ARCADIS Design & Consultancy for natural and built assets

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ENVIRONMENT

Subject:
Results of First Quarter 2018 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.

Date:
May 24, 2018

Contact:
Christopher Engler

Phone:
315.409.6579

Email:
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Our ref:
NY001496.32TM.RPTI4

Dear Jason:

Enclosed is one electronic PDF copy of the first quarter results of the OU3 BPGWCS operation and monitoring, preformed in accordance with the NYSDEC-approved OU3 Groundwater IRM 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.

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

Sincerely,

Arcadis of New York, Inc.

Christopher D. Engler

Christopher Engler, PE
New York PE-069748

Vice President

Enclosure

Copies:
Edward Hannon, Northrop Grumman Corporation
Donald Hesler, NYSDEC
Steven Karpinski, NYS Dept. of Health
John Lovejoy, Nassau County Dept. of Health
Lorenzo Thantu, USEPA
Carlo San Giovanni, Arcadis
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TABLES

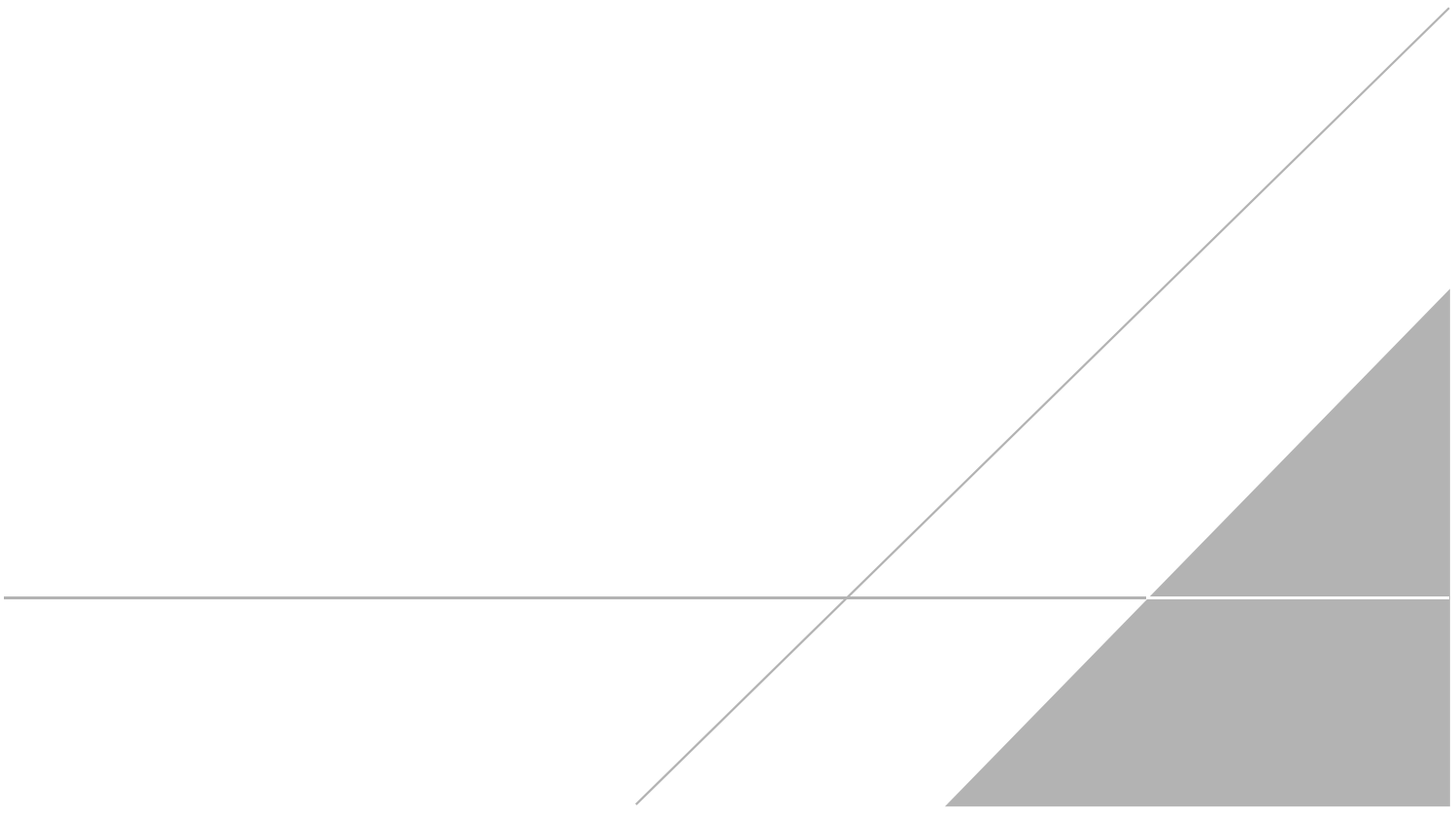

Table 1
Operational Summary
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

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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
Jan 2018																																31
Feb 2018																																28
Mar 2018																																31
1Q 2018																																90
TOTAL																																**3062**

Legend:

Indicates system online the majority or all of the day.
Indicates system operated with reduced flow rates.
Indicates system off-line the majority or all of the day.

Notes:

1. Days in which the system was operational for the majority of the day are counted as one day.

Abbreviations/Units:

1Q First Quarter

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

ARCADIS Design & Consultancy for natural and built assets

Compound	06/16/17 (µg/L)	08/16/17 (µg/L)	11/29/17 (µg/L)	02/01/18 (µg/L)
Project VOCs				
1,1,1 - Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0
1,1 - Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0
1,2 - Dichloroethane	< 1.0	< 1.0	< 1.0	< 1.0
1,1 - Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	**3.5**	**3.3**	**3.9**	**2.8**
Vinyl Chloride	**3.4**	**2.1**	**4.3**	**3.0**
cis 1,2-Dichloroethene	**4.7**	**4.1**	**6.2**	**6.5**
trans 1,2-Dichloroethene	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	< 1.0	< 1.0	< 1.0	< 1.0
Xylene-O	< 1.0	< 1.0	< 1.0	< 1.0
Xylenes - M,P	< 1.0	< 1.0	< 1.0	< 1.0
Subtotal Project VOCs	**11.6**	**9.5**	**14.4**	**12.3**
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloroethane	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Butanone	< 5.0	< 5.0	< 5.0	< 5.0
2-Butanone	< 10	< 10	< 10	< 10
4-Methyl-2-Pentanone	< 5.0	< 5.0	< 5.0	< 5.0
Acetone	< 10	< 10	< 10	< 10
Bromodichloromethane	< 1.0	< 1.0	< 1.0	< 1.0
Bromoform	< 1.0	< 1.0	< 1.0 J	< 1.0
Bromomethane	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Disulfide	< 2.0	< 2.0	< 2.0	< 2.0
Carbon Tetrachloride	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodibromomethane	< 1.0	< 1.0	< 1.0	< 1.0
Chlorodifluoromethane (Freon 22)	< 5.0	< 5.0	< 5.0	< 5.0
Chloroethane	< 1.0	< 1.0	< 1.0	< 1.0
Chloroform	**0.88 J**	**0.71 J**	**0.65 J**	**0.47 J**
Chloromethane	< 1.0	< 1.0	< 1.0	< 1.0 J
cis-1,3-Dichloropropene	< 1.0	< 1.0	< 1.0	< 1.0

Abbreviations, Notes, Qualifers, 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)
Bethpage, New York

Compound	06/16/17 (µg/L)	08/16/17 (µg/L)	11/29/17 (µg/L)	02/01/18 (µg/L)
Non-Project VOCs				
Dichlorodifluoromethane (Freon 12)	< 2.0	< 2.0	< 2.0	< 2.0 J
Dichloromethane	< 2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	< 1.0	< 1.0	< 1.0	< 1.0
Methyl N-Butyl Ketone	< 5.0	< 5.0	< 5.0	< 5.0
Methyl Tert-Butyl Ether	< 1.0	< 1.0	< 1.0	< 1.0
Styrene (Monomer)	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,3-Dichloropropene	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane (Freon 11)	< 2.0	< 2.0	< 2.0	< 2.0 J
Trichlorotrifluoroethane (Freon 113)	< 5.0	< 5.0	< 5.0	< 5.0
1-Chloro-1,1-difluoroethane (Freon 142b)	< 5.0	< 5.0	< 5.0	< 5.0
Subtotal Non-Project VOCs	**0.88**	**0.71**	**0.65**	**0.47**
Total VOCs[1]	**13**	**10**	**15**	**13**
1,4-Dioxane[2]	**0.87**	**0.665**	**0.848**	**0.910**
Compound	**6/16/2017 (µg/L)**	**08/16/17 (µg/L)**	**11/29/17 (µg/L)**	**02/01/18 (µg/L)**
Inorganics				
Dissolved Cadmium	--	< 3.0	--	--
Total Cadmium	--	< 3.0	--	--
Dissolved Chromium	--	**12**	--	--
Total Chromium	--	**11**	--	--
Dissolved Iron	**123**	**151**	**225**	--
Total Iron	**161**	**195**	**1080**	--
pH[3]	**5.3**	**5.6**	**5.7**	**5.6**

Abbreviations, Notes, Qualifiers, and Units:

-- Not Analyzed
USEPA United States Environmental Protection Agency
VOC Volatile Organic Compound

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. 1,4-Dioxane samples analyzed using USEPA Method 522.
3. 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.

6.5 Bold value indicates a detection.
< 1.0 Compound not detected at or above the laboratory quantification limit.
J Compound detected below laboratory reporting limit; result is estimated.
µg/L micrograms per liter

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

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Compound	Discharge Limit[1] (µg/L)	04/21/17 (µg/L)	05/11/17 (µg/L)	06/18/17 (µg/L)	08/01/17 (µg/L)	08/16/17 (µg/L)	09/11/17 (µg/L)	10/12/17 (µg/L)	11/29/17 (µg/L)	12/20/17 [2] (µg/L)	01/11/18 (µg/L)	02/01/18 (µg/L)	03/01/18 (µg/L)
Project VOCs													
1,1,1-Trichloroethane	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
1,1-Dichloroethane	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
1,2-Dichloroethane	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
1,1-Dichloroethene	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50 **J**	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethene	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethene	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Vinyl Chloride	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
cis 1,2-Dichloroethene	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
trans 1,2-Dichloroethene	5[3]	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50 **J**	< 0.50	< 0.50	< 0.50	< 0.50
Benzene	5	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 1.0	--	--	--	--
Toluene	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Xylene-O	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Xylenes-M,P	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Subtotal Project VOCs		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Compound	Discharge Limit[1] (µg/L)	04/21/17 (µg/L)	05/11/17 (µg/L)	06/16/17 (µg/L)	08/01/17 (µg/L)	08/16/17 (µg/L)	09/11/17 (µg/L)	10/12/17 (µg/L)	11/29/17 (µg/L)	12/20/17 [2] (µg/L)	01/11/18 (µg/L)	02/01/18 (µg/L)	03/01/18 (µg/L)
Non-Project VOCs													
1,1,2,2-Tetrachloroethane	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
1,1,2-Trichloroethane	1	< 1.0	< 1.0	< 1.0 **J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
1,2-Dichloropropane	0.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
1,3-Butadiene	0.5[4]	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
2-Butanone	50	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 5.0	--	--	--	--
4-Methyl-2-Pentanone	50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Acetone	50	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 5.0	--	--	--	--
Bromodichloromethane	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Bromoform	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Bromomethane	5	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 1.0	--	--	--	--
Carbon Disulfide	60	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	R[5]	--	--	--	--
Carbon Tetrachloride	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Chlorobenzene	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Chlorodibromomethane	50	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Chlorodifluoromethane (Freon 22)	50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	R[5]	--	--	--	--
Chloroethane	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Chloroform	5[3]	< 1.0	< 1.0	< 1.0 **J**	< 1.0	< 1.0	< 1.0	< 1.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Chloromethane	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
cis-1,3-Dichloropropene	0.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Dichlorodifluoromethane (Freon 12)	5	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	--	--	--
Dichloromethane	5[3]	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Ethylbenzene	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Methyl N-Butyl Ketone	50	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Methyl Tert-Butyl Ether	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Styrene (Monomer)	5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 2.0	--	--	--	--
trans-1,3-Dichloropropene	0.4	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	--	--	--	--
Trichlorofluoromethane (Freon 11)	5	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	--	--	--	--
Trichlorotrifluoroethane (Freon 113)	5[3]	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 0.50 **J**	< 0.50	< 0.50	< 0.50	< 0.50
1-Chloro-1,1-difluoroethane (Freon 142b)	NE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	--	--	--	--
Subtotal Non-Project VOCs		**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total VOCs[6]		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Treatment Efficiency[7]		> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%	> 99.9%

Abbreviations, Notes, Qualifers, 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)
Bethpage, New York

Compound	Discharge Limit[1] (µg/L)	04/21/17 (µg/L)	05/11/17 (µg/L)	06/16/17 (µg/L)	08/01/17 (µg/L)	08/16/17 (µg/L)	09/11/17 (µg/L)	10/12/17 (µg/L)	11/29/17 (µg/L)	12/20/17 [2] (µg/L)	01/11/18 (µg/L)	02/01/18 (µg/L)	03/01/18 (µg/L)
Inorganics													
Dissolved Cadmium	5	--	--	**3.1**	< 3.0	< 3.0	--	--	< 3.0	--	--	< 3.0	--
Total Cadmium	5	--	--	< 3.0	< 3.0	< 3.0	--	--	< 3.0	--	--	< 3.0	--
Dissolved Chromium	50	--	--	< 10	< 10	< 10	--	--	< 10	--	--	< 10	--
Total Chromium	50	--	--	< 10	< 10	< 10	--	--	< 10	--	--	< 10	--
Dissolved Iron	600	**136**	**184**	**102**	**200**	**163**	< 100 [8]	**132**	**245**	**153**	**150**	**116**	**181**
Total Iron	600	**236**	**242**	**140**	**241**	**179**	**129** [8]	**193**	**275**	**212**	**204**	**183**	**229**
Total Mercury	250	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
1,4-Dioxane[9]	NE	**0.82**	**1.0**	**0.89**	**0.78**	**0.75**	**0.70**	**0.64**	**0.77**	**0.85**	**0.819**	**0.997**	**1.45**
pH[10]	5.5 - 8.5	**6.4**	**6.4**	**7.0**	NA [11]	**6.2**	**6.6**	**6.3**	**6.6**	**6.9**	**6.8**	**6.6**	**6.7**

Abbreviations, Notes, Qualifiers, and Units:

MS Matrix Spike
MSD Matrix Spike Duplicate
-- Not Analyzed
NE Not Established
NYSDEC New York State Department of Environmental Conservation
SPDES State Pollutant Discharge Elimination System
USEPA United States Environmental Protection Agency
VOC Volatile Organic Compound

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 interim SPDES equivalency program.
2. As of December 2017, effluent analysis reduced to the following 10 SPDES VOCs: 1,1,1-Trichloroethane, 1,1-Dichloroethene, Tetrachloroethene, Trichloroethene, Vinyl Chloride, cis 1,2-Dichloroethene, trans 1,2-Dichloroethene, Chloroform, Dichloromethane, Trichlorotrifuoroethane; in accordance with Site Number 1-30-003A operable Unit 3 SPDES Permit Equivalency.
3. As of September 2017, the 10 SPDES VOCs discharge limits are per Site Number 1-30-003A Operable Unit 3 SPDES Permit Equivalency.
4. Discharge limit per Department of Environmental Conservation Chapter X- Division of Water Part 703.
5. Carbon Disulfide and Chlorodifluoromethane (Freon 22) results rejected due to compounds MS/MSD recovery precentage falling below 10%.
6. "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.
7. Treatment efficiency was calculated by dividing the difference between the influent and effluent total VOC concentrations by the influent total VOC concentration.
8. Iron sampled on 09/13/17.
9. Samples collected were analyzed for 1,4-Dioxane using USEPA Method 522.
10. Effluent pH samples collected and measured in the field by Arcadis personnel on the dates listed using an Oakton Model 300 pH/conductivity meter. pH units are standard units.
11. pH not recorded.

229 Bold value indicates a detection.
< 1.0 Compound not detected above the laboratory quantification limit.
J Compound detected below laboratory reporting limit; result is estimated.
R Indictates rejected result
Indicates an exceedance of an SCG.
µg/L micrograms per liter

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

Compound[1]	06/16/17 (µg/m^3)	08/16/17 (µg/m^3)	11/29/17 (µg/m^3)	02/01/18 (µg/m^3)
Project VOCs				
1,1,1 - Trichloroethane	< 2.2	**0.71**	**0.65**	**0.46**
1,1 - Dichloroethane	**3.4**	**4.0**	**3.6**	**2.8**
1,2 - Dichloroethane	< 3.2	< 0.81	< 0.81	< 0.65
1,1 - Dichloroethene	< 3.2	**2.3**	**2.1**	**1.2**
Tetrachloroethene	**3.8**	**20**	**5.2**	**2.4**
Trichloroethene	**58**	**74.7**	**70.4**	**47**
Vinyl Chloride	**45**	**52.1**	**71.8**	**48.6**
cis 1,2-Dichloroethene	**67**	**93.6**	**122**	**105**
trans 1,2-Dichloroethene	< 3.2	**0.48 J**	< 0.79	**0.28 J**
Benzene	< 2.6	< 0.64	**0.32 J**	**0.45 J**
Toluene	**2.4 J**	**0.60 J**	**2.4**	**0.94**
Xylene-O	< 3.5	< 0.87	< 0.87	< 0.69
Xylenes - M,P	< 3.5	< 0.87	**0.69 J**	**0.48 J**
Subtotal Project VOCs	**179**	**248**	**279**	**210**
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 2.7	< 0.69	< 0.69	< 0.55
1,1,2-Trichloroethane	< 2.2	< 0.55	< 0.55	< 0.44
1,2-Dichloropropane	< 3.7	< 0.92	< 0.92	**0.25 J**
1,3-Butadiene	< 1.8	< 0.44	< 0.44	< 0.35
2-Butanone	**1.6 J**	**0.65**	**0.62**	**0.41 J**
4-Methyl-2-Pentanone	< 3.3	< 0.82	< 0.82	< 0.66
Acetone	**21**	**4.3**	**7.1**	**4.0**
Bromodichloromethane	< 2.7	< 0.67	< 0.67	< 0.54
Bromoform	< 1.7	< 0.41	< 0.41	< 0.33
Bromomethane	< 3.1	< 0.78	< 0.78	< 0.62
Carbon Disulfide	< 2.5	**0.72**	< 0.62	< 0.50
Carbon Tetrachloride	< 1.0	< 0.25	< 0.25	**0.47**
Chlorobenzene	< 3.7	< 0.92	< 0.92	< 0.74
Chlorodibromomethane	< 3.4	< 0.85	< 0.85	< 0.68
Chlorodifluoromethane (Freon 22)	**26**	**26**	**16**	**14**
Chloroethane	< 2.1	< 0.53	< 0.53	< 0.42
Chloroform	**15**	**18**	**13**	**8.8**
Chloromethane	**1.5 J**	**1.3**	**1.3**	**1.3**
cis-1,3-Dichloropropene	< 3.6	< 0.91	< 0.91	< 0.73
Dichlorodifluoromethane (Freon 12)	**2.7 J**	**3.0**	**2.4**	**2.4**
Dichloromethane	**3.8**	**1.8**	< 0.69	**0.97**
Ethylbenzene	< 3.5	**0.42 J**	< 0.87	**0.37 J**
Methyl N-Butyl Ketone	< 3.3	< 0.82	< 0.82	< 0.65
Methyl Tert-Butyl Ether	< 2.9	**0.72**	**0.35 J**	**0.36 J**
Styrene (Monomer)	< 3.4	< 0.85	< 0.85	< 0.68
trans-1,3-Dichloropropene	< 3.6	< 0.91	< 0.91	< 0.73
Trichlorofluoromethane (Freon 11)	< 2.2	**1.9**	**1.9**	**1.7**
Trichlorotrifluoroethane (Freon 113)	< 3.1	**2.5**	**2.1**	**2.0**
1-Chloro-1,1-difluoroethane (Freon 142b)	< 3.3	< 0.82	< 0.82	**0.32 J**
Subtotal Non-Project VOCs	**72**	**61**	**45**	**37**
Total VOCs[2]	**251**	**309**	**324**	**247**

Abbreviations, Notes, 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)
Bethpage, New York

Abbreviations, Notes, Qualifiers, and Units:

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. 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.

105	Bold value indicates a detection.
< 1.0	Compound not detected above the laboratory quantification limit.
J	Compound detected below laboratory reporting limit; result is estimated.
µg/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)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Compound[1]	06/16/17 (µg/m^3)	08/16/17 (µg/m^3)	12/1/2017 [3] (µg/m^3)	02/01/18 (µg/m^3)
Project VOCs				
1,1,1 - Trichloroethane	< 2.2	< 0.55	< 0.55	< 0.44
1,1 - Dichloroethane	**5.3**	**3.9**	**3.9**	**3.6**
1,2 - Dichloroethane	< 3.2	< 0.81	< 0.81	**0.32 J**
1,1 - Dichloroethene	< 3.2	< 0.79	**0.83**	**1.1**
Tetrachloroethene	< 1.1	**1.8**	**0.47**	**0.68**
Trichloroethene	**2.1**	**2.1**	**4.2**	**4.0**
Vinyl Chloride	**2.8**	**1.6**	**8.9**	**16**
cis 1,2-Dichloroethene	**21**	**10**	**31**	**51.9**
trans 1,2-Dichloroethene	< 3.2	< 0.79	< 0.79	< 0.63
Benzene	< 2.6	**5.8**	**1.6**	**1.5**
Toluene	**1.1 J**	**1.8**	< 0.75	**0.60**
Xylene-O	**1.7 J**	< 0.87	< 0.87	< 0.69
Xylenes - M,P	**2.6 J**	**0.87**	< 0.87	**0.40 J**
Subtotal Project VOCs	**37**	**28**	**51**	**80**
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 2.7	< 0.69	< 0.69	< 0.55
1,1,2-Trichloroethane	< 2.2	< 0.55	< 0.55	< 0.44
1,2-Dichloropropane	< 3.7	< 0.92	< 0.92	< 0.74
1,3-Butadiene	< 1.8	< 0.44	< 0.44	< 0.35
2-Butanone	< 2.4	**4.4**	**1.1**	**5.0**
4-Methyl-2-Pentanone	< 3.3	< 0.82	< 0.82	< 0.66
Acetone	**21**	**72**	**43**	**82.7 D**
Bromodichloromethane	< 2.7	< 0.67	< 0.67	< 0.54
Bromoform	< 1.7	< 0.41	< 0.41	< 0.33
Bromomethane	< 3.1	< 0.78	< 0.78	< 0.62
Carbon Disulfide	< 2.5	**0.72**	< 0.62	**17**
Carbon Tetrachloride	< 1.0	< 0.25	< 0.25	< 0.20
Chlorobenzene	< 3.7	< 0.92	< 0.92	< 0.74
Chlorodibromomethane	< 3.4	< 0.85	< 0.85	< 0.68
Chlorodifluoromethane (Freon 22)	**27**	**22**	**17**	**15**
Chloroethane	< 2.1	< 0.53	< 0.53	< 0.42
Chloroform	**27**	**19**	**20**	**18**
Chloromethane	**1.7**	**1.6**	**1.2**	**1.8**
cis-1,3-Dichloropropene	< 3.6	< 0.91	< 0.91	< 0.73
Dichlorodifluoromethane (Freon 12)	< 4.0	**3.3**	**2.3**	**2.4**
Dichloromethane	**3.2**	**1.8**	< 0.69	**0.76**
Ethylbenzene	**2.0 J**	**0.43 J**	< 0.87	< 0.69
Methyl N-Butyl Ketone	< 3.3	< 0.82	< 0.82	< 0.65
Methyl Tert-Butyl Ether	< 2.9	< 0.72	< 0.72	< 0.58
Styrene (Monomer)	< 3.4	< 0.85	< 0.85	< 0.68
trans-1,3-Dichloropropene	< 3.6	< 0.91	< 0.91	< 0.73
Trichlorofluoromethane (Freon 11)	< 2.2	**2.2**	**1.9**	**1.9**
Trichlorotrifluoroethane (Freon 113)	< 3.1	**2.4**	**2.5**	**2.6**
1-Chloro-1,1-difluoroethane (Freon 142b)	< 3.3	< 0.82	< 0.82	**0.36 J**
Subtotal Non-Project VOCs	**82**	**130**	**89**	**148**
Total VOCs[2]	**119**	**158**	**140**	**228**

Abbreviations, Notes, 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)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Abbreviations, Notes, Qualifiers, and Units:

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. 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. 2017 fourth quarter effluent vapor sample collected two days after the influent vapor sample.

15	Bold data indicates that the analyte was detected at or above the reporting limit.
< 1.0	Compound not detected above the laboratory quantification limit.
J	Compound detected below laboratory reporting limit; result is estimated.
$\mu g/m^3$	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)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Compound[1]	06/23/17 (ppbv)	08/16/17 (ppbv)	12/01/17 (ppbv)	02/01/18 (ppbv)
Tentatively Identified Compounds				
alkane	--	**14 JN**	--	--
alkane	--	**9.4 JN**	--	--
alkane	--	**9.2 JN**	--	--
alkane	--	**8.3 JN**	--	--
alkane	--	**7.8 JN**	--	--
alkane	--	**7.6 JN**	--	--
alkane	--	**7.4 JN**	--	--
alkane	--	**7.0 JN**	--	--
alkane	--	**7.0 JN**	--	--
Carbon Dioxide	--	--	**290 JNB**	--
Pentyl-Cyclohexane	--	**11 JN**	**2.4 JN**	--
trans-2-methyl decalin	--	--	**3.0 JN**	--
Unknown	--	**8.8 JN**	--	--
Unknown	--	**8.1 JN**	--	--
Unknown	--	**6.3 JN**	--	--
Unknown	--	**5.4 JN**	--	--
Unknown	--	**4.4 JN**	--	--
Unknown Alkane	--	**6.5 JN**	--	--
Unknown Alkane	--	**6.1 JN**	--	--
Unknown Alkane	--	**5.1 JN**	--	--
Unknown Alkane	--	**5.0 JN**	--	--
Unknown Alkene	--	**7.9 JN**	--	--
Total VOC TICs	**0**	**152 JN**	**5.4 JN**	**0**

Abbreviations, Notes, Qualifiers, and Units:

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

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.

290	Bold data indicates that the TIC was detected at or above the reporti
--	TIC not detected.
B	TIC was detected in the associated field blank.
J	TIC detected below the laboratory reporting limit; 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)
Bethpage, New York

Date [1]	Water Flow Rates						Water Pressures [2]					Air Flow Rate [2]	Air Pressures [5]					Air Temp. [5]
	Remedial Well [2]				Combined Influent [3]	Effluent [2]	Remedial Well Effluent [4]				Effluent	Effluent	ECU Influents				Effluent	Effluent
	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)	(iwc)	(iwc)	(iwc)	(iwc)	(iwc)	(^{o}R)
04/21/17	30.6	74.8	75.3	29.8	210	219	55	69	26	54	13	1,695	6.5	3.0	1.0	1.5	0.0	534
05/18/17	30.9	73.9	75.7	30.0	211	229	54	50	25	54	13	1,676	6.0	3.0	1.0	1.9	0.0	538
06/16/17	30.0	58.2	73.1	30.7	192	213	55	8	25	54	14	1,571	6.0	2.9	1.0	1.9	0.0	540
08/01/17	30.7	77.1	74.6	29.5	212	242	55	50	25	55	10	1,607	4.9	2.5	1.0	1.5	0.0	538
08/16/17	30.3	75.0	75.0	30.8	211	234	55	67	17	54	10	1,549	6.0	2.9	1.0	1.8	0.0	542
09/09/17	29.2	61.2	75.3	29.8	196	226	56	16	18	55	13	1,596	6.0	2.9	1.0	1.7	0.0	540
10/12/17	30.4	74.0	74.4	29.9	209	239	55	69	19	55	15	1,577	6.0	2.9	1.0	1.6	0.0	539
11/29/17	30.8	84.3	62.8	30.2	208	240	54	51	50	54	13	1,571	5.5	2.5	0.5	1.5	0.0	532
12/20/17	31.0	80.5	63.6	30.4	205	237	54	53	46	54	14	1,551	5.5	2.5	0.5	1.5	0.0	532
01/11/18	31.0	78.8	63.6	30.0	203	231	54	53	45	54	20	1,591	5.5	2.5	0.5	1.5	0.0	528
02/01/18	30.9	61.5	69.8	29.5	192	224	54	11	23	55	17	1,563	5.9	2.5	0.5	1.5	0.0	530
03/01/18	30.5	97.0 [6]	60.0	29.4	120	248	55	7	52	55	19	1,555	0.6 [7]	0.0 [7]	0.2 [7]	0.0 [7]	0.2	532

Abbreviations, Notes, and Units on last page.

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

Abbreviations, Notes, and Units:

ECU	Emission Control Unit
GAC	Granular Activated Carbon
HMI	Human-Machine Interface
PPZ	Potassium Permanganate-impregnated Zeolite
RW	Remedial Well
SCADA	Supervisory Control and Data Acquisition
Temp	Temperature

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. RW-2 flow rate was increased on 2/15/2018 to test for performance and life cycle gains.
7. The ECUs were placed in a parallel configuration on 3/1/2018 to test for performance gain.

gpm	gallons per minute
iwc	inches of water column
psi	pounds per square inch
^{o}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)
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
2009 Totals	6,592	13,838	16,445	6,574	43,449	0.17	275	53	14	342	0.17	273	19	0.20	293	< 0.01	0.56	35	13	48	< 0.01	1.7	0.33	0.086	2.1	< 0.01	1.7	0.12	< 0.01	1.8	< 0.01	< 0.01	0.22	0.080	0.30
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	0.05	< 0.01	0.035	< 0.01	< 0.01	0.038	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
January 2018 through March 2018 Totals																																			
01/01/18 - 02/01/18	1,368	3,184	1,951	1,324	7,828	< 0.01	1.5	0.053	0.067	1.6	< 0.01	1.5	0.042	< 0.01	1.5	< 0.01	0.029	0.011	0.058	0.098	< 0.01	0.048	< 0.01	< 0.01	0.052	< 0.01	0.048	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
02/01/18 - 03/01/18	1,192	2,913	1,207	1,159	6,471	< 0.01	1.4	0.033	0.059	1.5	< 0.01	1.3	0.026	< 0.01	1.3	< 0.01	0.027	<0.01	0.051	0.078	< 0.01	0.049	< 0.01	< 0.01	0.052	< 0.01	0.046	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
03/01/18 - 04/01/18	1,343	4,300	1,828	1,322	8,794	< 0.01	2.0	0.050	0.067	2.1	< 0.01	2.0	0.040	< 0.01	2.0	< 0.01	0.039	0.010	0.058	0.11	< 0.01	0.065	< 0.01	< 0.01	0.068	< 0.01	0.065	< 0.01	< 0.01	0.07	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Subtotal Jan - Mar 2018 [9]	3,904	10,397	4,986	3,806	23,093	< 0.01	4.9	0.14	0.19	5.2	< 0.01	4.8	0.11	< 0.01	4.9	< 0.01	0.10	0.021	0.17	0.28	< 0.01	0.054	< 0.01	< 0.01	0.058	< 0.01	0.053	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2018 Totals	3,904	10,397	4,986	3,806	23,093	< 0.01	4.9	0.14	0.19	5.2	< 0.01	4.8	0.11	< 0.01	4.9	< 0.01	0.10	0.021	0.17	0.28	< 0.01	0.054	< 0.01	< 0.01	0.058	< 0.01	0.053	< 0.01	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total [10]	136,185	306,337	313,380	135,024	890,926	1.6	1,009	913	255	2,177	1.6	998	104	1.9	1,106	< 0.01	10	809	253	1,065	< 0.01	3.7	2.6	0.73	7.1	< 0.01	3.7	0.33	< 0.01	4.1	< 0.01	< 0.01	2.3	0.72	3.1

Abbreviations, Notes, Qualifiers, and Units:

NA Not Applicable
VOC Volatile Organic Compound.

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 are rounded to the nearest gallon, but should only be considered accurate to two significant figures to account for error associated with field measurements.
3. 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.
4. 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.
5. "Total VOCs" represents the sum of individual concentrations of the VOCs detected.
6. "Project VOCs" represents the sum of individual compound concentrations of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethelyene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and xylenes-o,m, p.
7. "Non-Project VOCs" represents the difference between Total VOCs and Project VOCs.
8. Values based on operational data recorded prior to system startup on July 21, 2009.
9. The volume of groundwater recovered and mass recovered calculations represent the operational period between January 1, 2018 and April 1, 2018.
10. "Total" refers to the amounts removed by the Operable Unit 3 Bethpage Park Groundwater Containment System.

< 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)
Bethpage, New York

Toxic Air Contaminant	VSP-05 Vapor Effluent ($\mu g/m^3$)	Emission Rate[1]			Scaled Impact - Hourly[2] ($\mu g/m^3$)	Scaled Impact - Annual[2] ($\mu g/m^3$)	SGC[3] ($\mu g/m^3$)	AGC[3] ($\mu g/m^3$)	% of SGC	% of AGC
	2/1/2018	lb/yr	lb/hr	g/s						
Project VOCs										
1,1-Dichloroethane	3.6	0.18	2.10E-05	2.6E-06	8.4E-03	2.6E-04	--	0.63	--	0.0%
1,1-Dichloroethene	1.1	0.06	6.43E-06	8.10E-07	2.55E-03	7.8E-05	--	200	--	0.0%
1,2-Dichloroethane	0.32	0.02	1.87E-06	2.36E-07	7.43E-04	2.27E-05	--	3.8E-02	--	0.1%
Benzene	1.5	0.08	8.76E-06	1.1E-06	3.5E-03	1.1E-04	1,300	0.13	0.0%	0.1%
cis-1,2-Dichloroethene	51.9	2.66	3.03E-04	3.8E-05	1.2E-01	3.7E-03	--	63	--	0.0%
Tetrachloroethene	0.68	0.03	3.97E-06	5.0E-07	1.6E-03	4.8E-05	300	4	0.0%	0.0%
Toluene	0.60	0.03	3.51E-06	4.4E-07	1.4E-03	4.3E-05	37,000	5,000	0.0%	0.0%
trans-1,2-Dichloroethene	0.0	0.00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	--	63	--	0.0%
Trichloroethene	4.0	0.20	2.34E-05	2.9E-06	9.3E-03	2.8E-04	20	0.20	0.0%	0.1%
Vinyl Chloride	16	0.82	9.35E-05	1.2E-05	3.7E-02	1.1E-03	180,000	0.11	0.0%	1.0%
Xylenes - M,P	0.40	0.02	2.34E-06	2.9E-07	9.3E-04	2.8E-05	22,000	100	0.0%	0.0%
Non-Project VOCs										
1-Chloro-1,1-difluoroethane (Freon 142b)	0.36	0.02	2.34E-06	2.95E-07	9.31E-04	2.8E-05	--	50000	--	0.0%
2-Butanone	5.0	0.26	2.92E-05	3.7E-06	1.2E-02	3.6E-04	13,000	5,000	0.0%	0.0%
Acetone	82.7	4.2	4.83E-04	6.1E-05	1.9E-01	5.9E-03	180,000	30,000	0.0%	0.0%
Carbon Disulfide	17	0.87	9.93E-05	1.3E-05	3.9E-02	1.2E-03	6,200	700	0.0%	0.0%
Chlorodifluoromethane (Freon 22)	15	0.8	8.76E-05	1.1E-05	3.5E-02	1.1E-03	--	50,000	--	0.0%
Chloroform	18	0.9	1.05E-04	1.3E-05	4.2E-02	1.3E-03	150	15	0.0%	0.0%
Chloromethane	1.8	0.09	1.05E-05	1.3E-06	4.2E-03	1.3E-04	22,000	90	0.0%	0.0%
Dichlorodifluoromethane (Freon 12)	2.4	0.12	1.40E-05	1.8E-06	5.6E-03	1.7E-04	--	12,000	--	0.0%
Dichloromethane	0.76	0.04	4.44E-06	5.6E-07	1.8E-03	5.4E-05	14,000	60	0.0%	0.0%
Trichlorofluoromethane (Freon 11)	1.9	0.10	1.11E-05	1.4E-06	4.4E-03	1.3E-04	9,000	5,000	0.0%	0.0%
Trichlorotrifluoroethane (Freon 113)	2.6	0.13	1.52E-05	1.9E-06	6.0E-03	1.8E-04	960,000	180,000	0.0%	0.0%

Abbreviations, Notes, 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)
Bethpage, New York

Abbreviations, Notes, and Units:

AGC	Annual Guideline Concentration
CAS#	Chemical Abstracts Service Registry Number
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

1. Emission rate calculated based on VSP-05 effluent concentration and a daily average exit air flow rate of 1,563 ft^3/min for 2/1/2018.
   1,1,1-Trichloroethane (lb/hr) = TCE [µg/m^3] x Air Flow Rate [ft^3/min] x (1 m^3/35.3147 ft^3) x (60 min/hr) x (0.000001 g/1 µg) x (0.0022 lb/g)
   lb/yr = lb/hr x 8,760 hrs/yr
   g/s = lb/hr x hr/3,600 sec x 453.59 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 2011 through 2015. The maximum impact from all the years used for the calculations.
   Scaled hourly impact (µg/m^3) = AERMOD predicted hourly ambient impact at 1 g/s ([µg/m^3]/[g/s]) x Actual emission rate (g/s)
   Scaled annual impact (µg/m^3) = AERMOD predicted annual ambient impact at 1 g/s ([µg/m^3]/[g/s]) x Actual emission rate (g/s)

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([µg/m^3]/[g/s])	Annual ([µg/m^3]/[g/s])
3,153.03	96.49

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.

cfm	cubic feet per minute
g/s	grams per second
lb/hr	pounds per hour
lb/yr	pounds per year
µg/m^3	micrograms per cubic meter

FIGURES

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

0 2000' 4000'
SCALE IN FEET

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

SITE LOCATION

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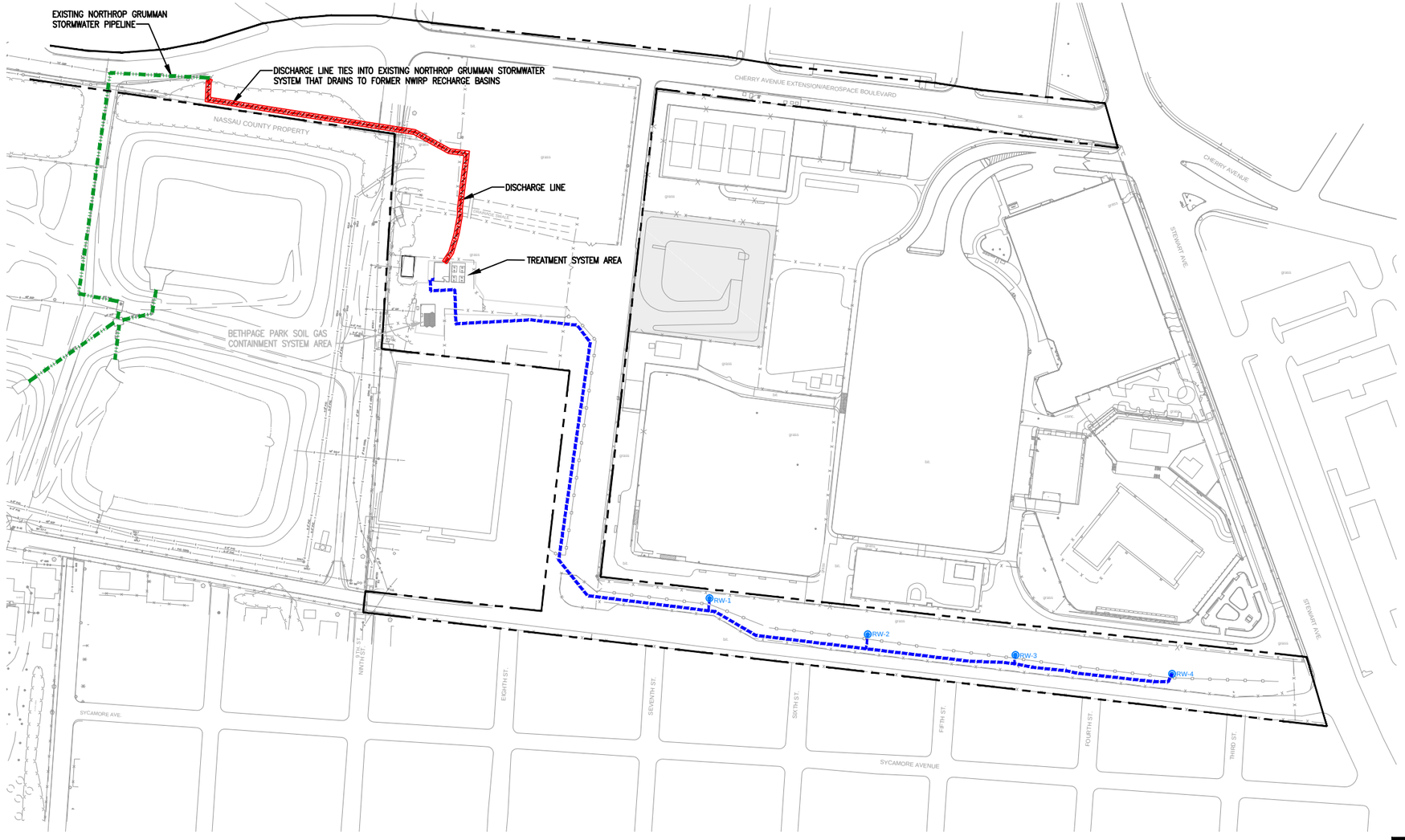
FIGURE
1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD: PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF* PLOTTED: 11/11/2015 4:54 PM BY: STOWELL, GARY
G:\ENVCAD\SYRACUSE\ACT\NY001496\1114\OMM\4NY1496_B01.dwg LAYOUT: BETHPAGE PARK SAVED: 11/11/2015 4:51 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ----
XREFS: IMAGES: AMITYVILLE.TIF FREEPORT.TIF HICKSVILLE.TIF HUNTINGTON.TIF PROJECTNAME: ----



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)

0 200' 400'

SCALE IN FEET

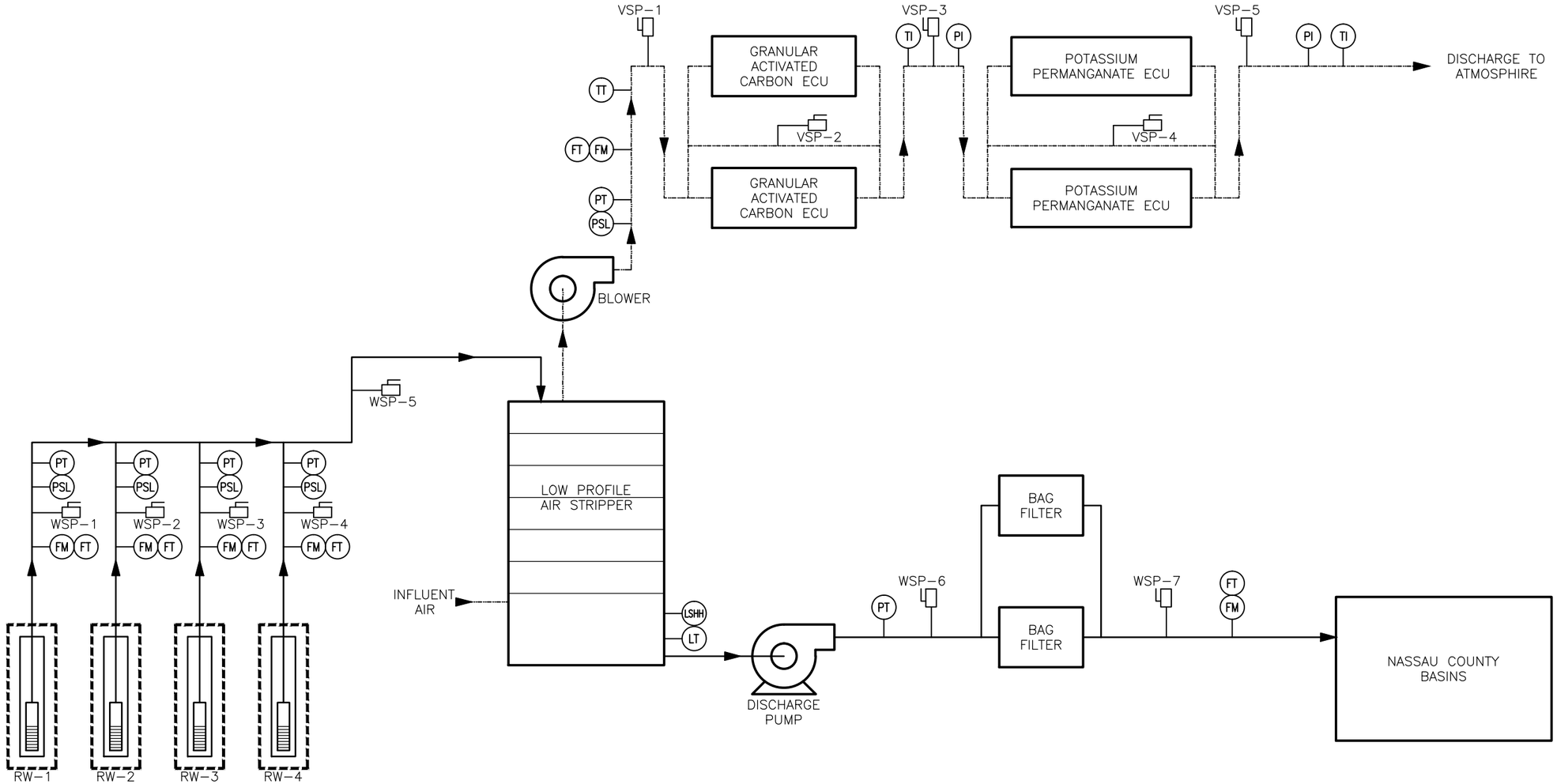
BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

GROUNDWATER CONTAINMENT SYSTEM SITE PLAN

ARCADIS Design & Consultancy for natural and built assets

FIGURE 2

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:AS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVITY\00149\6114\IOMM\4NY1496B01.DWG LAYOUT: 2 SAVED: 11/11/2015 4:26 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 11/11/2015 4:54 PM BY: STOWELL, GARY
XREFS:
X:\1496X00
X:\1496X01
IMAGES:
PROJECTNAME: ----



LEGEND:

	PROCESS WATER
	PROCESS AIR
FM	INSTRUMENT
	SAMPLE PORT
	FLOW DIRECTION
FM	FLOW METER
FT	FLOW RATE TRANSMITTER
PSL	PRESSURE SWITCH 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 AND MONITORING LOCATIONS

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FIGURE 3

EXPLANATION:

— · —	NORTHROP GRUMMAN PROPERTY LINE
— x — x —	FENCE
	BASIN
bit.	BITUMINOUS PAVEMENT
MW-200-1	MONITORING WELL
RW-2	REMEDIAL WELL
PZ-2C	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.

0 100' 200'

APPROXIMATE SCALE IN FEET

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

GROUNDWATER MONITORING NETWORK PLAN

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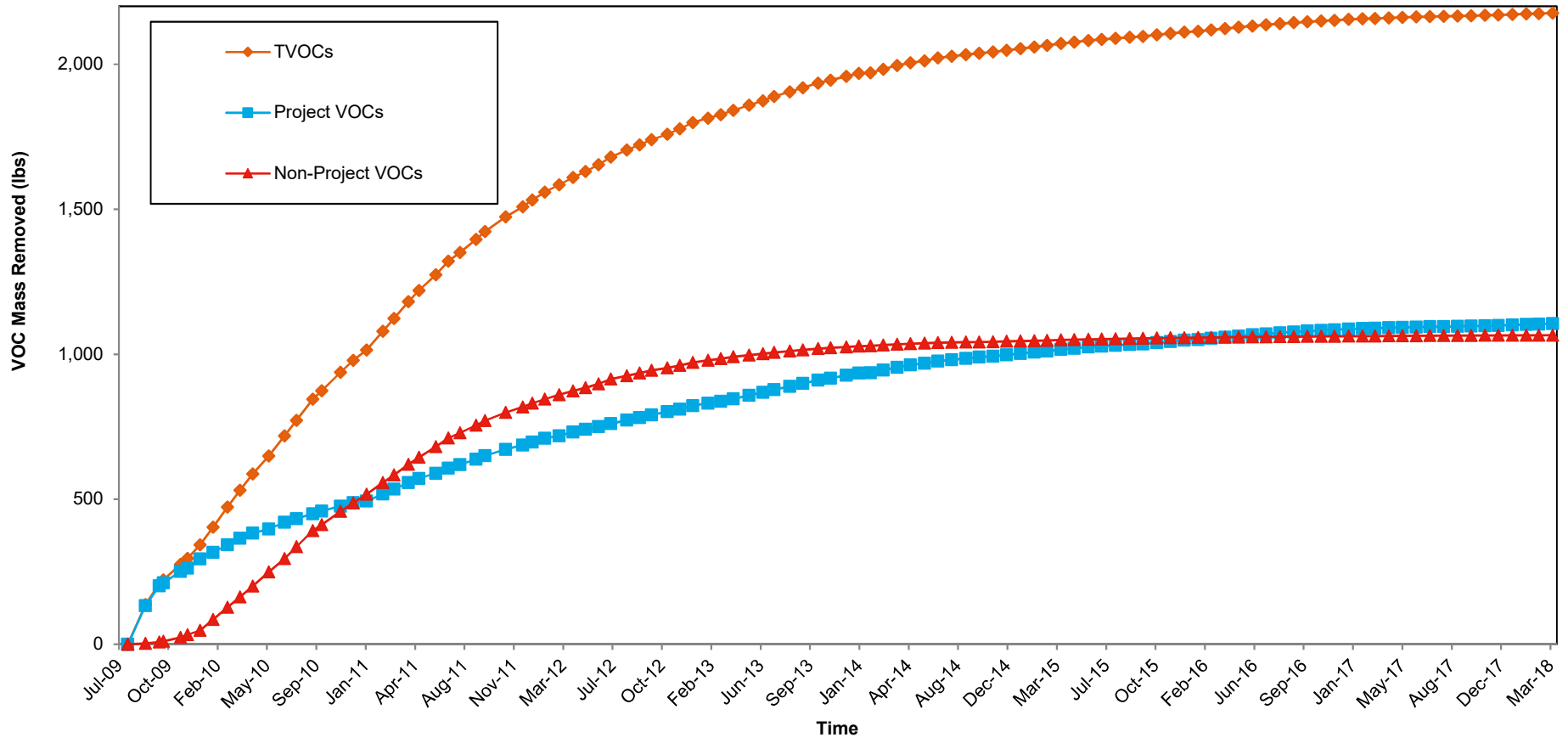
FIGURE 4



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

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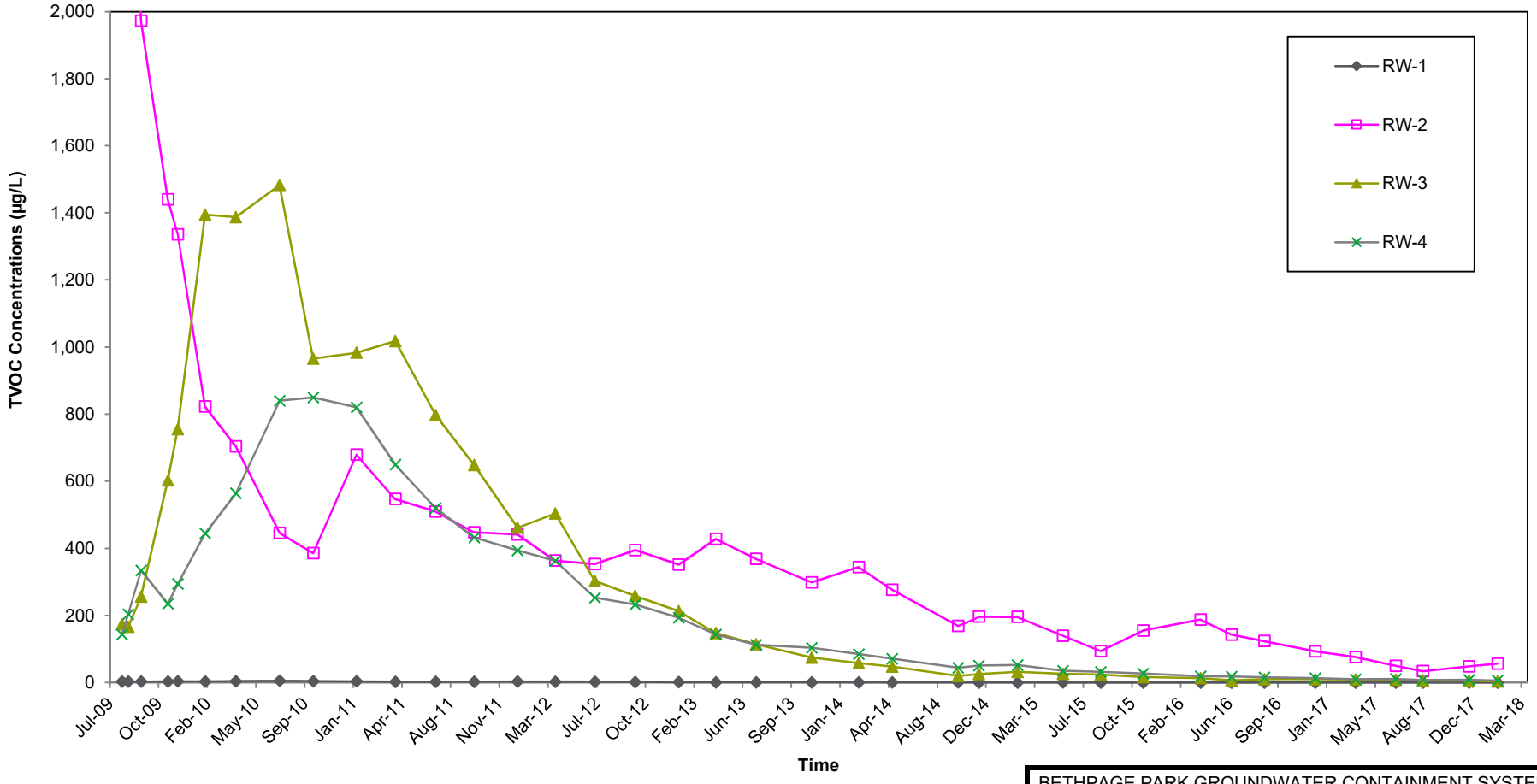
FIGURE
5

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 5 TVOC Mass Graph



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
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

REMEDIAL WELL TOTAL VOC CONCENTRATIONS

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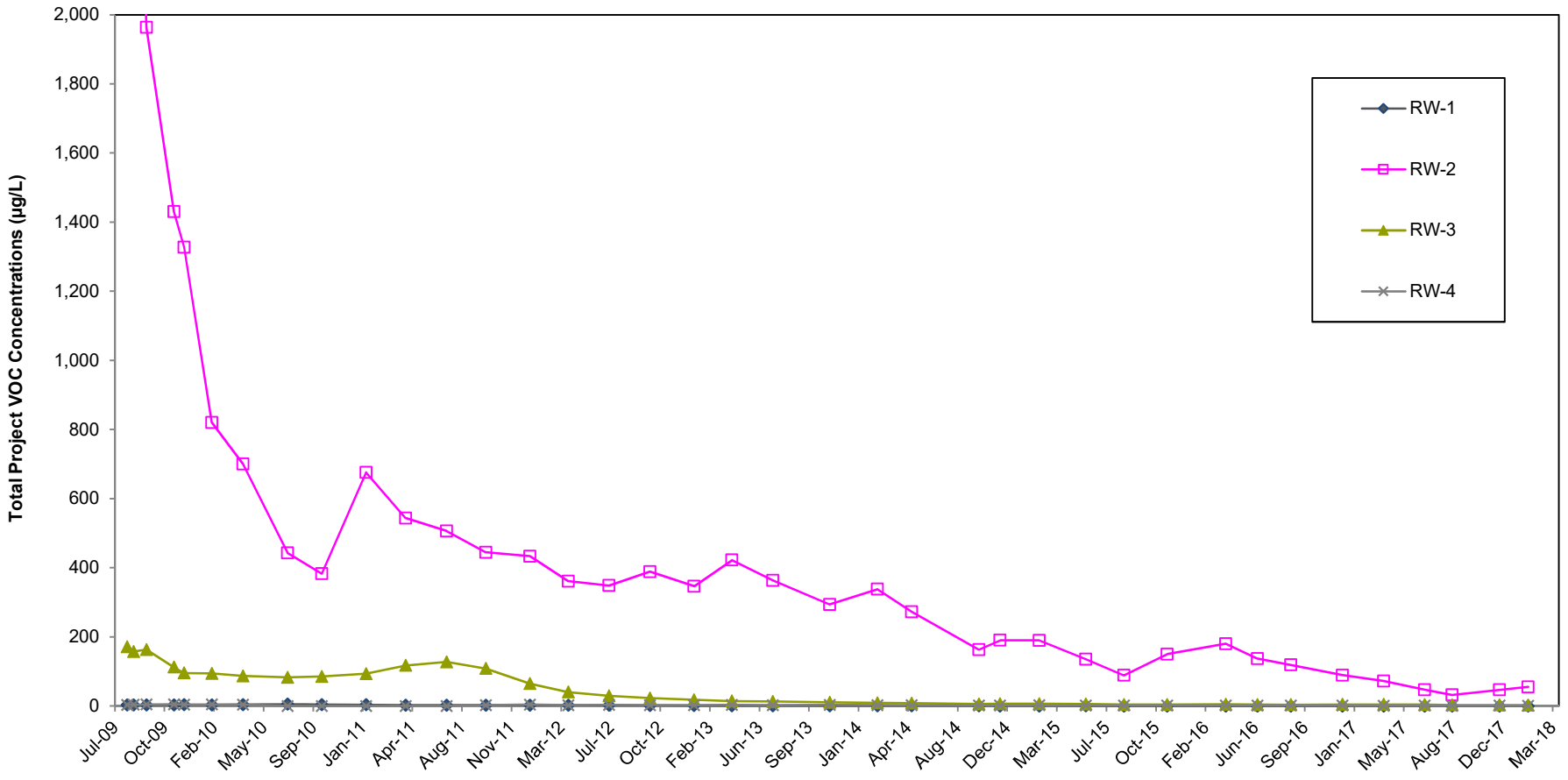
FIGURE
6A

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 6A RW Total VOC



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

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

REMEDIAL WELL PROJECT VOC CONCENTRATIONS

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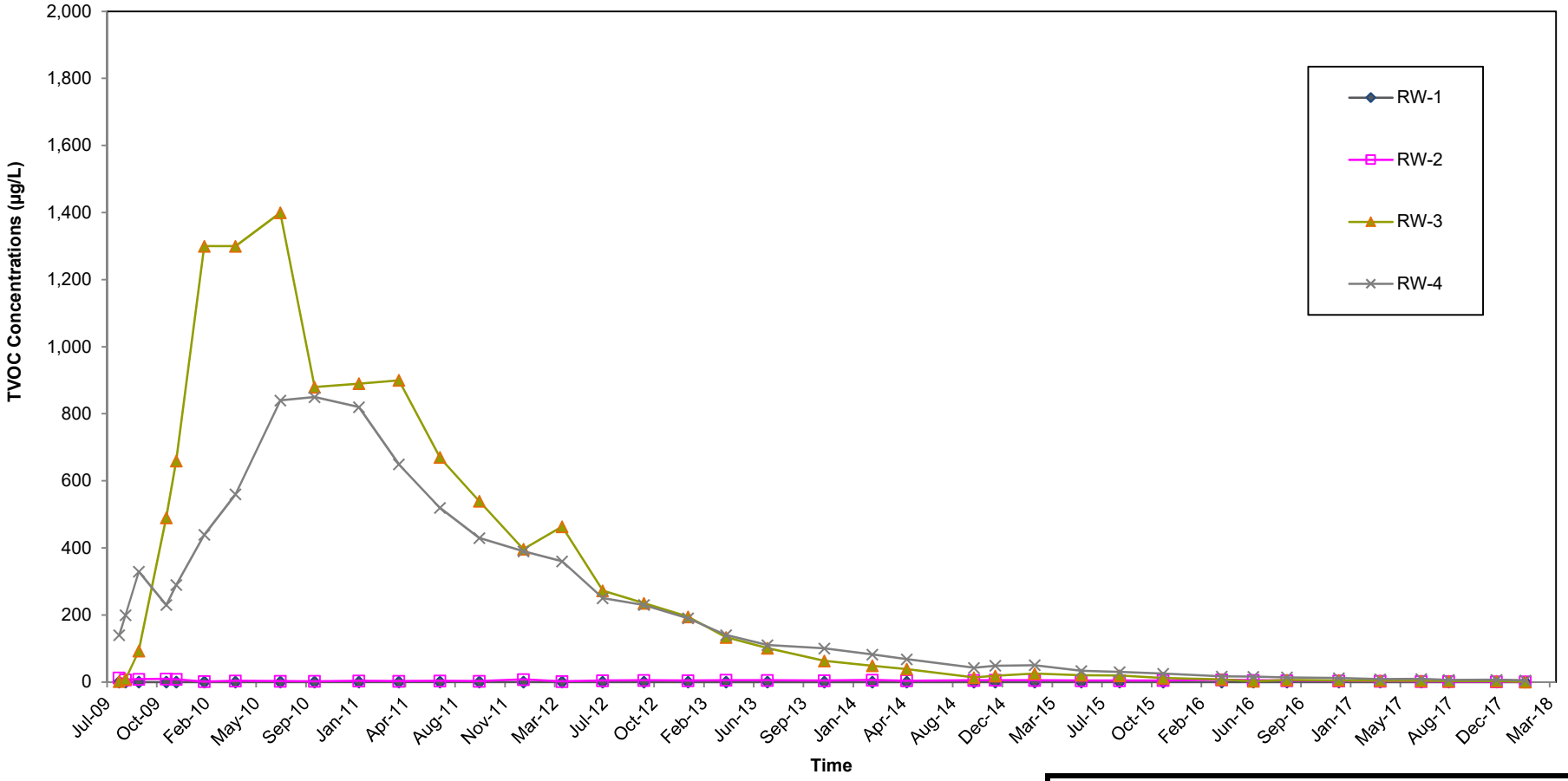
FIGURE
6B

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 6B RW Project VOC



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound
TVOCs = Total VOCs detected.

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

µg/L = micrograms per liter

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

REMEDIAL WELL NON-PROJECT VOC CONCENTRATIONS

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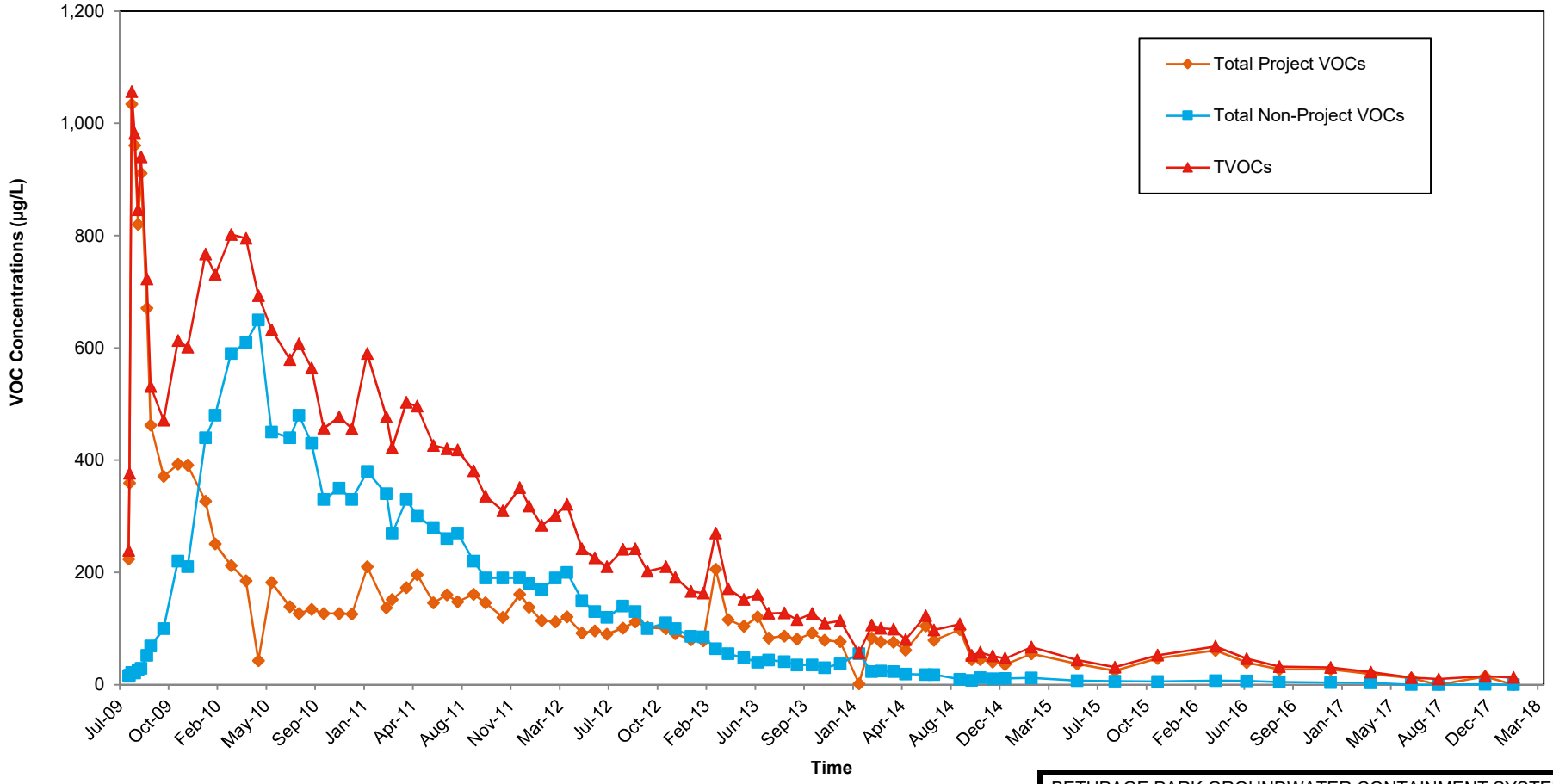
FIGURE
6C

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 6C RW Non-Proj VOC



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.

µg/L = micrograms per liter

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

INFLUENT TOTAL, PROJECT AND NON-PROJECT VOC CONCENTRATIONS

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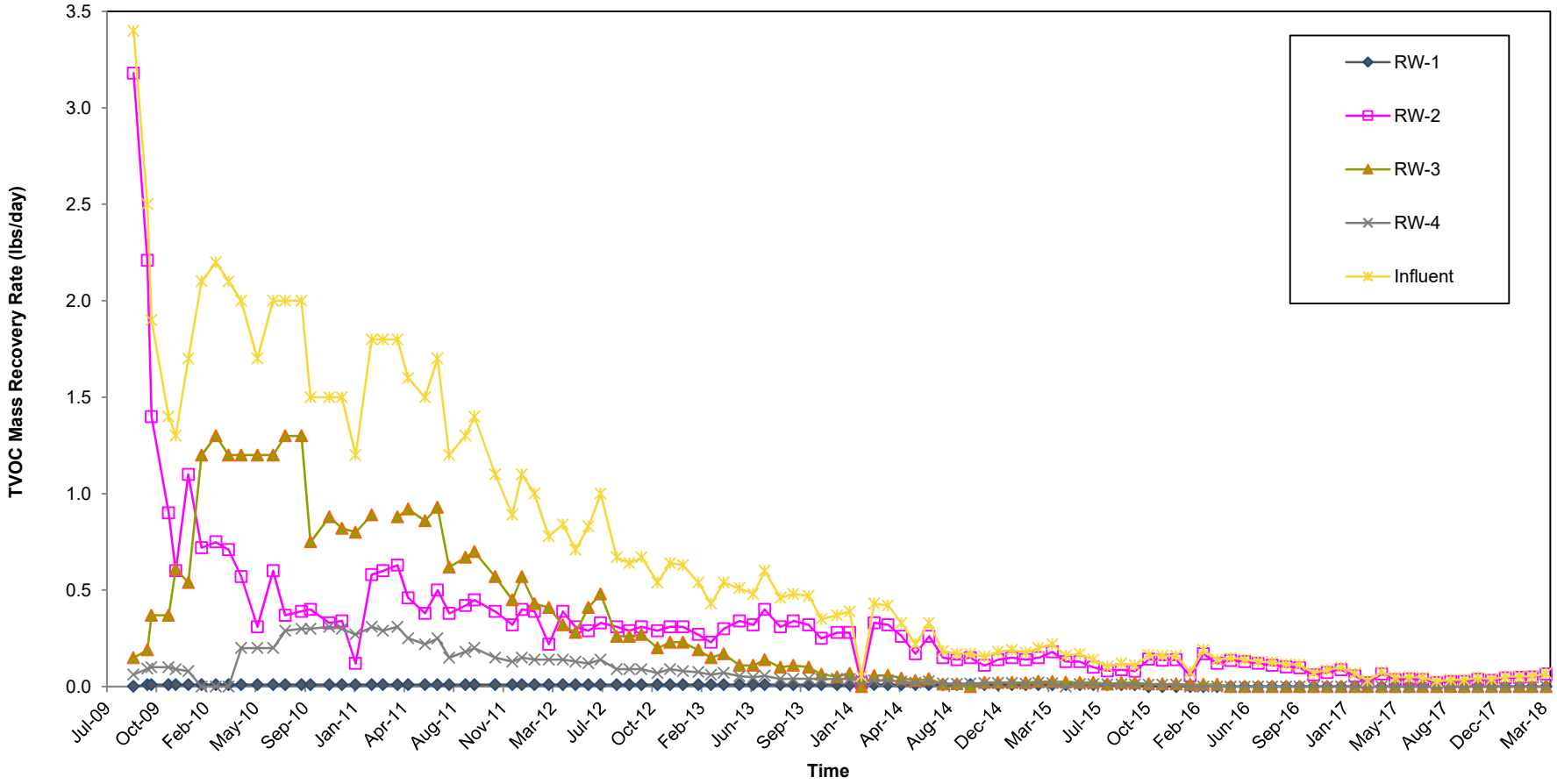
FIGURE
7

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 7 Comb. Inf. VOC Conc.



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

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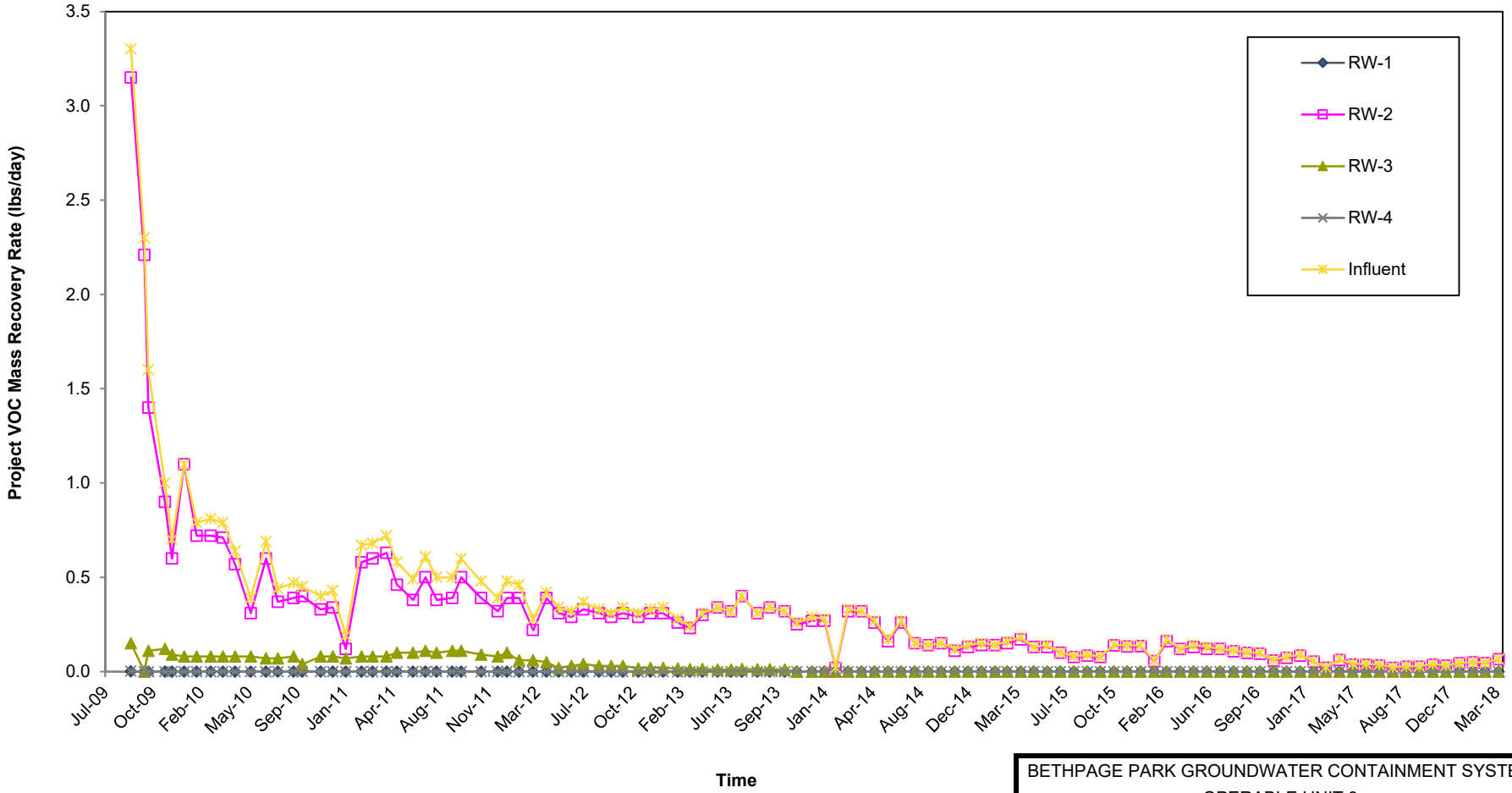
FIGURE
8A

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 8A VOC Recovery Rates



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound

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

lbs/day = pounds per day

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

PROJECT VOC MASS RECOVERY RATES

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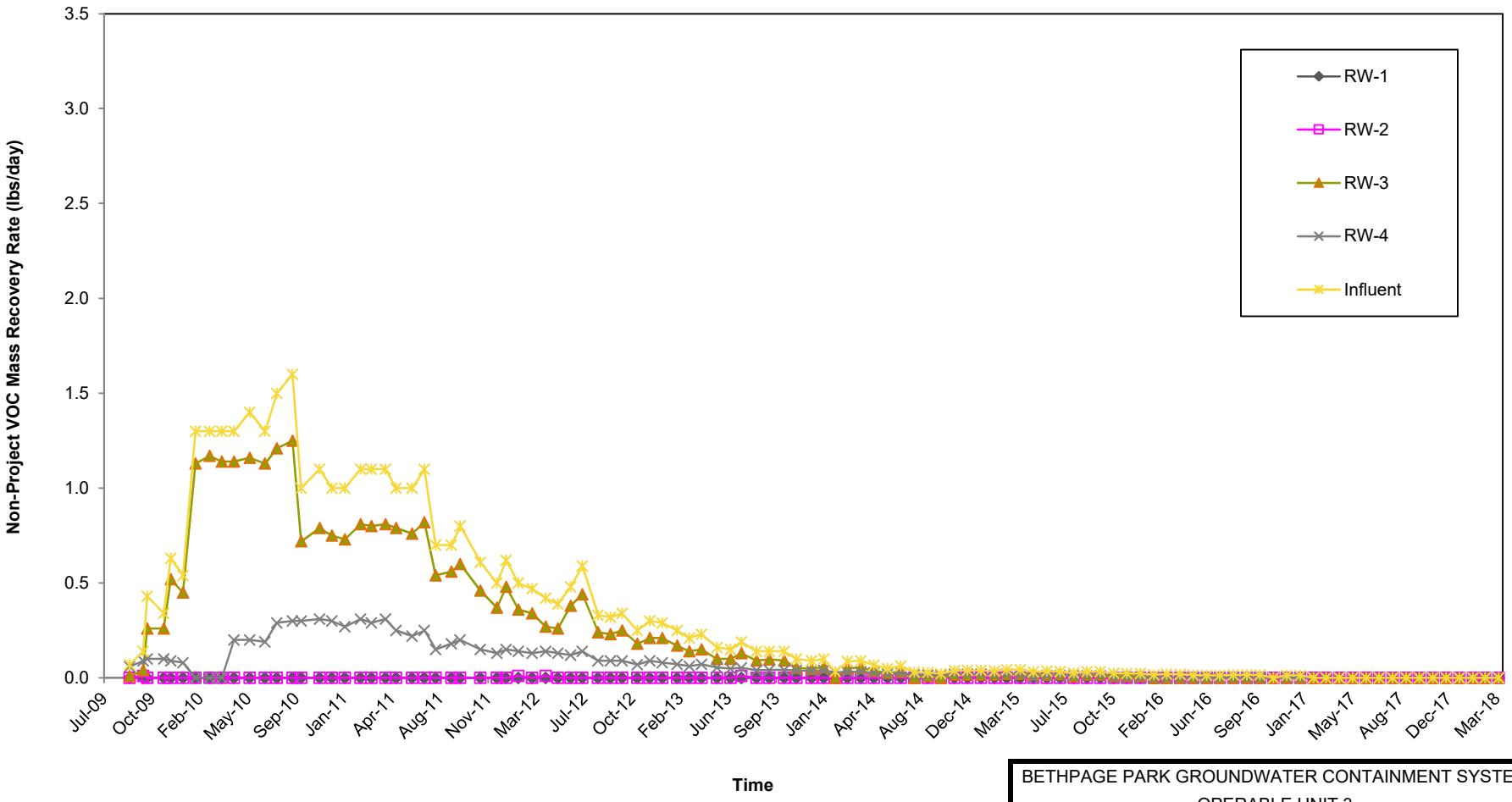
FIGURE
8B

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 8B VOC Recovery Rates



Abbreviations, Notes, and Units:

VOC = Volatile Organic Compound

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

lbs/day = pounds per day

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

NON-PROJECT VOC MASS RECOVERY RATES

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FIGURE
8C

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\11 Draft Reports-Presentations\Reports\2018 Q1\Tables\Q1_Table 2-8Figure 8C VOC Recovery Rates