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Date: November 24, 2021

Our Ref: 30059266

Subject: Results of Third Quarter 2021 System Operation and Monitoring,
Bethpage Park Groundwater Containment System (BPGWCS),
Operable Unit 3 (Former Grumman Settling Ponds),
Bethpage, New York, NYSDEC Site #1-30-003A.

Dear Jason,

Enclosed is one electronic PDF copy of the Third Quarter 2021 Report for the BPGWCS operation and monitoring, performed in accordance with the NYSDEC-approved OU3 Groundwater IRM (although approved as an IRM, based on the ,2013 NYSDEC ROD it is the approved groundwater remedy for the Site) OM&M Manual (Arcadis 2009) and the NYSDEC-approved Sampling and Analysis Plan (SAP; Arcadis 2009). As we have transitioned to electronic submittals (via PDF) in line with NYSDEC's paper reduction program, hard copies of the report can be provided on request.

A notable increase in concentrations of cis-1,2-Dichloroethene, Trichloroethylene, Vinyl Chloride, Toluene, o-Xylene, m, p-Xylene, and Ethylbenzene was detected in the August 13, 2021 influent water sample and the August 17, 2021 Influent and effluent vapor samples compared to previous quarters (Tables 2, 4, and 5, and Figures 5 through 7). A similar increase in concentrations of these constituents was also noted in the August 13, 2021, water sample collected from recovery well RW-2 (Table 10). These increases are likely due to the previous ISTR system activities on the Bethpage Community Park property. However, these constituents were not detected in the BPGWCS effluent water samples collected on August 13, and September 27, 2021 (Table 3). In addition, the air quality impact analysis (Table 9) shows that none of the detected compounds exceed the SCGs or AGCs specified in NYSDEC DAR-1. We will continue monitoring this situation during subsequent quarterly monitoring rounds.

If you have any questions, please do not hesitate to contact me.

Sincerely,
Arcadis of New York, Inc.



Christopher Engler, PE New York PE-069748
Vice President

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Mr. Jason Pelton
NYSDEC RB
November 24, 2021

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Table 1
Operational Summary
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



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			
2009 Total																																160		
2010 Total																																352		
2011 Total																																351		
2012 Total																																353		
2013 Total																																354		
2014 Total																																349		
2015 Total																																348		
2016 Total																																351		
2017 Total																																354		
2018 Total																																348		
2019 Total																																355		
Jul 2021	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	(2)	(2)	(2)	■	■	■	24	
Aug 2021	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	28
Sep 2021	■	■	■	■	■	■	■	■	■	■	(2)	(2)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	30	
3Q 2021																																82		
2021 Total																																260		
TOTAL																																4280		

Legend:

- Indicates system online online for greater than 18 hours.
- Indicates system operated with reduced flows for 6 hours or greater.
- Indicates system off-line for 6 hours or greater.

Notes, Abbreviations, and Units on last page.

Table 1
Operational Summary
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes:

1. Days the system was operational for greater than 18 hours are counted as one day.

Third Quarter 2021

2. ISTR Discharge event.

Abbreviations/Units:

3Q Third Quarter

Table 2
Summary of Influent Water Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound (All Constituent Concentrations in µg/L)	12/02/2020 ⁽³⁾	02/10/21	04/08/21	08/13/21
Project VOCs				
1,1,1 - Trichloroethane	NS	< 1.0	< 1.0	< 1.0
1,1 - Dichloroethane	NS	< 1.0	< 1.0	0.74 J
1,2 - Dichloroethane	NS	< 1.0	< 1.0	< 1.0
1,1 - Dichloroethene	NS	< 1.0	< 1.0	0.62 J
Tetrachloroethene	NS	< 1.0	< 1.0	< 1.0
Trichloroethene	NS	3.8	4.8	22.8
Vinyl Chloride	NS	3.6	4.1	18.0
cis 1,2-Dichloroethene	NS	13.2	17.7	126
trans 1,2-Dichloroethene	NS	< 1.0	< 1.0	< 1.0
Benzene	NS	< 0.50	< 0.50	0.67
Toluene	NS	< 1.0	< 1.0	230
o-Xylene	NS	< 1.0	< 1.0	10.2
m,p-Xylene	NS	< 1.0	< 1.0	21.2
Subtotal Project VOCs	--	20.6	26.6	430.2
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	NS	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	NS	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	NS	< 1.0	< 1.0	< 1.0
1,3-Butadiene	NS	< 5.0	< 5.0	< 5.0
2-Butanone	NS	< 10	< 10	< 10
4-Methyl-2-Pentanone	NS	< 5.0	< 5.0	< 5.0
Acetone	NS	< 10	< 10	< 10
Bromodichloromethane	NS	< 1.0	< 1.0	< 1.0
Bromoform	NS	< 1.0	< 1.0	< 1.0
Bromomethane	NS	< 2.0	< 2.0	< 2.0
Carbon Disulfide	NS	< 2.0	< 2.0	< 2.0
Carbon Tetrachloride	NS	< 1.0	< 1.0	< 1.0
Chlorobenzene	NS	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	NS	< 1.0	< 1.0	< 1.0
Chlorodifluoromethane (Freon 22)	NS	< 5.0	< 5.0	< 5.0
Chloroethane	NS	< 1.0	< 1.0	< 1.0
Chloroform	NS	< 1.0	< 1.0	< 1.0
Chloromethane	NS	< 1.0	< 1.0	< 1.0
cis-1,3-Dichloropropene	NS	< 1.0	< 1.0	< 1.0

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 2
Summary of Influent Water Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound (All Constituent Concentrations in µg/L)	12/2/2020 ⁽³⁾	02/10/21	04/08/21	08/13/21
Non-Project VOCs				
Dichlorodifluoromethane (Freon 12)	NS	< 2.0	< 2.0	< 2.0
Dichloromethane	NS	< 2.0	< 2.0	< 2.0
Ethylbenzene	NS	< 1.0	< 1.0	7.6
Methyl N-Butyl Ketone	NS	< 5.0	< 5.0	< 5.0
Methyl Tert-Butyl Ether	NS	< 1.0	< 1.0	< 1.0
Styrene (Monomer)	NS	< 1.0	< 1.0	< 1.0
trans-1,3-Dichloropropene	NS	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon 11)	NS	< 2.0	< 2.0	< 2.0
Trichlorotrifluoroethane (Freon 113)	NS	< 5.0	< 5.0	< 5.0
1-Chloro-1,1-difluoroethane (Freon 142b)	NS	< 5.0	< 5.0	< 5.0
Subtotal Non-Project VOCs	--	ND	ND	7.6
Total VOCs¹	--	21	27	438
1,4-Dioxane	NS	0.43	1.3	1.1
pH ²	--	5.2	5.9	5.6

Notes, Abbreviations, Qualifiers, and Units:

1. "Total VOCs" represents the sum of individual concentrations of the compounds detected. The values used in calculations referenced in this report have been rounded to the nearest whole number.
2. Influent pH samples collected and measured in the field by Arcadis personnel on the dates listed using a field calibrated pH/conductivity meter. pH units are standard units.
3. Quarter 4 2020 sampling was conducted during ISTR Baker Tank discharge. The combined Influent sample port (WSP-5) is located upstream of the ISTR connection into the influent line. Due to this setup, the combined influent port (WSP-5) was not sampled as it would not be representative of the true combined influent.

USEPA United States Environmental Protection Agency
VOC Volatile Organic Compound
3.8 Bold value indicates a detection.
< 1.0 Compound not detected at or above the laboratory quantification limit.
µg/L micrograms per liter
ND Analyte not detected at, or above its laboratory quantification limit.
NS Not sampled

Table 3
Summary of Effluent Water Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound (All Constituent Concentrations in µg/L)	Discharge Limit ¹	07/08/20	08/18/20	09/02/20	10/6/2020 ⁷	11/5/2020 ⁷	12/2/2020 ⁷	01/05/21	02/10/21	03/02/21	04/08/21	05/04/21	06/02/21	07/13/21	08/13/21	09/27/21	
Project VOCs																	
1,1,1-Trichloroethane	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloroethene	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Tetrachloroethene	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Trichloroethene	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Vinyl Chloride	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
cis 1,2-Dichloroethene	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
trans 1,2-Dichloroethene	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Subtotal Project VOCs		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Non-Project VOCs																	
Acetone	50	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	3.4 J	< 10	< 10
Chloroform	5 ²	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Dichloromethane	5 ²	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	
Trichlorotrifluoroethane (Freon 113)	5 ²	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	
Subtotal Non-Project VOCs		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Total VOCs³		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Treatment Efficiency ⁴		> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	
Inorganics																	
Total Iron	600	< 100	< 100	< 100	< 100	< 100	189	< 100	< 100	< 100	< 100	< 100	329	268	253	300	
Total Manganese	600	45.0	47.8	46.0	51.1	43.9	46.1	41.3	39.2	42.5	43.7	40.8	44.0	48.9	47.2	43.9	
Nitrate and Nitrite	10,000	2,700	2,700	2,600	2,600	2,500	2,600	2,300	2,800	2,500	2,600	2,700	2,600	2,600	2,300	2,500	
Total Kjeldahl Nitrogen	10,000	< 200	< 200	< 200	< 200	< 200	< 200	< 200	210	230	< 200	< 200	< 200	< 200	< 200	< 200	
Total Nitrogen	10,000	2,700	2,700	2,600	2,600	2,500	2,600	2,300	3,000	2,700	2,600	2,700	2,600	2,800	2,500	2,500	
1,4-Dioxane	NE	1.3	1.1	1.2	1.1	1.6	1.3	0.24	0.64	1.4	1.80	1.30	1.5	1.2	1.4	2.1	
pH ⁵	5.5-8.5	6.5	6.7	6.6	6.9 ⁽⁶⁾	6.8	6.8	6.5	5.9	6.4	6.1	5.9	7.2	6.4	7.1	6.3	

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 3
Summary of Effluent Water Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, Qualifiers, and Units:

1. 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 SPDES Permit Equivalency.
2. As of September 2017, the 10 SPDES VOCs discharge limits are per Site Number 1-30-003A Operable Unit 3 SPDES Permit Equivalency.
3. "Total VOCs" represents the sum of individual concentrations of compounds detected. The values used in calculations referenced in this report have been rounded to the nearest whole number.
4. Treatment efficiency was calculated by dividing the difference between the influent and effluent total VOC concentrations by the influent total VOC concentration.
5. Effluent pH measured on site using a handheld pH meter. pH units are standard units.
6. Due to pH meter malfunction on 10/6/20, the reported pH was measured on 10/15/20 under similar conditions during the second ISTR tank discharge.
7. Results validated following protocols specified in Sampling and Analysis Plan in the Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). See previous annual reports for historical analytical results.

NYSDEC New York State Department of Environmental Conservation
SPDES State Pollutant Discharge Elimination System
USEPA United States Environmental Protection Agency
VOC Volatile Organic Compound
NE Not Established

102 Bold value indicates a detection.

< 0.50 Compound not detected above the laboratory quantification limit.

µg/L micrograms per liter

ND Analyte not detected at, or above its laboratory quantification limit.

Table 4
Influent Vapor Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound ¹ (All Constituent Concentrations in µg/m ³)	10/6/2020 ³	2/10/2021 ³	04/08/21	08/17/21
Project VOCs				
1,1,1 - Trichloroethane	1.3	< 0.44	1.4	< 22
1,1 - Dichloroethane	5.7	< 0.65	7.3	< 32
1,2 - Dichloroethane	0.34 J	< 0.65	0.36 J	< 32
1,1 - Dichloroethene	0.99	< 0.13	1.3	< 6.3
Tetrachloroethene	3.1	< 0.22	2.5	< 11
Trichloroethene	76.3	0.36	96.7	301
Vinyl Chloride	54.4	0.33	77.7	159
cis 1,2-Dichloroethene	195	1.2	326	1450
trans 1,2-Dichloroethene	0.67	< 0.63	0.59 J	< 32
Benzene	0.73	0.30 J	1.1	< 26
Toluene	0.53 J	< 0.6	3.0	3590
o-Xylene	1.1	< 0.69	1.4	135
m,p-Xylene	0.65 J	< 0.69	1.3	295
Subtotal Project VOCs	341	2	521	5931
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 0.55	< 0.55	< 0.55	< 27
1,1,2-Trichloroethane	< 0.44	< 0.44	< 0.44	< 22
1,2-Dichloropropane	0.55 J	< 0.74	0.83	< 37
1,3-Butadiene	<0.35	< 0.35	< 0.35	< 18
2-Butanone	0.68	< 0.47	0.47	< 24
4-Methyl-2-Pentanone	< 0.66	< 0.66	< 0.66	< 33
Acetone	5.5	2.6	6.7	< 19
Bromodichloromethane	< 0.54	< 0.54	1.1	< 27
Bromoform	< 0.33	< 0.33	< 0.33	< 17
Bromomethane	< 0.62	< 0.62	< 0.62	< 31
Carbon Disulfide	< 0.50	< 0.5	< 0.5	< 25
Carbon Tetrachloride	0.62	0.49	0.48	< 10
Chlorobenzene	< 0.74	< 0.74	< 0.74	< 37
Chlorodibromomethane	< 0.68	< 0.68	< 0.68	< 34
Chlorodifluoromethane (Freon 22)	6.3	0.77	5.6	< 28
Chloroethane	< 0.42	< 0.42	< 0.42	< 21
Chloroform	10	< 0.78	9.3	< 39
Chloromethane	1.6	0.89	1.9	< 17
cis-1,3-Dichloropropene	< 0.73	< 0.73	< 0.73	< 36
Dichlorodifluoromethane (Freon 12)	2.8	1.6	1.7	< 40
Dichloromethane	1.6	3.8	0.63	< 28
Ethylbenzene	< 0.69	< 0.69	1.3	95.6
Methyl N-Butyl Ketone	< 0.65	< 0.65	< 0.65	< 33
Methyl Tert-Butyl Ether	0.50 J	< 0.58	0.43 J	< 29
Styrene (Monomer)	< 0.68	< 0.68	< 0.68	< 34
trans-1,3-Dichloropropene	< 0.73	< 0.73	< 0.73	< 36
Trichlorofluoromethane (Freon 11)	1.7	2.4	1.2	< 22
Trichlorotrifluoroethane (Freon 113)	1.8	< 0.61	1.5	< 31
1-Chloro-1,1-difluoroethane (Freon 142b)	< 0.66	< 0.66	< 0.66	< 33
Subtotal Non-Project VOCs	34	13	33	96
Total VOCs²	374	15	554	6027

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 4
Influent Vapor Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, Qualifiers, and Units:

1. Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15. A VOC analyte list is provided in the DRAFT Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). 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. "Total VOCs" represents the sum of individual concentrations of compounds detected. The values used in calculations referenced in this report have been rounded to the nearest whole number.
3. Results validated following protocols specified in Sampling and Analysis Plan in the Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). See previous annual reports for historical analytical results.

ELAP	Environmental Laboratory Approval Program
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance, and Monitoring
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.3	Bold value indicates a detection.
< 0.44	Compound not detected above the laboratory quantification limit.
J	Result is estimated.
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter

Table 5
Summary of Effluent Vapor Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound ¹ (All Constituent Concentrations in µg/m ³)	10/6/2020 ³	02/10/21	04/08/21	08/17/21
Project VOCs				
1,1,1 - Trichloroethane	1.1	0.65	1.0	< 11
1,1 - Dichloroethane	5.7	3.70	6.1	9.7 J
1,2 - Dichloroethane	0.36 J	0.23 J	0.45 J	< 16
1,1 - Dichloroethene	0.87	0.91	0.83	< 3.2
Tetrachloroethene	4.0	1.6	1.6	< 5.4
Trichloroethene	37	29	42	260
Vinyl Chloride	28.1	27.6	38.1	170
cis 1,2-Dichloroethene	107	104	122	1140
trans 1,2-Dichloroethene	< 0.63	< 0.63	< 0.63	< 16
Benzene	0.35 J	0.58	0.35 J	8.0 J
Toluene	1.2	1.3	2.3	3360
o-Xylene	0.96	< 0.69	0.74	109
m,p-Xylene	1.5	0.52 J	1.1	232
Subtotal Project VOCs	188	170	217	5289
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 0.55	< 0.55	< 0.55	< 14
1,1,2-Trichloroethane	< 0.44	< 0.44	< 0.44	< 11
1,2-Dichloropropane	0.38 J	< 0.74	0.46 J	< 18
1,3-Butadiene	< 0.35	< 0.35	< 0.35	< 8.8
2-Butanone	5.0	2.3	4.1	< 12
4-Methyl-2-Pentanone	< 0.66	< 0.66	< 0.66	< 16
Acetone	36.8	16	22	52.5
Bromodichloromethane	< 0.54	< 0.54	< 0.54	< 13
Bromoform	< 0.33	< 0.33	< 0.33	< 8.3
Bromomethane	< 0.62	< 0.62	< 0.62	< 16
Carbon Disulfide	< 0.50	< 0.50	< 0.5	< 12
Carbon Tetrachloride	0.50	0.75	0.40	< 5
Chlorobenzene	< 0.74	< 0.74	< 0.74	< 18
Chlorodibromomethane	< 0.68	< 0.68	< 0.68	< 17
Chlorodifluoromethane (Freon 22)	6.7	4.9	5.6	< 14
Chloroethane	< 0.42	< 0.42	< 0.42	< 11
Chloroform	10	8.3	8.8	9.3 J
Chloromethane	1.5	1.2	1.6	< 8.3
cis-1,3-Dichloropropene	< 0.73	< 0.73	< 0.73	< 18
Dichlorodifluoromethane (Freon 12)	2.9	1.6	1.8	< 20
Dichloromethane	2.6	< 0.56	0.90	< 14
Ethylbenzene	< 0.69	0.52 J	0.69	76.9
Methyl N-Butyl Ketone	< 0.65	< 0.65	< 0.65	< 16
Methyl Tert-Butyl Ether	< 0.58	< 0.58	< 0.58	< 14
Styrene (Monomer)	< 0.68	< 0.68	< 0.68	< 17
trans-1,3-Dichloropropene	< 0.73	< 0.73	< 0.73	< 18
Trichlorofluoromethane (Freon 11)	2.0	1.2	1.5	< 11
Trichlorotrifluoroethane (Freon 113)	2.1	1.8	1.5	< 15
1-Chloro-1,1-difluoroethane (Freon 142b)	< 0.66	< 0.66	0.32 J	< 16
Subtotal Non-Project VOCs	70	39	50	139
Total VOCs²	259	209	266	5427

Notes, Abbreviations, Qualifiers, and Units on last page.

Table 5
Summary of Effluent Vapor Sample Analytical Results
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, Qualifiers, and Units:

1. Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15. A VOC analyte list is provided in the DRAFT Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). 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. "Total VOCs" represents the sum of individual concentrations of all compounds detected. The values used in calculations referenced in this report have been rounded to the nearest whole number.
3. Results validated following protocols specified in Sampling and Analysis Plan in the Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). See previous annual reports for historical analytical results.

ELAP	Environmental Laboratory Approval Program
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance, and Monitoring
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

- 1.1** Bold value indicates a detection.
- < 11 Compound not detected above the laboratory quantification limit.
- J Result is estimated.
- $\mu\text{g}/\text{m}^3$ micrograms per cubic meter

Table 6
Summary of Effluent Vapor Tentatively Identified Compounds
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Compound ¹ (All Constituent Concentrations in ppbv)	10/6/2020 ³	02/10/21	04/08/21	08/17/21
<u>Tentatively Identified Compounds</u>				
Acetone	ND	ND	ND	ND
Carbon Dioxide	65 JNB	230 JNB	330 JNB	21000 JNB
Difluorochloromethane	ND	ND	ND	ND
Ethanol	1.3 JN	1.2 JN	ND	ND
Cumene	1.6 JN	ND	ND	ND
2-Phenyl-2-Propanol	ND	ND	ND	ND
Acetaldehyde	4.2 JN	ND	ND	ND
Unknown (A)	ND	ND	ND	ND
Unknown (B)	ND	ND	ND	ND
Total VOC TICs²	7.1 J	1.2 J	ND	ND

Notes, Abbreviations, Qualifiers, and Units:

1. Vapor samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15. A VOC analyte list is provided in the DRAFT Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). 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.

3. VSP-5 sample location moved to new sample port at ECU effluent stack.

2. Compounds found in associated method blank are not included in Total VOC TICs.

3. Results validated following protocols specified in Sampling and Analysis Plan in the Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). See previous annual reports for historical analytical results.

ECU	Emission Control Unit
ELAP	Environmental Laboratory Approval Program
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance, and Monitoring
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

65	Bold value indicates a detection.
ND	TIC were not detected.
B	TIC was detected in the associated method blank.
J	Result is estimated.
N	Indicates presumptive evidence of a compound.
ppbv	parts per billion by volume

Table 7
Summary of System Parameters
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Date ¹	Water Flow Rates (All Flows in gpm)						Water Pressures (All Pressures in psi)					Air Flow Rate (scfm) ²	Air Pressures (All Pressures in iwc) ^{5,6}				Air Temp. (°R) ⁵	
	Remedial Well ²				Combined Influent ³	Effluent ²	Remedial Well Effluent ^{2,4}				Effluent ⁵		Effluent	ECU Influent				
	RW-1	RW-2	RW-3	RW-4			RW-1	RW-2	RW-3	RW-4		GAC-501		GAC-502	PPZ-601	PPZ-602	Effluent	Effluent
10/19/2020 ⁷	30.2	75.0	75.4	30.1	211	226	56	66	39	56	14	1,515	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	540
11/05/20	30.7	75.0	74.8	30.4	211	227	56	60	38	55	16	1,475	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	540
12/02/20	30.1	77.2	75.4	30.1	213	221	57	37	36	56	12	1,493	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	531
01/05/21	30.3	66.8	75.5	30.4	203	218	56	6	31	56	14	1,474	< 1.0	< 1.0	< 1.0	< 1.0	5.0	521
02/10/21	30.1	45.0	75.0	30.2	180	195	56	4	33	56	9	1,533	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	520
03/02/21	29.9	73.9	76.0	29.4	209	232	57	59	31	57	25	1,460	< 1.0	< 1.0	< 1.0	< 1.0	1.0	519
04/08/21	31.6	75.0	74.6	29.9	211	227	56	11	36	57	12	1,468	< 1.0	< 1.0	< 1.0	< 1.0	1.0	540
05/04/21	30.8	65.3	75.9	30.7	203	220	56	5	38	56	21	1,384	< 1.0	< 1.0	< 1.0	< 1.0	1.0	536
06/02/21	31.0	76.0	75.2	30.3	213	227	56	66	39	56	12	1,327	< 1.0	< 1.0	< 1.0	< 1.0	1.0	542
07/13/21	29.0	75.5	75.8	29.9	210	223	58	65	38	56	17	1,724	< 1.0	< 1.0	< 1.0	< 1.0	0.5	542
08/13/21	30.4	69.9	70.0	30.6	201	228 ⁸	57	74	56	56	18 ⁸	1,753	< 1.0	< 1.0	< 1.0	< 1.0	0.5	554
09/10/21	29.2	75.8	75.8	30.2	211	235 ⁹	57	55	42	57	22 ⁹	1,746	< 1.0	< 1.0	< 1.0	< 1.0	0.5	546

Notes, Abbreviations, and Units on last page.

Table 7
Summary of System Parameters
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, and Units:

1. Operational data collected by Arcadis on days noted. Parameters listed were typically recorded during compliance monitoring events. Data in this table correspond to approximately the past year of system operation.
2. Instantaneous parameters obtained from the SCADA HMI: Water Flow Rate, Water Pressure, Air Flow Rate.
3. Combined influent water-flow rate is the sum of individual well flow rates via the SCADA System.
4. Remedial Well effluent pressure readings measured at the influent manifold within the treatment system building.
5. Instantaneous values recorded from field-mounted instruments during weekly site visits.
6. Pressure readings recorded as < 1.0 iwc due to pressure being too low for gauge sensitivity.
7. Data recorded by Northrop Grumman Operator due to compliance monitoring event taking place during ISTR discharge event which required RW-1 to be turned off.
8. Data recorded by Northrop Grumman Operator on 8/09/2021 due to field recording error.
9. Data recorded by Northrop Grumman Operator on 9/08/2021 due to field recording error.

ECU	Emission Control Unit
GAC	Granular Activated Carbon
HMI	Human-Machine Interface
RW	Remedial Well
SCADA	Supervisory Control and Data Acquisition
Temp	Temperature
gpm	gallons per minute
iwc	inches of water column
psi	pounds per square inch
°R	degrees Rankine
scfm	standard cubic feet per minute

Table 8
 Summary of Groundwater Recovered, VOC Mass Recovered, and VOC Mass Recovery Rates
 Bethpage Park Groundwater Containment System
 Operable Unit 3 (Former Grumman Settling Ponds)
 Northrop Grumman,
 Bethpage, New York



Operating Period ¹	Volume of Groundwater Recovered (x1,000 gal) ²					VOC Mass Recovered (lbs) ³															VOC Mass Recovery Rate (lbs/day) ⁴															
						Total VOCs ⁵					Project VOCs ⁶					Non-Project VOCs ⁷					Total VOCs ⁵				Project VOCs ⁶				Non-Project VOCs ⁷							
	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	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	RW-1	RW-2	RW-3	RW-4	Total	
System Pilot Test, Shakedown and Startup Totals ⁸	137	270	251	150	808	NA	NA	NA	NA	1.1	NA	NA	NA	NA	1.0	NA	NA	NA	NA	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2010 Totals	15,726	35,127	38,160	15,689	104,702	0.56	172	412	89	672	0.56	171	28	0.10	200	< 0.01	0.17	383	89	469	< 0.01	0.46	1.1	0.24	1.8	< 0.01	0.46	0.075	< 0.01	0.54	< 0.01	< 0.01	1.0	0.24	1.3	
2011 Totals	15,218	36,570	37,682	15,196	104,666	0.36	167	271	78	516	0.36	167	35	0.090	203	< 0.01	1.1	236	78	314	< 0.01	0.45	0.73	0.21	1.4	< 0.01	0.45	0.095	< 0.01	0.55	< 0.01	< 0.01	0.64	0.21	0.85	
2012 Totals	15,260	35,178	36,111	15,336	101,885	0.28	114	113	40	267	0.25	113	12	0.39	126	< 0.01	1.5	101	40	141	< 0.01	0.31	0.31	0.11	0.73	< 0.01	0.31	0.032	< 0.01	0.35	< 0.01	< 0.01	0.28	0.11	0.39	
2013 Totals	15,968	37,514	36,622	16,036	106,140	0.14	111	41	18	171	0.14	110	4.3	0.36	113	< 0.01	1.6	37	18	57	< 0.01	0.30	0.11	0.050	0.47	< 0.01	0.30	0.012	< 0.01	0.31	< 0.01	< 0.01	0.10	0.049	0.16	
2014 Totals	15,690	33,222	31,199	15,691	95,802	0.063	67	9.9	8.1	85	0.063	65	2.0	0.20	67	< 0.01	1.5	8.1	7.9	17	< 0.01	0.19	0.028	0.023	0.24	< 0.01	0.18	< 0.01	< 0.01	0.19	< 0.01	< 0.01	0.023	0.022	0.047	
2015 Totals	15,859	38,082	34,961	14,755	103,657	0.028	47	7.1	4.5	57	0.021	45	1.5	0.20	45	< 0.01	1.7	5.6	4.2	12	< 0.01	0.13	0.019	0.012	0.16	< 0.01	0.12	< 0.01	< 0.01	0.12	< 0.01	< 0.01	0.015	0.012	0.032	
2016 Totals	15,826	34,539	39,349	15,826	105,540	< 0.01	38	3.2	2.2	44	< 0.01	37	1.4	0.20	39	< 0.01	1.5	1.7	2.0	5.2	< 0.01	0.10	< 0.01	< 0.01	0.12	< 0.01	0.10	< 0.01	< 0.01	0.11	< 0.01	< 0.01	< 0.01	< 0.01	0.014	
2017 Totals	16,005	31,600	37,614	15,965	101,184	< 0.01	13	2.2	1.2	17	< 0.01	13	1.1	0.16	14	< 0.01	0.56	1.1	1.1	2.7	< 0.01	0.037	< 0.01	< 0.01	0.046	< 0.01	0.035	< 0.01	< 0.01	0.038	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
2018 Totals	15,145	37,712	32,473	14,917	100,247	< 0.01	13.71	0.90	0.56	15.2	< 0.01	13.5	0.70	< 0.01	14.2	< 0.01	0.27	0.19	0.52	0.97	< 0.01	0.038	< 0.01	< 0.01	0.042	< 0.01	0.037	< 0.01	< 0.01	0.039	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
2019 Totals	15,456	32,470	38,416	15,343	101,685	< 0.01	11.51	1.36	0.22	13.10	< 0.01	11.51	1.07	< 0.01	12.59	< 0.01	< 0.01	0.29	0.18	0.63	< 0.01	0.032	< 0.01	< 0.01	0.036	< 0.01	0.032	< 0.01	< 0.01	0.034	< 0.01	< 0.01	0.001	< 0.01		
2020 Totals	14,475	35,814	37,537	15,113	102,939	< 0.01	19.3	1.3	< 0.01	20.6	< 0.01	19.3	0.91	< 0.01	20.2	< 0.01	< 0.01	0.36	< 0.01	0.36	< 0.01	0.053	< 0.01	< 0.01	0.056	< 0.01	0.053	< 0.01	< 0.01	0.055	< 0.01	< 0.01	< 0.01	< 0.01		
January 2021 through March 2021																																				
01/01/21 - 02/01/21	1,325	2,694	3,340	1,345	8,704	< 0.01	1.93	0.15	< 0.01	2.08	< 0.01	1.9	0.11	< 0.01	2.0	< 0.01	< 0.01	0.03	< 0.01	0.033	< 0.01	0.062	< 0.01	< 0.01	0.067	< 0.01	0.062	< 0.01	< 0.01	0.066	< 0.01	< 0.01	< 0.01	< 0.01		
02/01/21 - 03/01/21	1,186	2,579	3,043	1,210	8,018	< 0.01	1.85	0.13	< 0.01	1.98	< 0.01	1.9	0.10	< 0.01	2.0	< 0.01	< 0.01	0.03	< 0.01	0.030	< 0.01	0.066	< 0.01	< 0.01	0.071	< 0.01	0.066	< 0.01	< 0.01	0.070	< 0.01	< 0.01	< 0.01	< 0.01		
03/01/21 - 04/01/21	1,308	3,281	3,298	1,314	9,201	< 0.01	2.35	0.15	< 0.01	2.50	< 0.01	2.4	0.11	< 0.01	2.5	< 0.01	< 0.01	0.03	< 0.01	0.033	< 0.01	0.076	< 0.01	< 0.01	0.081	< 0.01	0.076	< 0.01	< 0.01	0.080	< 0.01	< 0.01	< 0.01	< 0.01		
Subtotal Jan - Mar 2021	3,820	8,554	9,681	3,869	25,923	< 0.01	6.14	0.43	< 0.01	6.56	< 0.01	6.1	0.33	< 0.01	6.5	< 0.01	< 0.01	0.10	< 0.01	0.10	< 0.01	0.068	< 0.01	< 0.01	0.073	< 0.01	0.068	< 0.01	< 0.01	0.072	< 0.01	< 0.01	< 0.01	< 0.01		
April 2021 through June 2021 ⁹																																				
04/01/21 - 05/01/21	1,267	2,960	3,182	1,262	8,670	< 0.01	2.25	0.10	< 0.01	2.35	< 0.01	2.2	0.08	< 0.01	2.3	< 0.01	< 0.01	0.02	< 0.01	0.024	< 0.01	0.075	< 0.01	< 0.01	0.078	< 0.01	0.075	< 0.01	< 0.01	0.078	< 0.01	< 0.01	< 0.01	< 0.01		
05/01/21 - 06/01/21	1,339	2,852	3,334	1,341	8,866	< 0.01	2.16	0.11	< 0.01	2.27	< 0.01	2.2	0.08	< 0.01	2.2	< 0.01	< 0.01	0.03	< 0.01	0.025	< 0.01	0.070	< 0.01	< 0.01	0.073	< 0.01	0.070	< 0.01	< 0.01	0.073	< 0.01	< 0.01	< 0.01	< 0.01		
06/01/21 - 07/01/21	1,291	3,200	3,208	1,292	8,991	< 0.01	2.43	0.10	< 0.01	2.53	< 0.01	2.4	0.08	< 0.01	2.5	< 0.01	< 0.01	0.02	< 0.01	0.024	< 0.01	0.081	< 0.01	< 0.01	0.084	< 0.01	0.081	< 0.01	< 0.01	0.084	< 0.01	< 0.01	< 0.01	< 0.01		
Subtotal Apr - Jun 2021 ⁹	3,896	9,012	9,724	3,895	26,528	< 0.01	6.84	0.32	< 0.01	7.16	< 0.01	6.8	0.24	< 0.01	7.1	< 0.01	< 0.01	0.07	< 0.01	0.073	< 0.01	0.075	< 0.01	< 0.01	0.079	< 0.01	0.075	< 0.01	< 0.01	0.078	< 0.01	< 0.01	< 0.01	< 0.01		
07/01/21 - 08/01/21	1,128	2,881	2,862	1,141	8,013	< 0.01	39.89	0.10	< 0.01	39.99	< 0.01	38.9	0.08	< 0.01	38.9	< 0.01	1.040	0.02	0.02	1.081	< 0.01	1.287	< 0.01	< 0.01	1.290	< 0.01	1.253	< 0.01	< 0.01	1.256	< 0.01	0.03	< 0.01	0.001	0.0350	
08/01/21 - 09/01/21	871	3,013	2,959	1,262	8,104	< 0.01	41.72	0.10	< 0.01	41.82	< 0.01	40.6	0.08	< 0.01	40.7	< 0.01	1.087	0.02	0.02	1.131	< 0.01	1.346	< 0.01	< 0.01	1.349	< 0.01	1.311	< 0.01	< 0.01	1.313	< 0.01	0.04	< 0.01	0.001	0.0360	
09/01/21 - 10/01/21	944	3,255	3,271	1,307	8,776	< 0.01	45.06	0.11	< 0.01	45.17	< 0.01	43.9	0.09	< 0.01	44.0	< 0.01	1.174	0.03	0.02	1.221	< 0.01	1.502	< 0.01	< 0.01	1.506	< 0.01	1.463	< 0.01	< 0.01	1.466	< 0.01	0.04	< 0.01	0.001	0.0410	
Subtotal Jul - Sep 2021	2,943	9,149	9,092	3,709	24,893	< 0.01	126.67	0.32	< 0.01	126.98	< 0.01	123.4	0.24	< 0.01	123.6	< 0.01	3.301	0.07	0.06	3.433	< 0.01	1.377	< 0.01	< 0.01	1.380	< 0.01	1.341	< 0.01	< 0.01	1.344	< 0.01	0.04	< 0.01	0.001	0.0370	
2021 Totals	10,659	26,715	28,497	11,473	77,344	< 0.01	139.6	1.1	< 0.01	140.7	< 0.01	136.3	0.82	< 0.01	137.2	< 0.01	3.3	0.24	0.06	3.60	< 0.01	1.520	< 0.01	< 0.01	1.532	< 0.01	1.484	< 0.01	< 0.01	1.494	< 0.01	< 0.01	< 0.01	0.0370		
Total Since System Start Up	188,017	428,650	445,317	188,064	1,250,048	2	1,189	917	256	2,361	2	1,174	107	2	1,285	< 0.01	14	810	254	1,071	--	--	--	--	--	--	--	--	--	--	--	--	--	--		

Notes, Abbreviations, Qualifiers, and Units:

- Represents operating period between consecutive monitoring events.
- 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 are rounded to the nearest gallon, but should only be considered accurate to two significant figures to account for error associated with field measurements.
- Mass recovered per well was calculated by multiplying the Total VOC concentration from the most recent sampling event by the number of gallons extracted during the reporting period. The total amount recovered during a given operating period is the sum of masses recovered from each of the individual wells. Values less than ten pounds are presented using two significant figures and values greater than ten pounds have been rounded to the nearest whole number; however, these values should only be considered accurate to two significant figures to account for error associated with field measurements and analytical data.
- Mass recovery rates were calculated by dividing the total mass recovered for each well and for the system by the number of days in the respective operating period. Values are presented using two significant figures.
- "Total VOCs" represents the sum of individual concentrations of the VOCs detected.
- "Project VOCs" represents the sum of individual compound concentrations of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethylene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and xylenes-o,m, p.
- "Non-Project VOCs" represents the difference between Total VOCs and Project VOCs.
- Values based on operational data recorded prior to system startup on July 21, 2009.
- The volume of groundwater recovered and mass recovered calculations represent the operational period between April 1st, 2021 and July 1st 2021.

NA Not Applicable
 VOC Volatile Organic Compound.
 < Less than
 gal Gallons
 lbs Pounds
 lbs/day Pounds per day

Table 9
Summary of Air Quality Impact Analysis
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Toxic Air Contaminant ⁴	CAS#	VSP-05 Vapor Effluent (µg/m ³)	Emission Rate ¹			Scaled Impact - Hourly ² (µg/m ³)	Scaled Impact - Annual ² (µg/m ³)	SGC ³ (µg/m ³)	AGC ³ (µg/m ³)	% of SGC	% of AGC
		8/17/2021	lb/yr	lb/hr	g/s						
Project VOCs											
1,1-Dichloroethane	75-34-3	9.7 J	0.58	6.61E-05	8.3E-06	8.1E-02	1.6E-03	--	0.63	--	0.3%
Benzene	71-43-2	8.0 J	0.48	5.45E-05	6.9E-06	6.7E-02	1.3E-03	1,300	0.13	0.0%	1.0%
cis-1,2-Dichloroethene	156-59-2	1140	68.02	7.77E-03	9.8E-04	9.6E+00	1.9E-01	--	63	--	0.3%
Toluene	108-88-3	3360	200.49	2.29E-02	2.9E-03	2.8E+01	5.5E-01	37,000	5,000	0.1%	0.0%
Trichloroethene	79-01-6	260	15.51	1.77E-03	2.2E-04	2.2E+00	4.2E-02	20	0.2	10.9%	21.1%
Vinyl Chloride	75-01-4	170	10.14	1.16E-03	1.5E-04	1.4E+00	2.8E-02	180,000	0.11	0.0%	25.1%
Xylene-O	1330-20-7	109	6.50	7.42E-04	9.4E-05	9.1E-01	1.8E-02	22,000	100	0.0%	0.0%
Xylenes - M,P	1330-20-7	232	13.84	1.58E-03	2.0E-04	1.9E+00	3.8E-02	22,000	100	0.0%	0.0%
Non-Project VOCs											
Acetone	67-64-1	52.5	3.13	3.58E-04	4.5E-05	4.4E-01	8.5E-03	180,000	30,000	0.0%	0.0%
Chloroform	67-66-3	9.3 J	0.55	6.33E-05	8.0E-06	7.8E-02	1.5E-03	150	14.7	0.1%	0.0%
Ethylbenzene	100-41-4	76.9	4.59	5.24E-04	6.6E-05	6.5E-01	1.2E-02	--	1,000	--	0.0%

Notes, Abbreviations, and Units on last page.

Table 9
Summary of Air Quality Impact Analysis
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, and Units:

1. Emission rate calculated based on VSP-05 effluent concentration and daily average air flow rate of 1,822 ft³/min during compliance monitoring event on 8/17/2021. Emission rate standardized at 70 °F and 1 atm.

$$1,1,1\text{-Trichloroethane (lb/hr)} = \text{TCE } [\mu\text{g}/\text{m}^3] \times \text{Air Flow Rate } [\text{ft}^3/\text{min}] \times (1 \text{ m}^3/35.3147 \text{ ft}^3) \times (60 \text{ min/hr}) \times (0.000001 \text{ g}/1 \mu\text{g}) \times (0.0022 \text{ lb/g})$$

$$\text{lb/yr} = \text{lb/hr} \times 8,760 \text{ hrs/yr}$$

$$\text{g/s} = \text{lb/hr} \times \text{hr}/3,600 \text{ sec} \times 453.59 \text{ g/lb}$$

2. Ambient impact based on AERMOD modeling using normalized rate of 1 g/s is scaled to the actual emission rate of the pollutant. Modeling was performed using the representative meteorological data from the nearest station (Brookhaven/Farmingdale) for the years 2015 through 2019. The maximum impact from all the years was used for the calculations.

$$\text{Scaled hourly impact } (\mu\text{g}/\text{m}^3) = \text{AERMOD predicted hourly ambient impact at 1 g/s } ([\mu\text{g}/\text{m}^3]/[\text{g/s}]) \times \text{Actual emission rate (g/s)}$$

$$\text{Scaled annual impact } (\mu\text{g}/\text{m}^3) = \text{AERMOD predicted annual ambient impact at 1 g/s } ([\mu\text{g}/\text{m}^3]/[\text{g/s}]) \times \text{Actual emission rate (g/s)}$$

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([$\mu\text{g}/\text{m}^3$]/[g/s])	Annual ([$\mu\text{g}/\text{m}^3$]/[g/s])
9,778.35	189.33

3. Short-term and annual guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised August 10, 2016.
 4. Compounds not detected above the laboratory reporting limit are excluded from the air quality impact analysis summary.

AGC	Annual Guideline Concentration
DAR-1	Division of Air Resources-1
--	None Specified
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
VSP	Vapor Sampling Point
cfm	cubic feet per minute
g/s	grams per second
lb/hr	pounds per hour
lb/yr	pounds per year
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter

Table 10
Summary of Remedial Well Groundwater Sample Analytical Results - VOCs
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman,
Bethpage, New York



Notes, Abbreviations, Qualifiers, and Units:

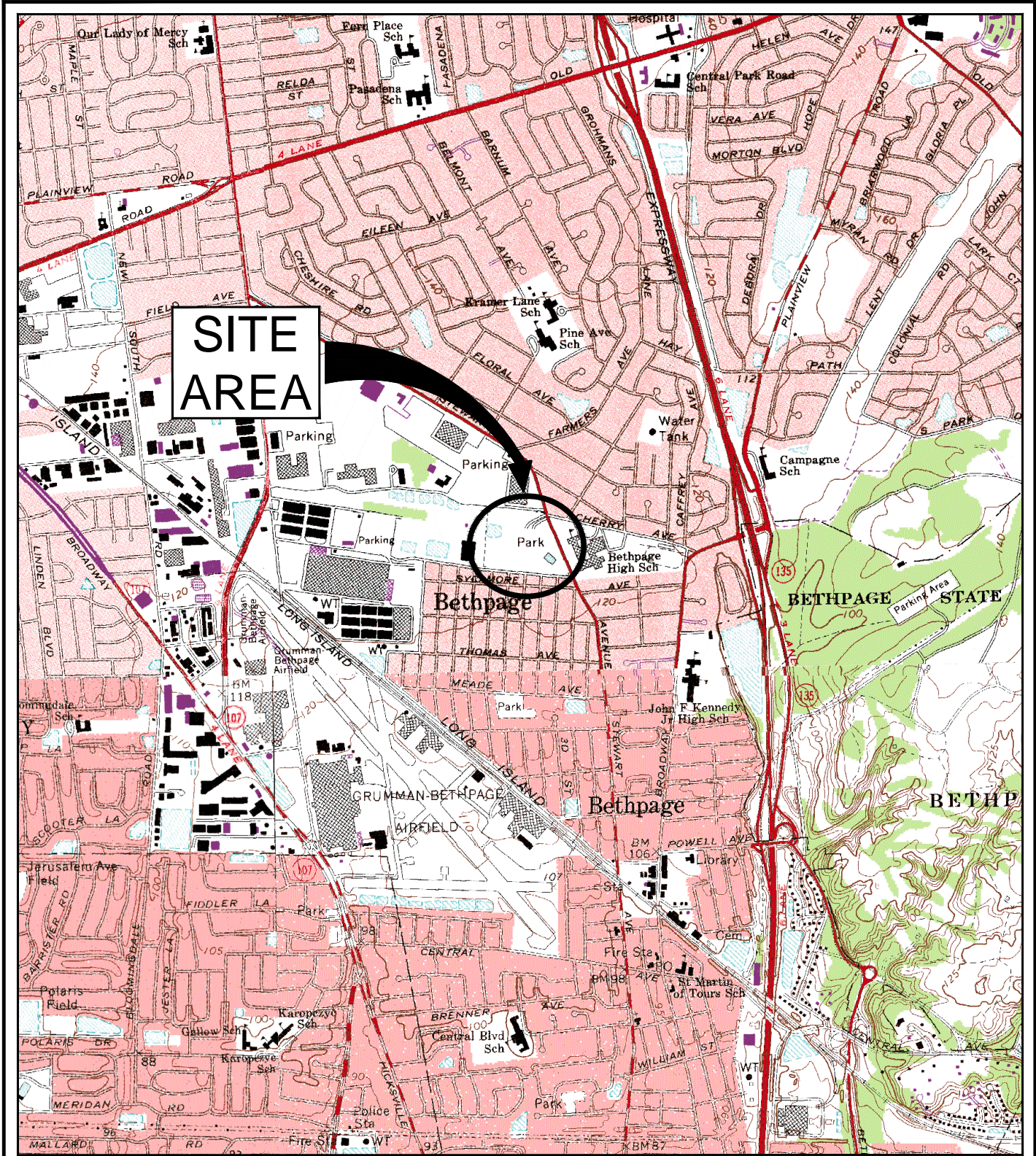
1. Water samples collected by Arcadis on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per NYSDEC ASP 2005, Method OLM 4.3 (prior to September 1, 2014) and per EPA Method 8260C (after September 1, 2014). Results validated following protocols specified in Sampling and Analysis Plan in the DRAFT Bethpage Park Groundwater Containment System OM&M Manual (Arcadis 2016). See previous quarterly reports for historical analytical results.

2. "Total VOCs" represents the sum of individual concentrations of the VOCs detected.

ASP	Analytical Services Protocol
ELAP	Environmental Laboratory Approval Program
NE	Not Established
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OLM	Ozone Limited Method
OM&M	Operation, Maintenance, and Monitoring
SCGs	Standards, Criteria, and Guidance values
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0	Bold cell outline indicates an exceedance of an SCG
1.0	Bold data indicates a detection
< 1.0	Compound not detected above its laboratory quantification limit
J	Compound detected below its reporting limit; value is estimated
U	Indicates the compound was analyzed for but not detected above the specified level
ND	Analyte not detected at, or above its laboratory quantification limit.
µg/L	micrograms per liter

CITY:SYRACUSE,NY DIV:GROUP:ENV DB:A.SANCHEZ TM:(Op) LVR:(Op)ION:OFF-REF. PLOT: 11/11/2015 4:54 PM BY: STOWELL,GARY
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**SITE
AREA**

SOURCE:
 USGS 7.5 MIN. AMITYVILLE QUADRANGLE, AMITYVILLE, N.Y., 1994, FREEPORT QUADRANGLE, FREEPORT, N.Y., 1994,
 HICKSVILLE QUADRANGLE, HICKSVILLE, N.Y., 1967, PHOTOREVISED 1979, HUNTINGTON, N.Y., 1967, PHOTOREVISED 1979

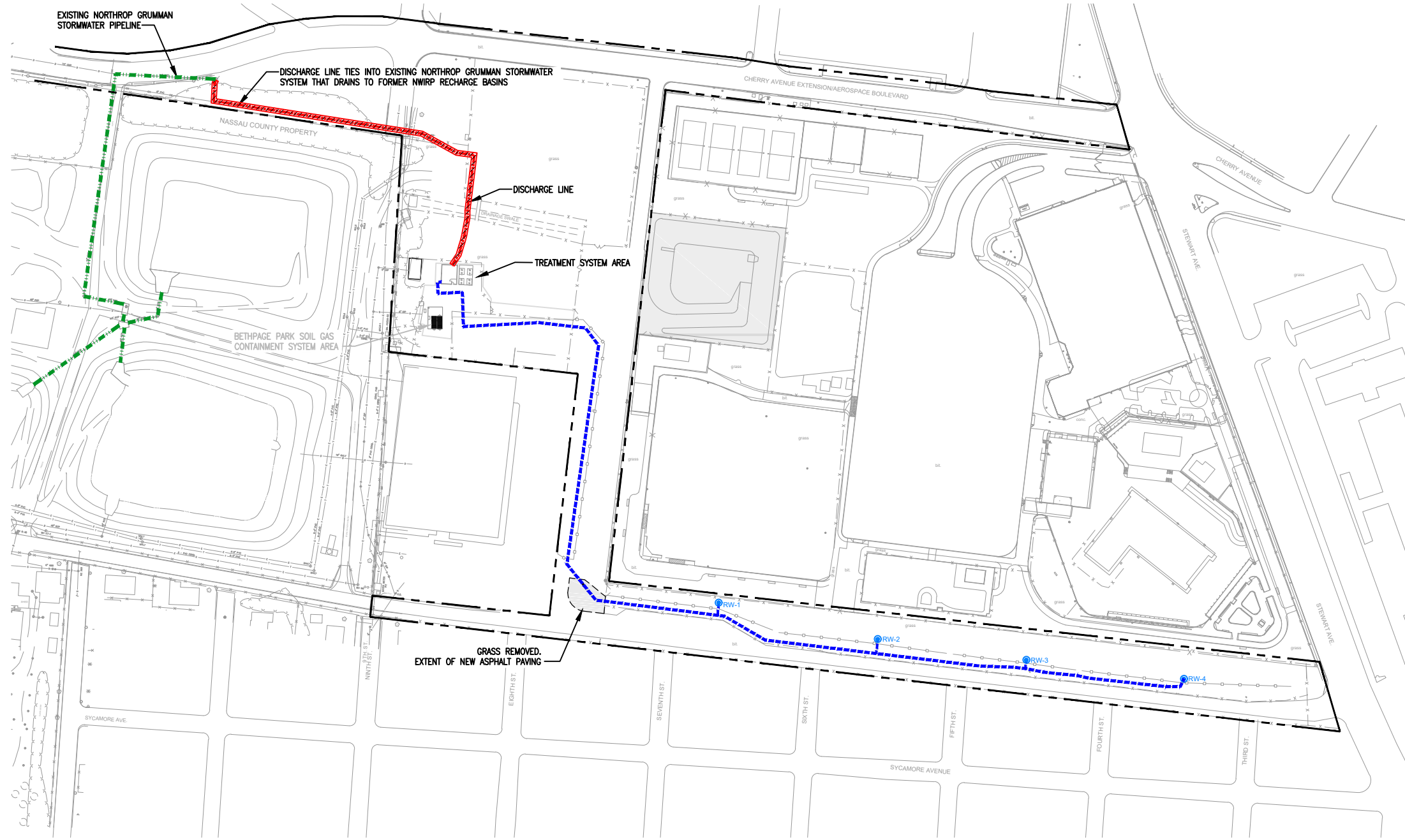


**BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK**

SITE LOCATION



FIGURE
1



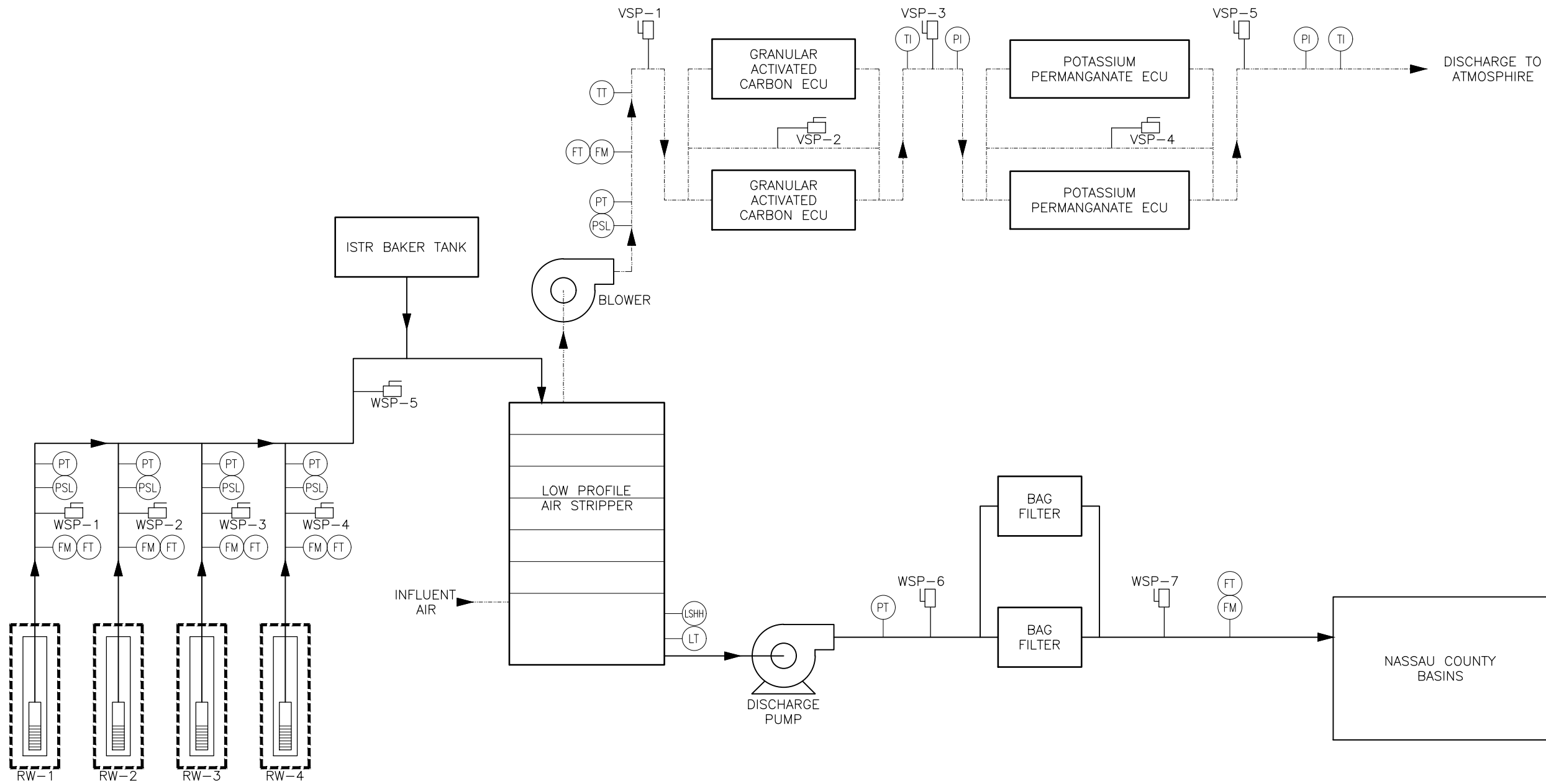
- LEGEND:**
- NORTHROP GRUMMAN PROPERTY LINE
 - - - - FENCE
 - bit. BITUMINOUS PAVEMENT
 - INFLUENT PIPELINE AND ELECTRICAL CONDUITS
 - EFFLUENT PIPELINE
 - EXISTING NORTHROP GRUMMAN STORMWATER PIPELINE
 - RW-4 REMEDIAL WELL
 - NWIRP NAVAL WEAPONS INDUSTRIAL RESERVE PLANT (NOW OWNED BY NASSAU COUNTY)



BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

**SITE AND
GROUNDWATER CONTAINMENT SYSTEM**

ARCADIS | FIGURE 2



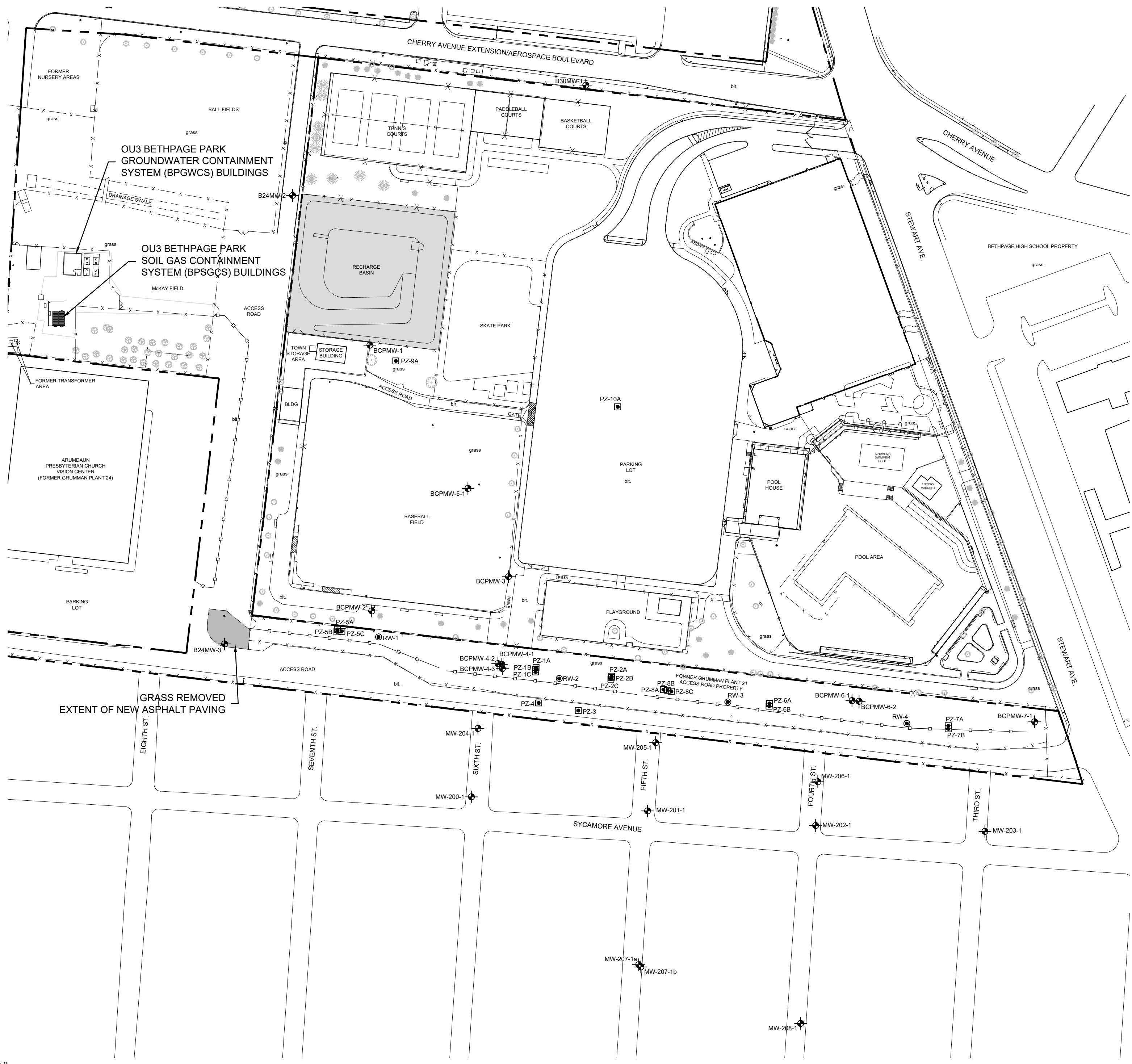
- LEGEND:**
- PROCESS WATER
 - - - PROCESS AIR
 - ⊖ FM INSTRUMENT
 - SAMPLE PORT
 - ▶ FLOW DIRECTION
 - FM FLOW METER
 - FT FLOW RATE TRANSMITTER
 - PSL PRESSURE VACUUM LOW
 - PT PRESSURE TRANSMITTER
 - PI PRESSURE INDICATOR
 - LSHH LEVEL SWITCH HIGH HIGH
 - LT LEVEL TRANSMITTER
 - TT TEMPERATURE TRANSMITTER
 - TI TEMPERATURE INDICATOR
 - WSP WATER SAMPLE PORT
 - VSP VAPOR SAMPLE PORT
 - ECU EMISSION CONTROL UNIT

BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK

**GROUNDWATER TREATMENT SYSTEM
 PROCESS SCHEMATIC,
 PROCESS FLOW DIAGRAM,
 AND MONITORING LOCATIONS**

ARCADIS | FIGURE 3

CITY: SYRACUSE, NY DIV: GROUP ENV DB: A SANCHEZ LDALS PIC: (04) PM (Read) TM: (04) LVR: (0) ON: OFF-REF
 C:\Users\asanchez\OneDrive - ARCADIS\BIM300 Docs\NORTHROP GRUMMAN\COMM\141466RPH4801.dwg LAYOUT: 4 SAVED: 01/19/2018 7:41 PM ACAD: (ER: 2) (LS TECH) PAGESETUP: PLOTSTYLETABLE: PLOTSTYLETABLE: PLOTTED: 8/10/2018 1:18 PM BY: SANCHEZ, ADRIAN
 AREAS: IMAGES: PROJECTNAME: X: SITE-BASE SITE XT: 146654



EXPLANATION:

- NORTHROP GRUMMAN PROPERTY LINE
- x - x - FENCE
- [Hatched Box] BASIN
- bit. BITUMINOUS PAVEMENT
- MW-200-1 [Well Symbol] MONITORING WELL
- RW-2 [Well Symbol] REMEDIAL WELL
- PZ-2C [Well Symbol] PIEZOMETER

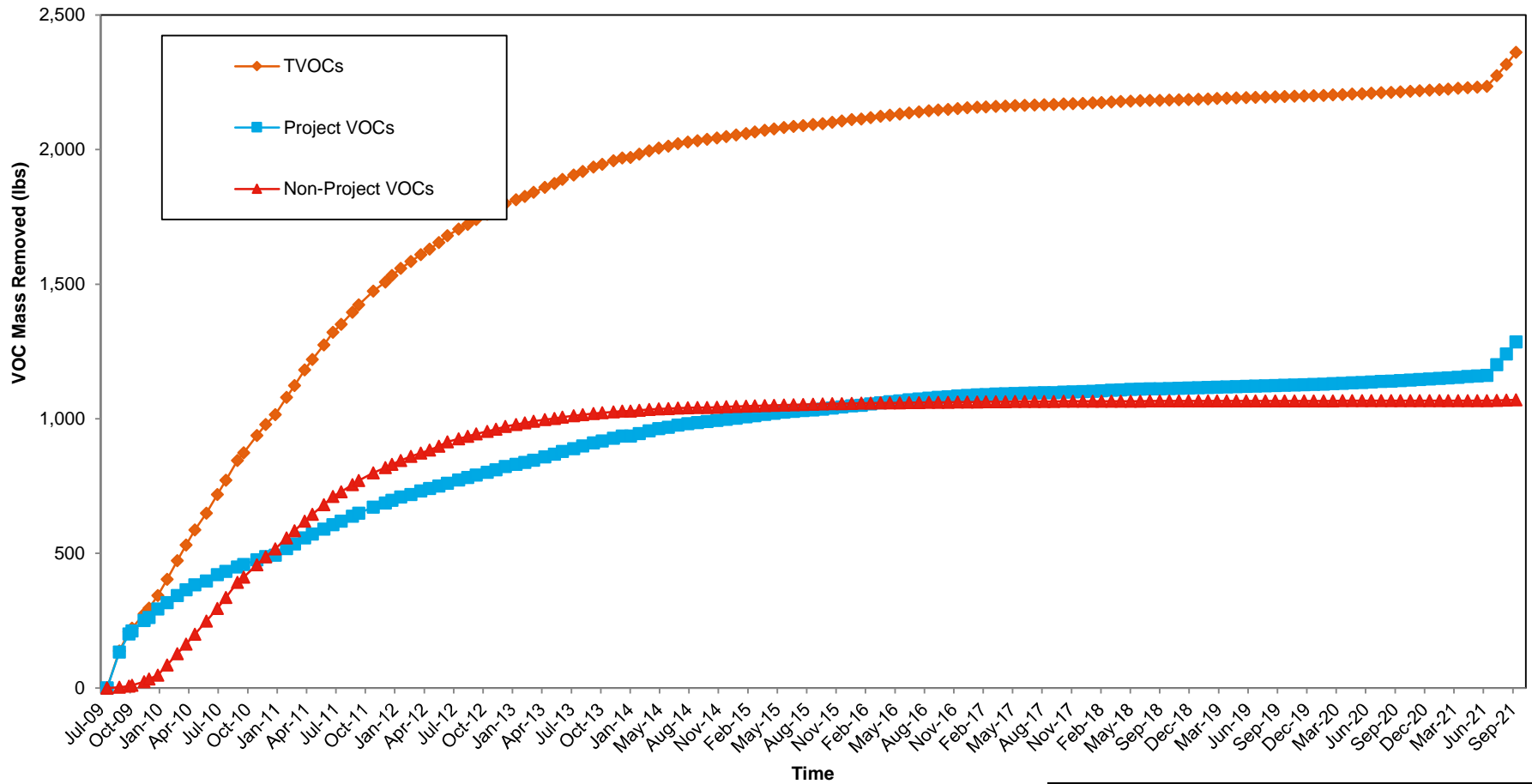
NOTES:

1. MONITORING WELLS, REMEDIAL WELLS, AND PIEZOMETERS SURVEYED TO NORTH AMERICAN DATUM (NAD) 83.
2. PARK FEATURES SHOWN WERE PRESENT PRIOR TO TOWN OF OYSTER BAY REDEVELOPMENT IN 2005.



BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

**GROUNDWATER MONITORING NETWORK
SITE PLAN**



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound
 TVOCs = Total VOCs detected

Project VOCs = sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.

Non-Project VOCs = sum of VOCs that are not Project VOCs.

lbs = pounds

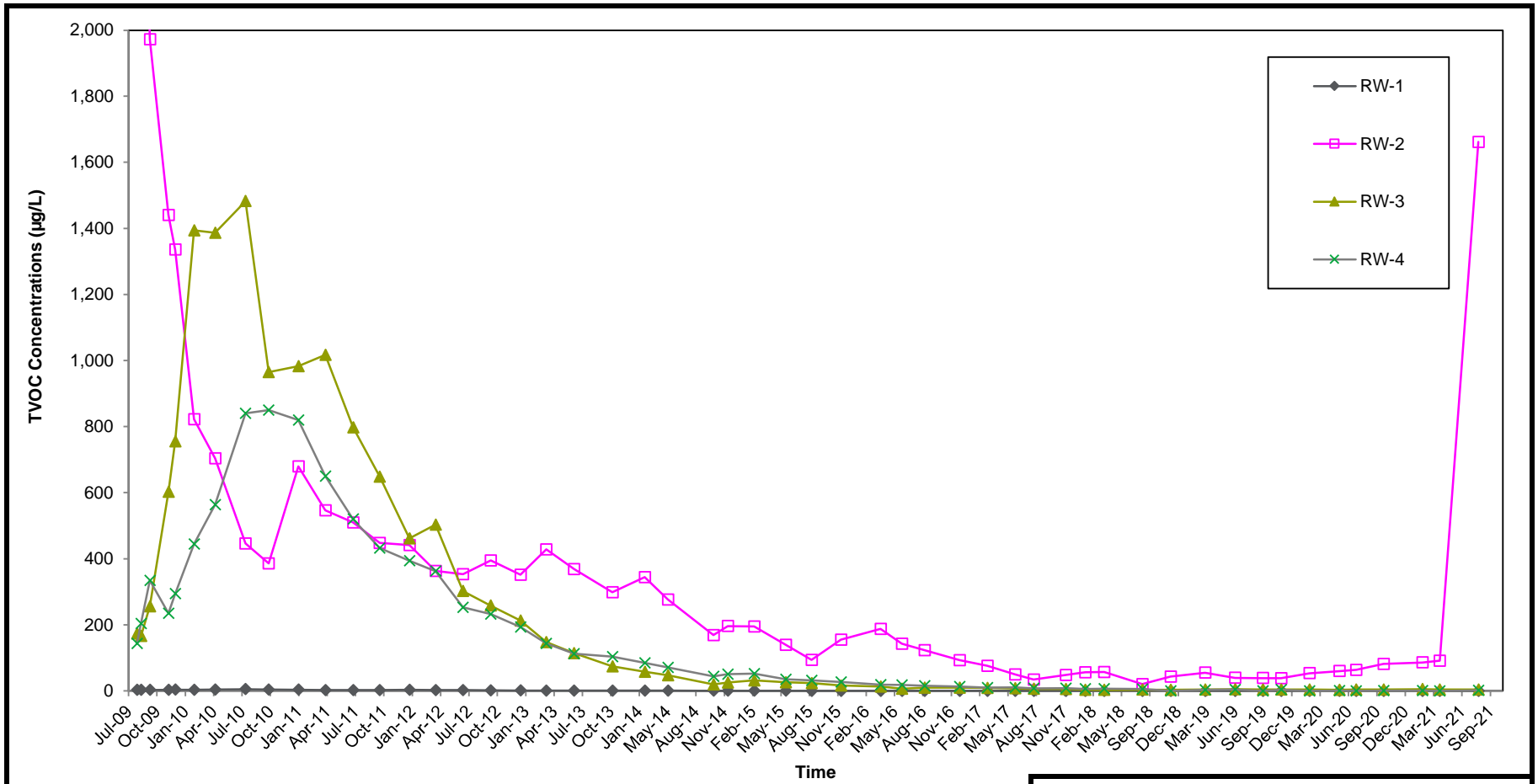
BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK

**CUMULATIVE TOTAL, PROJECT, AND
 NON-PROJECT VOC MASS REMOVED**



FIGURE

5



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound
 TVOCs = Total VOCs detected

1. Results prior to September 10, 2009 are not shown to improve figure clarity. The TVOC concentrations are greater than 2,000 µg/L. See previous reports for full data set.

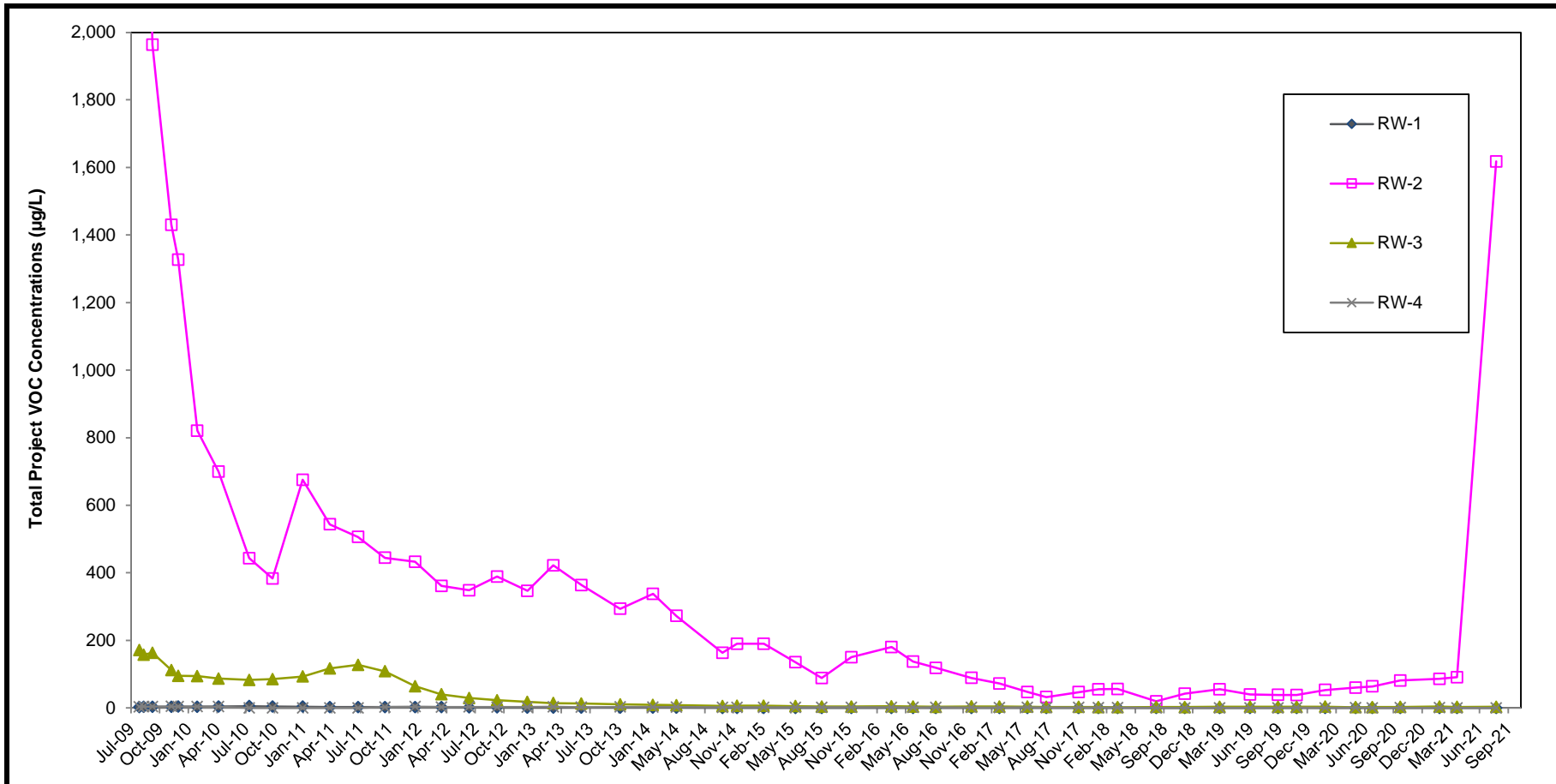
µg/L = micrograms per liter

BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
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 BETHPAGE, NEW YORK

**REMEDIAL WELL TOTAL VOC
 CONCENTRATIONS**



FIGURE
6A



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound
 TVOCs = Total VOCs detected

Project VOCs = sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.

1. Results prior to September 10, 2009 are not shown to improve figure clarity. Total Project VOC concentrations are greater than 2,000 µg/L. See previous reports for full data set.

µg/L = micrograms per liter

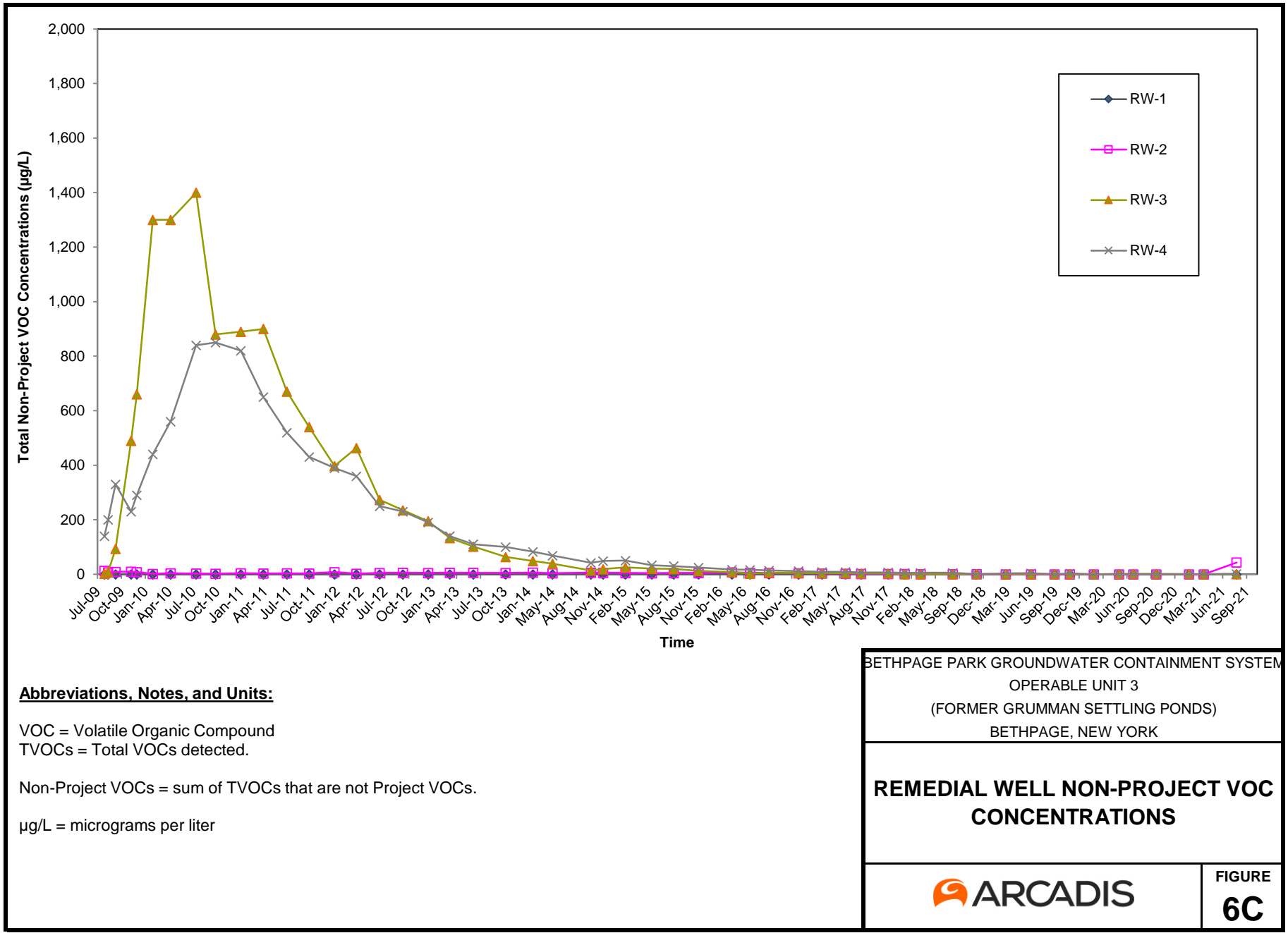
Time

BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK

REMEDIAL WELL PROJECT VOC CONCENTRATIONS



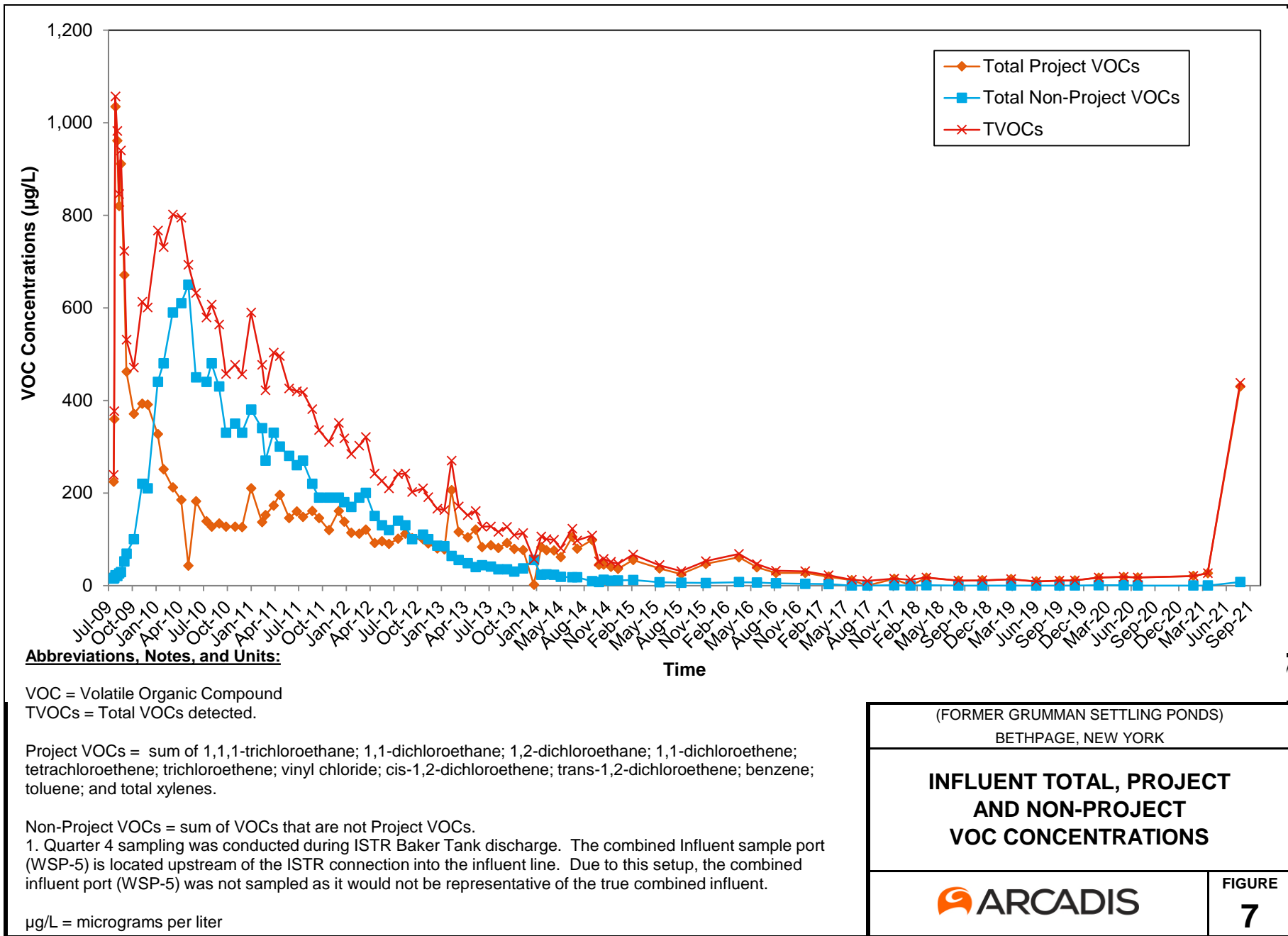
FIGURE
6B

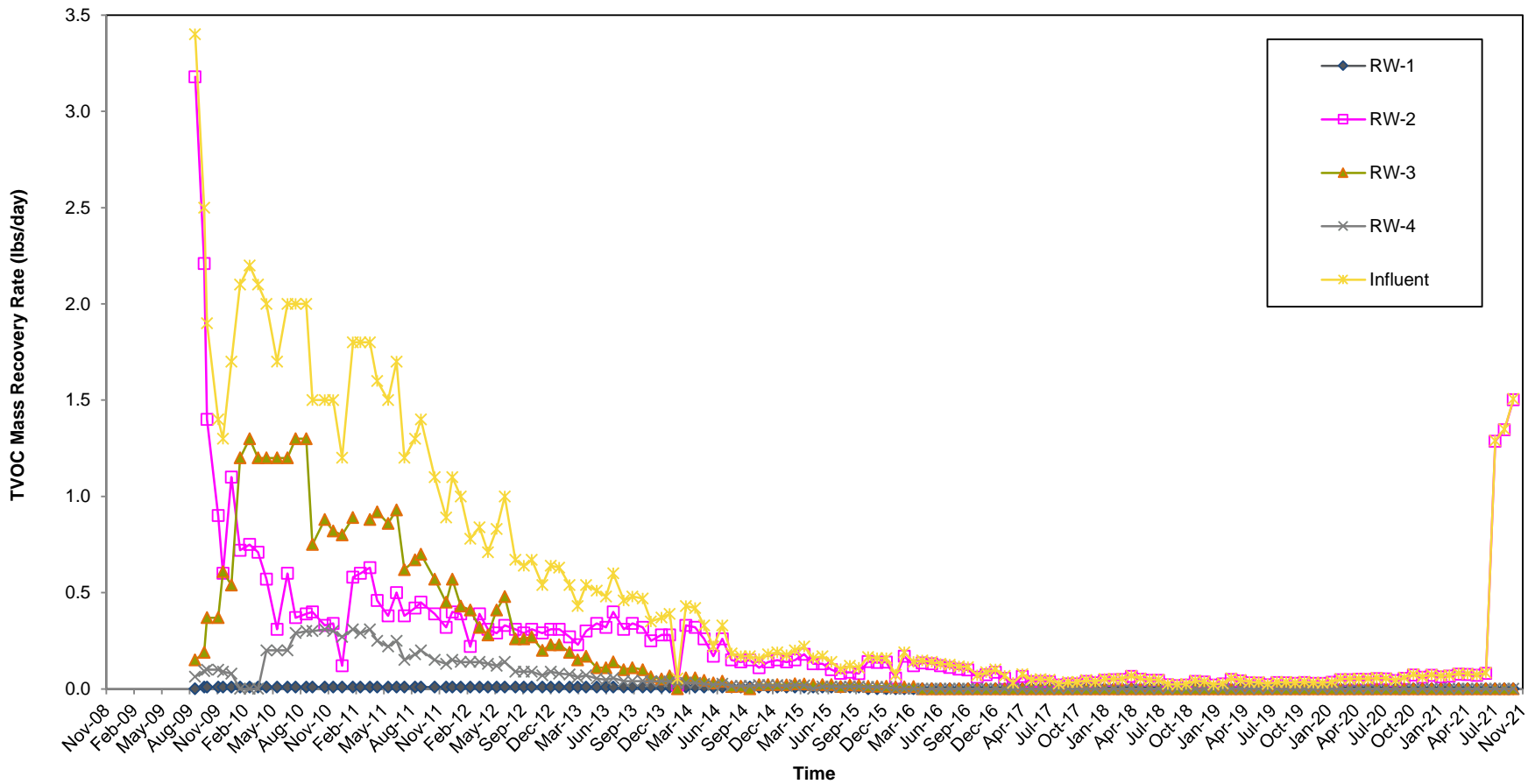


BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK

REMEDIAL WELL NON-PROJECT VOC CONCENTRATIONS

ARCADIS **FIGURE 6C**





Abbreviation, Notes, and Units:

VOC = Volatile Organic Compound
 TVOCs = Total VOCs detected

lbs/day = pounds per day

BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
 OPERABLE UNIT 3
 (FORMER GRUMMAN SETTLING PONDS)
 BETHPAGE, NEW YORK

TOTAL VOC MASS RECOVERY RATES



FIGURE
8A

