ARCADIS Design & Consultancy for natural and built assets

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ENVIRONMENT

Subject:
Results of Third Quarter 2017 System Operation and Monitoring,
Bethpage Park Soil Gas Containment System (BPSGCS),
Operable Unit 3 (OU3; Former Grumman Settling Ponds),
Bethpage, New York, NYSDEC Site #1-30-003A

Date:
November 16, 2017

Contact:
Christopher Engler

Phone:
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Email:
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Our ref:
NY001496.1616

Dear Jason:

Enclosed is one electronic PDF copy of the third quarter results of the OU3 BPSGCS operation and monitoring, performed in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (Arcadis 2016) and the NYSDEC-approved Sampling and Analysis Plan (SAP; Arcadis 2016). As we have transitioned to electronic submittals (via PDF) as part of ongoing sustainability and cost savings efforts, 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 Engler PE

Vice President

Enclosure

Copies:
Ed Hannon, Northrop Grumman
Donald Hesler, NYSDEC
Steven Karpinski, New York State Department of Health
John Lovejoy, NCDOH
Lorenzo Thantu, USEPA
Carlo San Giovanni, Arcadis
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TABLES

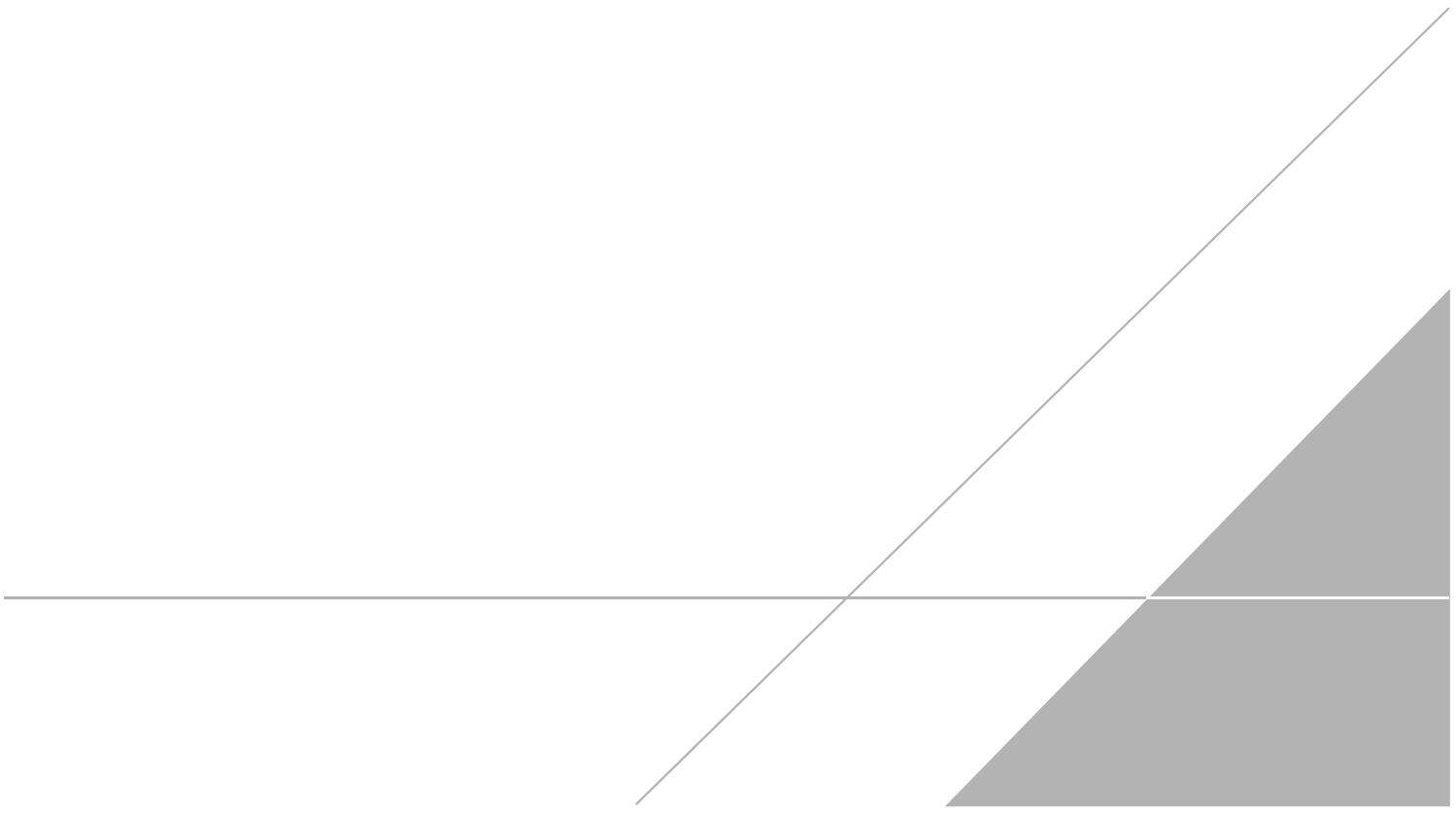

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

	DW-7S Parameters			DW-7D Parameters			DW-3S Parameters			DW-3D Parameters			DW-5S Parameters			DW-5D Parameters			DW-6S Parameters			DW-6D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**
12/19/16	111	-25	-2.0	8.0	-8.5	-0.56	6.0	-5.3	-0.20	12	-6.1	-0.36	95	-18	-1.7	15	-9.2	-2.5	82	-16	-1.8	6.9	-5.4	-1.3
03/24/17	102	-19	-1.8	12	-12	-0.55	6.5	-5.0	-0.30	14	-5.0	-0.44	86	-14	-1.7	14	-14	-2.8	65	-16	-1.6	7.0	-5.0	-1.3
06/14/17	120	-21	-1.6	4.5	-11	-0.50	12	-6.0	-0.33	10	-6.2	-0.42	62	-24	-1.1	13	-13	-2.2	85	-16	-1.7	4.0	-4.3	-1.8
09/21/17	100	-18	-1.8	5.0	-20	-0.56	5.0	-7.5	-0.26	11	-6.0	-0.36	86	-13	-1.3	14	-13	-2.5	80	-15	-1.6	6.2	-5.0	-1.2

Notes and abbreviations on last page.

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

	DW-1S Parameters			DW-1D Parameters			DW-4S Parameters			DW-4D Parameters			DW-8S Parameters			DW-9S Parameters			DW-2S Parameters			DW-2D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**
12/19/16	88	-25	-2.4	5.0	-2.5	-1.4	71	-14	-1.5	6.8	-6.8	-0.64	60	-19	-1.8	35	-13	-1.5	27	-27	-2.0	33	-19	-1.4
03/24/17	96	-23	-2.3	6.3	-3.0	-1.7	70	-15	-1.6	7.0	-6.5	-0.84	61	-17	-1.9	36	-13	-1.7	33	-28	-1.5	34	-19	-1.4
06/14/17	90	-22	-1.9	4.6	-2.5	-1.3	69	-14	-1.3	5.0	-6.0	-0.56	65	-17	-1.8	43	-14	-1.7	22	-21	-1.4	39	-23	-2.2
09/21/17	85	-22	-2.0	5.1	-2.5	-1.5	75	-14	-1.5	7.0	-7.0	-0.76	73	-19	-2.1	35	-13	-1.4	33	-26	-2.0	36	-21	-2.2

Notes and abbreviations on last page.

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

	DW-10S Parameters			DW-11S Parameters			Knock Out Tank Parameters - Vacuum			Condensate Water Collected [1]	Blower Parameters BL-200			Blower Parameters BL-300			Blower Parameters BL-400			Combined Effluent Parameters				
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Influent KO-200	Influent KO-300	Influent KO-400	Influent ST-510	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Total Effluent Flow Rate [2]	Total Effluent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.
Date	**scfm**	**iwc**	**iwc**	**scfm**	**iwc**	**iwc**	**iwc**	**iwc**	**iwc**	**Gallons**	**iwc**	**iwc**	**Hz**	**iwc**	**iwc**	**Hz**	**iwc**	**iwc**	**Hz**	**scfm**	**ppmv**	**°F**	**iwc**	**°F**
12/19/16	30	-14	-1.8	31	-27	-2.1	--	-35	--	100	--	--	--	-36	2.1	60	--	--	--	626	0.0	100	2.0	89
03/24/17	29	-13	-1.6	32	-20	-2.3	--	-38	--	200	--	--	--	-40	3.0	60	--	--	--	738	0.0	100	1.0	84
06/14/17	35	-14	-1.9	34	-23	-2.0	--	-32	--	150	--	--	--	-37	2.5	60	--	--	--	664	0.0	111	0.0	100
09/21/17	34	-15	-1.9	24	-19	-1.6	--	-36	--	30	--	--	--	-37	2.0	60	--	--	--	670	0.1	120	2.9	106

Notes and abbreviations on last page.

Table 1
General System Operating Parameters
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

Notes and Abbreviations:

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1. Total gallons of water accumulated at storage tank ST-510 per quarter. Values for 4Q 2016, 1Q 2017, 2Q 2017 and 3Q 2017 are estimated based on average volume collected during condensate removal events.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.

Table 2
Summary of Induced Vacuum Readings at Compliance Monitoring Points
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[1,2]

Well ID:	DW-7S		DW-7D	DW-3S	DW-3D	DW-5S		DW-5D	DW-1S			DW-1D	DW-4D	DW-8S		DW-2S		DW-2D		DW-11S	
MP ID:	VMWC-14A	VMWC-14B	VMWC-14D	VMWC-11B	VMWC-12D	VMWC-15A	VMWC-15B	VMWC-15D	VMWC-3A	VMWC-3B	VMWC-3C	VMWC-3D	VMWC-16D	VMWC-16A	VMWC-16B	VMWC-7A	VMWC-7B	VMWC-13D	VMWC-17D	VMWC-18A	VMWC-18B
Date	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc
12/19/16	-0.12	-0.19	-0.20	-0.12	-0.11	-0.12	-0.12	-0.13	-0.13	-0.14	-0.20	-0.19	-0.14	-0.12	-0.15	-0.091	-0.092	-0.14	-0.18	-0.20	-0.10
03/24/17	-0.13	-0.20	-0.20	-0.20	-0.12	-0.15	-0.16	-0.15	-0.19	-0.16	-0.18	-0.20	-0.13	-0.11	-0.13	-0.17	-0.11	-0.23	-0.29	-0.19	-0.18
06/14/17	-0.12	-0.18	-0.19	-0.11	-0.14	-0.11	-0.11	-0.13	-0.13	-0.14	-0.15	-0.17	-0.15	-0.12	-0.15	-0.12	-0.16	-0.12	-0.28	-0.11	-0.11
09/21/17	-0.10	-0.19	-0.19	-0.12	-0.56	-0.16	-0.14	-0.15	-0.14	-0.15	-0.15	-0.20	-0.27	-0.18	-0.17	-0.12	-0.13	-0.19	-0.24	-0.090	-0.10
Time Weighted Rolling Average [3]	**-0.11**	**-0.19**	**-0.20**	**-0.14**	**-0.33**	**-0.15**	**-0.14**	**-0.14**	**-0.15**	**-0.15**	**-0.17**	**-0.20**	**-0.20**	**-0.15**	**-0.15**	**-0.12**	**-0.11**	**-0.19**	**-0.24**	**-0.14**	**-0.12**

Gross Average Compliance Points [4]	
09/21/17	-0.18

Notes and Abbreviations:

DW	depressurization well
VMWC	vapor monitoring well cluster
iwc	inches of water column

1 All induced vacuum measurements units in iwc. Values shown have been rounded to two significant figures.
2 Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.
3 Time weighted rolling average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.
4 Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.

Table 3
Total Effluent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[1]

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Compound (units in µg/m^3)	Sample ID: Sample Date:	VSP-601 12/22/2016	VSP-601 3/24/2017	VSP-601 6/23/2017 [4]	VSP-601 9/22/2017
Project VOCs	CAS No.				
1,1,1-Trichloroethane	71-55-6	**8.7**	**2.8**	**12**	**16**
1,1-Dichloroethane	75-34-3	**9.7**	< 3.2 U	8.9	**13**
1,1-Dichloroethene	75-35-4	< 3.2 U	< 3.2 U	<7.9 U	**0.56 J**
1,2-Dichloroethane	107-06-2	< 3.2 U	< 3.2 U	<8.1 U	< 0.81 U
Benzene	71-43-2	**18**	< 2.6 U	<6.4 U	< 0.64 U
cis-1,2-Dichloroethene	156-59-2	**322**	**110**	**400**	**311**
Tetrachloroethene	127-18-4	**6.7**	< 1.1 U	14	**20**
Toluene	108-88-3	< 3.0 U	< 3.0 U	<7.5 U	**1.7**
trans-1,2-Dichloroethene	156-60-5	**2.5**	< 3.2 U	4.4 J	**4.0**
Trichloroethylene	79-01-6	**291**	**85**	**437**	**429**
Vinyl chloride	75-01-4	< 0.41 U	< 0.41 U	<1.0 U	**0.95**
Xylene-O	95-47-6	< 3.5 U	< 3.5 U	<8.7 U	**0.43 J**
Xylenes - M,P	1330-20-7	**9.1**	< 3.5 U	<8.7 U	**1.2**
Subtotal Project VOCs		**668**	**198**	**876**	**798**
Non-Project VOCs					
1,1,2,2-Tetrachloroethane	79-34-5	< 2.7 U	< 2.7 U	<6.9 U	<0.69 U
1,1,2-Trichloroethane	79-00-5	< 2.2 U	< 2.2 U	<5.5 U	<0.55 U
1,2-Dichloropropane	78-87-5	< 3.7 U	< 3.7 U	<9.2 U	<0.92 U
1,3-Butadiene	106-99-0	< 1.8 U	< 1.8 U	<4.4 U	<0.44 U
2-Butanone	78-93-3	**7.1**	< 2.4 U	<5.9 U	**1.3**
2-Hexanone	591-78-6	< 3.3 U	< 3.3 U	<8.2 U	<0.82 U
4-Methyl-2-Pentanone	108-10-1	< 3.3 U	< 3.3 U	<8.2 U	<0.82 U
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	**71**	ND[3]	**200**	**220**
Acetone	67-64-1	**26**	**4.5**	**4.5 J**	**5.5**
Bromodichloromethane	75-27-4	< 2.7 U	< 2.7 U	<6.7 U	<0.67 U
Bromoform	75-25-2	< 1.7 U	< 1.7 U	<4.1 U	< 0.41 U
Bromomethane	74-83-9	< 3.1 U	< 3.1 U	<7.8 U	<0.78 U
Carbon Disulfide	75-15-0	< 2.5 U	< 2.5 U	<6.2 U	<0.62 U
Carbon Tetrachloride	56-23-5	< 1.0 U	< 1.0 U	<2.5 U	**1.4**
Chlorobenzene	108-90-7	< 3.7 U	< 3.7 U	<9.2 U	<0.92 U
Chlorodibromomethane	124-48-1	< 3.4 U	< 3.4 U	<8.5 U	<0.85 U

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[1]

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Compound (units in µg/m^3)	Sample ID: Sample Date:	VSP-601 12/22/2016	VSP-601 3/24/2017	VSP-601 6/23/2017 [4]	VSP-601 9/22/2017
Non-Project VOCs	CAS No.				
Chloroethane	75-00-3	< 2.1 U	< 2.1 U	<5.3 U	<0.53 U
Chlorodifluoromethane (Freon 22)	75-45-6	< 2.8 U	< 2.8 U	2.3 J	<0.070 U
Chloroform	67-66-3	**11**	**2.7 J**	**25**	**45**
Chloromethane	74-87-3	< 1.7 U	**1.3 J**	<4.1 U	<0.41 U
cis-1,3-Dichloropropene	10061-01-5	< 3.6 U	< 3.6 U	<9.1 U	<0.91 U
Dichlorodifluoromethane (Freon 12)	75-71-8	< 4.0 U	**2.7 J**	<9.9 U	**3.8**
Ethylbenzene	100-41-4	**6.5**	< 3.5 U	<8.7 U	<0.87 U
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 3.1 U	< 3.1 U	<7.7 U	**0.74 J**
Methyl Tert-Butyl Ether	1634-04-4	< 2.9 U	< 2.9 U	<7.2 U	<0.72 U
Methylene Chloride	75-09-2	**12**	**14**	**4.5 J**	<0.69 U
Styrene	100-42-5	< 3.4 U	< 3.4 U	<8.5 U	<0.85 U
Trans-1,3-Dichloropropene	10061-02-6	< 3.6 U	< 3.6 U	<9.1 U	<0.91 U
Trichlorofluoromethane (Freon 11)	75-69-4	< 2.2 U	**2.7**	<5.6 U	**2.1**
Subtotal Non-Project VOCs		**134**	**28**	**236.3**	**280**
TVOC[2]		**801**	**226**	**1,113**	**1,078**

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[(1)]

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Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected at or above its reporting limit.
--	Not analyzed.
CAS No.	Chemical Abstracts Service list number
ELAP	Environmental Laboratory Approval Program
D	Concentration is based on diluted sample analysis
J	Compound detected below its reporting limit; value is estimated.
ND	Not detected.
NYSDOH	New York State Department of Health
TIC	tentatively identifed compound
TVOC	total volatile organic compounds
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
µg/m^3	micrograms per cubic meter
< 1.0 U	Compound not detected above its laboratory quantification limit.

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.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. 1-Chloro-1,1-difluoroethane (Freon 142b) was reported as a TIC for the March 24, 2017 sampling event.
4. 3Q 2017 sample taken 1 day after parameter and vacuum readings.

Table 4
Total Effluent Vapor Sample Analytical Results
Tentatively Identified Compounds
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[1,2,3]

Sample ID: / Sample Date: / Units:	VSP-601 12/22/2016 ppbv	VSP-601 3/24/2017 ppbv	VSP-601 6/23/2017 [4] ppbv	VSP-601 9/22/2017 ppbv
alkane	**9.4 J**	--	--	--
alkane	**8.9 J**	--	--	--
alkane	**8.4 J**	--	--	--
alkane	**8.1 J**	--	--	--
alkane	**6.6 J**	--	--	--
alkane	**5.4 J**	--	--	--
Cycloalkane/alkene	**100 J**	--	--	--
Cycloalkane/alkene	**7.1 J**	--	--	--
Cycloalkane/alkene	**5.8 J**	--	--	--
Cycloalkane/alkene	**37 J**	--	--	--
Cycloalkane/alkene	**18 J**	--	--	--
Cycloalkane/alkene	**17 J**	--	--	--
Cycloalkane/alkene	**16 J**	--	--	--
Cycloalkane/alkene	**16 J**	--	--	--
Cycloalkane/alkene	**10 J**	--	--	--
Cycloalkane/alkene	**9.5 J**	--	--	--
Cycloalkane/alkene	**8.2 J**	--	--	--

Notes and abbreviations on last page.

Table 4
Total Effluent Vapor Sample Analytical Results
Tentatively Identified Compounds
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York[1,2,3]

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Notes and Abbreviations:

--	Not detected.
B	Indicates analyte found in associated method blank
ELAP	Environmental Laboratory Approval Program.
J	Indicates an estimated value.
JN	Compound tentatively identified, concentration is estimated.
NYSDOH	New York State Department of Health.
ppbv	parts per billion by volume
USEPA	U.S. 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.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.
4. 3Q 2017 sample taken 1 day after parameter and vacuum readings.

Table 5
Air Quality Impact Analysis
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

Toxic Air Contaminant	CAS#	VSP-601 Vapor Effluent (µg/m^3) 9/22/2017[4]	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
			lb/yr	lb/hr	g/s						
1,1,1 - Trichloroethane	00071-55-6	16	3.5E-01	4.0E-05	5.0E-06	2.3E-03	1.0E-04	9,000	5,000	0.0%	0.0%
1,1 - Dichloroethane	00075-34-3	13	2.9E-01	3.3E-05	4.1E-06	1.9E-03	8.2E-05	--	0.63	--	0.0%
1,1 - Dichloroethene	00075-35-4	0.56	1.2E-02	1.4E-06	1.8E-07	8.2E-05	3.5E-06	--	200	--	0.0%
Tetrachloroethene	00127-18-4	20	4.4E-01	5.0E-05	6.3E-06	2.9E-03	1.3E-04	300	4	0.0%	0.0%
Trichloroethene	00079-01-6	429	9.4E+00	1.1E-03	1.4E-04	6.3E-02	2.7E-03	20	0.20	0.3%	1.4%
Vinyl Chloride	00075-01-4	0.95	2.1E-02	2.4E-06	3.0E-07	1.4E-04	6.0E-06	180000	0.11	0.0%	0.0%
cis 1,2-Dichloroethene	00156-59-2	311	6.8E+00	7.8E-04	9.8E-05	4.5E-02	2.0E-03	--	63	--	0.0%
trans 1,2-Dichloroethene	00156-60-5	4.0	8.8E-02	1.0E-05	1.3E-06	5.8E-04	2.5E-05	--	63	--	0.0%
Toluene	00108-88-3	1.7	3.7E-02	4.3E-06	5.4E-07	2.5E-04	1.1E-05	37,000	5000	0.0%	0.0%
Xylene-O	01330-20-7	0.43	9.4E-03	1.1E-06	1.4E-07	6.3E-05	2.7E-06	22,000	100	0.0%	0.0%
Xylenes - M,P	01330-20-7	1.2	2.6E-02	3.0E-06	3.8E-07	1.8E-04	7.6E-06	22,000	100	0.0%	0.0%
2-Butanone	00078-93-3	1.3	2.9E-02	3.3E-06	4.1E-07	1.9E-04	8.2E-06	13,000	5,000	0.0%	0.0%
Acetone	00067-64-1	5.5	1.2E-01	1.4E-05	1.7E-06	8.0E-04	3.5E-05	180,000	30,000	0.0%	0.0%
Carbon Tetrachloride	00056-23-5	1.4	3.1E-02	3.5E-06	4.4E-07	2.0E-04	8.8E-06	1900	0.17	0.0%	0.0%
Chloroform	00067-66-3	45	9.9E-01	1.1E-04	1.4E-05	6.6E-03	2.8E-04	150	14.7	0.0%	0.0%
Dichlorodifluoromethane (Freon 12)	00075-71-8	3.8	8.3E-02	9.5E-06	1.2E-06	5.5E-04	2.4E-05	--	12000	--	0.0%
Trichlorofluoromethane (Freon 11)	00075-69-4	2.1	4.6E-02	5.3E-06	6.6E-07	3.1E-04	1.3E-05	9000	5,000	0.0%	0.0%

Notes and abbreviations on last page.

Table 5
Air Quality Impact Analysis
Bethpage Park Soil Gas Containment System
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

ARCADIS Design & Consultancy for natural and built assets

Notes and Abbreviations:

--	none specified
AGC	annual guideline concentration
CAS#	Chemical Abstracts Service Registry Number
DAR-1	Division of Air Resources-1
ft^3/min	cubic feet per minute
g/s	grams per second
lb/hr	pounds per hour
lb/yr	pounds per year
NYSDEC	New York State Department of Environmental Conservation
SGC	short-term guideline concentration
VSP	vapor sampling point
$\mu g/m^3$	micrograms per cubic meter

(1) Emission rate calculated based on VSP-601 effluent concentration and table 1 total effluent flow rate.
TCE (lb/hr) = TCE [$\mu g/m^3$] x Air Flow Rate [ft^3/min] x (1 m^3/35 ft^3) x (60 min/hr) x (0.000001 g/1 ug) x (0.0022 lb/g)
lb/yr = lb/hr x 8,760 hrs/yr
g/s = lb/hr x 1 hr/ 3,600 sec x 453.59 g/lb

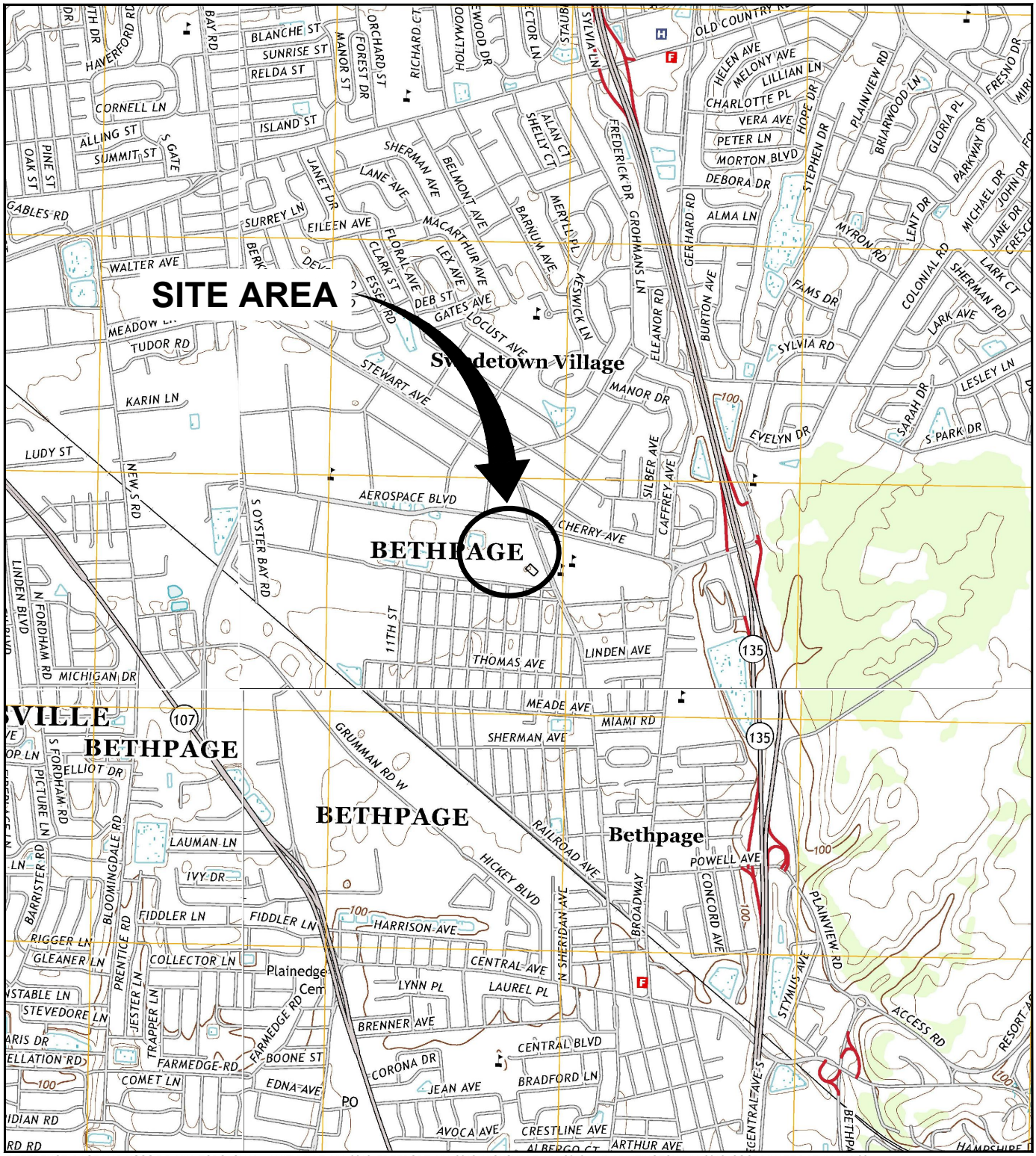
(2) Ambient impact based on AERMOD modeling using normalized rate of 1 g/s is scaled to the actual emission rate of the pollutant. Modeling was performed using the representative meteorological data from the nearest station (Farmingdale) for the years 2011 through 2015. The maximum impact from all the years was used for the calculations.
Scaled hourly impact ($\mu g/m^3$) = AERMOD predicted hourly ambient impact at 1 g/s ([$\mu g/m^3$]/[g/s]) x Actual emission rate (g/s)
Scaled annual impact ($\mu g/m^3$) = AERMOD predicted annual ambient impact at 1 g/s ([$\mu g/m^3$]/[g/s]) x Actual emission rate (g/s)

AERMOD Normalized Ambient Impact at 1 g/s	
Hourly ([$\mu g/m^3$]/[g/s])	Annual ([$\mu g/m^3$]/[g/s])
462.83	20.02

(3) Short-term and annual guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised August 10, 2016.

(4) Only contaminants with detected concentrations are included in the table.

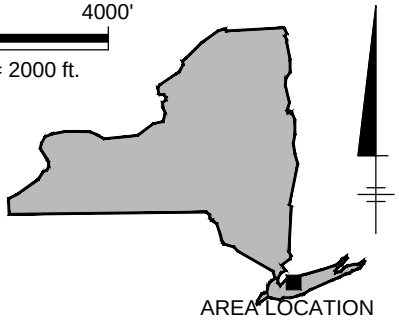
FIGURES



REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., AMITYVILLE, NY, 2013, FREEPORT, NY, 2013, HICKSVILLE, NY, 2013, AND HUNTINGTON, NY, 2013, COORDINATE DATUM NAD83.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.



NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SITE LOCATION MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
Z:\ENVCAD\SYRACUSE\ACTIVITY\001496\SiteLocMap.dwg LAYOUT: BP SAVED: 3/15/2017 9:38 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/15/2017 9:38 AM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
2013Amityville.jpg
2013Freeport.jpg
2013Hicksville.jpg
2013Huntington.jpg

PROPERTY OWNED BY TOWN OF OYSTER BAY

STACK LOCATION
grass
GRASS
TREATMENT BUILDING AREA
McKAY FIELD
McKAY FIELD ACCESS ROAD
FORMER TRANSFORMER AREA
ARUMDAUN PRESBYTERIAN CHURCH VISION CENTER (FORMER GRUMMAN PLANT 24)
PARKING LOT
PLANT 24 ACCESS ROAD
FORMER GRUMMAN PLANT 24 ACCESS ROAD PROPERTY
EIGHTH ST.
SEVENTH ST.
SIXTH ST.
FIFTH ST.
TH ST.
grass
bit.

VMWC-14A
VMWC-14B
VMWC-14D
DW-7S
DW-7D
DW-3S
DW-3D
VMWC-9A
VMWC-9B
VMWC-10B
VMWC-10D
VMWC-11B
VMWC-11D
VMWC-12D
VMWC-15A
VMWC-15B
VMWC-15D
DW-5D
DW-5S
DW-6S
DW-6D
VMWC-1A/C
VMWC-4A/B/C/D
VMWC-3A/B/C/D
VMWC-2A/C/D
VMWC-1B/D
DW-1D
DW-1S
DW-4S
DW-4D
VMWC-16B
VMWC-16A
VMWC-16D
DW-8S
VMWC-17D
DW-9S
DW-2S
DW-2D
VMWC-8A/B/D
VMWC-7A/B
VMWC-7D
VMWC-5A/B/D
VMWC-6A/B/D
VMWC-18B
VMWC-18A
DW-10S
VMWC-13D
DW-11S

VMWC-14A	
Date	IV (IWC)
9/21/2017	-0.10

VMWC-14B	
Date	IV (IWC)
9/21/2017	-0.19

VMWC-14D	
Date	IV (IWC)
9/21/2017	-0.19

VMWC-11B	
Date	IV (IWC)
9/21/2017	-0.12

VMWC-12D	
Date	IV (IWC)
9/21/2017	-0.56

VMWC-3A	
Date	IV (IWC)
9/21/2017	-0.14

VMWC-3B	
Date	IV (IWC)
9/21/2017	-0.15

VMWC-3C	
Date	IV (IWC)
9/21/2017	-0.15

VMWC-3D	
Date	IV (IWC)
9/21/2017	-0.20

VMWC-15D	
Date	IV (IWC)
9/21/2017	-0.15

VMWC-15B	
Date	IV (IWC)
9/21/2017	-0.14

VMWC-15A	
Date	IV (IWC)
9/21/2017	-0.16

VMWC-16D	
Date	IV (IWC)
9/21/2017	-0.27

VMWC-16B	
Date	IV (IWC)
9/21/2017	-0.17

VMWC-16A	
Date	IV (IWC)
9/21/2017	-0.18

VMWC-17D	
Date	IV (IWC)
9/21/2017	-0.24

VMWC-7A	
Date	IV (IWC)
9/21/2017	-0.12

VMWC-7B	
Date	IV (IWC)
9/21/2017	-0.13

VMWC-13D	
Date	IV (IWC)
9/21/2017	-0.19

VMWC-18B	
Date	IV (IWC)
9/21/2017	-0.10

VMWC-18A	
Date	IV (IWC)
9/21/2017	-0.090

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — SHALLOW DEPRESSURIZATION WELL
- DW-3D — DEEP DEPRESSURIZATION WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN
- USEPA — UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

0 50' 100'
SCALE IN FEET

NOTES:

1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE-RELATED VACUUM MONITORING WELLS ON A 12-MONTH ROLLING AVERAGE (ARCADIS 2007).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED VACUUM MONITORING WELLS ONLY.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS THIRD QUARTER 2017

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FIGURE
2

DISCHARGE TO ATMOSPHERE

DISCHARGE TO ATMOSPHERE

VSP-602

V-27

TEMPORARY VAPOR PHASE GAC VP-600 (REMOVED FROM OPERATION DECEMBER 2008)

AMBIENT AIR OUTLET

TI 602

TT 602

HEAT EXCHANGER HX-600

ON STANDBY

AMBIENT AIR INLET

FE

PIT 601

PI 601

TI 601

V-26

VSP-601

VSP-201

PI 201

BLOWER BL-200 ON STANDBY

VI 202

VIT 202

VSP-301

PI 301

BLOWER BL-300

VI 302

VIT 302

VSP-401

PI 401

BLOWER BL-400 ON STANDBY

VI 402

VIT 402

WSP-510

SG 510

STORAGE TANK ST-510

VENT

AIR FILTER AF-200

KNOCK OUT TANK KO-200

WSP-210

SG 200

VI 201

RECIRCULATION LINE (TYP. OF 3)

FE 210

FQI 210

TRANSFER PUMP TP-210

AIR FILTER AF-300

KNOCK OUT TANK KO-300

WSP-310

SG 300

VI 301

FE 310

FQI 310

TRANSFER PUMP TP-310

AIR FILTER AF-400

KNOCK OUT TANK KO-400

WSP-410

SG 400

VI 401

FE 410

FQI 410

TRANSFER PUMP TP-410

V-24

V-19

V-21

V-25

V-22

V-20

V-23

LIMIT OF TREATMENT BUILDING 2

LIMIT OF TREATMENT BUILDING 1

V-1 VI 119 VSP-101 FI 101 FROM DW-7D

V-2 VI 120 VSP-102 FI 102 FROM DW-3D

V-3 VI 121 VSP-103 FI 103 FROM DW-5D

V-4 VI 122 VSP-104 FI 104 FROM DW-6D

V-5 VI 123 VSP-105 FI 105 FROM DW-1D

V-6 VI 124 VSP-106 FI 106 FROM DW-4D

V-7 VI 125 VSP-107 FI 107 FROM DW-2D

V-8 VI 126 VSP-108 FI 108 FROM DW-11S

V-9 VI 127 VSP-109 FI 109 FROM DW-10S

V-10 VI 128 VSP-110 FI 110 FROM DW-2S

V-11 VI 129 VSP-111 FI 111 FROM DW-9S

V-12 VI 130 VSP-112 FI 112 FROM DW-8S

V-13 VI 131 VSP-113 FI 113 FROM DW-4S

V-14 VI 132 VSP-114 FI 114 FROM DW-1S

V-15 VI 133 VSP-115 FI 115 FROM DW-6S

V-16 VI 134 VSP-116 FI 116 FROM DW-5S

V-17 VI 135 VSP-117 FI 117 FROM DW-3S

V-18 VI 136 VSP-118 FI 118 FROM DW-7S

VI 101

DEPRESSURIZATION WELL (TYPICAL OF 7 DEEP)

VI 108

DEPRESSURIZATION WELL (TYPICAL OF 11 SHALLOW)

LEGEND:

- CONDENSATE LINE
- LIMITS OF TREATMENT BUILDING
- PROCESS VAPOR LINE
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY CLOSED)
- CHECK VALVE
- UNION
- SAMPLE PORT/DRAIN
- REDUCER
- FERNCO
- FLEXIBLE HOSE
- FLANGE
- FE — FLOW ELEMENT ACCESS
- 1/4" BARB — 1/4" BARB INDUCED VACUUM MONITORING CONNECTION
- INLINE INSTRUMENT
- ISOLATED INSTRUMENT CONNECTED TO PROCESS LINE
- INSTRUMENT CONNECTED TO PROCESS LINE

FE	FLOW MONITORING ELEMENT
FI	FLOW RATE INDICATOR
FQI	FLOW TOTALIZER INDICATOR
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
SG	SIGHT GLASS
TT	TEMPERATURE TRANSMITTER
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VSP	VAPOR SAMPLE POINT
WSP	WATER SAMPLE POINT

NOTE:

SYSTEM OPERATED WITH BLOWER BL-300 ONLINE FOR THE ENTIRE 2017 REPORTING PERIOD.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

PROCESS FLOW DIAGRAM

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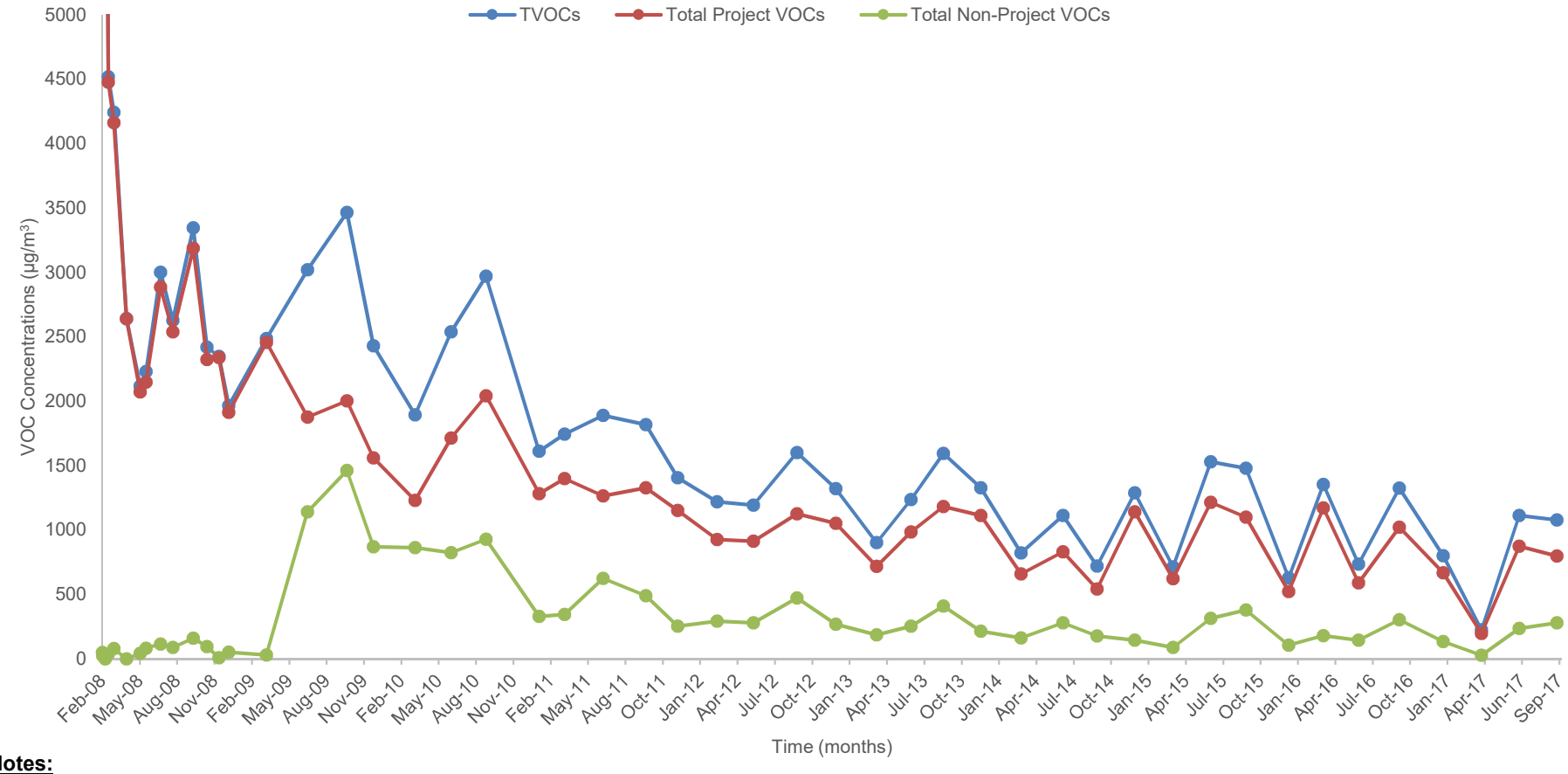
FIGURE 3



Notes:

µg/m³ = micrograms per cubic meter
TVOCs = total VOCs detected
VOCs = volatile organic compounds
Total 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.
Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

1. Samples were collected at Vapor Sample Port-601 (VSP-601); refer to Figure 3 of this OM&M report for the location of VSP-601.
2.Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 18, 2008 - 20,622 µg/m³, February 19, 2008 - 14,519 µg/m³, and February 25, 2008 - 8,196 µg/m³.
3. The sample results from December 3, 2010 were not consistent with historical data and is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/m³.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SOIL GAS VOC CONCENTRATIONS THROUGH SEPTEMBER 2017

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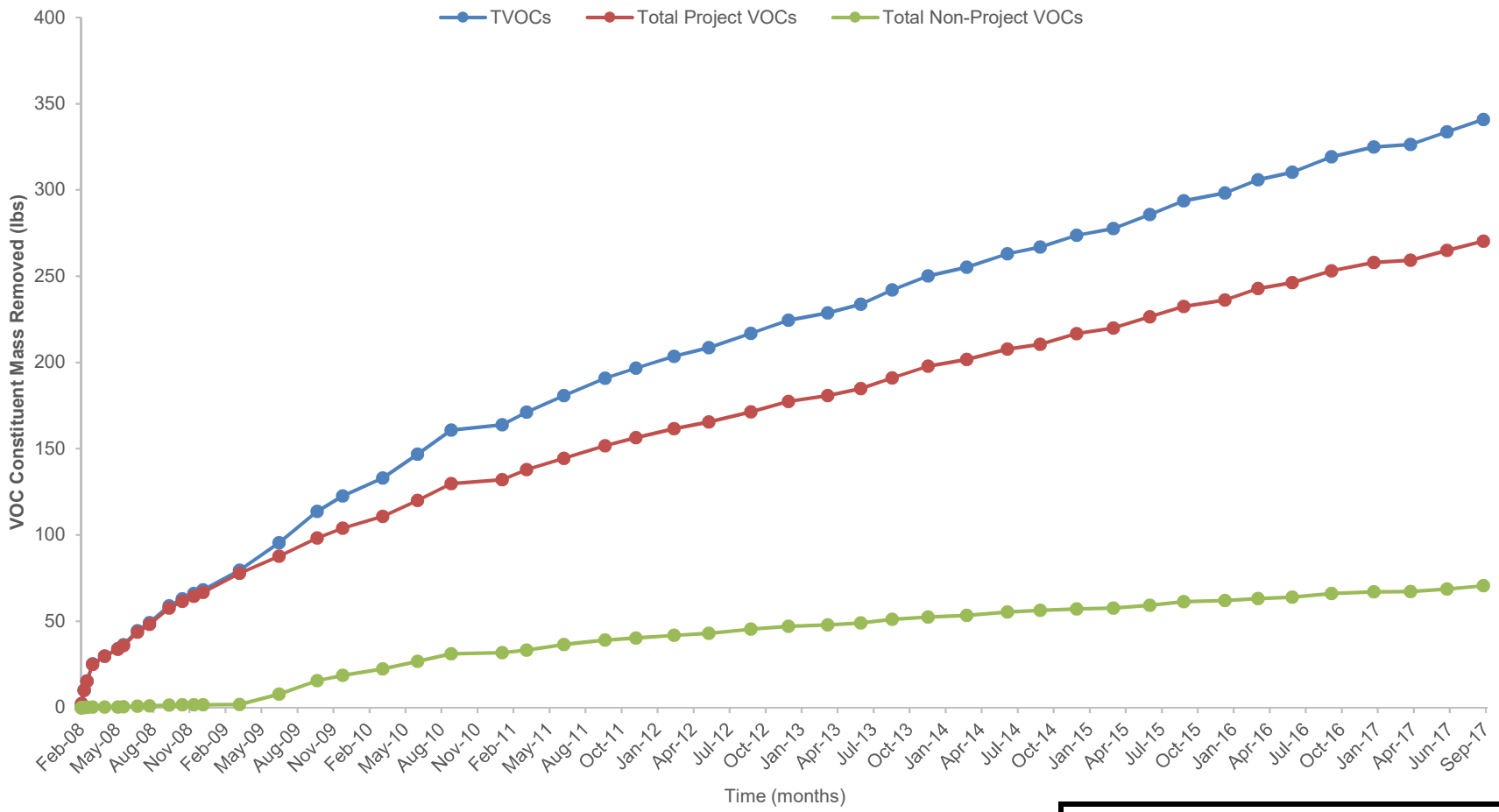
FIGURE
4



Notes:

TVOCs = total VOCs detected

VOCs = volatile organic compounds

Total 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.

Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

1. The sample results from December 3, 2010 were not consistent with historical data and thus, the recovery rate is not included in this table.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

CUMULATIVE TOTAL, PROJECT, AND NON-PROJECT VOC MASS REMOVED THROUGH SEPTEMBER 2017

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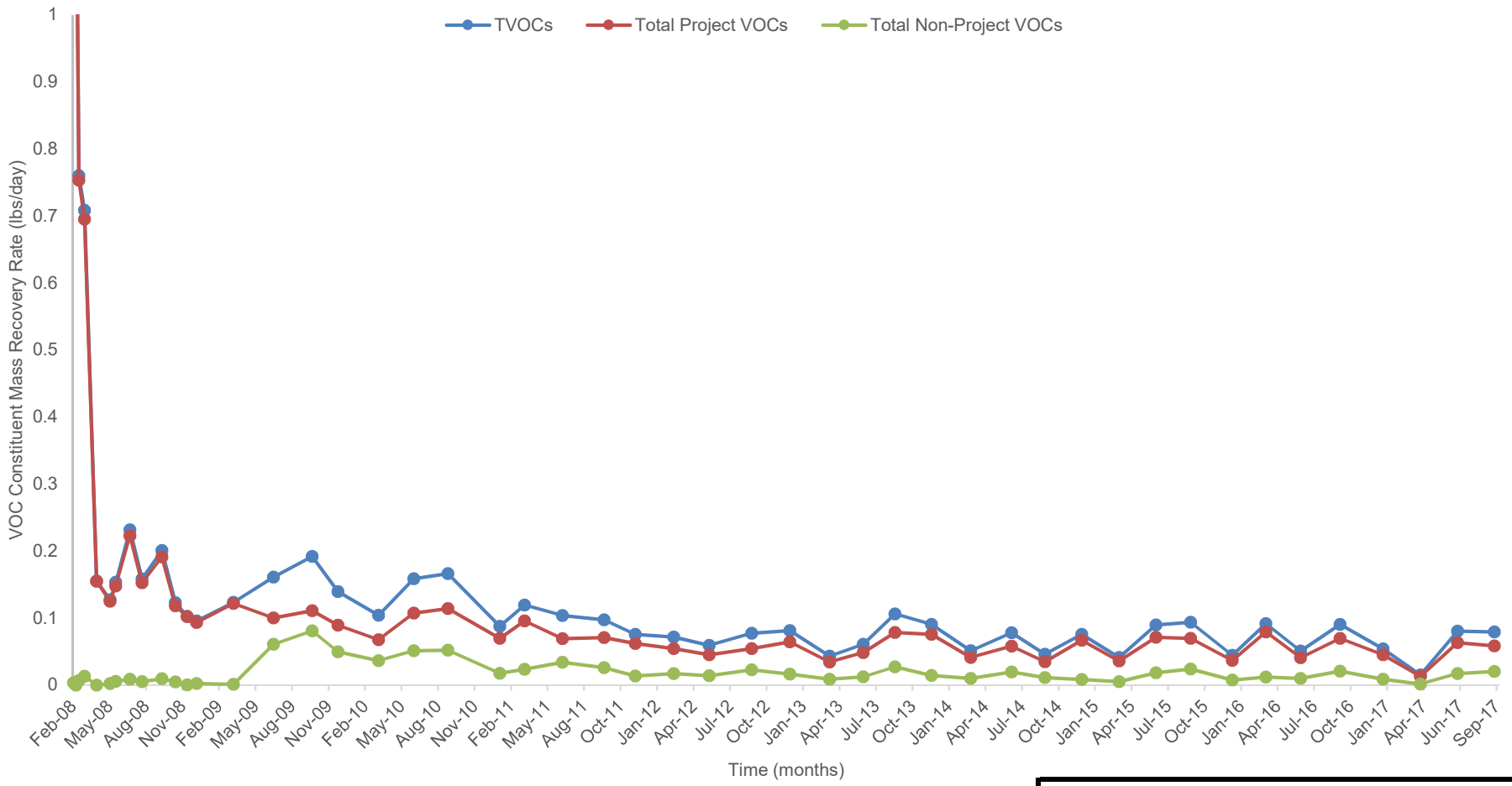
FIGURE
5



Notes:

TVOCs = total VOCs detected.
VOCs = volatile organic compounds
Total 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.
Total Non-Project VOCs = Sum of VOCs that are not Project VOCs.

1. Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 19, 2008 - 2.2 lbs/day and February 25, 2008 1.3 lbs/day.
2. The sample results from December 3, 2010 were not consistent with historical data and thus the recovery rate is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/L.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM
BETHPAGE, NEW YORK, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

VOC MASS RECOVERY RATES THROUGH SEPTEMBER 2017

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FIGURE
6