04		74.48		74.58		74.56		74.69		74.35		73.54
B24MW-3	127.11		72.63		73.2		72.86		73.03		73.04		73.07		72.37		71.46		69.71		72.33		72.23		71.71
B30MW-1	128.33		73.55		74.02		73.78		73.92		73.97		73.92		73.27		73.43		73.35		73.29		73.19		72.68
BCPMW-1	125.73		73.16		73.7		73.37		73.69		73.57		73.56		72.83		73.16		73.00		72.98		72.79		72.43
BCPMW-2	126.39		72.55		73.05		71.37		72.75		72.69		72.71		72.01		72.26		72.16		72.04		71.93		71.38
BCPMW-3	124.94		72.46		72.94		64.59		72.44		72.44		72.39		71.74		71.94		71.82		71.75		71.60		71.12
BCPMW-4-1	128.76		72.30		72.81		72.26		72.18		72.12		72.13		71.51		70.36		71.55		71.51		71.40		70.96
BCPMW-4-2	129.15		72.58		72.82		72.25		72.21		72.24		72.16		71.53		70.43		71.59		71.55		71.44		70.95
BCPMW-4-3	129.19		72.32		72.8		72.34		72.37		72.31		72.31		71.67		70.59		71.81		71.65		71.55		71.07
BCPMW-5-1	129.37		72.79		73.26		72.88		73.05		73.52		73.42		72.22		72.55		72.36		72.24		72.15		71.77
BCPMW-6-1	126.01		72.12		72.55		72.21		72.15		72.09		72.09		71.47		71.61		71.58		71.43		71.31		70.85
BCPMW-6-2	125.16		71.74		72.13		71.77		71.83		71.73		71.73		71.11		71.29		70.53		71.11		70.87		70.58
BCPMW-7-1	124.81		72.00		72.39		72.22		72.23		72.14		72.14		71.55		71.68		71.62		71.50		71.41		70.94
MW-200-1	123.49		72.16		72.64		72.30		72.22		72.25		72.22		71.58		70.52		71.74		71.66		72.64		70.95
MW-201-1	121.69		72.04		72.49		72.10		72.03		71.99		71.96		71.38		71.50		71.40		71.37		72.45		70.69
MW-202-1	119.27		71.90		72.36		71.98		72.07		72.02		72.94		71.35		71.48		71.46		71.40		72.26		70.72
MW-203-1	118.25		71.83		72.22		71.99		71.96		72.01		71.93		71.32		71.45		71.40		71.40		72.24		70.69
Piezometers																									
PZ-1a	128.82		72.56		72.8		72.03		71.95		71.90		71.90		71.30		71.40		71.50		71.31		71.20		70.75
PZ-1b	128.92		72.47		72.79		71.74		71.84		71.76		71.78		71.18		71.35		71.37		71.21		71.11		70.67
PZ-1c	128.96		72.47		72.81		72.32		72.36		72.26		72.34		71.65		71.21		71.75		71.62		71.48		71.11
PZ-2a	128.36		72.47		72.75		72.02		71.95		71.88		71.87		71.27		71.41		71.38		71.27		71.15		70.73
PZ-2b	128.37		72.43		72.75		70.32		71.90		71.87		71.86		71.26		71.40		71.37		71.24		71.13		70.70
PZ-2c	128.55		72.41		72.67		70.60		72.28		72.21		72.21		71.57		71.75		71.66		71.57		71.44		71.02
PZ-3	124.99		72.52		72.66		47.10		71.77		71.68		71.72		71.10		71.27		71.18		71.10		71.03		70.52
PZ-4	125.31		72.50		72.73		53.89		71.75		71.77		71.84		71.20		71.38		71.29		71.21		71.11		70.64
PZ-5a	129.07		72.50		73.04		75.43		72.81		72.75		72.79		72.12		72.33		72.17		72.12		71.99		71.53
PZ-5b	129.06		72.50		73.02		75.43		72.67		72.66		72.72		72.01		72.24		72.07		71.98		71.90		71.45
PZ-6a	125.67		72.50		72.6		72.85		71.94		71.85		71.84		71.24		71.35		71.31		71.21		71.09		70.65
PZ-6b	125.74		72.50		72.58		72.63		71.84		71.76		71.76		71.16		71.29		71.22		71.12		71.00		72.54
PZ-7a	125.10		72.50		72.52		68.82		72.24		72.16		72.16		71.57		71.69		71.61		71.52		71.41		70.96
PZ-7b	125.06		72.50		72.39		68.66		72.01		71.46		71.94		71.31		71.49		71.15		71.29		71.18		70.81

Acronyms\Key:

ft msl: feet relative to mean sea level.

NM: not measured.

Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells,  
Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: Sample Date:	B24MW-2 4/23/2009	B24MW-3 4/20/2009	B30MW-1 4/23/2009	BCPMW-1 4/28/2009	BCPMW-2 4/28/2009	BCPMW-3 4/29/2009
	NYSDEC SCGs						
1,1,1-Trichloroethane	5	< 5	0.62 J	< 5	< 5	< 10	< 25
1,1,2,2-Tetrachloroethane	5	< 5	< 5	< 5	< 5	< 10	< 25
1,1,2-Trichloroethane	1	< 5	< 5	< 5	< 5	< 10	< 25
1,1-Dichloroethane	5	< 5	< 5	< 5	0.37 J	8 J	9.6 J
1,1-Dichloroethene	5	< 5	< 5	< 5	< 5	3.8 J	43
1,2-Dichloroethane	0.6	< 5	< 5	< 5	< 5	0.68 J	< 25
1,2-Dichloropropane	1	< 5	< 5	< 5	< 5	< 10	< 25
2-Butanone	NE	< 50	< 50	< 50	< 50	< 100	< 250
2-Hexanone	50	< 50	< 50 J	< 50	< 50	< 100	< 250
4-methyl-2-pentanone	50	< 50	< 50 J	< 50	< 50	< 100	< 250
Acetone	NE	< 50 B	< 50	< 50 B	< 50 B	< 100	< 250
Benzene	1	< 0.7	< 0.7	< 0.7	< 0.7	< 1.4	< 3.5
Bromodichloromethane	50	< 5	< 5	< 5	< 5	< 10	< 25
Bromoform	50	< 5	< 5	< 5	< 5	< 10	< 25
Bromomethane	5	< 5	< 5	< 5	< 5	< 10	< 25
Carbon Disulfide	60	< 5	< 5	< 5	< 5	< 10	< 25
Carbon tetrachloride	5	< 5	< 5	< 5	< 5	< 10	< 25
Chlorobenzene	5	< 5	< 5	< 5	< 5	< 10	< 25
Chlorodifluoromethane (Freon 22)	NE	< 5	< 5	< 5	< 5	< 10	< 25
Chloroethane	5	< 5	< 5	< 5	< 5	< 10	< 25
Chloroform	7	< 5	< 5	< 5	0.88 J	< 10	< 25
Chloromethane	5	< 5	< 5	< 5	< 5	< 10	< 25
cis-1,2-dichloroethene	5	< 5	10	< 5	22	310	900
cis-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 5	< 10	< 25
Dibromochloromethane	50	< 5	< 5	< 5	< 5	< 10	< 25
Dichlorodifluoromethane (Freon 12)	5	< 5	< 5	< 5	< 5	< 10	< 25
Ethylbenzene	5	< 5	< 5	< 5	< 5	< 10	< 25 B
Methylene Chloride	5	< 5	< 5	< 5	0.52 J	< 10	< 25
Styrene	5	< 5	< 5	< 5	< 5	< 10	< 25
Tetrachloroethene	5	< 5	0.51 J	< 5	< 5	1.5 J	< 25
Toluene	5	< 5	< 5	< 5	0.33 J	< 10	< 25 B
trans-1,2-dichloroethene	5	< 5	< 5	< 5	0.44 J	2.4 J	8.9 J
trans-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 5	< 10	< 25
Trichloroethylene	5	3.7 J	45	< 5	190	180	470
Trichlorotrifluoroethane (Freon 113)	5	< 5	< 5	< 5	< 5	< 10	< 25
Vinyl Chloride	2	< 2	< 2	< 2	< 2	4.1	300
Xylene-o	5	< 5	< 5	< 5	< 5	< 10	< 25 B
Xylenes - m,p	5	< 5	< 5	< 5	< 5	< 10	< 25 B
<b>Total VOCs <sup>(3)</sup></b>		<b>3.7</b>	<b>56.1</b>	<b>0</b>	<b>214.5</b>	<b>510.5</b>	<b>1,731.5</b>

See notes on last page.

Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: BCPMW-4-1		BCPMW-4-1		BCPMW-4-2		BCPMW-4-2		BCPMW-4-3		BCPMW-4-3	
	Sample Date: 4/17/2009		12/1/2009		4/17/2009		12/4/2009		4/17/2009		12/1/2009	
NYSDEC SCGs												
1,1,1-Trichloroethane	5	< 25	2.4 J		< 250		< 10		< 5		< 5	
1,1,2,2-Tetrachloroethane	5	< 25	< 5		< 250		< 10		< 5		< 5	
1,1,2-Trichloroethane	1	< 25	0.38 J		< 250		< 10		< 5		< 5	
1,1-Dichloroethane	5	6.5 J	46		57 J		8.7 J		< 5		< 5	
1,1-Dichloroethene	5	1.8 J	14		34 J		2.7 J		< 5		< 5	
1,2-Dichloroethane	0.6	< 25	0.65 J		< 250		< 10		< 5		< 5	
1,2-Dichloropropane	1	< 25	4.7 J		< 250		< 10		< 5		< 5	
2-Butanone	NE	< 250	< 50		< 2500		< 100		< 50		< 50	
2-Hexanone	50	< 250 J	< 50		< 2500 J		< 100		< 50 J		< 50	
4-methyl-2-pentanone	50	< 250 J	< 50		< 2500 J		< 100		< 50 J		< 50	
Acetone	NE	< 250 J	< 50		< 2500 J		< 100		< 50 J		< 50	
Benzene	1	< 3.5	0.44 J		< 35		< 1.4		< 0.7		< 0.7	
Bromodichloromethane	50	< 25	< 5		< 250		< 10		< 5		< 5	
Bromoform	50	< 25	< 5		< 250		< 10		< 5		< 5	
Bromomethane	5	< 25	R		< 250		< 10		< 5		< 5	
Carbon Disulfide	60	< 25	< 5		< 250		< 10		< 5		< 5	
Carbon tetrachloride	5	< 25	< 5		< 250		< 10		< 5		< 5	
Chlorobenzene	5	< 25	< 5		< 250		< 10		< 5		< 5	
Chlorodifluoromethane (Freon 22)	NE	17 J	6.2		< 250		0.8 J		< 5		< 5	
Chloroethane	5	< 25	2.4 J		< 250		1.1 J		< 5		< 5	
Chloroform	7	< 25	< 5		< 250		< 10		0.53 J		0.32 J	
Chloromethane	5	< 25	R		< 250		R		< 5		R	
cis-1,2-dichloroethene	5	1800 D	750 D		18000 D		270		0.37 J		< 5	
cis-1,3-dichloropropene	0.4	< 25	< 5		< 250		< 10		< 5		< 5	
Dibromochloromethane	50	< 25	< 5		< 250		< 10		< 5		< 5	
Dichlorodifluoromethane (Freon 12)	5	< 25	< 5		< 250		< 10		< 5		< 5	
Ethylbenzene	5	< 25	< 5		62 J		0.78 J		< 5		< 5	
Methylene Chloride	5	< 25	< 5		< 250		< 10		< 5		< 5	
Styrene	5	< 25	< 5		< 250		< 10		< 5		< 5	
Tetrachloroethene	5	< 25	0.64 J		< 250		0.82 J		< 5		< 5	
Toluene	5	< 25	< 5		2400		< 10 B		< 5		< 5	
trans-1,2-dichloroethene	5	110	2.5 J		< 250		1.3 J		< 5		< 5	
trans-1,3-dichloropropene	0.4	< 25	< 5		< 250		< 10		< 5		< 5	
Trichloroethylene	5	22 J	170		< 250		310		0.56 J		0.51 J	
Trichlorotrifluoroethane (Freon 113)	5	< 25	< 5		< 250		< 10		< 5		< 5	
Vinyl Chloride	2	180	540 D		6300		58		< 2		< 2	
Xylene-o	5	< 25	8		110 J		< 10 B		< 5		< 5	
Xylenes - m,p	5	< 25	< 5		190 J		< 10 B		< 5		< 5	
Total VOCs <sup>(3)</sup>												
		2,137.3	1,548.3		27,153		655		1.5		0.83	

See notes on last page.

Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: Sample Date:	BCPMW-5-1 4/23/2009	BCPMW-6-1 4/20/2009	BCPMW-6-1 12/4/2009	BCPMW-6-2 5/8/2009	BCPMW-6-2 12/4/2009
	NYSDEC SCGs					
1,1,1-Trichloroethane	5	< 100	< 5	< 5	< 5	<b>0.78 J</b>
1,1,2,2-Tetrachloroethane	5	< 100	< 5	< 5	< 5	< 5
1,1,2-Trichloroethane	1	< 100	< 5	< 5	< 5	< 5
1,1-Dichloroethane	5	< 100	<b>0.3 J</b>	< 5	<b>0.37 J</b>	<b>0.65 J</b>
1,1-Dichloroethene	5	<b>21 J</b>	< 5	< 5	< 5	<b>0.44 J</b>
1,2-Dichloroethane	0.6	< 100	< 5	< 5	< 5	< 5
1,2-Dichloropropane	1	< 100	< 5	< 5	< 5	< 5
2-Butanone	NE	< 1000	< 50	< 50	< 50	< 50
2-Hexanone	50	< 1000	< 50 J	< 50	< 50	< 50
4-methyl-2-pentanone	50	< 1000	< 50 J	< 50	< 50	< 50
Acetone	NE	< 1000	< 50 J	< 50	< 50	< 50
Benzene	1	< 14	< 0.7	< 0.7	< 0.7	< 0.7
Bromodichloromethane	50	< 100	< 5	< 5	< 5	< 5
Bromoform	50	< 100	< 5	< 5	< 5	< 5
Bromomethane	5	< 100	< 5	R	< 5	R
Carbon Disulfide	60	< 100	< 5	< 5	< 5	< 5
Carbon tetrachloride	5	< 100	< 5	< 5	< 5	< 5
Chlorobenzene	5	< 100	< 5	< 5	< 5	< 5
Chlorodifluoromethane (Freon 22)	NE	< 100	<b>4500 D</b>	<b>1700 EJ</b>	< 5	< 5
Chloroethane	5	< 100	< 5	< 5	< 5	< 5
Chloroform	7	< 100	<b>1.7 J</b>	<b>0.32 J</b>	<b>0.53 J</b>	< 5
Chloromethane	5	< 100	< 5	R	< 5	R
cis-1,2-dichloroethene	5	<b>960</b>	<b>21</b>	<b>1.7 J</b>	< 5	< 5
cis-1,3-dichloropropene	0.4	< 100	< 5	< 5	< 5	< 5
Dibromochloromethane	50	< 100	< 5	< 5	< 5	< 5
Dichlorodifluoromethane (Freon 12)	5	< 100	< 5	< 5	< 5	< 5
Ethylbenzene	5	<b>48 J</b>	< 5	< 5	< 5	< 5
Methylene Chloride	5	< 100	< 5	< 5	< 5	< 5
Styrene	5	< 100	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 100	<b>0.34 J</b>	< 5	< 5	<b>0.79 J</b>
Toluene	5	<b>2700</b>	< 5	< 5	< 5	< 5
trans-1,2-dichloroethene	5	< 100	< 5	< 5	< 5	< 5
trans-1,3-dichloropropene	0.4	< 100	< 5	< 5	< 5	< 5
Trichloroethylene	5	<b>220</b>	<b>4.9 J</b>	<b>1.6 J</b>	< 5	<b>0.45 J</b>
Trichlorotrifluoroethane (Freon 113)	5	< 100	< 5	< 5	< 5	< 5
Vinyl Chloride	2	<b>330</b>	< 2	< 2	< 2	< 2
Xylene-o	5	<b>40 J</b>	< 5	< 5	< 5	< 5
Xylenes - m,p	5	<b>110</b>	< 5	< 5	< 5	< 5
<b>Total VOCs <sup>(3)</sup></b>		<b>4,429</b>	<b>4,528.2</b>	<b>1,703.6</b>	<b>0.9</b>	<b>3.1</b>

See notes on last page.

Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

	Sample Location: BCPMW-7-1 BCPMW-7-1		MW-200-1	MW-200-1	MW-201-1	MW-201-1
COMPOUND	Sample Date: 4/20/2009 12/1/2009		4/29/2009	12/2/2009	5/1/2009	12/2/2009
(ug/L)						
	NYSDEC					
	SCGs					
1,1,1-Trichloroethane	5	< 5	< 5	< 5	5.5 J	3.3 J
1,1,2,2-Tetrachloroethane	5	< 5	< 5	< 5	< 25	< 50
1,1,2-Trichloroethane	1	< 5	< 5	< 5	< 25	< 50
1,1-Dichloroethane	5	< 5	< 5	0.79 J	10 J	9 J
1,1-Dichloroethene	5	< 5	< 5	< 5	7.9 J	8.1 J
1,2-Dichloroethane	0.6	< 5	< 5	< 5	< 25	< 50
1,2-Dichloropropane	1	< 5	< 5	< 5	< 25	< 50
2-Butanone	NE	< 50	< 50	< 50	< 250	< 500
2-Hexanone	50	< 50 J	< 50	< 50	< 250	< 500
4-methyl-2-pentanone	50	< 50 J	< 50	< 50	< 250	< 500
Acetone	NE	< 50	< 50	< 50 B	< 50	< 250 B
Benzene	1	< 0.7	< 0.7	< 0.7	< 3.5	< 7
Bromodichloromethane	50	< 5	< 5	< 5	< 25	< 50
Bromoform	50	< 5	< 5	< 5	< 25	< 50
Bromomethane	5	< 5	R	< 5	< 25	< 50
Carbon Disulfide	60	< 5	< 5	< 5	< 25	< 50
Carbon tetrachloride	5	< 5	< 5	< 5	< 25	< 50
Chlorobenzene	5	< 5	< 5	< 5	< 25	< 50
Chlorodifluoromethane (Freon 22)	NE	2.6 J	1.5 J	< 5	< 25	< 50
Chloroethane	5	< 5	< 5	< 5	< 25	< 50
Chloroform	7	< 5	< 5	2.3 J	2.3 J	< 25
Chloromethane	5	< 5	R	< 5	R	< 25
cis-1,2-dichloroethene	5	< 5	< 5	38	5.7	970 D
cis-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 5	< 25
Dibromochloromethane	50	< 5	< 5	< 5	< 25	< 50
Dichlorodifluoromethane (Freon 12)	5	< 5	< 5	< 5	< 25	< 50
Ethylbenzene	5	< 5	< 5	< 5	< 25	< 50
Methylene Chloride	5	< 5	< 5	< 5	< 25	< 50
Styrene	5	< 5	< 5	< 5	< 25	< 50
Tetrachloroethene	5	< 5	< 5	0.54 J	< 25	< 50
Toluene	5	< 5	< 5	< 5	< 25	< 50
trans-1,2-dichloroethene	5	< 5	< 5	0.3 J	< 25	2.7 J
trans-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 25	< 50
Trichloroethylene	5	< 5	< 5	34	12	160
Trichlorotrifluoroethane (Freon 113)	5	< 5	< 5	< 5	< 25	< 50
Vinyl Chloride	2	< 2	< 2	< 2	< 10	38
Xylene-o	5	< 5	< 5	< 5	< 25	< 50
Xylenes - m,p	5	< 5	< 5	< 5	< 25	< 50
Total VOCs <sup>(3)</sup>		2.6	1.5	75.9	20	1,156.1
						1,591.9

See notes on last page.

Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: MW-202-1		MW-202-1	MW-203-1	MW-203-1
	Sample Date: 5/1/2009	12/2/2009	5/1/2009	12/2/2009	
	NYSDEC SCGs				
1,1,1-Trichloroethane	5	< 5	< 5	< 5	< 5
1,1,2,2-Tetrachloroethane	5	< 5	< 5	< 5	< 5
1,1,2-Trichloroethane	1	< 5	< 5	< 5	< 5
1,1-Dichloroethane	5	< 5	< 5	< 5	< 5
1,1-Dichloroethene	5	< 5	< 5	< 5	< 5
1,2-Dichloroethane	0.6	< 5	< 5	< 5	< 5
1,2-Dichloropropane	1	< 5	< 5	< 5	< 5
2-Butanone	NE	< 50	< 50	< 50	< 50
2-Hexanone	50	< 50	< 50	< 50	< 50
4-methyl-2-pentanone	50	< 50	< 50	< 50	< 50
Acetone	NE	< 50	< 50	< 50 B	< 50
Benzene	1	< 0.7	< 0.7	< 0.7	< 0.7
Bromodichloromethane	50	< 5	< 5	< 5	< 5
Bromoform	50	< 5	< 5	< 5	< 5
Bromomethane	5	< 5	< 5	< 5	< 5
Carbon Disulfide	60	< 5	< 5	< 5	< 5
Carbon tetrachloride	5	< 5	< 5	< 5	< 5
Chlorobenzene	5	< 5	< 5	< 5	< 5
Chlorodifluoromethane (Freon 22)	NE	< 5	< 5	73	17
Chloroethane	5	< 5	< 5	< 5	< 5
Chloroform	7	6.2	6.7	7.9	2.6 J
Chloromethane	5	< 5	< 5	< 5	< 5
cis-1,2-dichloroethene	5	0.64 J	0.58 J	1.6 J	0.83 J
cis-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 5
Dibromochloromethane	50	< 5	< 5	< 5	< 5
Dichlorodifluoromethane (Freon 12)	5	< 5	< 5	< 5	< 5
Ethylbenzene	5	< 5	< 5	< 5	< 5
Methylene Chloride	5	< 5	< 5	< 5	< 5
Styrene	5	< 5	< 5	< 5	< 5
Tetrachloroethene	5	< 5	< 5	< 5	< 5
Toluene	5	< 5	< 5	< 5	< 5
trans-1,2-dichloroethene	5	< 5	< 5	< 5	< 5
trans-1,3-dichloropropene	0.4	< 5	< 5	< 5	< 5
Trichloroethylene	5	7.5	9.3	1.3 J	0.7 J
Trichlorotrifluoroethane (Freon 113)	5	< 5	< 5	< 5	< 5
Vinyl Chloride	2	< 2	< 2	< 2	< 2
Xylene-o	5	< 5	< 5	< 5	< 5
Xylenes - m,p	5	< 5	< 5	< 5	< 5
Total VOCs <sup>(3)</sup>		14.3	16.6	83.8	21.1

See notes on last page.


Table 10. Concentrations of Volatile Organic Compounds in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

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**Notes:**

- (1) Results validated following protocols specified in March 2006 RI/FS Work Plan (ARCADIS G&M, Inc. 2006).
- (2) Samples analyzed for the TCL VOCs using NYSDEC ASP Method 2000 OLM4.2.
- (3) "Total VOCs" represents the sum of individual concentrations of all compounds detected.

**Acronyms\Key:**

 Indicates an exceedance of an SCG.

**Bold value indicates a detection.**

RI/FS	Remedial Investigation/Feasibility Study.
NYSDEC	New York State Department of Environmental Conservation.
TCL	Target compound list.
VOC	Volatile Organic Compound.
ASP	Analytical services protocol.
SCGs	Standards, criteria, and guidance values.
ug/L	Micrograms per liter.
NE	Not established.
J	Value is estimated.
D	Constituent identified from secondary dilution.
R	Concentration for the constituent was rejected.
B	Compound detected in associated blank sample.
> 5	Compound not detected above its laboratory quantification limit.



Table 11. Concentrations of Metals in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: B24MW-2		B24MW-3	BCPMW-1	BCPMW-2	BCPMW-3	BCPMW-4-1	BCPMW-4-2	BCPMW-4-3	BCPMW-5-1	BCPMW-6-1	BCPMW-6-2
	Sample Date: 4/23/2009		4/20/2009	4/28/2009	4/28/2009	4/29/2009	4/17/2009	4/17/2009	4/17/2009	4/23/2009	4/20/2009	5/8/2009
	NYSDEC SCGs											
Cadmium (total)	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Cadmium (dissolved)	5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
Chromium (total)	50	<b>40.3</b>	<b>28.2</b>	<b>20.8</b>	< 10	< 10	<b>22.7</b>	<b>10.6</b>	< 10	< 10	< 10	<b>10.3</b>
Chromium (dissolved)	50	< 10	<b>10.6</b>	< 10	< 10	< 10	<b>12.8</b>	< 10	< 10	< 10	< 10	< 10
Iron (total)	300	--	<b>597</b>	--	< 100	<b>2,080</b>	<b>103</b>	<b>4,630</b>	< 100	<b>7,420</b>	< 100	--
Iron (dissolved)	300	--	< 100	--	< 100	<b>1,760</b>	< 100	<b>4,080</b>	< 100	<b>6,370</b>	< 100	--
Manganese (total)	300	--	<b>16.9</b>	--	<b>12.7</b>	<b>51.4</b>	<b>11.2</b>	<b>228</b>	< 10	<b>145</b>	< 10	--
Manganese (dissolved)	300	--	<b>13.7</b>	--	<b>11.3</b>	<b>49.2</b>	< 10	<b>217</b>	< 10	<b>131</b>	< 10	--

See notes on last page.


Table 11. Concentrations of Metals in Groundwater Samples Collected from Monitoring Wells, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2)</sup>

COMPOUND (ug/L)	Sample Location: BCPMW-7-1 MW-200-1 MW-201-1 MW-202-1 MW-203-1					
	Sample Date: 4/20/2009 4/29/2009 5/1/2009 5/1/2009 5/1/2009					
	NYSDEC SCGs					
Cadmium (total)	5	< 5	< 5	< 5	< 5	< 5
Cadmium (dissolved)	5	< 5	< 5	< 5	< 5	< 5
Chromium (total)	50	< 10	< 10	< 10	<b>16.5</b>	<b>31.5</b>
Chromium (dissolved)	50	< 10	< 10	< 10	< 10	< 10
Iron (total)	300	< 100	--	--	--	--
Iron (dissolved)	300	< 100	--	--	--	--
Manganese (total)	300	<b>106</b>	--	--	--	--
Manganese (dissolved)	300	<b>94.8</b>	--	--	--	--

**Notes:**

- (1) Results validated following protocols specified in March 2006 RI/FS Work Plan (ARCADIS G&M, Inc. 2006).  
(2) Samples analyzed for the metals using NYSDEC ASP Method 2000 ILM4.0.

**Acronyms/Key:**

 Indicates an exceedance of an SCG.

**Bold value indicates a detection.**

RI/FS Remedial Investigation/Feasibility Study.

NYSDEC New York State Department of Environmental Conservation.

ASP Analytical services protocol.

SCGs Standards, criteria, and guidance values.

ug/L Micrograms per liter.

-- Not analyzed.

> 5U Compound not detected above its laboratory quantification limit.

> 5 Compound not detected above its laboratory quantification limit.



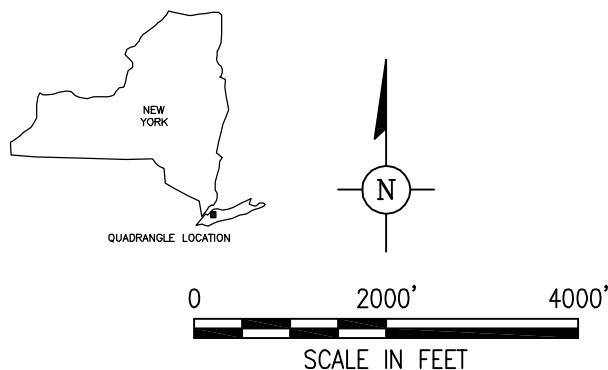


GROUNDWATER INTERIM REMEDIAL MEASURE  
OPERABLE UNIT 3  
(FORMER GRUMMAN SETTLING PONDS)  
NORTHROP GRUMMAN SYSTEMS CORPORATION  
BETHPAGE, NEW YORK

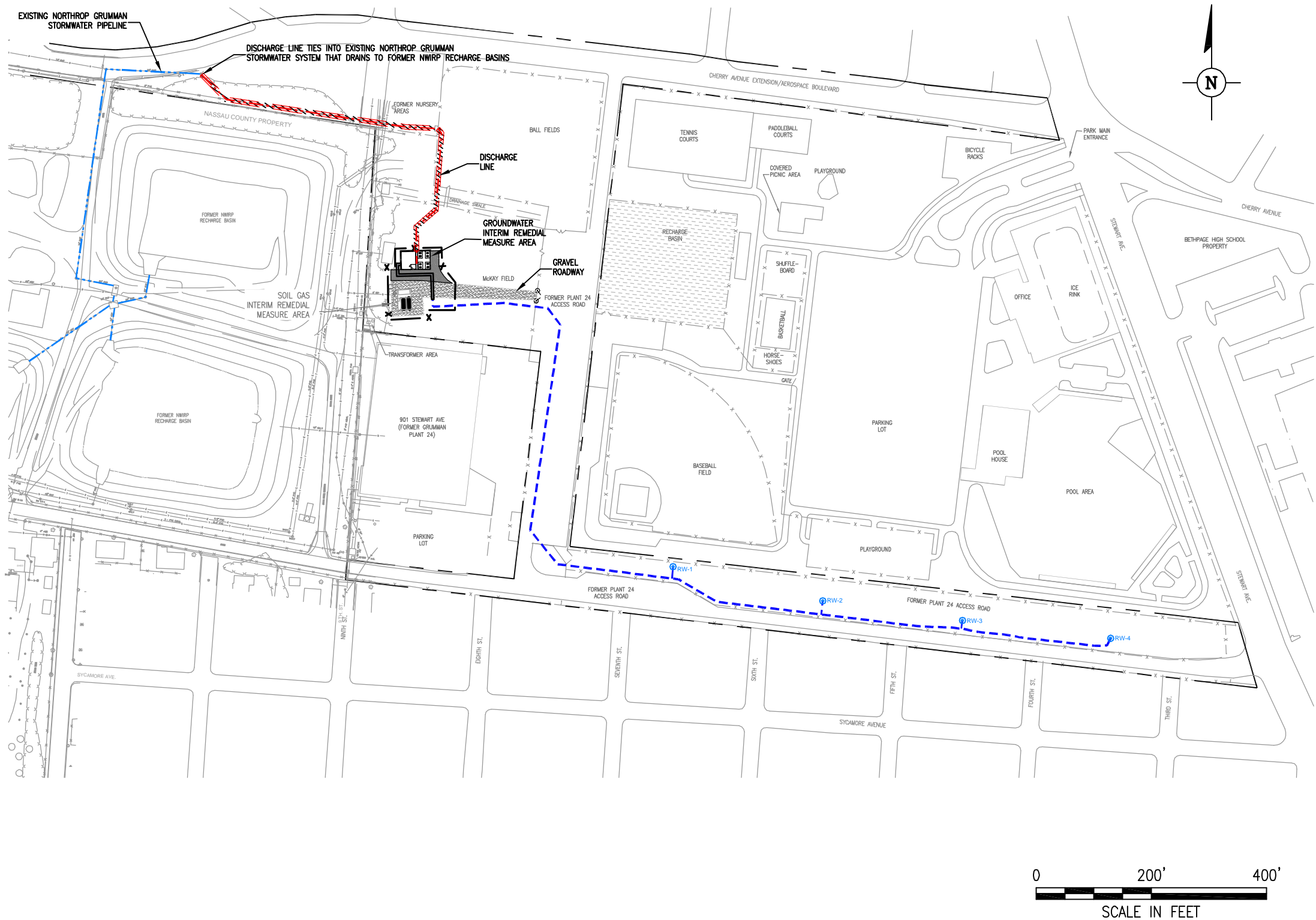
## SITE LOCATION MAP



FIGURE  
1



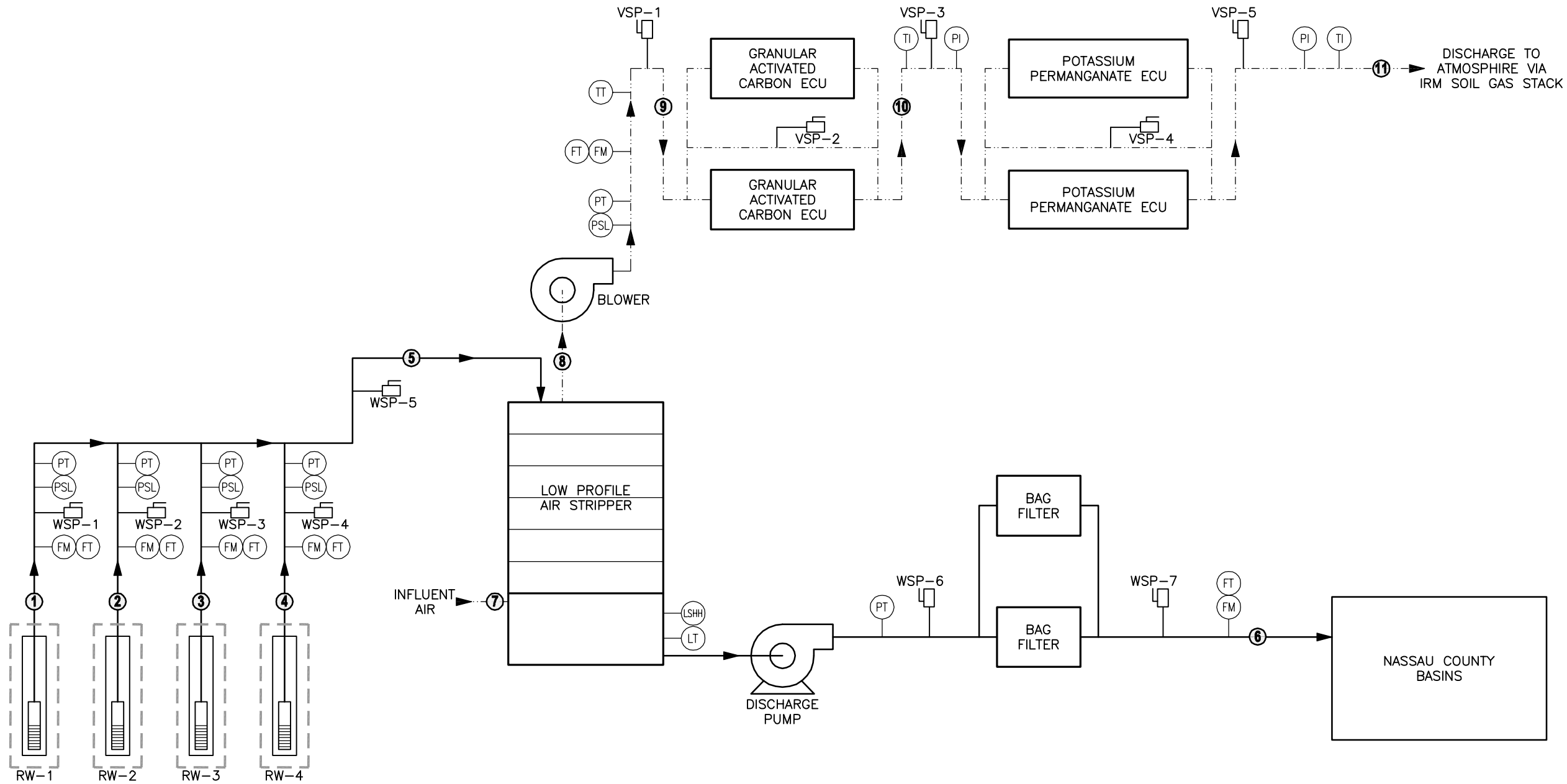




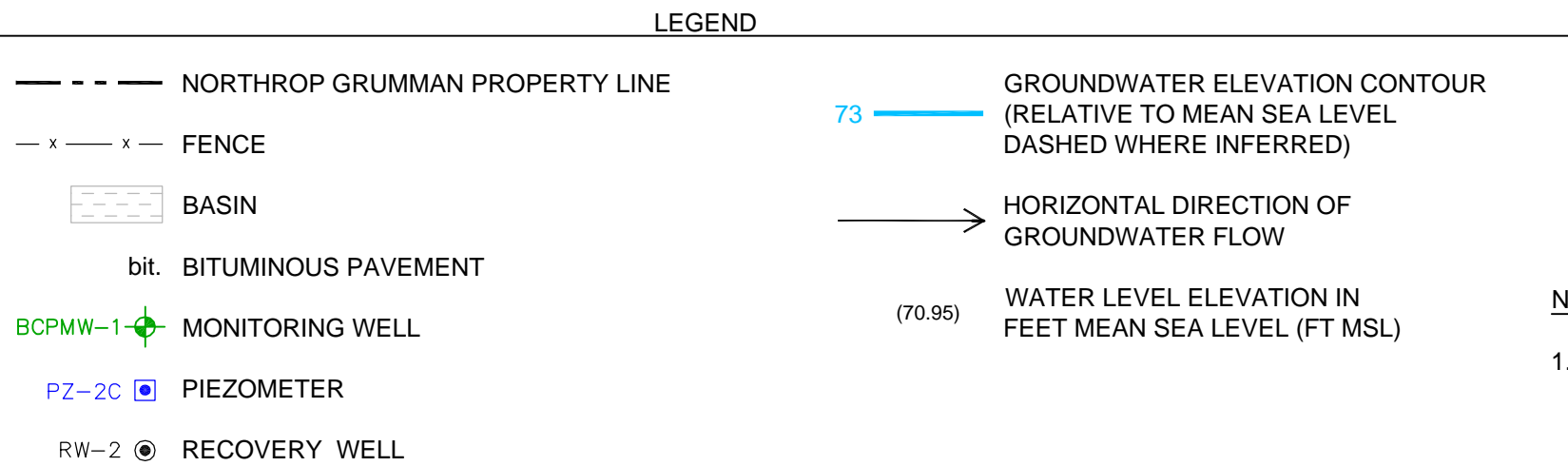
GROUNDWATER INTERIM REMEDIAL MEASURE  
OPERABLE UNIT 3  
(FORMER GRUMMAN SETTLING PONDS)  
NORTHROP GRUMMAN SYSTEMS CORPORATION  
BETHPAGE, NEW YORK

**SITE AND GROUNDWATER INTERIM  
REMEDIAL MEASURE LAYOUT**



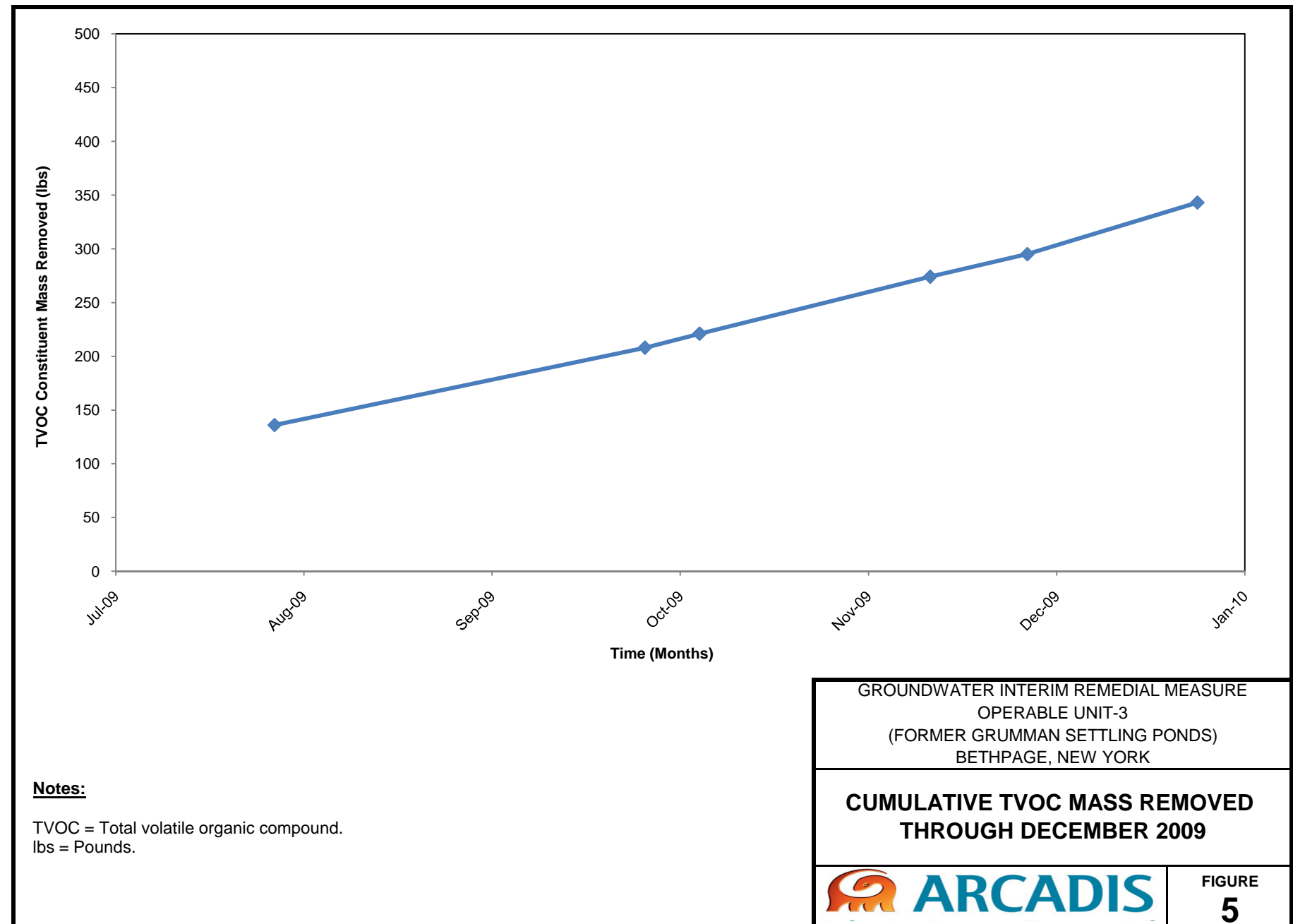


PROCESS	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
Mass Loading (lbs/day)											
Trichloroethene	0.009	0.041	0.082	0.008	0.140	<0.008	0.000	0.140	0.140	<0.014	<0.014
cis -1,2 Dichloroethene	0.007	1.877	0.431	0.030	2.346	<0.008	0.000	2.346	2.346	<0.235	<0.235
Vinyl Chloride	0.000	0.443	0.001	0.000	0.444	<0.003	0.000	0.444	0.444	0.444	<0.044
Flow Rate (gpm)	40	85	85	40	250	250	---	---	---	---	---
Flow Rate (CFM)	---	---	---	---	---	---	1,300 - 1,600	1,300	1,535	1,557	1,581
Pressure (feet of water)	10	10	10	10	8	15	---	---	---	---	---
Pressure (inches of water)	---	---	---	---	---	---	0	- 28 to - 38	12	6	0
pH	6.4	6.4	6.4	6.4	6.4	6.2	---	---	---	---	---
Temperature	55	55	55	55	55	55	10	55	97	95	95
Relative Humidity	---	---	---	---	---	---	20 - 80	100	<50	<50	<50

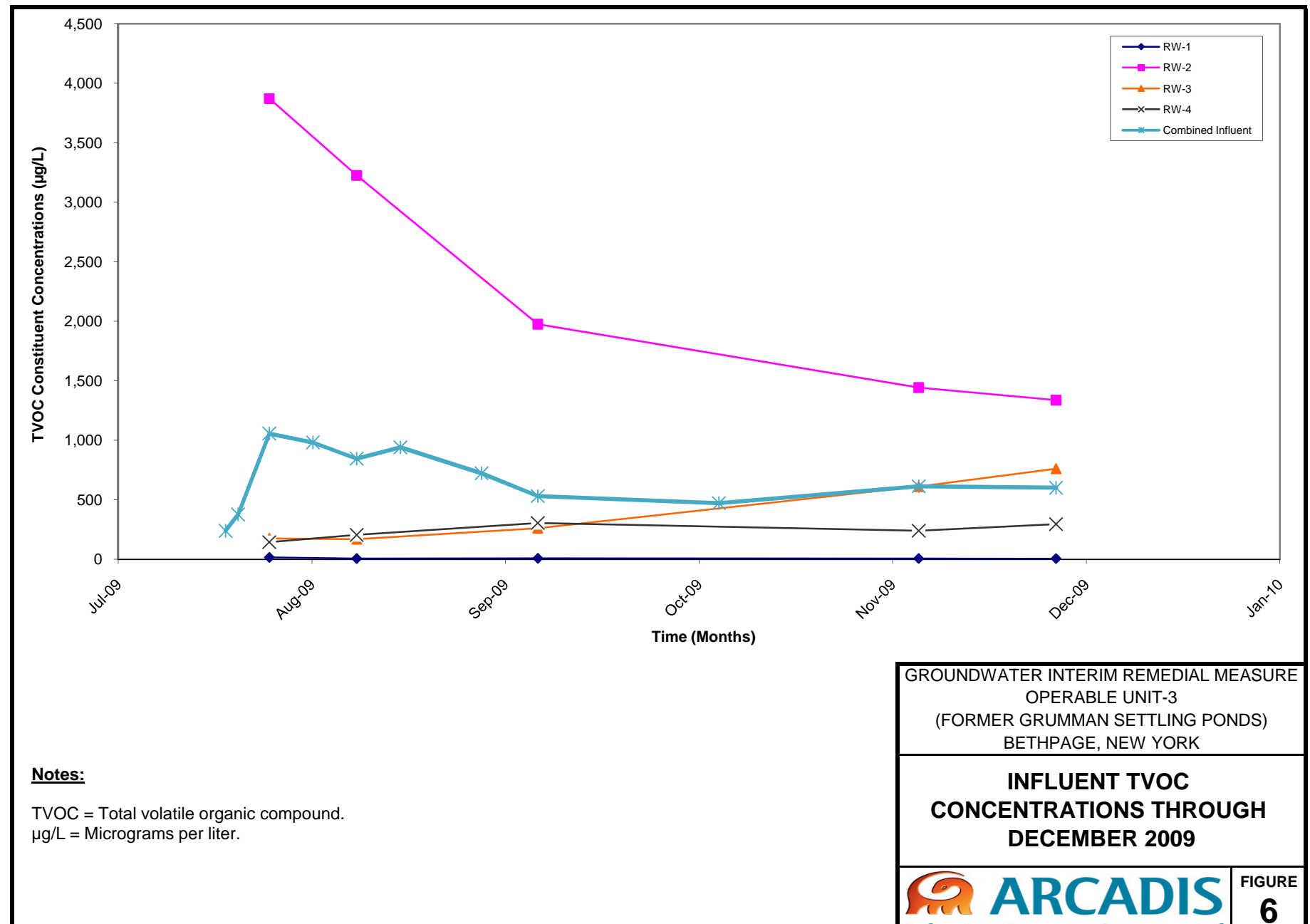


1. MONITORING WELLS, RECOVERY WELLS, AND PIEZOMETERS SURVEYED TO NORTH AMERICAN DATUM (NAD) 83.
2. PARK FEATURES SHOWN WERE PRESENT PRIOR TO TOWN OF OYSTER BAY REDEVELOPMENT IN 2006.

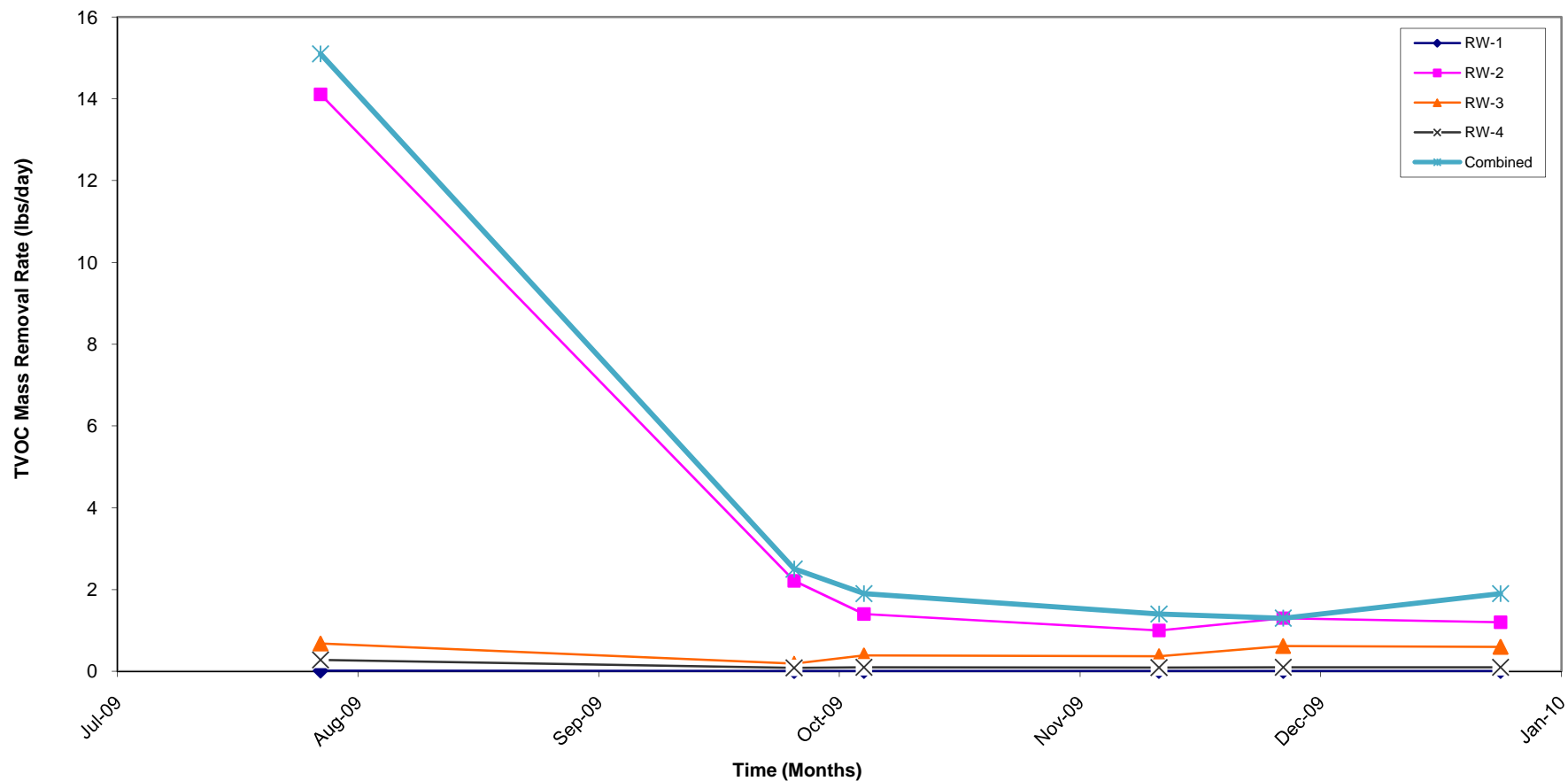
FIGURE  
4









**Notes:**

TVOC = Total volatile organic compound.  
 lbs/day = Pounds per day.

GROUNDWATER INTERIM REMEDIAL MEASURE  
 OPERABLE UNIT-3  
 (FORMER GRUMMAN SETTLING PONDS)  
 BETHPAGE, NEW YORK

**TVOC MASS REMOVAL RATES  
 THROUGH DECEMBER 2009**



FIGURE  
**7**

ARCADIS

## **Appendix A**

Well Construction Information and  
Environmental Effectiveness  
Monitoring Program.

Table A-1. Well Construction Information and Environmental Effectiveness Monitoring Program, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York. <sup>(1,2)</sup>

Well ID	Well Diameter (inches)	Depth to Screen		Screen Length (ft)	Well Depth (ft)	Well Materials	Water Levels <sup>(3)</sup>	MONITORING ACTIVITY		
		Top (ft bls)	Bottom (ft bls)					WATER QUALITY <sup>(4)</sup>		
								VOC	Cd/Cr/Hg	Fe/Mn
<b>Monitoring Wells</b>										
BCPMW-1	2	50	65	15	65	Sch. 40 PVC	Quarterly	Baseline	Baseline	--
BCPMW-2	2	60	75	15	75	Sch. 40 PVC	Quarterly	Baseline	Baseline	Baseline
BCPMW-3	2	59	74	15	74	Sch. 40 PVC	Quarterly	Baseline	Baseline	Baseline
BCPMW-4-1	4	45	65	20	70	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	Baseline
BCPMW-4-2	4	68.5	83.5	15	88.5	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	Baseline
BCPMW-4-3	4	115	125	10	130	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	Baseline
BCPMW-5-1	4	50	65	15	70	Sch. 80 PVC/ SS	Quarterly	Baseline	Baseline	Baseline
BCPMW-6-1	4	88.5	98.5	10	103.5	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
BCPMW-6-2	4	133	143	10	148	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
BCPMW-7-1	4	90	100	10	105	Sch. 40 PVC	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
B24MW-2	2	54	74	20	74	PVC	Quarterly	Baseline/Annual	Baseline	--
B24MW-3	2	55	70	15	70	PVC	Quarterly	Baseline/Annual	Baseline	--
B30MW-1	2	57	72	15	72	PVC	Quarterly	Baseline/Annual	Baseline	--
MW-200-1	4	85	95	10	100	Sch. 40 PVC/ SS	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
MW-201-1	4	70	80	10	85	Sch. 40 PVC/ SS	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
MW-202-1	4	125	135	10	140	Sch. 40 PVC/ SS	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
MW-203-1	4	103	113	10	118	Sch. 40 PVC/ SS	Quarterly	Baseline/Semiannual <sup>(5)</sup>	Baseline/Annual	--
<b>Remedial Wells <sup>(6)</sup></b>										
RW-01	8	108	128	20	134	Sch. 80 PVC/SS	Quarterly	Baseline/Quarterly	Baseline/Quarterly	--
RW-02	6	84	104	20	104	Steel/SS	Quarterly	Baseline/Quarterly	Baseline/Quarterly	--
RW-03	8	84	104	20	107	Sch. 80 PVC/SS	Quarterly	Baseline/Quarterly	Baseline/Quarterly	--
RW-04	8	110	130	20	133	Sch. 80 PVC/SS	Quarterly	Baseline/Quarterly	Baseline/Quarterly	--

See notes on last page.

Table A-1. Well Construction Information and Environmental Effectiveness Monitoring Program, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York. <sup>(1,2)</sup>

Well ID	Well Diameter (inches)	Depth to Screen		Screen Length (ft)	Well Depth (ft)	Well Materials	Water Levels <sup>(3)</sup>	<b>MONITORING ACTIVITY</b>		
		Top (ft bls)	Bottom (ft bls)					<b>WATER QUALITY <sup>(4)</sup></b>		
								VOC	Cd/Cr/Hg	Fe/Mn
<b>Piezometers</b>										
PZ-01a	2	60	65	5	68	Sch. 40 PVC	Quarterly	--	--	--
PZ-01b	1	80	85	5	88	Sch. 40 PVC	Quarterly	--	--	--
PZ-01c	1	130	135	5	138	Sch. 40 PVC	Quarterly	--	--	--
PZ-02a	2	60	65	5	68	Sch. 40 PVC	Quarterly	--	--	--
PZ-02b	1	80	85	5	85	Sch. 40 PVC	Quarterly	--	--	--
PZ-02c	1	130	135	5	138	Sch. 40 PVC	Quarterly	--	--	--
PZ-03	1	80	85	5	88	Sch. 40 PVC	Quarterly	--	--	--
PZ-04	1	80	85	5	88	Sch. 40 PVC	Quarterly	--	--	--
PZ-05a	2	65	70	5	74	Sch. 40 PVC	Quarterly	--	--	--
PZ-05b	1	110	115	5	117	Sch. 40 PVC	Quarterly	--	--	--
PZ-06a	2	65	70	5	72	Sch. 40 PVC	Quarterly	--	--	--
PZ-06b	1	90	95	5	97	Sch. 40 PVC	Quarterly	--	--	--
PZ-07a	2	65	70	5	72	Sch. 40 PVC	Quarterly	--	--	--
PZ-07b	1	113	118	5	120	Sch. 40 PVC	Quarterly	--	--	--

**Notes:**

- (1) Water samples will be collected and analyzed in accordance with the method and procedures described in this Sampling and Analysis Plan (SAP).
- (2) Approximate locations of the wells and piezometers in the OU-3 Groundwater Interim Remedial Measure Monitoring Program are shown in Figure 1.
- (3) Water levels will be measured in all wells/piezometers during the baseline monitoring event. Water levels will be measured in accordance with the procedures presented in this SAP.
- (4) VOC: VOCs, per Table D-3 in the Quality Assurance Project Plan (QAPP), using NYSDEC ASP 2000 Method OLM 4.3.  
Cd/Cr/Hg: Cadmium and Chromium using USEPA Method 6010 and Mercury using USEPA Method 7472: Mercury will only be analyzed for samples collected during the baseline monitoring.  
Fe/Mn: Iron and Manganese using USEPA Method 6010, both total and dissolved.
- (5) Semiannual wells will be monitored annually after Year 1.
- (6) Some of the analyses listed here are also covered in the Remedial System Sampling Program.

**Acronyms\Key:**

Sch. 80 PVC	Schedule 80 polyvinyl chloride.
Sch. 40 PVC	schedule 40 polyvinyl chloride.
SS	Stainless steel.
Steel	Low carbon steel.
ft	Feet.
ft ms	Feet relative to mean sea level.
ft bls	Feet below land surface.
--	Not applicable.
VOC	Volatile organic compound.

**Appendix B**

Compliance and Performance  
Program Elements, Water  
Sample Analytical Results, and  
Summary of pH Data

Table B-1. Compliance and Performance Program Elements, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York.

Sample Location/Instrument <sup>(1)</sup>	Parameter (Method) <sup>(2)</sup>	Frequency			SCADA Data Acquisition
		Short-Term <sup>(3)</sup> (first month)	(five month period following first month)	Long-Term <sup>(4)</sup>	
<b><u>Water Samples</u> <sup>(5)</sup></b>					
Remedial Well 1 (WSP-1)	VOCs (NYSDEC 2000 OLM 4.3)	Bi-Weekly	Quarterly	Quarterly	NA
	Iron (USEPA 6010)	Bi-Weekly	Annually	Annually	NA
Remedial Well 2 (WSP-2)	VOCs (NYSDEC 2000 OLM 4.3)	Bi-Weekly	Quarterly	Quarterly	NA
	Iron (USEPA 6010)	Bi-Weekly	Annually	Annually	NA
Remedial Well 3 (WSP-3)	VOCs (NYSDEC 2000 OLM 4.3)	Bi-Weekly	Quarterly	Quarterly	NA
	Iron (USEPA 6010)	Bi-Weekly	Annually	Annually	NA
Remedial Well 4 (WSP-4)	VOCs (NYSDEC 2000 OLM 4.3)	Bi-Weekly	Quarterly	Quarterly	NA
	Iron (USEPA 6010)	Bi-Weekly	Annually	Annually	NA
Air Stripper Influent (WSP-5)	VOCs (NYSDEC 2000 OLM 4.3)	1-hr <sup>(6)</sup> ; Days 1, 3, & Weekly	Monthly	Quarterly	NA
	Iron (USEPA 6010)	1-hr <sup>(6)</sup> ; Days 1, 3, & Weekly	Monthly	Quarterly	NA
Air Stripper Effluent (WSP-6)	Iron (USEPA 6010)	1-hr <sup>(6)</sup> ; As Needed	As Needed	As Needed	NA
<b>Plant Effluent (WSP-7)</b>	<b>VOCs (NYSDEC 2000 OLM 4.3)</b>	<b>1-hr <sup>(6)</sup>; Days 1, 3, &amp; Weekly</b>	<b>Monthly</b>	<b>Monthly</b>	NA
	<b>Iron (USEPA 6010)</b>	<b>1-hr <sup>(6)</sup>; Days 1, 3, &amp; Weekly</b>	<b>Monthly</b>	<b>Monthly</b>	NA
	<b>ph (field)</b>	<b>1-hr <sup>(6)</sup>; Days 1, 3, &amp; Weekly</b>	<b>Monthly</b>	<b>Monthly</b>	NA
<b><u>Air Samples</u> <sup>(7) (8)</sup></b>					
Air Stripper Effluent/ECU-1 Influent (VSP-1)	VOCs (TO-15 Modified)	Monthly	Monthly	Quarterly	NA
ECU-1 Effluent/ECU-2 Influent (VSP-2)	VOCs (TO-15 Modified)	As Needed	As Needed	As Needed	NA
ECU-2 Effluent/ECU-3 Influent (VSP-3)	VOCs (TO-15 Modified)	As Needed	As Needed	As Needed	NA
ECU-3 Effluent/ECU-4 Influent (VSP-4)	VOCs (TO-15 Modified)	As Needed	As Needed	As Needed	NA
<b>Total Effluent (VSP-5)</b>	<b>VOCs (TO-15 Modified)</b>	<b>Monthly</b>	<b>Monthly</b>	<b>Quarterly</b>	NA

See notes on last page.

Table B-1. Compliance and Performance Program Elements, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York.

Sample Location/Instrument <sup>(1)</sup>	Parameter (Method) <sup>(2)</sup>	Frequency			
		Short-Term <sup>(3)</sup> (first month)	(five month period following first month)	Long-Term <sup>(4)</sup>	SCADA Data Acquisition
<b><u>Water Flow Measurements</u></b>					
Remedial Well RW-1 (FT - 110)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-2 (FT - 120)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-3 (FT - 130)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-4 (FT - 140)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Combined Influent (FR - 200)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
System Effluent (FT-700)	Flow rate (gpm + total gal.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
<b><u>Air Flow Measurements</u></b>					
Air Stripper Effluent (FT-500)	Flow rate (SCFM)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
<b><u>Water Pressure Measurements</u></b>					
Remedial Well RW-1 (PT - 110)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-2 (PT - 120)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-3 (PT - 130)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Remedial Well RW-4 (PT - 140)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
Air Stripper Effluent (PT-700)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Weekly	Weekly	Continuously
<b><u>Air Temperature &amp; Relatively Humidity Measurements</u></b>					
Air Stripper Effluent (TT-500)	Temperature	Weekly	Weekly	Weekly	Continuously
ECU Mid-Train (TI-503)	Temperature	Weekly	Weekly	Weekly	NA
Effluent (TI-603)	Temperature	Weekly	Weekly	Weekly	NA

See notes on last page.

Table B-1. Compliance and Performance Program Elements, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York.

Sample Location/Instrument <sup>(1)</sup>	Parameter (Method) <sup>(2)</sup>	Frequency			
		Short-Term <sup>(3)</sup>		Long-Term <sup>(4)</sup>	SCADA
		(first month)	(five month period following first month)		Data Acquisition
<b><u>Air Pressure Measurements</u></b>					
Air Stripper Effluent (PT-500)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	Continuously
ECU #1 Influent (PI-501)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	NA
ECU #2 Influent (PI-502)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	NA
ECU #3 Influent (PI-601)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	NA
ECU #4 Influent (PI-602)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	NA
System Effluent (PI-603)	Pressure (i.w.g.)	(Daily -1st week) Weekly	Monthly	Quarterly	NA

See notes on last page.



Table B-1. Compliance and Performance Program Elements, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Northrop Grumman Systems Corporation, Bethpage, New York.

**Notes:**

- (1) Refer to Figure 3 of this Operation, Maintenance, & Monitoring (OM&M) Report and Appendix E of the Groundwater IRM OM&M Manual (OM&M Manual (ARCADIS 2009c)) for a diagram showing referenced sample locations and measurement points.
- (2) Parameters/methods may be modified based on review of short-term and/or long-term testing results. Parameters shown in **Bold** indicate parameters that require NYSDEC notification/approval prior to change in monitoring schedule.
- (3) Short-term schedule is tentative. Modification may be required/recommended based on the results of start-up and performance testing. In addition, per the Interim treated effluent (water) discharge criteria, per NYSDEC letter dated March 19, 2009 (NYSDEC 2009a), select samples are being analyzed for Mercury (Hg), this analyte is not expected to be a long-term analyte.
- (4) Long-term schedule is tentative. Modification may be required/recommended based on the results of short-term testing or water quality trends.
- (5) Water samples will be collected in accordance with the methods described in the Sampling and Analysis Plan, which is included as Appendix A of the OM&M Manual (ARCADIS 2009c). Samples will be analyzed in accordance with the methods and procedures described in the Sampling and Analysis Plan.
- (6) Per NYSDEC request, a 1-hr pilot test was performed during system shake-down. 1-hr pilot test samples were also analyzed for mercury.
- (7) Air samples collected and analyzed in accordance with methods described in the Sampling and Analysis Plan, which is included as Appendix A of the OM&M Manual (ARCADIS 2009c).
- (8) Additional air samples will be collected to help calculate media usage rates and to help determine media changeout frequencies.

**Acronyms\Key:**

NA	Not applicable.
ECU	Emissions control unit.
VOCs	Volatile organic compounds (refer Tables D-3 and D-5 in the Quality Assurance Project Plan (QAPP) (Appendix D of the OM&M Manual (ARCADIS 2009c)) for the analyte lists for aqueous and air samples, respectively).
gal.	Gallons.
gpm	Gallons per minute.
i.w.g.	Inches water gauge.
NYSDEC	New York State Department of Environmental Conservation.
EPA	U.S. Environmental Protection Agency.
SCADA	Supervisory Control And Data Acquisition.
OM&M	Operation, maintenance and monitoring.

Table B-2. Water Sample Analytical Results - October 9, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID Sample Location Sample Date	WSP-02 RW-2 10/9/2009	WSP-05 Influent 10/9/2009	WSP-06 AS Effluent 10/9/2009	WSP-07 Effluent 10/9/2009
<b><u>Volatile Organic Chemicals</u></b>					
1,1,1-Trichloroethane		--	< 13 U	--	< 5 U
1,1,2,2-Tetrachloroethane		--	< 13 U	--	< 5 U
1,1,2-Trichloroethane		--	< 13 U	--	< 5 U
1,1-Dichloroethane		--	<b>1.9 J</b>	--	< 5 U
1,1-Dichloroethene		--	< 13 U	--	< 5 U
1,2-Dichloroethane		--	< 13 U	--	< 5 U
1,2-Dichloropropane		--	< 13 U	--	< 5 U
2-Butanone		--	< 130 U	--	< 50 U
2-Hexanone		--	< 130 U	--	< 50 U
4-methyl-2-pentanone		--	< 130 U	--	< 50 U
Acetone		--	<b>17 J</b>	--	<b>1.9 J</b>
Benzene		--	< 1.8 U	--	< 0.7 U
Bromodichloromethane		--	< 13 U	--	< 5 U
Bromoform		--	< 13 U	--	< 5 U
Bromomethane		--	< 13 U	--	< 5 U
Carbon Disulfide		--	< 13 U	--	< 5 U
Carbon tetrachloride		--	< 13 U	--	< 5 U
Chlorobenzene		--	< 13 U	--	< 5 U
Chlorodifluoromethane (Freon 22)		--	<b>100</b>	--	< 5 U
Chloroethane		--	< 13 U	--	< 5 U
Chloroform		--	<b>3.1 J</b>	--	< 5 U
Chloromethane		--	< 13 U	--	< 5 U
cis-1,2-dichloroethene		--	<b>250</b>	--	< 5 U
cis-1,3-dichloropropene		--	< 13 U	--	< 5 U
Dibromochloromethane		--	< 13 U	--	< 5 U
Dichlorodifluoromethane (Freon 12)		--	< 13 U	--	< 5 U
Ethylbenzene		--	<b>0.88 J</b>	--	< 5 U
Methylene Chloride		--	< 13 U	--	< 5 U
Styrene		--	< 13 U	--	< 5 U
Tetrachloroethene		--	< 13 U	--	< 5 U
Toluene		--	<b>28</b>	--	< 5 U
trans-1,2-dichloroethene		--	<b>17</b>	--	< 5 U
trans-1,3-dichloropropene		--	< 13 U	--	< 5 U
Trichloroethylene		--	<b>22</b>	--	< 5 U
Trichlorotrifluoroethane (Freon 113)		--	< 13 U	--	< 5 U
Vinyl Chloride		--	<b>52</b>	--	< 2 U
Xylene-o		--	< 13 U	--	< 5 U
Xylenes - m,p		--	<b>0.8 J</b>	--	< 5 U
<b>Subtotal VOCs <sup>(4)</sup></b>		0	<b>493</b>	0	<b>1.9</b>
<b>Tentatively Identified Compounds</b>		ND	ND	ND	ND
<b>Subtotal TICs <sup>(5)</sup></b>		0	0	0	0
<b>Total VOCs <sup>(6)</sup></b>		0	<b>493</b>	0	<b>1.9</b>

See notes on last page.

Table B-2. Water Sample Analytical Results - October 9, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID Sample Location Sample Date	WSP-02 RW-2 10/9/2009	WSP-05 Influent 10/9/2009	WSP-06 AS Effluent 10/9/2009	WSP-07 Effluent 10/9/2009
<b>Metals</b>					
Cadmium (Dissolved)		--	--	< 5 U	< 5 U
Cadmium (Total)		--	--	< 5 U	< 5 U
Chromium (Dissolved)		--	--	< 10 U	< 10 U
Chromium (Total)		--	--	< 10 U	< 10 U
Iron (Dissolved)		--	--	<b>650</b>	<b>540</b>
Iron (Total)		<b>3,800</b>	<b>1,680</b>	<b>800</b>	<b>1,120</b>
Manganese (Total)		--	--	<b>113</b>	<b>114</b>
Manganese (Dissolved)		--	--	<b>113</b>	<b>114</b>
Mercury (Total)		--	--	< 0.3 U	< 0.3 U
Mercury (Dissolved)		--	--	< 0.3 U	< 0.3 U

**Notes:**

- (1) Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using NYSDEC ASP 2000 Method OLM 4.3 and metals using USEPA Method 6010, except for mercury, which was analyzed using USEPA Method 7470.
- (2) Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- (3) Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- (4) "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- (5) Sum of tentatively identified compounds (TICs).
- (6) Sum of VOCs and TICs.

**Acronyms/Key:**

**Bold value indicates a detection.**

NYSDEC New York State Department of Environmental Conservation.  
 USEPA United States Environmental Protection Agency.  
 ug/L Micrograms per liter.  
 -- Not sampled.  
 ND Non detect.  
 > 5U Not detected above its laboratory quantification limit.  
 J Estimated value.

Table B-3. Water Sample Analytical Results - November 10 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID: Sample Location: Sample Date:	WSP-01 RW-1 11/10/2009	WSP-02 RW-2 11/10/2009	WSP-03 RW-3 11/10/2009	WSP-04 RW-4 11/10/2009	WSP-05 Influent 11/10/2009	WSP-06 AS Effluent 11/10/2009	WSP-07 Effluent 11/10/2009
<b><u>Volatile Organic Chemicals</u></b>								
1,1,1-Trichloroethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
1,1,2,2-Tetrachloroethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
1,1,2-Trichloroethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
1,1-Dichloroethane		< 5 U	<b>5.2 J</b>	<b>1.4 J</b>	<b>0.52 J</b>	<b>1.9 J</b>	--	< 5 U
1,1-Dichloroethene		< 5 U	<b>2.9 J</b>	<b>0.53 J</b>	< 5 U	<b>0.86 J</b>	--	< 5 U
1,2-Dichloroethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
1,2-Dichloropropane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
2-Butanone		< 50 U	< 250 U	< 50 U	< 50 U	< 100 U	--	<b>1.5 J</b>
2-Hexanone		< 50 U	< 250 U	< 50 U	< 50 U	< 100 U	--	< 50 U
4-methyl-2-pentanone		< 50 U	< 250 U	< 50 U	< 50 U	< 100 U	--	< 50 U
Acetone		<b>1.5 J</b>	< 250 U	<b>3.1 J</b>	<b>3.5 J</b>	<b>4.9 J</b>	--	<b>4.3 J</b>
Benzene		< 0.7 U	< 3.5 U	< 0.7 U	< 0.7 U	< 1.4 U	--	< 0.7 U
Bromodichloromethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Bromoform		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Bromomethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Carbon Disulfide		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Carbon tetrachloride		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Chlorobenzene		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Chlorodifluoromethane (Freon 22)		< 5 U	<b>3.5 J</b>	<b>490 D</b>	<b>230 D</b>	<b>220</b>	--	< 5 U
Chloroethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Chloroform		<b>1.4 J</b>	<b>3 J</b>	<b>5.9</b>	<b>0.95 J</b>	<b>3.1 J</b>	--	< 5 U
Chloromethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
cis-1,2-dichloroethene		<b>1.5 J</b>	<b>930</b>	<b>85</b>	<b>1.9 J</b>	<b>260</b>	--	< 5 U
cis-1,3-dichloropropene		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Dibromochloromethane		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Dichlorodifluoromethane (Freon 12)		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Ethylbenzene		< 5 U	<b>6.4 J</b>	< 5 U	< 5 U	<b>1.7 J</b>	--	< 5 U
Methylene Chloride		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Styrene		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Tetrachloroethene		< 5 U	< 25 U	<b>0.54 J</b>	<b>0.48 J</b>	< 10 U	--	< 5 U
Toluene		< 5 U	<b>200</b>	< 5 U	< 5 U	<b>53</b>	--	< 5 U
trans-1,2-dichloroethene		< 5 U	<b>6.2 J</b>	<b>0.52 J</b>	< 5 U	<b>0.78 J</b>	--	< 5 U
trans-1,3-dichloropropene		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Trichloroethylene		<b>1.8 J</b>	<b>59</b>	<b>24</b>	<b>1.9 J</b>	<b>24</b>	--	< 5 U
Trichlorotrifluoroethane (Freon 113)		< 5 U	< 25 U	< 5 U	< 5 U	< 10 U	--	< 5 U
Vinyl Chloride		< 2 U	<b>210</b>	<b>0.42 J</b>	< 2 U	<b>52</b>	--	< 2 U
Xylene-o		< 5 U	<b>6 J</b>	< 5 U	< 5 U	<b>1.6 J</b>	--	< 5 U
Xylenes - m,p		< 5 U	<b>11 J</b>	< 5 U	< 5 U	<b>3 J</b>	--	< 5 U
<b>Subtotal VOCs <sup>(4)</sup></b>		<b>6.2</b>	<b>1,443</b>	<b>611</b>	<b>239</b>	<b>627</b>	--	<b>5.8</b>
<b>Tentatively Identified Compounds</b>		ND	ND	ND	ND	ND	--	ND
<b>Subtotal TICs <sup>(5)</sup></b>		ND	ND	ND	ND	ND	--	ND
<b>Total VOCs <sup>(6)</sup></b>		<b>6.2</b>	<b>1,443</b>	<b>611</b>	<b>239</b>	<b>627</b>	--	<b>5.8</b>

See notes on last page.

Table B-3. Water Sample Analytical Results - November 10 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID: Sample Location: Sample Date:	WSP-01 RW-1 11/10/2009	WSP-02 RW-2 11/10/2009	WSP-03 RW-3 11/10/2009	WSP-04 RW-4 11/10/2009	WSP-05 Influent 11/10/2009	WSP-06 AS Effluent 11/10/2009	WSP-07 Effluent 11/10/2009
<b>Metals</b>								
Cadmium (Dissolved)		--	--	--	--	--	< 5 U	< 5 U
Cadmium (Total)		--	--	--	--	--	< 5 U	< 5 U
Chromium (Dissolved)		--	--	--	--	--	< 10 U	< 10 U
Chromium (Total)		--	--	--	--	--	< 10 U	< 10 U
Iron (Dissolved)		--	--	--	--	--	<b>420</b>	<b>340</b>
Iron (Total)		< 100 U	<b>2,040</b>	< 100 U	< 100 U	<b>1,240</b>	<b>650</b>	<b>910</b>
Manganese (Total)		--	--	--	--	--	<b>109</b>	<b>108</b>
Manganese (Dissolved)		--	--	--	--	--	<b>112</b>	<b>111</b>
Mercury (Total)		--	--	--	--	--	< 0.3 U	< 0.3 U
Mercury (Dissolved)		--	--	--	--	--	< 0.3 U	< 0.3 U

**Notes:**

- (1) Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using NYSDEC ASP 2000 Method OLM 4.3 and metals using USEPA Method 6010, except for mercury, which was analyzed using USEPA Method 7470.
- (2) Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- (3) Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- (4) "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- (5) Sum of tentatively identified compounds (TICs).
- (6) Sum of VOCs and TICs.

**Acronyms\Key:**

**Bold value indicates a detection.**

NYSDEC	New York State Department of Environmental Conservation.
USEPA	United States Environmental Protection Agency.
ug/L	Micrograms per liter.
--	Not sampled.
ND	Non detect.
> 5U	Not detected above its laboratory quantification limit.
J	Estimated value.
D	Concentration is based on a diluted sample analysis.

Table B-4. Water Sample Analytical Results - December 2, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID: Sample Location: Sample Date:	WSP-01 RW-1 12/2/2009	WSP-02 RW-2 12/2/2009	WSP-03 RW-3 12/2/2009	WSP-04 RW-4 12/2/2009	WSP-05 Influent 12/2/2009	WSP-06 AS Effluent 12/2/2009	WSP-07 Effluent 12/2/2009
<b><u>Volatile Organic Chemicals</u></b>								
1,1,1-Trichloroethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
1,1,2,2-Tetrachloroethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
1,1,2-Trichloroethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
1,1-Dichloroethane		< 5 U	<b>5.3 J</b>	<b>1.3 J</b>	< 10 U	<b>1.7 J</b>	--	< 5 U
1,1-Dichloroethene		< 5 U	<b>3.1 J</b>	< 13 U	< 10 U	<b>0.98 J</b>	--	< 5 U
1,2-Dichloroethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
1,2-Dichloropropane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
2-Butanone		< 50 U	< 250 U	< 130 U	< 100 U	< 100 U	--	<b>18 J</b>
2-Hexanone		< 50 U	< 250 U	< 130 U	< 100 U	< 100 U	--	< 50 U
4-methyl-2-pentanone		< 50 U	< 250 U	< 130 U	< 100 U	< 100 U	--	< 50 U
Acetone		< 50 U	< 250 U	< 130 U	< 100 U	< 100 U	--	< 50 UB
Benzene		< 0.7 U	< 3.5 U	< 1.8 U	< 1.4 U	< 1.4 U	--	< 0.7 U
Bromodichloromethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Bromoform		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Bromomethane		R	R	< 13 U	R	R	--	< 5 U
Carbon Disulfide		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Carbon tetrachloride		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Chlorobenzene		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Chlorodifluoromethane (Freon 22)		< 5 U	<b>3.3 J</b>	<b>660 D</b>	<b>290</b>	<b>210</b>	--	< 5 U
Chloroethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Chloroform		<b>1.3 J</b>	<b>2.3 J</b>	<b>6 J</b>	<b>0.88 J</b>	<b>2.7 J</b>	--	< 5 U
Chloromethane		R	R	R	R	R	--	< 5 U
cis-1,2-dichloroethene		<b>1.7 J</b>	<b>880</b>	<b>72</b>	<b>2.2 J</b>	<b>260</b>	--	<b>0.32 J</b>
cis-1,3-dichloropropene		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Dibromochloromethane		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Dichlorodifluoromethane (Freon 12)		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Ethylbenzene		< 5 U	<b>5.1 J</b>	< 13 U	< 10 U	<b>1.5 J</b>	--	< 5 U
Methylene Chloride		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Styrene		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Tetrachloroethene		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Toluene		< 5 U	<b>150</b>	< 13 U	< 10 U	<b>43</b>	--	< 5 U
trans-1,2-dichloroethene		< 5 U	<b>2.1 J</b>	< 13 U	< 10 U	<b>2.8 J</b>	--	< 5 U
trans-1,3-dichloropropene		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Trichloroethylene		<b>2 J</b>	<b>63</b>	<b>22</b>	<b>1.8 J</b>	<b>25</b>	--	< 5 U
Trichlorotrifluoroethane (Freon 113)		< 5 U	< 25 U	< 13 U	< 10 U	< 10 U	--	< 5 U
Vinyl Chloride		< 2 U	<b>210</b>	< 5 U	< 4 U	<b>58</b>	--	< 2 U
Xylene-o		< 5 U	<b>4.9 J</b>	< 13 U	< 10 U	<b>1.3 J</b>	--	< 5 U
Xylenes - m,p		< 5 U	<b>9 J</b>	< 13 U	< 10 U	<b>2.5 J</b>	--	< 5 U
<b>Subtotal VOCs <sup>(4)</sup></b>		<b>5</b>	<b>1,338</b>	<b>761</b>	<b>295</b>	<b>609</b>	--	<b>18.32</b>
<b>Tentatively Identified Compounds</b>		ND	ND	ND	ND	ND	--	ND
<b>Subtotal TICs <sup>(5)</sup></b>		ND	ND	ND	ND	ND	--	ND
<b>Total VOCs <sup>(6)</sup></b>		<b>5</b>	<b>1,338</b>	<b>761</b>	<b>295</b>	<b>609</b>	--	<b>18.32</b>

See notes on last page.

Table B-4. Water Sample Analytical Results - December 2, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/L)	Sample ID: Sample Location: Sample Date:	WSP-01 RW-1 12/2/2009	WSP-02 RW-2 12/2/2009	WSP-03 RW-3 12/2/2009	WSP-04 RW-4 12/2/2009	WSP-05 Influent 12/2/2009	WSP-06 AS Effluent 12/2/2009	WSP-07 Effluent 12/2/2009
<b>Metals</b>								
Cadmium (Dissolved)		--	--	--	--	--	< 5 U	< 5 U
Cadmium (Total)		--	--	--	--	--	< 5 U	< 5 U
Chromium (Dissolved)		--	--	--	--	--	< 10 U	< 10 U
Chromium (Total)		--	--	--	--	--	< 10 U	< 10 U
Iron (Dissolved)		--	--	--	--	<b>130</b>	<b>160</b>	<b>140</b>
Iron (Total)		< 100 U	<b>1,260</b>	< 100 U	< 100 U	<b>1,930</b>	<b>530</b>	<b>350</b>
Manganese (Total)		--	--	--	--	--	<b>107</b>	<b>104</b>
Manganese (Dissolved)		--	--	--	--	--	<b>106</b>	<b>104</b>
Mercury (Total)		--	--	--	--	--	< 0.3 U	< 0.3 U
Mercury (Dissolved)		--	--	--	--	--	< 0.3 U	< 0.3 U

**Notes:**

- (1) Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using NYSDEC ASP 2000 Method OLM 4.3 and metals using USEPA Method 6010, except for mercury, which was analyzed using USEPA Method 7470.
- (2) Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- (3) Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- (4) "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- (5) Sum of tentatively identified compounds (TICs).
- (6) Sum of VOCs and TICs.

**Acronyms/Key:**

**Bold value indicates a detection.**

NYSDEC	New York State Department of Environmental Conservation.
USEPA	United States Environmental Protection Agency.
ug/L	Micrograms per liter.
--	Not sampled.
ND	Non detect.
> 5U	Not detected above its laboratory quantification limit.
J	Estimated value.
D	Concentration is based on a diluted sample analysis.

Table B-5: Summary of pH Data, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Setting Ponds), Bethpage, New York. <sup>(1,2)</sup>

Date	Sample ID: Sample Location:	WSP-5 Influent (SU)	WSP-7 Effluent (SU)	Discharge Limit <sup>(3)</sup> (SU)
7/22/2009		6.2	7.1	5.5 - 8.5
7/24/2009		6.1	7.0	5.5 - 8.5
7/29/2009		6.1	7.1	5.5 - 8.5
8/5/2009		6.1	7.0	5.5 - 8.5
8/12/2009		6.1	6.8	5.5 - 8.5
8/19/2009		5.7	6.5	5.5 - 8.5
8/28/2009		NM	7.0	5.5 - 8.5
9/1/2009		6.1	7.0	5.5 - 8.5
9/10/2009		6.1	7.0	5.5 - 8.5
10/2/2009		NM	7.0	5.5 - 8.5
10/9/2009		5.9	7.2	5.5 - 8.5
10/24/2009		6.1	7.0	5.5 - 8.5
11/10/2009		6.1	6.9	5.5 - 8.5
11/16/2009		6.1	6.9	5.5 - 8.5
11/25/2009		5.5	6.9	5.5 - 8.5
11/30/2009		5.7	6.8	5.5 - 8.5
12/7/2009		6.1	6.8	5.5 - 8.5

**Notes:**

- (1) pH samples collected and measured in the field by ARCADIS personnel on the dates listed using an Oakton model 300 pH/conductivity meter.
- (2) Refer to Process Schematic (Figure 3 of this OM&M Report) for the location of the sampling port.
- (3) Per the Interim State Pollutant Discharge Elimination System (SPDES) equivalency program (NYSDEC 2009a).

**Acronyms\Key:**

SU            Standard units.  
 NM           Not measured.



**Appendix C**

Vapor Sample Analytical Results

Table C-1. Vapor Sample Analytical Results - October 9, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 10/9/2009	VSP-2 VPGAC Mid-train 10/9/2009	VSP-3 VPGAC Effluent 10/9/2009
<b><u>Volatile Organic Chemicals</u></b>				
1,1,1-Trichloroethane		< 120 U	< 170 U	< 200 U
1,1,2,2-Tetrachloroethane		< 31 U	< 42 U	< 50 U
1,1,2-Trichloroethane		< 120 U	< 170 U	< 200 U
1,1-Dichloroethane		< 92 U	< 130 U	< 150 U
1,1-Dichloroethene		< 90 U	< 120 U	< 150 U
1,2-Dichloroethane		< 92 U	< 130 U	< 150 U
1,2-Dichloropropane		< 100 U	< 140 U	< 170 U
1,3-butadiene		< 100 U	< 140 U	< 160 U
2-Butanone		< 130 U	< 180 U	< 220 U
2-Hexanone		< 92 U	< 130 U	< 150 U
4-methyl-2-pentanone		< 180 U	< 250 U	< 300 U
Acetone		< 1,000 U	< 1,400 U	< 1,700 U
Benzene		< 72 U	< 98 U	< 120 U
Bromodichloromethane		< 31 U	< 42 U	< 50 U
Bromoform		< 230 U	< 320 U	< 380 U
Bromomethane		< 88 U	< 120 U	< 140 U
Carbon Disulfide		< 70 U	< 95 U	< 110 U
Carbon tetrachloride		< 14 U	< 20 U	< 23 U
Chlorobenzene		< 100 U	< 140 U	< 170 U
Chloroethane		< 120 U	< 160 U	< 190 U
Chloroform		< 110 U	< 150 U	< 180 U
Chloromethane		< 92 U	< 130 U	< 150 U
cis-1,2-dichloroethene		<b>6,000</b>	<b>7,300</b>	<b>9,900</b>
cis-1,3-dichloropropene		< 210 U	< 280 U	< 330 U
Dibromochloromethane		< 39 U	< 53 U	< 63 U
Dichlorodifluoromethane (Freon 12)		< 220 U	< 300 U	< 360 U
Ethylbenzene		< 200 U	< 260 U	< 320 U
Methyl tert-Butyl Ether		< 160 U	< 220 U	< 260 U
Methylene Chloride		< 78 U	< 110 U	< 130 U
Styrene		< 190 U	< 260 U	< 310 U
Tetrachloroethene		< 16 U	< 22 U	< 27 U
Toluene		<b>790</b>	< 110 U	< 140 U
trans-1,2-dichloroethene		< 90 U	< 120 U	< 150 U
trans-1,3-dichloropropene		< 100 U	< 140 U	< 170 U
Trichloroethylene		<b>330</b>	< 17 U	< 20 U
Trichlorofluoromethane (CFC-11)		< 130 U	< 170 U	< 210 U
Trichlorotrifluoroethane (Freon 113)		< 35 U	< 47 U	< 56 U
Vinyl Chloride		<b>1,200</b>	<b>970</b>	<b>1,200</b>
Xylene-o		< 200 U	< 260 U	< 320 U
Xylenes - m,p		< 390 U	< 530 U	< 630 U
<b>Subtotal VOCs <sup>(4)</sup></b>		<b>8,320</b>	<b>8,270</b>	<b>11,100</b>

See notes on last page.

Table C-1. Vapor Sample Analytical Results - October 9, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 10/9/2009	VSP-2 VPGAC Mid-train 10/9/2009	VSP-3 VPGAC Effluent 10/9/2009
<b>Tentatively Identified Compounds</b>				
Chlorodifluoromethane (Freon 22)		<b>7.1 JN</b>	<b>5.1 JN</b>	<b>4.4</b>
<b>Subtotal TICs <sup>(5)</sup></b>		<b>7.1</b>	<b>5.1</b>	<b>4.4</b>
<b>Total VOCs <sup>(6)</sup></b>		<b>8,327</b>	<b>8,275</b>	<b>11,104</b>

**Notes:**

- (1) Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using Modified EPA Method TO-15.
- (2) Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- (3) Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- (4) "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- (5) Sum of tentatively identified compounds (TICs).
- (6) Sum of VOCs and TICs.

**Acronyms\Key:**

**Bold value indicates a detection.**

EPA	United States Environmental Protection Agency.
VPGAC	Vapor phase granular activated carbon.
ug/m <sup>3</sup>	Micrograms per cubic meter.
U	Undetected above its laboratory quantification limit.
JN	Compound tentatively identified, concentration is estimated.

Table C-2. Vapor Sample Analytical Results - November 10, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 11/10/2009	VSP-3 VPGAC Effluent 11/10/2009	VSP-4 PPZ Mid-train 11/10/2009	VSP-5 Effluent 11/10/2009
<b><u>Volatile Organic Chemicals</u></b>					
1,1,1-Trichloroethane		<b>5.2 J</b>	< 150 U	< 130 U	< 35 U
1,1,2,2-Tetrachloroethane		< 34 U	< 38 U	< 32 U	< 8.8 U
1,1,2-Trichloroethane		< 140 U	< 150 U	< 130 U	< 35 U
1,1-Dichloroethane		<b>36 J</b>	<b>32 J</b>	<b>35 J</b>	<b>37</b>
1,1-Dichloroethene		<b>18 J</b>	<b>11 J</b>	<b>12 J</b>	<b>5.8 J</b>
1,2-Dichloroethane		< 100 U	< 110 U	< 95 U	< 27 U
1,2-Dichloropropane		< 110 U	< 130 U	< 110 U	< 30 U
1,3-butadiene		< 110 U	< 120 U	< 100 U	< 29 U
2-Butanone		< 150 U	< 160 U	< 140 U	< 38 U
2-Hexanone		< 100 U	< 110 U	< 95 U	< 27 U
4-methyl-2-pentanone		< 200 U	< 230 U	< 190 U	< 53 U
Acetone		< 1100 U	<b>110 J</b>	<b>95 J</b>	<b>310</b>
Benzene		<b>5.5 J</b>	<b>5.9 J</b>	<b>22 J</b>	<b>13 J</b>
Bromodichloromethane		< 34 U	< 38 U	< 32 U	< 8.8 U
Bromoform		< 260 U	< 290 U	< 240 U	< 67 U
Bromomethane		< 97 U	< 110 U	< 91 U	< 25 U
Carbon Disulfide		< 77 U	< 85 U	< 72 U	< 20 U
Carbon tetrachloride		< 16 U	< 18 U	< 15 U	< 4.1 U
Chlorobenzene		< 110 U	< 130 U	< 110 U	< 30 U
Chloroethane		< 130 U	< 150 U	< 120 U	< 34 U
Chloroform		<b>57 J</b>	<b>40 J</b>	<b>38 J</b>	<b>30 J</b>
Chloromethane		< 100 U	< 110 U	< 95 U	<b>18 J</b>
cis-1,2-dichloroethene		<b>7,000</b>	<b>7,900</b>	<b>7,000</b>	<b>1,700</b>
cis-1,3-dichloropropene		< 230 U	< 250 U	< 210 U	< 59 U
Dibromochloromethane		< 43 U	< 48 U	< 40 U	< 11 U
Dichlorodifluoromethane (Freon 12)		< 250 U	<b>42 J</b>	<b>42 J</b>	<b>61 J</b>
Ethylbenzene		<b>24 J</b>	< 240 U	< 200 U	<b>1.4 J</b>
Methyl tert-Butyl Ether		< 180 U	< 200 U	< 170 U	< 47 U
Methylene Chloride		< 86 U	<b>12 J</b>	<b>35 J</b>	<b>2.5 J</b>
Styrene		< 210 U	< 240 U	< 200 U	< 55 U
Tetrachloroethene		<b>11 J</b>	< 20 U	< 17 U	< 4.7 U
Toluene		<b>1,200</b>	<b>6.8 J</b>	<b>73 J</b>	<b>87</b>
trans-1,2-dichloroethene		<b>9 J</b>	<b>5.1 J</b>	< 93 U	< 26 U
trans-1,3-dichloropropene		< 110 U	< 130 U	< 110 U	< 29 U
Trichloroethylene		<b>400</b>	< 15 U	<b>43</b>	<b>15</b>
Trichlorofluoromethane (CFC-11)		< 140 U	< 160 U	< 130 U	<b>2.2 J</b>
Trichlorotrifluoroethane (Freon 113)		< 38 U	< 43 U	< 36 U	< 10 U
Vinyl Chloride		<b>1,200</b>	<b>890</b>	<b>880</b>	<b>200</b>
Xylene-o		<b>24 J</b>	< 240 U	< 200 U	<b>1.6 J</b>
Xylenes - m,p		<b>42 J</b>	< 480 U	<b>4.4 J</b>	<b>2.8 J</b>
<b>Subtotal VOCs <sup>(4)</sup></b>		<b>10,032</b>	<b>9,055</b>	<b>8,279</b>	<b>2,487</b>

See notes on last page.

Table C-2. Vapor Sample Analytical Results - November 10, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 11/10/2009	VSP-3 VPGAC Effluent 11/10/2009	VSP-4 PPZ Mid-train 11/10/2009	VSP-5 Effluent 11/10/2009
<b>Tentatively Identified Compounds</b>					
3-Methyl Decane		ND	ND	1,200 JN	110 JN
(isomer) Decane, dimethyl-		ND	ND	ND	410 JN
2,6-Dimethyldecane		ND	ND	3,900 JN	ND
Acetaldehyde		ND	ND	ND	340 JN
Chlorodifluoromethane (Freon 22)		2,800 JN	2,300 JN	2,300 JN	3,600 JN
Cyclohexanone, 5-methyl-2-(1-methylethy		ND	ND	4,500 JN	480 JN
Decahydro-2-Methyl Naphthalene		ND	ND	19,000 JN	1,600 JN
Undecane		ND	ND	3,400 JN	290 JN
Undecane, 2-methyl-		ND	ND	5,400 JN	370 JN
unknown aromatic hydrocarbon		ND	ND	3,000 JN	ND
unknown		ND	ND	1,700 JN	ND
unknown aliphatic hydrocarbon {1}		ND	ND	ND	170 JN
unknown aliphatic hydrocarbon {1}		ND	ND	2,900 JN	ND
unknown aliphatic hydrocarbon {2}		ND	ND	1,800 JN	ND
unknown aliphatic hydrocarbon {2}		ND	ND	ND	250 JN
unknown aliphatic hydrocarbon {3}		ND	ND	ND	180 JN
unknown aliphatic hydrocarbon {3}		ND	ND	2,800 JN	ND
unknown aliphatic hydrocarbon {4}		ND	ND	2,100 JN	ND
unknown aliphatic hydrocarbon {4}		ND	ND	ND	570 JN
unknown aliphatic hydrocarbon {5}		ND	ND	4,000 JN	270 JN
unknown aliphatic hydrocarbon {6}		ND	ND	2,100 JN	190 JN
unknown aliphatic hydrocarbon {7}		ND	ND	1,600 JN	ND
unknown aromatic hydrocarbon		ND	ND	3,300 JN	420 JN
unknown aromatic hydrocarbon		ND	ND	ND	260 JN
unknown cyclic hydrocarbon {1}		ND	ND	1,500 JN	160 JN
unknown cyclic hydrocarbon {2}		ND	ND	ND	310 JN
unknown cyclic hydrocarbon {2}		ND	ND	1,900 JN	ND
unknown cyclic hydrocarbon {3}		ND	ND	ND	190 JN
unknown hydrocarbon {1}		ND	ND	3,700 JN	ND
unknown hydrocarbon {1}		ND	ND	ND	180 JN
unknown hydrocarbon {2}		ND	ND	1,700 JN	170 JN
<b>Subtotal TICs <sup>(5)</sup></b>		<b>2,800</b>	<b>2,300</b>	<b>73,800</b>	<b>10,520</b>
<b>Total VOCs <sup>(6)</sup></b>		<b>12,832</b>	<b>11,355</b>	<b>82,079</b>	<b>13,007</b>

#### Notes:

- Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using Modified EPA Method TO-15.
- Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- Sum of Tentatively Identified Compounds (TICs).
- Sum of VOCs and TICs.

#### Acronyms\Key:

**Bold value indicates a detection.**

EPA	United States Environmental Protection Agency.
VPGAC	Vapor phase granular activated carbon.
PPZ	Potassium permanganate-impregnated zeolite.
ug/m <sup>3</sup>	Micrograms per cubic meter.
--	Not sampled.
ND	Non detect.
> 5U	Undetected above its laboratory quantification limit.
J	Estimated value.
JN	Compound tentatively identified, concentration is estimated.

Table C-3. Vapor Sample Analytical Results - December 2, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 12/2/2009	VSP-2 VPGAC Bed 1 Effluent 12/2/2009	VSP-5 Effluent 12/2/2009
<b><u>Volatile Organic Chemicals</u></b>				
1,1,1-Trichloroethane		< 15 U	< 0.75 U	< 0.76 U
1,1,1,2-Tetrachloroethane		< 15 U	< 0.75 U	< 0.76 U
1,1,2-Trichloroethane		< 15 U	< 0.75 U	< 0.76 U
1,1-Dichloroethane		<b>29</b>	< 0.75 U	<b>3.7</b>
1,1-Dichloroethene		<b>17</b>	< 0.75 U	<b>1.4</b>
1,2-Dichloroethane		< 15 U	< 0.75 U	< 0.76 U
1,2-Dichloropropane		< 15 U	< 0.75 U	< 0.76 U
1,3-butadiene		< 15 U	< 0.75 U	< 0.76 U
1-Chloro-1,1-difluoroethane (CFC 142b)		< 51 U	< 15 U	< 30 U
2-Butanone		< 15 U	<b>8.3</b>	<b>5.5</b>
2-Hexanone		< 15 U	< 0.75 U	< 0.76 U
4-methyl-2-pentanone		< 15 U	< 0.75 U	< 0.76 U
Acetone		< 150 U	<b>53</b>	<b>13</b>
Benzene		< 15 U	<b>2.2</b>	<b>12</b>
Bromodichloromethane		< 15 U	< 0.75 U	< 0.76 U
Bromoform		< 15 U	< 0.75 U	< 0.76 U
Bromomethane		< 15 U	< 0.75 U	< 0.76 U
Carbon Disulfide		< 15 U	<b>2.2</b>	< 0.76 U
Carbon tetrachloride		< 15 U	< 0.75 U	< 0.76 U
Chlorobenzene		< 15 U	< 0.75 U	< 0.76 U
Chlorodifluoromethane (Freon 22)		<b>2,500</b>	<b>2,600 D</b>	<b>2,400 D</b>
Chloroethane		< 15 U	< 0.75 U	< 0.76 U
Chloroform		<b>43</b>	< 0.75 U	<b>5.7</b>
Chloromethane		< 15 U	< 0.75 U	< 0.76 U
cis-1,2-dichloroethene		<b>4,500 D</b>	<b>1.3</b>	<b>230 D</b>
cis-1,3-dichloropropene		< 15 U	< 0.75 U	< 0.76 U
Dibromochloromethane		< 15 U	< 0.75 U	< 0.76 U
Dichlorodifluoromethane (Freon 12)		< 15 U	<b>2.6</b>	<b>2.4</b>
Ethylbenzene		<b>30</b>	< 0.75 U	<b>3</b>
Methyl tert-Butyl Ether		< 15 U	< 0.75 U	< 0.76 U
Methylene Chloride		< 15 U	< 0.75 U	< 0.76 U
Styrene		< 15 U	< 0.75 U	< 0.76 U
Tetrachloroethene		< 15 U	< 0.75 U	< 0.76 U
Toluene		<b>770</b>	< 0.75 U	<b>90</b>
trans-1,2-dichloroethene		< 15 U	< 0.75 U	< 0.76 U
trans-1,3-dichloropropene		< 15 U	< 0.75 U	< 0.76 U
Trichloroethylene		<b>420</b>	< 0.75 U	<b>30</b>
Trichlorofluoromethane (CFC-11)		< 15 U	< 0.75 U	< 0.76 U
Trichlorotrifluoroethane (Freon 113)		< 15 U	< 0.75 U	< 0.76 U
Vinyl Chloride		<b>800</b>	<b>770 D</b>	<b>52</b>
Xylene-o		<b>30</b>	< 0.75 U	<b>3.4</b>
Xylenes - m,p		<b>56</b>	< 1.5 U	<b>6.2</b>
<b>Subtotal VOCs <sup>(4)</sup></b>		<b>9,195</b>	<b>3,440</b>	<b>2,858</b>

See notes on last page.

Table C-3. Vapor Sample Analytical Results - December 2, 2009, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York. <sup>(1,2,3)</sup>

COMPOUND (ug/m <sup>3</sup> )	Location ID: Sample Location: Sample Date:	VSP -1 Influent 12/2/2009	VSP-2 VPGAC Bed 1 Effluent 12/2/2009	VSP-5 Effluent 12/2/2009
<b>Tentatively Identified Compounds</b>				
Propylene Glycol		ND	<b>13 JN</b>	ND
1-Butanol		ND	<b>5.7 JN</b>	ND
2,5-Dimethylfuran		ND	ND	<b>4 JN</b>
2,5-Hexanedione		ND	ND	<b>19 JN</b>
2-Butoxyethanol		ND	<b>150 JN</b>	ND
2-Ethyl- 1-Hexanol		ND	<b>7.1 JN</b>	ND
2-Phenyl-2-Propanol		<b>160 JN</b>	<b>290 JN</b>	<b>86 JN</b>
3-Penten-2-one		ND	<b>4.5 JN</b>	<b>5.6 JN</b>
Acetaldehyde		ND	<b>13 JN</b>	<b>6.2 JN</b>
Acetophenone		ND	<b>100 JN</b>	<b>98 JN</b>
Benzaldehyde		ND	<b>4.5 JN</b>	<b>6.4 JN</b>
Benzene, 1-methylethyl-		ND	<b>17 JN</b>	<b>21 JN</b>
Hexamethyl Cyclotrisiloxane		ND	<b>28 JN</b>	ND
Silanol, trimethyl-		ND	<b>20 JN</b>	ND
Unidentified Compound		ND	<b>12 JN</b>	ND
Unidentified Siloxane		ND	<b>11 JN</b>	ND
Unidentified Siloxane		ND	<b>4.1 JN</b>	ND
<b>Subtotal TICs <sup>(5)</sup></b>		<b>160</b>	<b>680</b>	<b>246</b>
<b>Total VOCs <sup>(6)</sup></b>		<b>9,355</b>	<b>4,120</b>	<b>3,105</b>

**Notes:**

- (1) Samples collected by ARCADIS on the dates shown and submitted to Columbia Laboratories for Volatile Organic Compound (VOC) analyses using Modified EPA Method TO-15.
- (2) Refer to Figure 3 of this Operations, Maintenance, and Monitoring (OM&M) Report for schematic sample locations.
- (3) Results validated following protocols specified in the Sampling and Analysis Plan (Appendix A) of the Groundwater OM&M Manual (ARCADIS 2009c).
- (4) "Subtotal VOCs" represents the sum of individual concentrations of all volatile organic chemicals detected.
- (5) Sum of Tentatively Identified Compounds (TICs).
- (6) Sum of VOCs and TICs.

**Acronyms\Key:**

**Bold value indicates a detection.**

EPA	United States Environmental Protection Agency.
VPGAC	Vapor phase granular activated carbon.
ug/m <sup>3</sup>	Micrograms per cubic meter.
ND	Non detect.
> 5U	Undetected above its laboratory quantification limit.
JN	Compound tentatively identified, concentration is estimated.
D	Concentration is based on a diluted sample analysis.

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## **Appendix D**

Air Discharge Quality Evaluation



Table D-1. Summary of SCREEN3 Model Input and Outputs, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

Parameters	Date Sampled:	07/24/09	8/12/09 <sup>(9)</sup>	09/10/09	11/10/09	12/02/09
<b>SCREEN3 Model Input</b>						
Source Type		Point	Point	Point	Point	Point
Emission Rate (g/s)		1	1	1	1	1
Stack Height (ft)		13.5	13.5	13.5	13.5	13.5
Stack Height (m)		4.1	4.1	4.1	4.1	4.1
Stack Inside Diameter (m)		0.36	0.36	0.36	0.36	0.36
Air Flow Rate (scfm) <sup>(1)</sup>		2,020	1,999	2,077	2,126	1,935
Air Flow Rate (acfm @ stack temp) <sup>(2)</sup>		2,058	2,048	2,116	2,142	1,964
Stack Gas Exit Temperature (K) <sup>(1)</sup>		300	302	300	297	299
Ambient Air Temperature (K) <sup>(3)</sup>		298	296	296	281	278
Receptor Height (m) <sup>(4)</sup>		1.5	1.5	1.5	1.5	1.5
Urban/Rural		Urban	Urban	Urban	Urban	Urban
Building Height (m)		2.6	2.6	2.6	2.6	2.6
Min Horizontal Bldg Dim (m)		7.9	7.9	7.9	7.9	7.9
Max Horizontal Bldg Dim (m)		9.8	9.8	9.8	9.8	9.8
Consider Bldg Downwash?		Yes	Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack		Simple	Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base		Simple	Simple	Simple	Simple	Simple
Meteorology		Full	Full	Full	Full	Full
Automated Distances Array		Yes	Yes	Yes	Yes	Yes
Terrain Height Above Stack Base		0	0	0	0	0
<b>SCREEN3 Model Output</b>						
1-HR Max Concentration at Receptor Height ( $\mu\text{g}/\text{m}^3$ ) <sup>(5)</sup>		1,941	1,958	1,909	1,900	2,084
Annualization Factor <sup>(6)</sup>		0.08	0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ( $\mu\text{g}/\text{m}^3$ ) <sup>(7)</sup>		155.3	156.6	152.7	152	166.7
Distance To Max Concentration (m) <sup>(8)</sup>		8	8	8	8	8

See notes on last page.

Table D-1. Summary of SCREEN3 Model Input and Outputs, Groundwater Interim Remedial Measure, Operable Unit 3 (Former Grumman Settling Ponds), Bethpage, New York.

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**Notes:**

- (1) The stack air flow rate (in scfm) and temperature were measured using inline instrumentation. Values were measured at the blower effluent location.
- (2) The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
- (3) The ambient temperature was recorded from the weather.newday.com website for Islip, New York. The mean actual temperature from the website was used in model calculation.
- (4) The receptor height corresponds to the average inhalation level.
- (5) SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
- (6) A USEPA time averaging conversion factor of 1/0.08 was used to convert the 1-hour maximum concentration output to an annual average.
- (7) Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization
- (8) SCREEN3 calculated distance to the 1-hour maximum concentration.
- (9) The effluent air flow was not recorded on August 12, 2009. The air flow measurement used in calculations was recorded on August 5, 2009.

**Acronyms\Key:**

µg/m <sup>3</sup>	Micrograms per cubic meter.
acfm	Actual cubic feet per minute.
ft	Feet.
g/s	Grams per second.
K	Kelvin.
m	Meters.
scfm	Standard cubic feet per minute.
USEPA	United States Environmental Protection Agency.

Table D-2. Summary of Annual Maximum Allowable Stack Concentration Calculations, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York.

Compound	Actual Effluent Concentrations <sup>(1)</sup> (µg/m <sup>3</sup> )				
	7/24/09	8/12/09	9/10/09	11/10/09	12/2/09
1,1,1 - Trichloroethane	0.96	0	0	0	0
1,1 - Dichloroethane	3.9	5.7	5.3	37	3.7
1,2 - Dichloroethane	0	0	0	0	0
1,1 - Dichloroethene	0	0	0	5.8	1.4
2-Butanone	0	0	0	0	5.5
Acetone	0	0	0	310	13
Chloroform	0	0	0	30	5.7
Ethylbenzene	0	0	0	1.4	3
Xylenes (o)	0	0	0	1.6	3.4
Xylenes (m,p)	0	0	0	2.8	6.2
Chloromethane	0	0	0	18	0
Methylene Chloride	0	0	0	2.5	0
Tetrachloroethene	0.64	0	0	0	0
Trichloroethene	9.3	4.7	8.8	15	30
Vinyl Chloride	54	260	160	200	52
cis 1,2 Dichloroethene	47	120	150	1,700	230
trans 1,2 Dichloroethene	0	0	0	0	0
Benzene	48	21	17	13	12
Toluene	1.5	110	120	87	90
Trichlorofluoromethane (Freon 11)	0	0	0	2.2	0
Dichlorodifluoromethane (Freon 12)	5.1	0	10	61	2.4
Chlorodifluoromethane (Freon 22) <sup>(3)</sup>	0	220	540	0	2,400

See notes on last page.

Table D-2. Summary of Annual Maximum Allowable Stack Concentration Calculations, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York.

Compound	AGC <sup>(2)</sup> (µg/m <sup>3</sup> )	Annual Maximum Allowable Stack Concentration <sup>(3)</sup> (µg/m <sup>3</sup> )				
		7/24/09	8/12/09	09/10/09	11/10/09	12/2/09
1,1,1 - Trichloroethane	1,000	6.63E+06	6.61E+06	6.56E+06	6.51E+06	6.47E+06
1,1 - Dichloroethane	0.63	4.18E+03	4.16E+03	4.13E+03	4.10E+03	4.08E+03
1,2 - Dichloroethane	0.038	2.52E+02	2.51E+02	2.49E+02	2.47E+02	2.46E+02
1,1 - Dichloroethene	70	4.64E+05	4.62E+05	4.59E+05	4.56E+05	4.53E+05
2-Butanone	5,000	3.31E+07	3.30E+07	3.28E+07	3.25E+07	3.24E+07
Acetone	28,000	1.86E+08	1.85E+08	1.84E+08	1.82E+08	1.81E+08
Chloroform	0.043	2.85E+02	2.84E+02	2.82E+02	2.80E+02	2.78E+02
Ethylbenzene	1,000	6.63E+06	6.61E+06	6.56E+06	6.51E+06	6.47E+06
Xylenes (o)	100	6.63E+05	6.61E+05	6.56E+05	6.51E+05	6.47E+05
Xylenes (m,p)	100	6.63E+05	6.61E+05	6.56E+05	6.51E+05	6.47E+05
Chloromethane	90	5.97E+05	5.95E+05	5.90E+05	5.86E+05	5.82E+05
Methylene Chloride	2.1	1.39E+04	1.39E+04	1.38E+04	1.37E+04	1.36E+04
Tetrachloroethene	1	6.63E+03	6.61E+03	6.56E+03	6.51E+03	6.47E+03
Trichloroethene	0.5	3.31E+03	3.30E+03	3.28E+03	3.25E+03	3.24E+03
Vinyl Chloride	0.11	7.29E+02	7.27E+02	7.21E+02	7.16E+02	7.12E+02
cis 1,2 Dichloroethene	63	4.18E+05	4.16E+05	4.13E+05	4.10E+05	4.08E+05
trans 1,2 Dichloroethene	63	4.18E+05	4.16E+05	4.13E+05	4.10E+05	4.08E+05
Benzene	0.13	8.62E+02	8.59E+02	8.53E+02	8.46E+02	8.41E+02
Toluene	5,000	3.31E+07	3.30E+07	3.28E+07	3.25E+07	3.24E+07
Trichlorofluoromethane (Freon 11)	1,000	6.63E+06	6.61E+06	6.56E+06	6.51E+06	6.47E+06
Dichlorodifluoromethane (Freon 12)	12,000	7.96E+07	7.93E+07	7.87E+07	7.81E+07	7.77E+07
Chlorodifluoromethane (Freon 22) <sup>(3)</sup>	50,000	3.31E+08	3.30E+08	3.28E+08	3.25E+08	3.24E+08

See notes on last page.

Table D-2. Summary of Annual Maximum Allowable Stack Concentration Calculations, Groundwater Interim Remedial Measure, Operable Unit 3  
(Former Grumman Settling Ponds), Bethpage, New York.

Compound	Percent of Annual Maximum Allowable Stack Concentration <sup>(4)</sup>				
	7/24/09	8/12/09	09/10/09	11/10/09	12/2/09
1,1,1 - Trichloroethane	0.00%	0.00%	0.00%	0.00%	0.00%
1,1 - Dichloroethane	0.09%	0.14%	0.13%	0.90%	0.09%
1,2 - Dichloroethane	0.00%	0.00%	0.00%	0.00%	0.00%
1,1 - Dichloroethene	0.00%	0.00%	0.00%	0.00%	0.00%
2-Butanone	0.00%	0.00%	0.00%	0.00%	0.00%
Acetone	0.00%	0.00%	0.00%	0.00%	0.00%
Chloroform	0.00%	0.00%	0.00%	10.72%	2.05%
Ethylbenzene	0.00%	0.00%	0.00%	0.00%	0.00%
Xylenes (o)	0.00%	0.00%	0.00%	0.00%	0.00%
Xylenes (m,p)	0.00%	0.00%	0.00%	0.00%	0.00%
Chloromethane	0.00%	0.00%	0.00%	0.00%	0.00%
Methylene Chloride	0.00%	0.00%	0.00%	0.02%	0.00%
Tetrachloroethene	0.01%	0.00%	0.00%	0.00%	0.00%
Trichloroethene	0.28%	0.14%	0.27%	0.46%	0.93%
Vinyl Chloride	7.40%	35.78%	22.18%	27.94%	7.30%
cis 1,2 Dichloroethene	0.01%	0.03%	0.04%	0.41%	0.06%
trans 1,2 Dichloroethene	0.00%	0.00%	0.00%	0.00%	0.00%
Benzene	5.57%	2.45%	1.99%	1.54%	1.43%
Toluene	0.00%	0.00%	0.00%	0.00%	0.00%
Trichlorofluoromethane (Freon 11)	0.00%	0.00%	0.00%	0.00%	0.00%
Dichlorodifluoromethane (Freon 12)	0.00%	0.00%	0.00%	0.00%	0.00%
Chlorodifluoromethane (Freon 22) <sup>(3)</sup>	0.00%	0.00%	0.00%	0.00%	0.00%

#### Notes:

- (1) Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the first two months of system operation.
- (2) AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised September 10, 2007.
- (3) Annual maximum allowable stack concentrations were calculated by dividing the product of the annual guideline concentration of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.
- (4) Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for a given monitoring event.

#### Acronyms/Key:

µg/m <sup>3</sup>	Micrograms per cubic meter.
AGC	Annual guideline concentration.
MASC	Maximum allowable stack concentration.