Mr. Jason Pelton
Project Manager
New York State Department of Environmental Conservation
Remedial Bureau D
625 Broadway
Albany, NY 12233-7015

Arcadis of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610
www.arcadis.com

ENVIRONMENT

Subject:
Results of First Quarter 2020 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 29, 2020

Contact:
Christopher Engler

Phone:
315.409.6579

Email:
christopher.engler@arcadis.com

Our ref:
30037969

Dear Jason:

Enclosed is one electronic PDF copy of the First Quarter 2020 Report for the BPGWCS operation and monitoring, performed 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 me.

Sincerely,

Arcadis of New York, Inc.

Christopher Engler, PE
New York PE-069748

Vice President

Enclosure

Copies:
Edward Hannon, Northrop Grumman Corporation
Donald Hesler, NYSDEC
Jim Sullivan, NYS Dept. of Health
John Lovejoy, Nassau County Dept. of Health
Carlo San Giovanni, Arcadis
Nidal Azzam, USEPA
Carol Stein, USEPA
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Table 1
Operational Summary
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Northrop Grumman Systems Corporation
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
2018 Total																																348
2019 Total																																355
Jan 2020	[2]																															22
Feb 2020																																29
Mar 2020																																31
1Q 2020																																82
2020 Total																																82
TOTAL																																**3757**

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, Abbreviations, and Units on last page.

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

Notes:

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

First Quarter 2020

2. System shutdown due to broken fan on blower, repair and system restart completed

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)
Northrop Grumman Systems Corporation
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Compound	06/07/19 (µg/L)	09/06/19 (µg/L)	11/05/19 (µg/L)	02/06/20 (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	**2.4**	**3.0**	**3.6**	**3.9**
Vinyl Chloride	**1.6**	**1.8**	**1.3**	**3.1**
cis 1,2-Dichloroethene	**4.9**	**5.7**	**6.0**	**10.0**
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
o-Xylene	< 1.0	< 1.0	< 1.0	< 1.0
m,p-Xylene	< 1.0	< 1.0	< 1.0	< 1.0
Subtotal Project VOCs	**8.9**	**10.5**	**10.9**	**17.0**
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
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	< 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	< 1.0	< 1.0	< 1.0	**0.56**
Chloromethane	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,3-Dichloropropene	< 1.0	< 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 Systems Corporation
Bethpage, New York

Compound	06/07/19 (µg/L)	09/06/19 (µg/L)	11/05/19 (µg/L)	02/06/20 (µg/L)
Non-Project VOCs				
Dichlorodifluoromethane (Freon 12)	< 2.0	< 2.0	< 2.0	< 2.0
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
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	0.0	0.0	0.0	**0.6**
Total VOCs[1]	**9**	**11**	**11**	**18**
1,4-Dioxane	**0.33**	**0.70**	**0.71**	**1.0**
pH[2]	5.3	5.5	5.5	5.1

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.

--	Not Analyzed
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
3.0	Bold value indicates a detection.
< 1.0	Compound not detected at or above the laboratory quantification limit.
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)
Northrop Grumman Systems Corporation
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Compound	Discharge Limit[1] (µg/L)	04/02/19 (µg/L)	05/15/19 (µg/L)	06/07/19 (µg/L)	07/02/19 (µg/L)	08/02/19 (µg/L)	09/06/19 (µg/L)	10/15/19 (µg/L)	11/05/19 (µg/L)	12/04/19 (µg/L)	01/14/20 (µg/L)	02/06/20 (µg/L)	03/03/20 (µg/L)
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
1,1-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
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
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
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
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
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
Subtotal Project VOCs		0	0	0	0	0	0	0	0	0	0	0	0
Compound	**Discharge Limit[1] (µg/L)**	**04/02/19 (µg/L)**	**05/15/19 (µg/L)**	**06/07/19 (µg/L)**	**07/02/19 (µg/L)**	**08/02/19 (µg/L)**	**09/06/19 (µg/L)**	**10/15/19 (µg/L)**	**11/05/19 (µg/L)**	**12/04/19 (µg/L)**	**01/14/20 (µg/L)**	**02/06/20 (µg/L)**	**03/03/20 (µg/L)**
Non-Project VOCs													
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
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
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
Subtotal Non-Project VOCs		0	0	0	0	0	0	0	0	0	0	0	0
Total VOCs[3]		0	0	0	0	0	0	0	0	0	0	0	0
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%
Compound	**Discharge Limit[1] (µg/L)**	**04/02/19 (µg/L)**	**05/15/19 (µg/L)**	**06/07/19 (µg/L)**	**07/02/19 (µg/L)**	**08/02/19 (µg/L)**	**09/06/19 (µg/L)**	**10/15/19 (µg/L)**	**11/05/19 (µg/L)**	**12/04/19 (µg/L)**	**01/14/20 (µg/L)**	**02/06/20 (µg/L)**	**03/03/20 (µg/L)**
Inorganics													
Total Iron	600	< 100	**126**	< 100	**102**	**133**	**133**	**201**	**110**	< 100	< 100	< 100	**144**
Total Manganese	600	**44.2**	**47.3**	**45.2**	**49.4**	**50.1**	**51.2**	**46.1**	**47.6**	**43.1**	**50.1**	**49.7**	**51.9**
Nitrate and Nitrite	10,000	**2,700**	**2,500**	**2,300**	**2,500**	**2,500**	**2,700**	**2,700**	**2,700**	**2,900**	**2,400**	**2,900**	**2,800**
Toal Kjeldahl Nitrogen	10,000	< 200	< 200	< 200	< 200	< 200	**310.0**	< 200	< 200	< 200	< 200	< 200	< 200
Total Nitrogen	10,000	**2,800**	**2,700**	**2,300**	**2,500**	**2,500**	**3,000**	**2,700**	**2,900**	**3,100**	**2,400**	**2,900**	**2,800**
1,4-Dioxane	NE	**0.61**	**0.74**	**0.61**	**0.68**	**0.34**	**0.71**	**0.70**	**0.68**	**0.87**	**0.76**	**1.0**	**0.79**
pH[5]	5.5-8.5	6.8	6.6	6.7	7.0	6.7	6.7	6.2	6.3	6.8	6.3	6.1	6.1

Notes, Abbreviations, 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)
Northrop Grumman Systems Corporation
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

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.

NYSDEC	New York State Department of Environmental Conservation
SPDES	State Pollutant Discharge Elimination System
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
102	Bold value indicates a detection.
< 0.50	Compound not detected above the laboratory quantification limit.
J	Result is estimated.
µg/L	micrograms per liter

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

ARCADIS Design & Consultancy for natural and built assets

Compound[1]	06/07/19 (µg/m^3)	09/06/19 (µg/m^3)	11/26/19 (µg/m^3)	03/30/20 (µg/m^3)
Project VOCs				
1,1,1 - Trichloroethane	**0.65**	**0.93**	**0.82**	**1.2**
1,1 - Dichloroethane	**4.5**	**4.5**	**3.8**	**7.3**
1,2 - Dichloroethane	< 0.65	< 0.81	< 0.81	**0.45 J**
1,1 - Dichloroethene	**1.1**	**1.1**	**0.99**	**1.3**
Tetrachloroethene	**10**	**2.6**	**2.2**	**2.6**
Trichloroethene	**48**	**54.8**	**49**	**58.6**
Vinyl Chloride	**29.7**	**30.7**	**23.0**	**50.1**
cis 1,2-Dichloroethene	**103**	**103**	**108**	**182**
trans 1,2-Dichloroethene	**0.34 J**	< 0.79	< 0.79	**0.52 J**
Benzene	**0.64**	< 0.64	**1.90**	**0.58 J**
Toluene	**0.57 J**	**0.49 J**	**2.30**	**0.83**
o-Xylene	**0.74**	**0.52 J**	**0.78 J**	**1.0**
m,p-Xylene	**0.48 J**	< 0.87	**1.7**	**0.65 J**
Subtotal Project VOCs	**200**	**193**	**194**	**307**
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 0.55	< 0.69	< 0.69	< 0.69
1,1,2-Trichloroethane	< 0.44	< 0.55	< 0.55	< 0.55
1,2-Dichloropropane	< 0.74	< 0.92	< 0.92	**0.60 J**
1,3-Butadiene	< 0.35	< 0.44	**0.42 J**	< 0.44
2-Butanone	**22**	**0.65**	< 0.59	< 0.59
4-Methyl-2-Pentanone	< 0.66	< 0.82	< 0.82	< 0.82
Acetone	**104**	**5.5**	**4.5**	< 0.48
Bromodichloromethane	< 0.54	< 0.67	< 0.67	< 0.67
Bromoform	< 0.33	< 0.41	< 0.41	< 0.41
Bromomethane	**0.47 J**	< 0.78	< 0.78	< 0.78
Carbon Disulfide	< 0.50	< 0.62	< 0.62	< 0.62
Carbon Tetrachloride	**0.43**	< 0.25	< 0.25	**0.48**
Chlorobenzene	< 0.74	< 0.92	< 0.92	< 0.92
Chlorodibromomethane	< 0.68	< 0.85	< 0.85	< 0.85
Chlorodifluoromethane (Freon 22)	**8.4**	**8.4**	**6.3**	< 0.70
Chloroethane	< 0.42	< 0.53	< 0.53	< 0.53
Chloroform	**7.3**	**7.8**	**7.3**	**11**
Chloromethane	**1.2**	**0.87**	**1.3**	**2.1**
cis-1,3-Dichloropropene	< 0.73	< 0.91	< 0.91	< 0.91
Dichlorodifluoromethane (Freon 12)	**2.2**	**2.2**	< 0.99	< 0.99
Dichloromethane	< 0.56	**0.94**	**4.2**	**0.83**
Ethylbenzene	< 0.69	< 0.87	**0.65 J**	**0.56 J**
Methyl N-Butyl Ketone	**0.41 J**	< 0.82	< 0.82	< 0.82
Methyl Tert-Butyl Ether	< 0.58	**0.43 J**	< 0.72	**0.69 J**
Styrene (Monomer)	< 0.68	< 0.85	< 0.85	< 0.85
trans-1,3-Dichloropropene	< 0.73	< 0.91	< 0.91	< 0.91
Trichlorofluoromethane (Freon 11)	**1.5**	**2.0**	**1.6**	< 0.56
Trichlorotrifluoroethane (Freon 113)	**2.1**	**1.8**	**1.5**	**1.7**
1-Chloro-1,1-difluoroethane (Freon 142b)	< 0.66	< 0.82	< 0.82	< 0.82
Subtotal Non-Project VOCs	**150**	**20**	**28**	**18**
Total VOCs[2]	**350**	**213**	**222**	**325**

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 Systems Corporation
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.

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
0.93	Bold value indicates a detection.
< 0.81	Compound not detected above the laboratory quantification limit.
J	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)
Northrop Grumman Systems Corporation
Bethpage, New York

Compound[1]	06/07/19 (µg/m^3)	09/06/19 (µg/m^3)	11/26/19 (µg/m^3)	03/30/20 (µg/m^3)
Project VOCs				
1,1,1 - Trichloroethane	**0.82**	**0.76**	**0.82**	**0.93**
1,1 - Dichloroethane	**5.7**	**4.5**	**4.5**	**6.1**
1,2 - Dichloroethane	**0.28 J**	< 0.81	< 0.81	**0.45 J**
1,1 - Dichloroethene	**0.95**	**0.87**	**0.99**	**1.0**
Tetrachloroethene	**43**	**1.9**	**1.8**	**1.7**
Trichloroethene	**22**	**26**	**31**	**29**
Vinyl Chloride	**13**	**15.0**	**16**	**26.3**
cis 1,2-Dichloroethene	**65.0**	**65.8**	**85.6**	**109**
trans 1,2-Dichloroethene	< 0.63	< 0.79	< 0.79	< 0.79
Benzene	**1.2**	< 0.64	**1.5**	**0.38 J**
Toluene	**3.5**	**1.5**	**2.8**	**1.4**
o-Xylene	**0.43 J**	< 0.87	**0.61 J**	**0.74 J**
m,p-Xylene	**0.43 J**	< 0.87	**1.4**	**0.61 J**
Subtotal Project VOCs	**156**	**116**	**147**	**178**
Non-Project VOCs				
1,1,2,2-Tetrachloroethane	< 0.56	< 0.69	< 0.69	< 0.69
1,1,2-Trichloroethane	**3.3**	< 0.55	< 0.55	< 0.55
1,2-Dichloropropane	< 0.74	< 0.92	< 0.92	**0.46 J**
1,3-Butadiene	< 0.35	< 0.44	< 0.44	< 0.44
2-Butanone	**26**	**1.8**	**4.7**	< 0.59
4-Methyl-2-Pentanone	< 0.66	< 0.82	< 0.82	< 0.82
Acetone	**302**	**21**	**38.5**	< 0.48
Bromodichloromethane	< 0.55	< 0.67	< 0.67	< 0.67
Bromoform	< 0.34	< 0.41	< 0.41	< 0.41
Bromomethane	< 0.62	< 0.78	< 0.78	< 0.78
Carbon Disulfide	< 0.50	< 0.62	< 0.62	< 0.62
Carbon Tetrachloride	**0.34**	< 0.25	< 0.25	**0.45**
Chlorobenzene	< 0.74	< 0.92	< 0.92	< 0.92
Chlorodibromomethane	< 0.70	< 0.85	< 0.85	< 0.85
Chlorodifluoromethane (Freon 22)	**8.4**	**8.4**	**7.7**	< 0.70
Chloroethane	< 0.42	< 0.53	< 0.53	< 0.53
Chloroform	**11**	**10**	**11**	**11**
Chloromethane	**1.5**	**0.85**	**1.3**	**1.4**
cis-1,3-Dichloropropene	< 0.73	< 0.91	< 0.91	< 0.91
Dichlorodifluoromethane (Freon 12)	**2.3**	**2.1**	< 0.99	< 0.99
Dichloromethane	**0.56**	< 0.69	< 0.69	**4.5**
Ethylbenzene	< 0.69	< 0.87	**0.48 J**	**0.48 J**
Methyl N-Butyl Ketone	< 0.65	< 0.82	< 0.82	< 0.82
Methyl Tert-Butyl Ether	< 0.58	< 0.72	< 0.72	< 0.72
Styrene (Monomer)	< 0.68	< 0.85	< 0.85	< 0.85
trans-1,3-Dichloropropene	< 0.73	< 0.91	< 0.91	< 0.91
Trichlorofluoromethane (Freon 11)	**1.5**	**1.6**	**1.7**	< 0.56
Trichlorotrifluoroethane (Freon 113)	**2.5**	**2.1**	**2.0**	**1.9**
1-Chloro-1,1-difluoroethane (Freon 142b)	< 0.66	< 0.82	< 0.82	< 0.82
Subtotal Non-Project VOCs	**359**	**39**	**67**	**20**
Total VOCs[2]	**516**	**156**	**214**	**198**

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 Systems Corporation
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.

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
0.76	Bold value indicates a detection.
< 0.81	Compound not detected above the laboratory quantification limit.
J	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)
Northrop Grumman Systems Corporation
Bethpage, New York

Compound[1]	06/07/19 (ppbv)	09/06/19 (ppbv)	11/26/19 (ppbv)	03/30/20 (ppbv)
Tentatively Identified Compounds				
2-Ethyl-1-hexanol	ND	ND	ND	ND
2-Phenyl-2-propanol	**3.3 JN**	ND	ND	ND
Acetone	ND	ND	ND	**8.9 JN**
Acetophenone	**2.1 JN**	ND	ND	ND
Alkane	ND	ND	**3.3 J**	ND
C3 alkyl benzene	**6.2 J**	ND	**3.9 J**	ND
Carbon Dioxide	**100 JNB**	**220 JB**	**29 JNB**	**15 JNB**
Difluorochloromethane	ND	ND	ND	**1.5 JN**
Ethanol	ND	ND	ND	**1.3 JN**
Unknown (A)	**2.8 J**	ND	ND	ND
Unknown (B)	ND	**3.3 J**	ND	ND
Unknown (C)	ND	ND	ND	**1.1 J**
Total VOC TICs[2]	**14.4 J**	**3.3 J**	**7.2 J**	**28 J**

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

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
3.3	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 Systems Corporation
Bethpage, New York

Date [1]	Water Flow Rates						Water Pressures					Air Flow Rate [2]	Air Pressures [5]					Air Temp. [5]
	Remedial Well [2]				Combined Influent [3]	Effluent [2]	Remedial Well Effluent [2,4]				Effluent [5]	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)
04/02/19	30.6	59.6	75.2	30.2	196	205	54	5	37	56	12	1,692	0.0	0.0	0.0	0.0	0.0	532
05/15/19	30.3	64.8	76.5	30.0	202	211	55	6	44	56	12	1,698	0.0	0.0	0.0	0.0	0.0	534
06/07/19	30.4	53.0 [6]	73.1	30.0	134	197 [6]	56	5 [6]	46	55	11	1,658	0.0	0.0	0.0	0.0	0.0	540
07/02/19	29.6	71.7	72.7	29.0	203	212	54	66	43	53	29	1,491	0.0	0.0	0.0	0.0	0.0	541
08/02/19	28.4	64.9	70.1	28.4	192	200	54	60	44	54	13	1,463	0.0	0.0	0.0	0.0	0.0	541
09/06/19	29.7	63.4	74.1	30.3	198	207	57	15	39	56	13	1,522	0.0	0.0	0.0	0.0	0.0	542
10/15/19	29.9	74.5	75.1	30.3	210	219	57	69	35	56	17	1,510	0.0	0.0	0.0	0.0	0.0	538
11/05/19	30.1	73.3	75.4	29.8	209	218	57	66	33	56	14	1,496	0.0	0.0	0.0	0.0	0.0	535
12/04/19	30.1	72.1	75.5	30.0	208	218	57	6	40	56	13	1,542	0.0	0.0	0.0	0.0	0.0	532
01/16/20	30.3	75.8	75.6	30.6	212	231	57	44	42	56	14	1,526	0.0	0.0	0.0	0.0	0.0	531
02/06/20	31.5	75.5	76.3	30.1	213	225	56	42	38	56	14	1,575	0.0	0.0	0.0	0.0	0.0	530
03/03/20	30.7	75.8	75.5	30.6	213	227	56	33	40	56	15	1,600	0.0	0.0	0.0	0.0	0.0	538

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 Systems Corporation
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. Due to a RW-2 pump failure on 6/07/19 after system sampling, the flow rate average was calculated using readings between midnight and the time of shutdown.

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
^{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
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
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	< 0.01	0.001	< 0.01
January 2020 through March 2020																																			
01/01/20 - 02/01/20	934	2,343	2,331	938	6,545	< 0.01	1.04	0.08	< 0.01	1.13	< 0.01	1.0	0.07	< 0.01	1.1	< 0.01	< 0.01	0.01	< 0.01	0.011	< 0.01	0.034	< 0.01	< 0.01	0.036	< 0.01	0.034	< 0.01	< 0.01	0.036	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
02/01/20 - 03/01/20	1,265	3,122	3,141	1,252	8,780	< 0.01	1.39	0.11	< 0.01	1.50	< 0.01	1.4	0.10	< 0.01	1.5	< 0.01	< 0.01	0.02	< 0.01	0.015	< 0.01	0.048	< 0.01	< 0.01	0.052	< 0.01	0.048	< 0.01	< 0.01	0.051	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
03/01/20 - 04/01/20	1,315	3,333	3,347	1,342	9,337	< 0.01	1.48	0.12	< 0.01	1.60	< 0.01	1.5	0.11	< 0.01	1.6	< 0.01	< 0.01	0.02	< 0.01	0.016	< 0.01	0.048	< 0.01	< 0.01	0.052	< 0.01	0.048	< 0.01	< 0.01	0.051	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Subtotal Jan - Mar 2020 [9]	3,514	8,798	8,818	3,532	24,662	< 0.01	3.91	0.32	< 0.01	4.23	< 0.01	3.9	0.28	< 0.01	4.2	< 0.01	< 0.01	0.04	< 0.01	0.042	< 0.01	0.043	< 0.01	< 0.01	0.046	< 0.01	0.043	< 0.01	< 0.01	0.046	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2020 Totals	3,514	8,798	8,818	3,532	24,662	< 0.01	3.9	0.3	< 0.01	4.2	< 0.01	3.9	0.28	< 0.01	4.19	< 0.01	< 0.01	0.04	< 0.01	0.04	< 0.01	0.043	< 0.01	< 0.01	0.046	< 0.01	0.043	< 0.01	< 0.01	0.046	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total [10]	166,396	374,920	388,101	165,010	1,094,427	2	1,034	915	256	2,204	2	1,022	106	2	1,132	< 0.01	10	809	254	1,067	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes, Abbreviations, Qualifiers, and Units:

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, 2020 and April 1st, 2020.

10. "Total" refers to the amounts removed by the Operable Unit 3 Bethpage Park Groundwater Containment System.

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 Systems Corporation
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

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
		3/30/2020	lb/yr	lb/hr	g/s						
Project VOCs											
1,1,1-Trichloroethane	71-55-6	0.93	0.05	5.45E-06	6.9E-07	2.2E-03	6.6E-05	9,000	5,000	0.0%	0.0%
1,1-Dichloroethane	75-34-3	6.1	0.31	3.57E-05	4.5E-06	1.4E-02	4.3E-04	--	0.63	--	0.1%
1,1-Dichloroethene	75-35-4	1.0	0.05	5.86E-06	7.4E-07	2.3E-03	7.1E-05	--	200	--	0.0%
1,2-Dichloroethane	107-06-2	0.45	0.02	2.64E-06	3.3E-07	1.0E-03	3.2E-05	--	0.04	--	0.1%
Benzene	71-43-2	0.38	0.02	2.23E-06	2.8E-07	8.8E-04	2.7E-05	1,300	0.13	0.0%	0.0%
cis-1,2-Dichloroethene	156-59-2	109	5.59	6.39E-04	8.0E-05	2.5E-01	7.8E-03	--	63	--	0.0%
Tetrachloroethene	127-18-4	1.7	0.09	9.96E-06	1.3E-06	4.0E-03	1.2E-04	300	4	0.0%	0.0%
Toluene	108-88-3	1.4	0.07	8.20E-06	1.0E-06	3.3E-03	1.0E-04	37,000	5,000	0.0%	0.0%
Trichloroethene	79-01-6	29	1.49	1.70E-04	2.1E-05	6.8E-02	2.1E-03	20	0.2	0.3%	1.0%
Vinyl Chloride	75-01-4	26.3	1.35	1.54E-04	1.9E-05	6.1E-02	1.9E-03	180,000	0.11	0.0%	1.7%
Xylene-O	1330-20-7	0.74	0.02	1.99E-06	2.5E-07	7.9E-04	2.4E-05	22,000	100	0.0%	0.0%
Xylenes - M,P	1330-20-7	0.61	0.03	3.28E-06	4.1E-07	1.3E-03	4.0E-05	22,000	100	0.0%	0.0%
Non-Project VOCs											
1,2-Dichloropropane	78-87-5	0.46	0.02	2.70E-06	3.4E-07	1.1E-03	3.3E-05	--	4	--	0.0%
Carbon Tetrachloride	56-23-5	0.45	0.02	2.64E-06	3.3E-07	1.0E-03	3.2E-05	1,900	0.17	0.0%	0.0%
Chloroform	67-66-3	11	0.56	6.45E-05	8.1E-06	2.6E-02	7.8E-04	150	14.7	0.0%	0.0%
Chloromethane	74-87-3	1.4	0.07	8.20E-06	1.0E-06	3.3E-03	1.0E-04	22,000	90	0.0%	0.0%
Dichloromethane	75-09-2	4.5	0.23	2.64E-05	3.3E-06	1.0E-02	3.2E-04	14,000	60	0.0%	0.0%
Ethylbenzene	100-41-4	0.48	0.02	2.81E-06	3.5E-07	1.1E-03	3.4E-05	--	1,000	--	0.0%
Trichlorotrifluoroethane (Freon 113)	76-13-1	1.9	0.10	1.11E-05	1.4E-06	4.4E-03	1.4E-04	960,000	180,000	0.0%	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 Systems Corporation
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Notes, Abbreviations, and Units:

1. Emission rate calculated based on VSP-05 effluent concentration and a daily average exit air flow rate of 1,567 ft^3/min for 3/30/2020. Emission rate standardized at 70 ^oF and 1 atm.
   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 was 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.

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
µg/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)
Bethpage, New York

Compound[1] (µg/L)	Sample Location: Sample Date: NYSDEC SCGs	RW-1 6/7/2019	RW-1 9/6/2019	RW-1 11/5/2019	RW-1 2/6/2020	RW-2 6/7/2019	RW-2 9/6/2019	RW-2 11/5/2019	RW-2 2/6/2020	RW-3 6/7/2019	RW-3 9/6/2019	RW-3 11/5/2019	RW-3 2/6/2020	RW-4 6/7/2019	RW-4 9/6/2019	RW-4 11/5/2019	RW-4 2/6/2020
Project VOCs																	
1,1,1-Trichloroethane	5	< 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	< 1.0
1,1-Dichloroethane	5	< 1.0	< 1.0	< 1.0	< 1.0	**0.78 J**	**0.58 J**	**0.65**	**0.84 J**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	0.6	< 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	< 1.0
1,1-Dichloroethene	5	< 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	< 1.0
Tetrachloroethene	5	< 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	< 1.0
Trichloroethylene	5	< 1.0	< 1.0	< 1.0	< 1.0	**8.1**	**10.2**	**10.8**	**10.5**	**2.5**	**2.0**	**2.0**	**2.2**	< 1.0	< 1.0	**0.64**	< 1.0
Vinyl Chloride	2	< 1.0	< 1.0	< 1.0	< 1.0	**8.0**	**8**	**4.9**	**10.3**	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
cis-1,2-dichloroethene	5	< 1.0	< 1.0	< 1.0	< 1.0	**22.7**	**19.9**	**21.9**	**31.7**	**1.3**	**1.1**	**1.2**	**1.6**	< 1.0	< 1.0	< 1.0	< 1.0
trans-1,2-dichloroethene	5	< 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	< 1.0
Benzene	1	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Toluene	5	< 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	< 1.0
Xylene-o	5	< 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	< 1.0
Xylenes-m,p	5	< 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	< 1.0
Subtotal Project VOCs		0	0	0	0	**39.6**	**38.1**	**38.3**	**53.3**	**3.8**	**3.1**	**3.2**	**3.8**	0	0	**0.6**	0
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	< 1.0	< 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	< 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
1,2-Dichloropropane	1	< 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	< 1.0
1,3-Butadiene	0.5	< 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	< 5.0
2-Butanone	NE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
4-methyl-2-pentanone	50	< 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	< 5.0
Acetone	NE	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Bromodichloromethane	50	< 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	< 1.0
Bromoform	50	< 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	< 1.0
Bromomethane	5	< 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	< 2.0
Carbon Disulfide	60	< 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	< 2.0
Carbon tetrachloride	5	< 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	< 1.0
Chlorobenzene	5	< 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	< 1.0
Chlorodibromomethane	50	< 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	< 1.0
Chlorodifluoromethane (Freon 22)	NE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	**4.0 J**	< 5.0	**3.1**	< 5.0
Chloroethane	5	< 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	< 1.0
Chloroform	7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	**0.87 J**	**0.91 J**	**1.1**	**0.56 J**	< 1.0	< 1.0	< 1.0	< 1.0
Chloromethane	5	< 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	< 1.0
cis-1,3-dichloropropene	0.4	< 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	< 1.0
Dichlorodifluoromethane (Freon 12)	5	< 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	< 2.0
Dichloromethane	5	< 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	< 2.0
Ethylbenzene	5	< 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	< 1.0
Methyl N-Butyl Ketone	50	< 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	< 5.0
Methyl tert-Butyl Ether	5	< 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	< 1.0
Styrene	5	< 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	< 1.0
trans-1,3-dichloropropene	0.4	< 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	< 1.0
Trichlorofluoromethane (Freon 11)	5	< 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	< 2.0
Trichlorotrifluoroethane (Freon 113)	5	< 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	< 5.0
1-Chloro-1,1-difluoroethane (Freon 142b)	NE	< 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	< 5.0
Subtotal Non-Project VOCs		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.9**	**0.9**	**1.1**	**0.6**	**4.0**	0.0	**3.1**	0.0
Total VOCs[2]		0.0	0.0	0.0	0.0	**39.6**	**38.1**	**38.3**	**53.3**	**4.7**	**4.0**	**4.3**	**4.4**	**4.0**	0.0	**3.7**	0.0
1,4-Dioxane		**0.33**	**0.41**	**0.47**	**0.38**	**1.4**	**1.7**	**1.5**	**2.3**	**0.32**	**0.35**	**0.39**	**0.56**	**0.15 J**	**0.17 J**	**0.23 J**	**0.20 J**

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

Table 10
Summary of Remedial Well Groundwater Sample Analytical Results - VOCs
Bethpage Park Groundwater Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
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
NA	Not Analyzed
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
	Bold cell outline indicates an exceedance of an SCG
8.1	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
µg/L	micrograms per liter

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

ARCADIS Design & Consultancy for natural and built assets

FIGURE 1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD: PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACTIVE\NY001496\114\IOMM4\NY1496_B01.dwg LAYOUT: BETHPAGE PARK SAVED: 11/11/2015 4:51 PM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 11/11/2015 4:54 PM BY: STOWELL, GARY
XREFS: IMAGES: PROJECTNAME: ----
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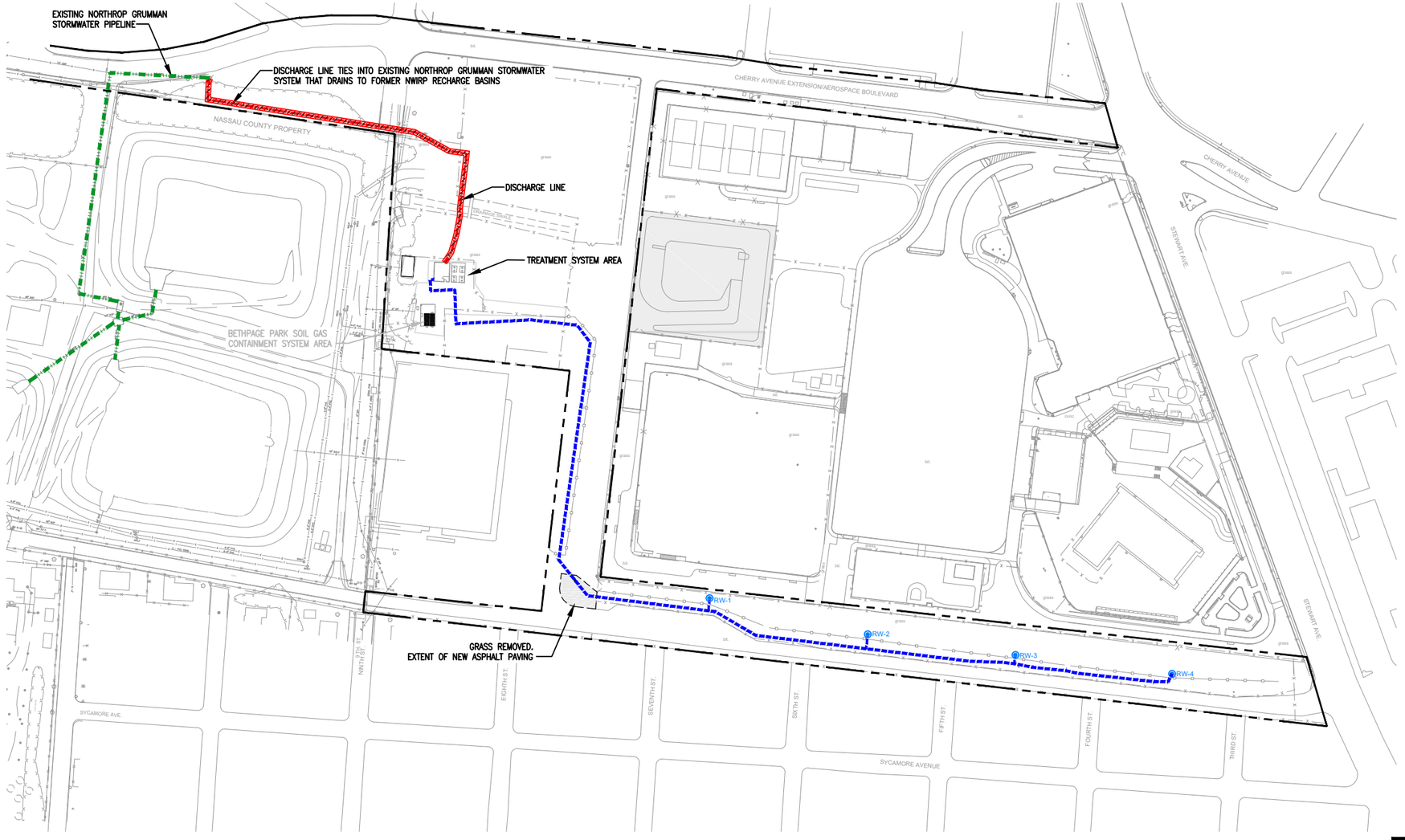
FREEPORT.TIF
HICKSVILLE.TIF
HUNTINGTON.TIF



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

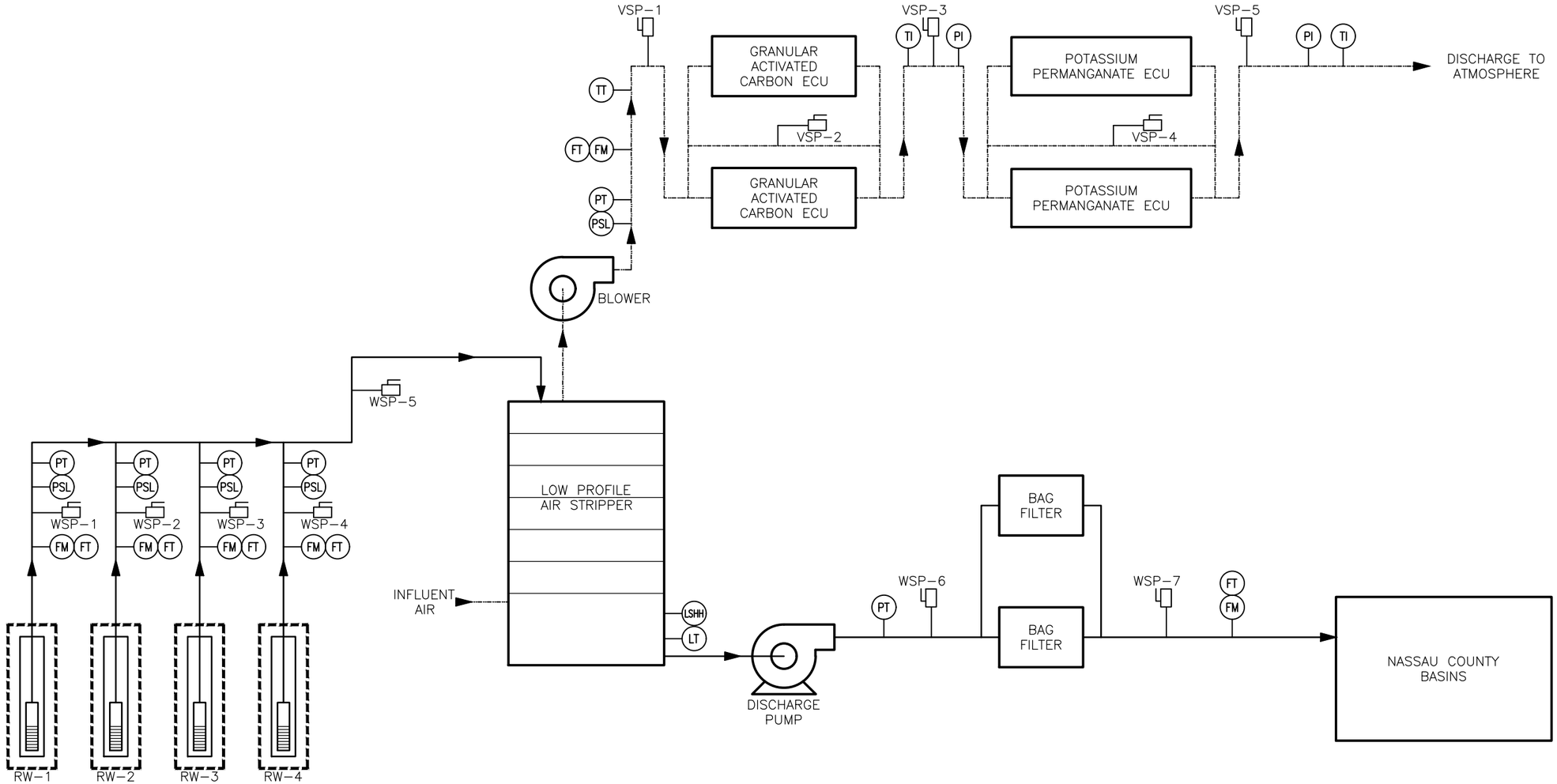
BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

SITE AND GROUNDWATER CONTAINMENT SYSTEM

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*
C:\Users\alsanchez\OneDrive - ARCADIS\BIM 360 Docs\NORTHROP GRUMMAN\OMM\4NY1496B01.DWG LAYOUT: 2 SAVED: 8/16/2018 1:24 PM ACADVER: 21.0S (LMS TECH) PAGESETUP:---- PLOTSTYLETABLE: ---- PLOTTED: 8/16/2018 1:24 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
X-r1496X00
X-ONSITE-BASE SITE



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 AND MONITORING LOCATIONS

ARCADIS Design & Consultancy for natural and built assets

FIGURE 3

EXPLANATION:

(dash-dot line)	NORTHROP GRUMMAN PROPERTY LINE
(x line)	FENCE
(hatched box)	BASIN
bit.	BITUMINOUS PAVEMENT
MW-200-1	MONITORING WELL
RW-2	REMEDIAL WELL
PZ-2C	PIEZOMETER

NOTES:

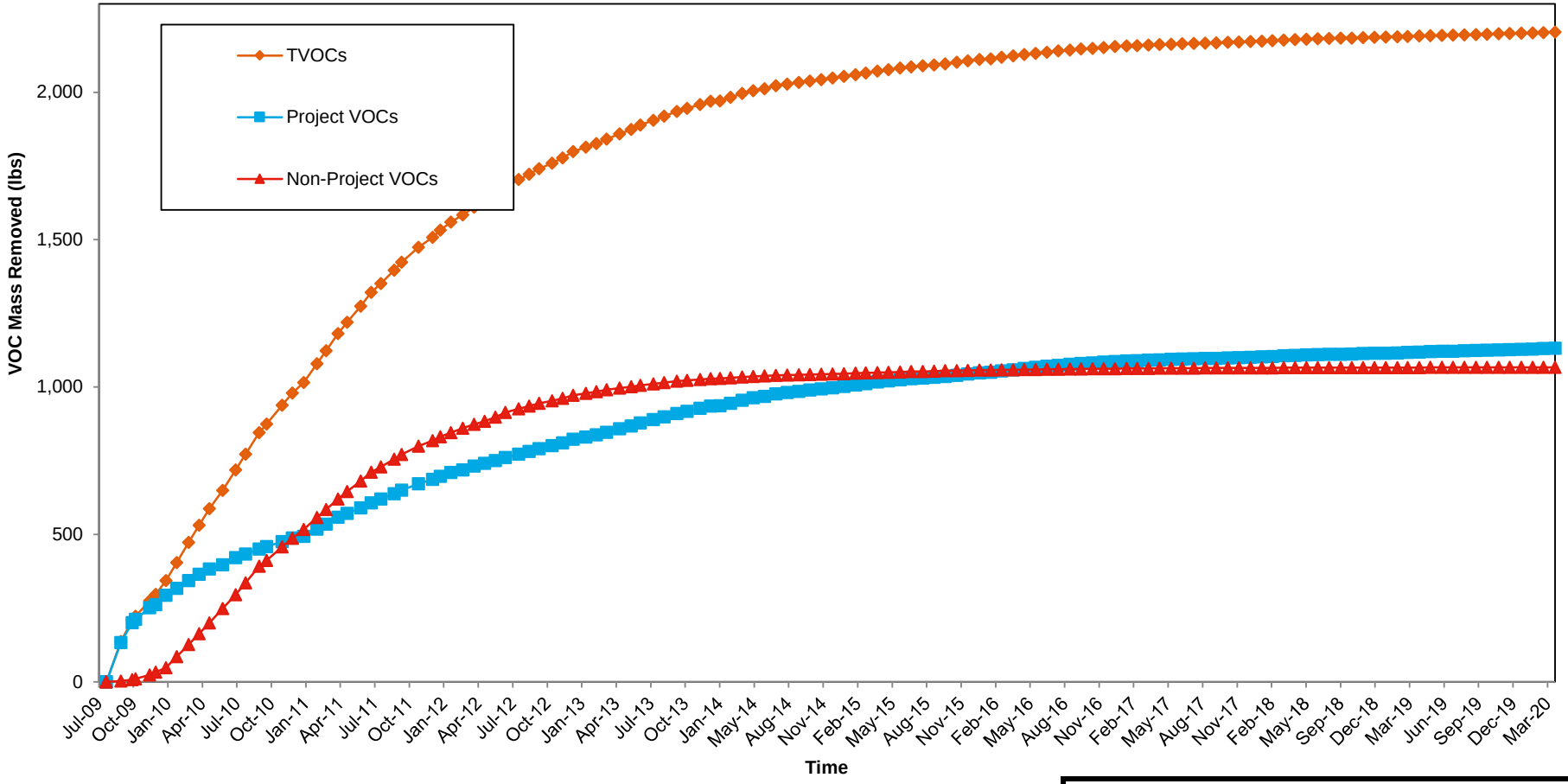
1. MONITORING WELLS, REMEDIAL WELLS, AND PIEZOMETERS SURVEYED TO NORTH AMERICAN DATUM (NAD) 83.
2. PARK FEATURES SHOWN WERE PRESENT PRIOR TO TOWN OF OYSTER BAY REDEVELOPMENT IN 2005.

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

GROUNDWATER MONITORING NETWORK SITE PLAN

ARCADIS Design & Consultancy for natural and built assets

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

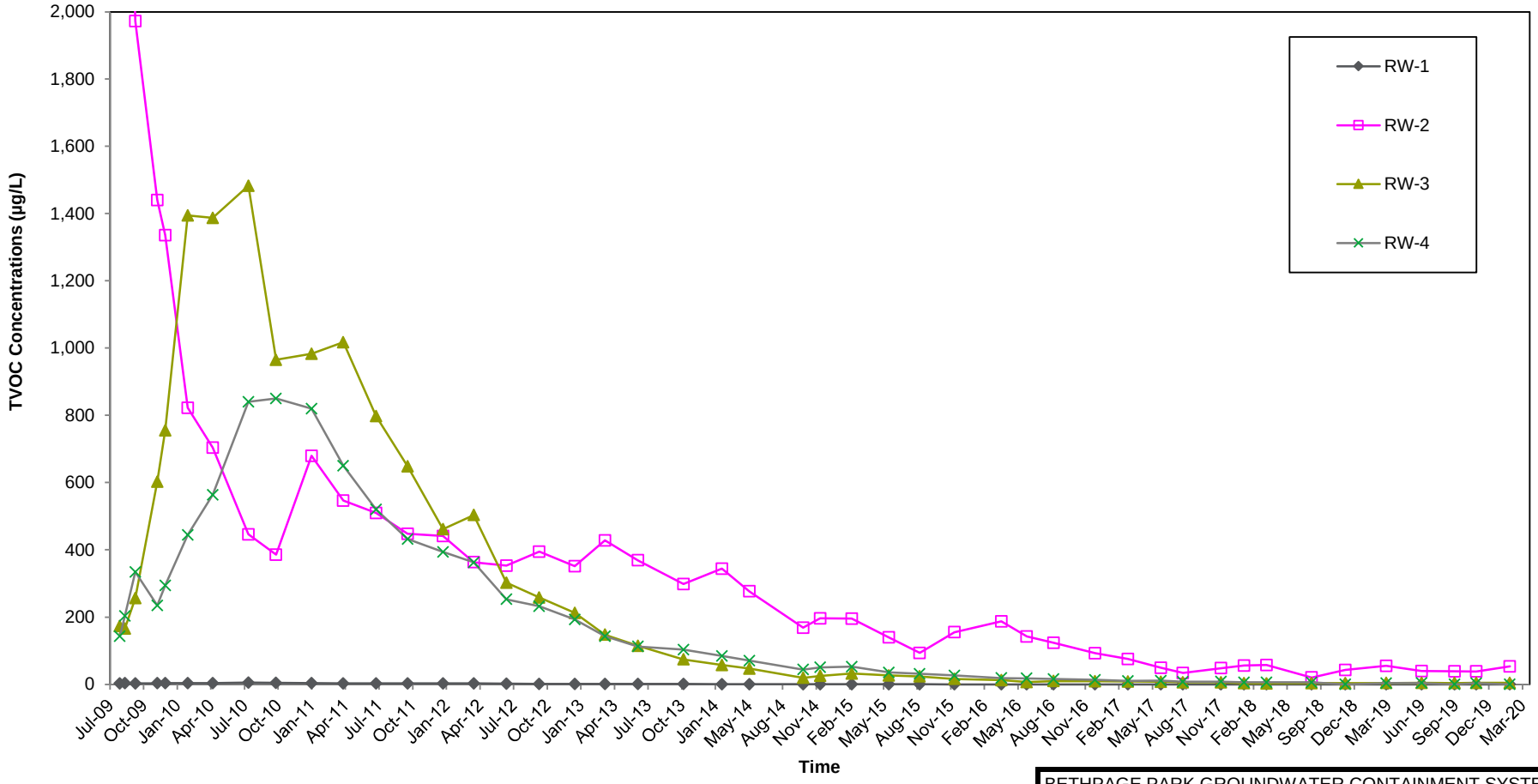
BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

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

ARCADIS

FIGURE
5

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\10 Final Reports-Presentations\OM&M Reports\2020 Q1\Raw Files\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.

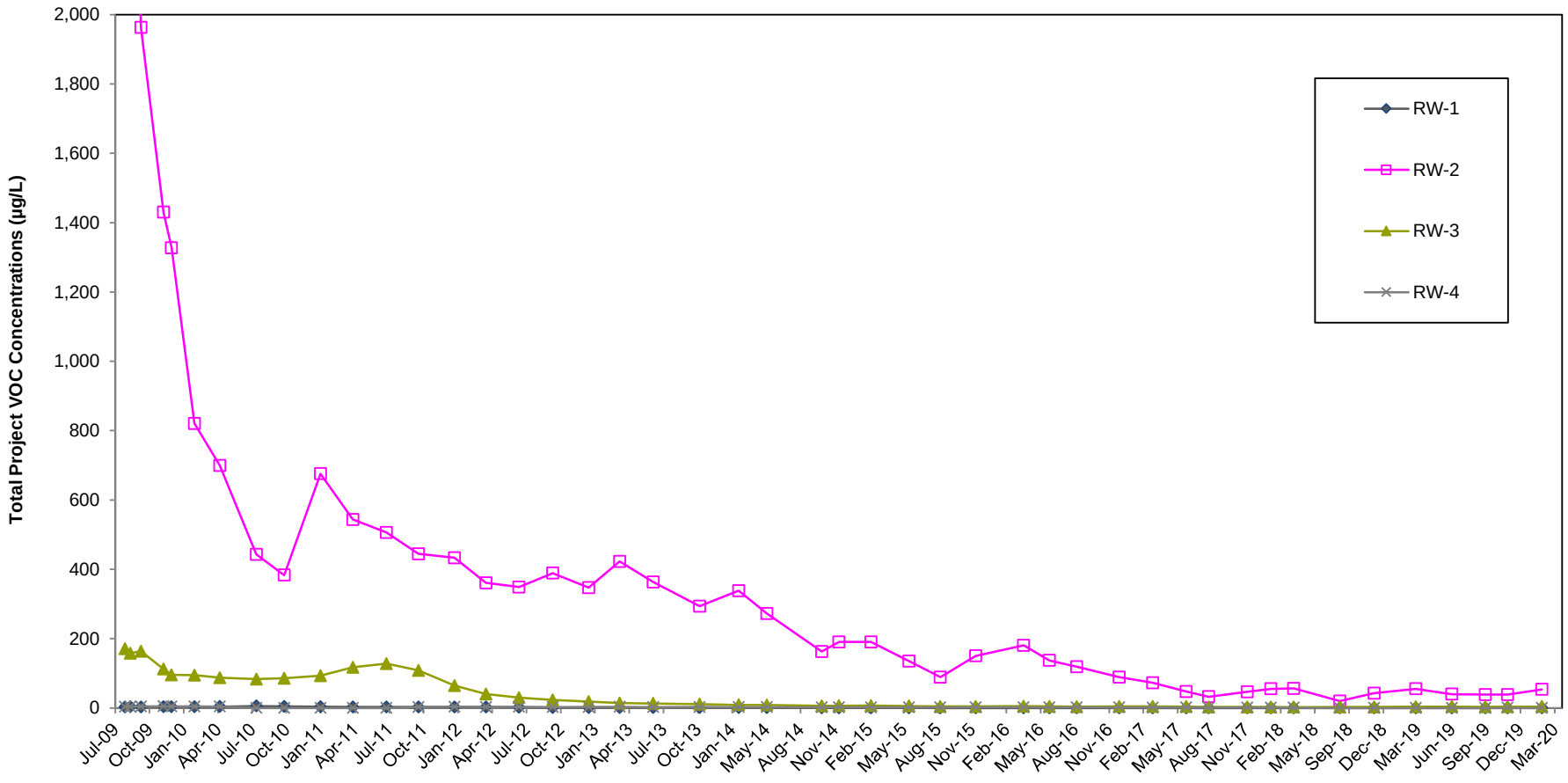
µg/L = micrograms per liter

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

REMEDIAL WELL TOTAL VOC CONCENTRATIONS

ARCADIS

FIGURE 6A



Abbreviations, Notes, and Units:

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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

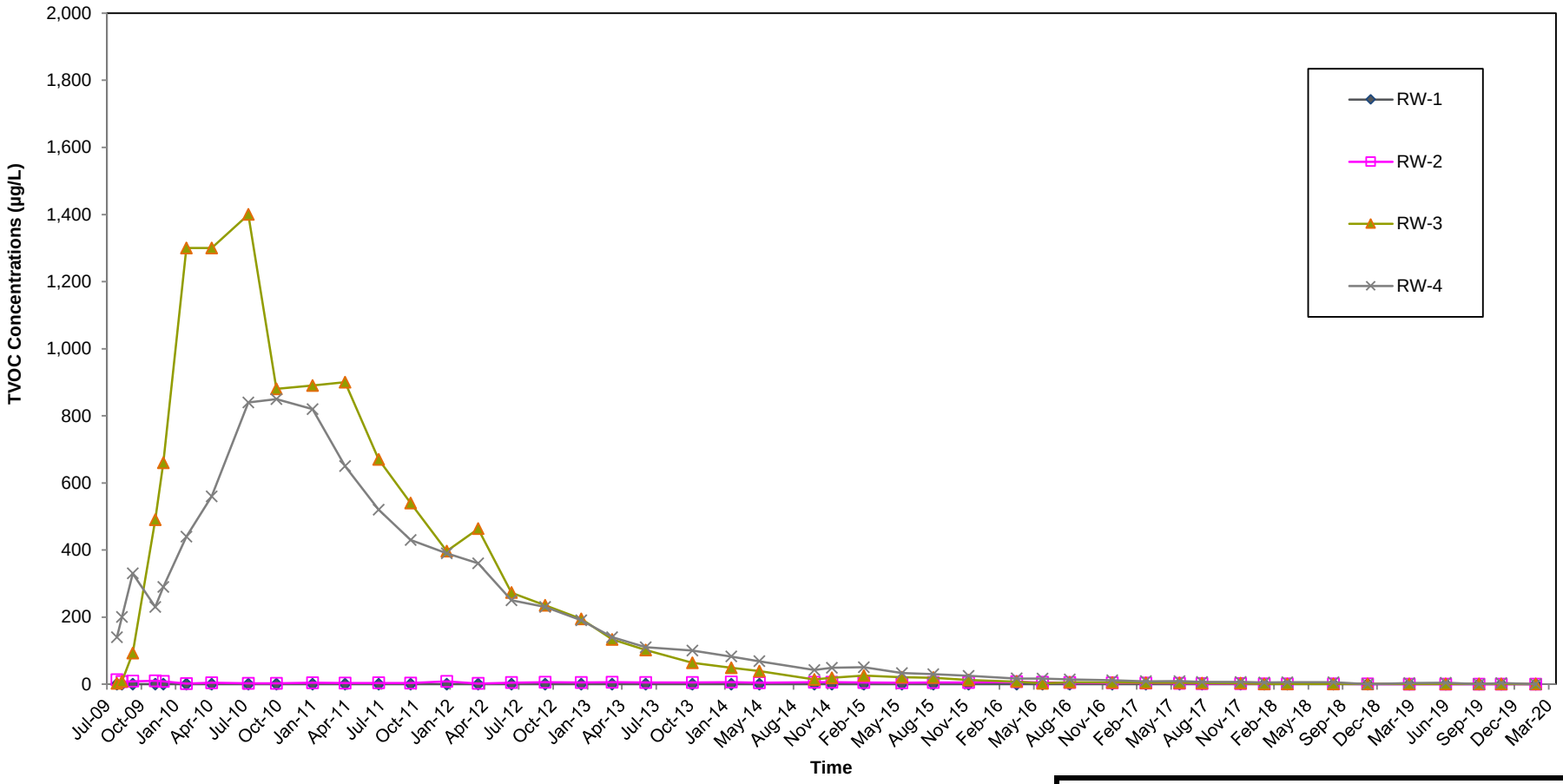
BETHPAGE PARK GROUNDWATER CONTAINMENT SYSTEM
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

REMEDIAL WELL PROJECT VOC CONCENTRATIONS

ARCADIS

FIGURE
6B

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\10 Final Reports-Presentations\OM&M Reports\2020 Q1\Raw Files\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.

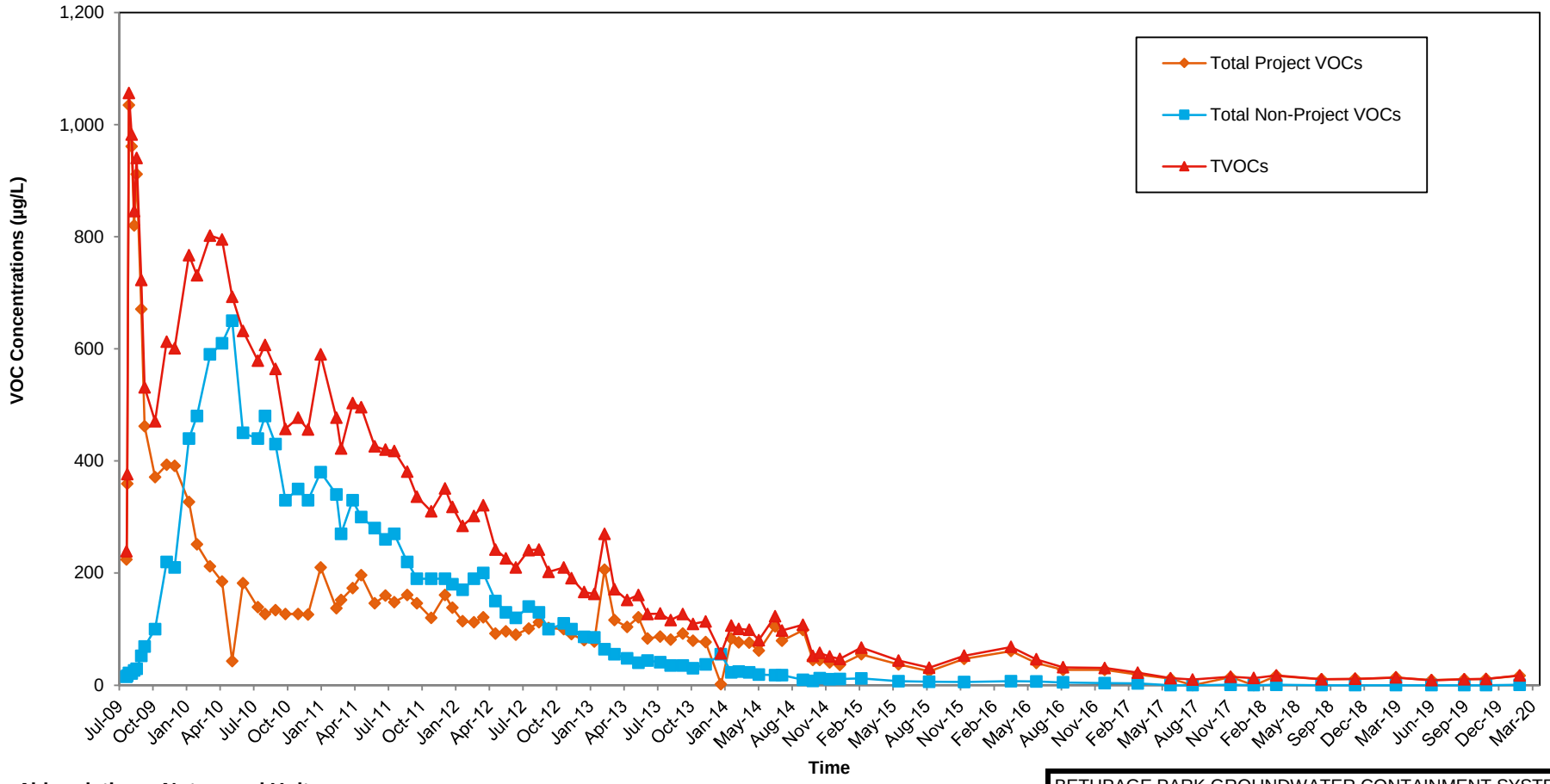
µg/L = micrograms per liter

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

REMEDIAL WELL NON-PROJECT VOC CONCENTRATIONS

ARCADIS

FIGURE
6C



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
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INFLUENT TOTAL, PROJECT AND NON-PROJECT VOC CONCENTRATIONS

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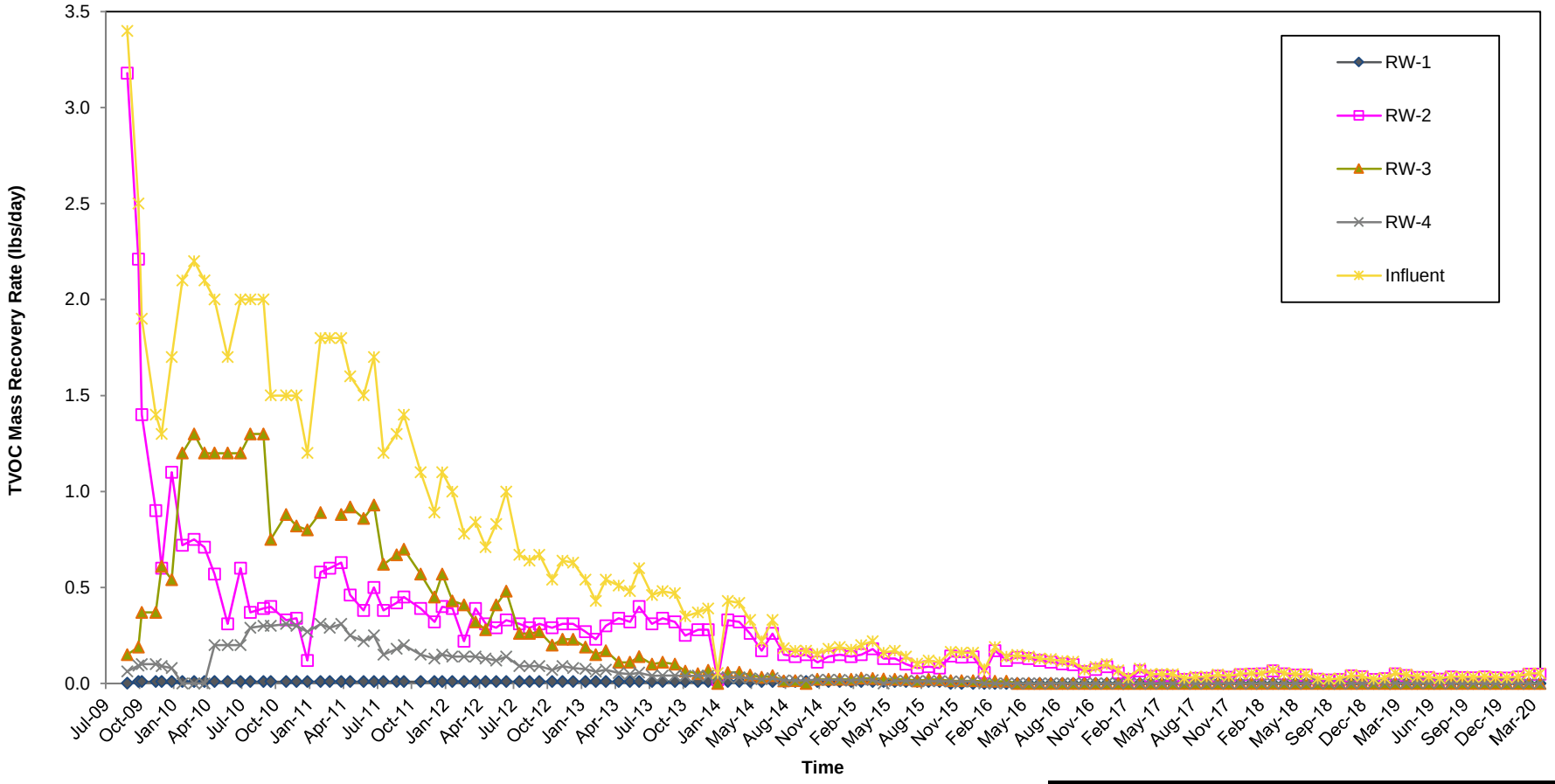
FIGURE
7

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\10 Final Reports-Presentations\OM&M Reports\2020 Q1\Raw Files\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

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TOTAL VOC MASS RECOVERY RATES

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FIGURE
8A

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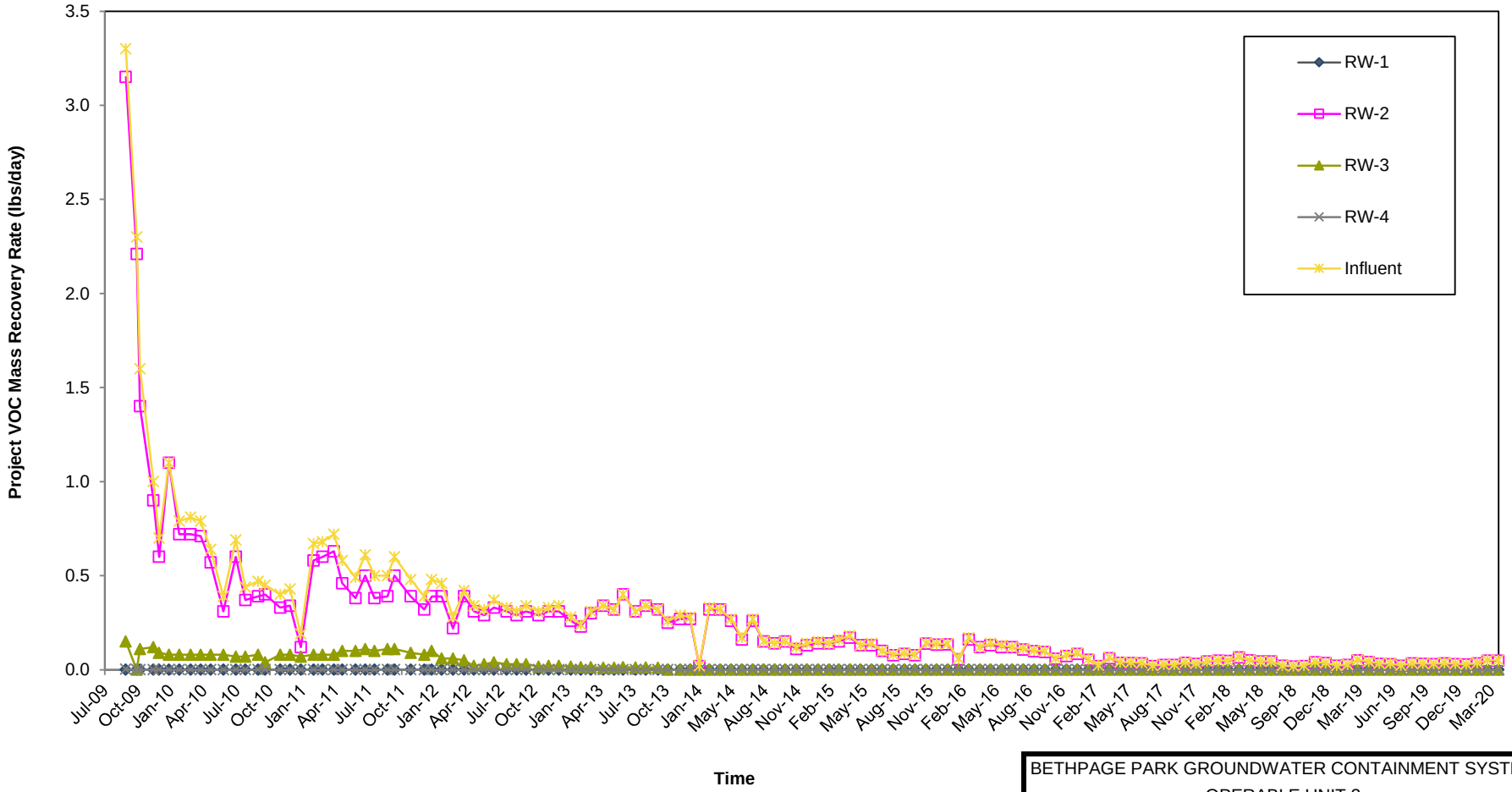

Abbreviations, Notes, and Units:

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

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PROJECT VOC MASS RECOVERY RATES

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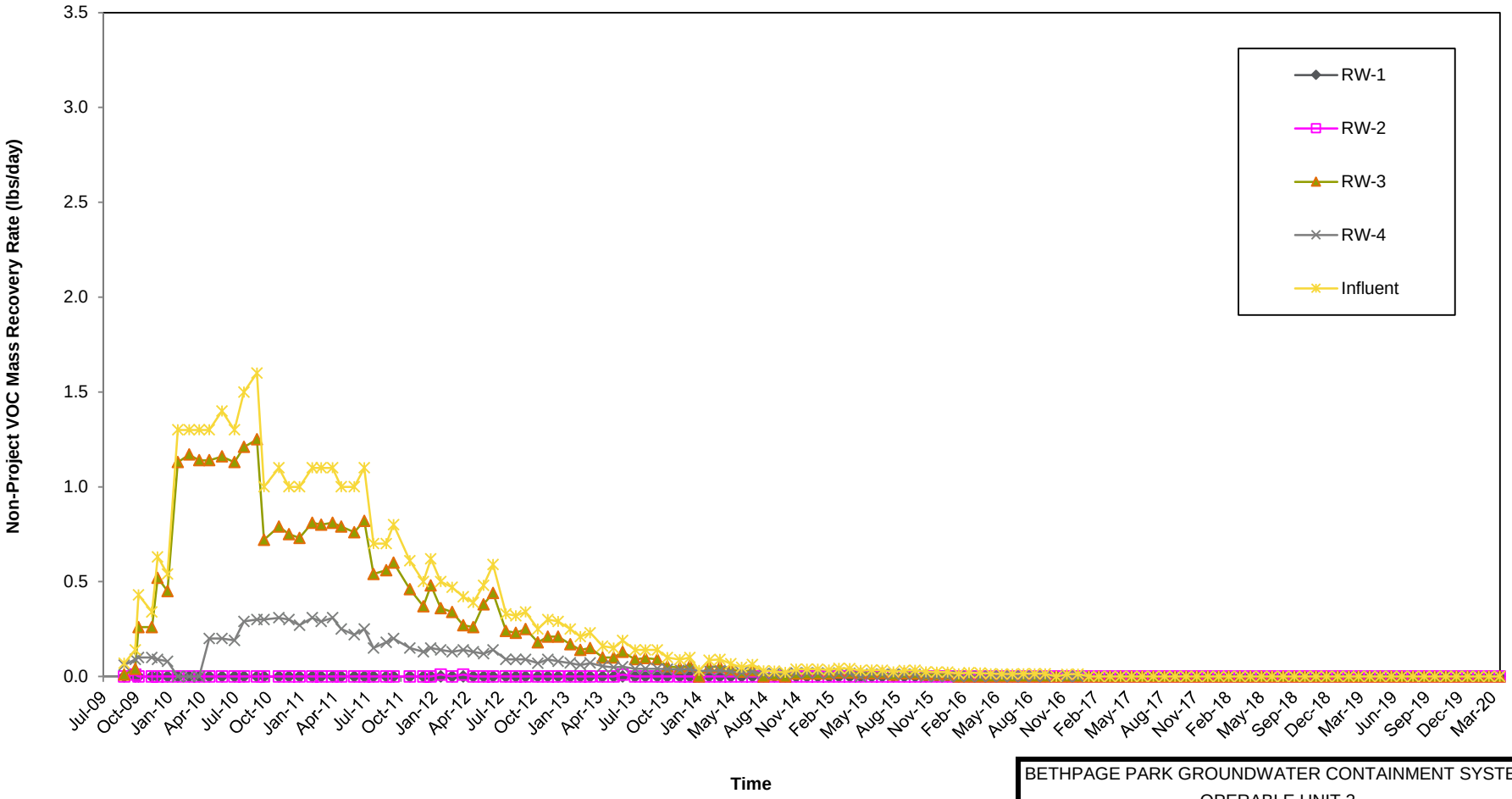
FIGURE
8B

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\10 Final Reports-Presentations\OM&M Reports\2020 Q1\Raw Files\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

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NON-PROJECT VOC MASS RECOVERY RATES

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FIGURE
8C

G:\APROJECT\Northrop Grumman Bethpage\OU3.2 Groundwater Containment System\10 Final Reports-Presentations\OM&M Reports\2020 Q1\Raw Files\Q1_Table 2-8Figure 8C VOC Recovery Rates