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February 19, 2018

Mr. Kenneth Thiessen
Oregon Department of Environmental Quality
700 NE Multnomah St., Suite #600
Portland, Oregon 97232

Subject: Work Plan for Soil Vapor Extraction System Expansion
East Multnomah County Troutdale Sandstone Aquifer Remedy
Fairview, Oregon (ECSI #1479)

Dear Ken:

Geosyntec Consultants (Geosyntec) has prepared this Work Plan on behalf of Cascade Corporation (Cascade) and The Boeing Company (Boeing) to describe the operation and performance of the current soil vapor extraction (SVE) system and recommend additional three wells (VMW-E, VMW-F, and VMW-G) be installed and added to the system. The SVE system is part of the East Multnomah County Troutdale Sandstone Aquifer (TSA) remedy being conducted jointly by Cascade and Boeing under the Department of Environmental Quality's (DEQ's) Consent Order No. WMCSR-NWR-96-08 (DEQ, 1997). Previously DEQ approved the December 2014 SVE system installation work plan (Geosyntec, 2014) and the November 2016 system expansion work plan (Geosyntec 2016). The SVE system has effectively removed approximately 50 pounds of volatile organic compounds (VOCs) from the unsaturated zone of the TSA.

CURRENT SVE SYSTEM

The current SVE system was installed in March/April 2015 and utilized 3 existing vapor monitoring wells (VW-17) with screens at depths of 42.5, 75, and 95.5 feet below ground surface (bgs). The shallow well (VW-17-42.5) was constructed with a 5-foot screen, while the two deep wells (VW-17-75 and VW-17-95.5) were constructed with 20-foot screens. The three wells were installed near the Central Treatment System (CTS) in the vicinity of groundwater monitoring well CMW-17ds.

In 2017, VW-17d-42.5 and VW-17d-75 were shut down with approval from DEQ (DEQ, 2017) based on declining VOC vapor concentrations. Four new SVE wells (VMW-A, VMW-B, VMW-C, and VMW-D) were installed in November 2016 to increase VOC mass removal in the unsaturated zone above the TSA groundwater and to expand the aerial coverage of the SVE system in the direct vicinity of the mound area. The five active SVE wells, CMW-17ds, and the CTS are shown on Figure 1.

The SVE system contains a blower rated for 900 standard cubic feet per minute (scfm), a moisture separator prior to the blower, and an exhaust stack that discharges 10 feet above ground surface. Aboveground polyvinyl chloride (PVC) piping to VW-17d-95 and underground PVC piping to VMW-A through VMW-D connects the vapor wells to the blower.

EXISTING SVE SYSTEM PERFORMANCE

Through January 2018, the SVE system has operated greater than 98% of the time and currently extracts an average of approximately 430 scfm of soil vapor at a vacuum of 4 inches of mercury (in Hg). The initial target extraction rate of approximately 160 scfm was increased in November 2015 and then again in November 2016 to the present flow (Figure 2) in order to optimize VOC mass removal and vary subsurface flow patterns. System process data is collected weekly for vacuums, flowrates, temperatures, and field VOC measurements using a photoionization detector [PID] of the SVE effluent. Process data readings are provided in Attachment A.

Vapor samples from the five SVE wells are collected on a quarterly basis (Table 1), and SVE system effluent samples are collected on a monthly basis (Table 1) for laboratory analysis. Field and laboratory VOC concentrations over time are shown for the SVE effluent in Figure 3 and for the vapor wells in Figure 4. VOC concentrations have decreased significantly in three of the operating SVE wells (VW17D-95.5, VMW-A, and VMW-B) since their respective startups. Based on the decreased VOC concentrations observed in these wells, it is recommended that these three wells be shut down.

Based on monthly laboratory results[1], nearly 50 pounds of VOCs have been removed through January 2018 (Figure 5). The removal efficiency is consistent with the removal efficiency of 10 to 20 pounds per year estimated in the original Work Plan (Geosyntec, 2014). The system effluent discharge rates have been below the DEQ's de minimis threshold for treatment of VOCs in air discharge effluent of one ton per year for total VOCs as hazardous air pollutants [OAR 340-200-0020]. As a result, treatment is not required, and vapor is discharged directly to the atmosphere via the stack.

Groundwater analytical results indicate VOC concentrations in CMW-17ds have shown a decreasing trend since February 2017 (Figure 6) with TCE concentrations decreasing from 42 to 16 µg/L. The combined treatment of the CTS (groundwater VOC mass removal) and the SVE (unsaturated VOC mass removal) are thought to be expediting the cleanup in the vicinity of the well by removing VOC mass from the unsaturated zone (formerly saturated prior to groundwater

[1] Monthly laboratory data is used rather than weekly PID field measurements to estimate mass removal rates, since laboratory data is believed to be more accurate and reliable. Field PID removal rates are included for reference.

drawdown from the remedy pumping), the capillary fringe, and VOCs that are potentially diffusing from the groundwater.

PROPOSED SVE SYSTEM EXPANSION

Installation of three new SVE wells (VMW-E, VMW-F, and VMW-G) is proposed to increase VOC mass removal in the unsaturated zone above the TSA groundwater near CMW-18ds with reported TCE concentrations ranging from 59.5 to 87.1 µg/L in 2017. Due to the limited number of existing extraction and observation wells around existing SVE wells, radius of influence (ROI) data is not available. A 50-foot ROI (100-foot spacing) is assumed for proposed well placement. Existing SVE wells VW-17d-95.5, VMW-A, and VMW-B will be shut down and utilized as groundwater and vacuum monitoring (or observation) wells, if possible, following installation of the new wells. Proposed SVE well locations are shown on Figure 1.

Vapor Well Locations

CMW-18ds is located on ODOT property and in the direct vicinity of residential housing, which limits drilling access; therefore, the SVE wells are proposed at locations on Cascade property. The wells will be directionally-drilled eastward beneath NE 201st Ave such that the SVE well screens terminate near the east side of NE 201st Ave in the vicinity of CMW-18ds. The boreholes will be advanced at an approximate 45-degree angle for a total estimated drilled length of 150 feet. The boreholes will be beneath the underground utilities located in NE 201st Ave, where the maximum invert depth is approximately 15 feet bgs in the west side of the roadway. Drilling operations and equipment will be staged on Cascade property to utilize existing SVE infrastructure and electricity, minimize noise disturbance to the neighborhood, avoid above- and below-ground utilities along/beneath NE 201st Avenue, and to eliminate the need for additional access agreements. A right-of-way permit will be needed to drill beneath NE 201st Ave, and the existing access agreement with ODOT will be amended to acknowledge these well locations beneath these properties. A cross section of the proposed drilling area is included in Figure 7.

Well Installation and Construction

The three well borings will be drilled using a sonic drill rig. Telescoping drilling methods (i.e. a stepdown) will be used at the contact between the Troutdale Gravel Aquifer (TGA) and underlying Confining Unit 1 (CU1). The boring will be drilled using 8-inch casing and a 6-inch diameter core barrel, stepped down to 6-inch casing with a 4-inch core barrel. Prior to advancing the 6-inch casing, the borehole will be backfilled with bentonite and allowed to set to minimize downward migrations of possible contaminants from one aquifer to another. Soil will be cored continuously and will be field screened for VOCs during drilling using a PID. Target depths for the borings will be approximately five feet beneath first encountered groundwater in the TSA, which is estimated to occur at 100 to 105 feet bgs (based on well CMW-18ds). The depth to groundwater

during the February 2018 monitoring event was 100 feet bgs at CMW-18ds. If groundwater is not encountered, the borings will be extended to a maximum depth of 110 feet bgs (or 165 feet total drilled length), and field observations and field screening results (i.e. PID measurements) will be used to evaluate well screen placement depths.

The wells will be installed with a 30-foot screen to a depth of approximately 110 feet bgs spanning the water table to allow for groundwater sampling as well as vapor extraction. Based on the estimated 45-degree drilling angles, the boring will be advanced approximately 150 lineal feet, with the screen located between approximately 120 to 150 lineal feet or 90 to 110 vertical feet bgs. At this time, a packer system is not anticipated to be necessary to separate the vapor and groundwater well screens, since the proposed vacuum is not strong enough to pull water into the SVE system. The applied vacuum will be monitored and adjusted to prevent groundwater rise above the top of the vapor screen. The wells will be constructed of 2-inch diameter, schedule 40 PVC, with a 0.01-inch (10-slot) screen and 10/20 silica sand filter pack.

Investigation derived waste (IDW) will consist of soil cuttings and water generated during drilling and well development. Soil cuttings will be stored on-site in 55-gallon drums or roll-off boxes to be dewatered as necessary, pending characterization and off-site permitted disposal. Water will be stored on-site in totes or a larger water storage container and solids will be settled out. Water will be treated through the on-site water treatment system (CTS) and ultimately discharged under the existing National Pollutant Discharge Elimination System permit. Remaining solids will be added to a soil roll off box prior to characterization and off-site disposal.

Vapor Well Startup

The new SVE wells will be connected to the existing SVE manifold with PVC piping buried approximately one-foot bgs (Figure 8). Valving and gauging will be installed to allow for vapor transfer and process data collection. Although significant water production is not expected, entrained water will be separated from the vapor with the current in-line moisture separator, and the collected liquids will be transferred to the CTS for treatment and disposal.

The SVE system will remain within the site chain-link fence to prevent unauthorized access. Process data and PID SVE effluent concentrations will continue to be recorded in the field on a weekly basis. Monthly SVE effluent and quarterly well vapor samples will be collected in evacuated 1.0-liter summa canisters for laboratory analysis. The summa canister samples will be analyzed for cVOCs by EPA Method TO-15. Groundwater samples will be collected every other month from the new wells to evaluate initial and post-startup groundwater VOC concentrations. After six months of monthly sampling, the sampling frequency will be evaluated and possibly reduced to quarterly monitoring.

EXPECTED EXPANDED SVE SYSTEM PERFORMANCE

The modified SVE system is expected to be operated for approximately 24 months, at a flow rate of approximately 625 scfm (125 scfm for each of the 5 wells) and an applied vacuum of 4 in Hg. Based on the long-term VOC concentrations observed in VW-17d-95.5, VMW-C, and VMW-D, VOC concentration are expected to stabilize around 1,000 micrograms per cubic meter. An additional 40 to 50 pounds of VOC mass is expected to be removed with the SVE system during the first 24 months of operation, based on the expected flows and concentrations. These discharge rates are estimated to remain below DEQ's de minimis treatment threshold of one ton per year for total VOCs and, as a result, effluent treatment is not planned.

DATA EVALUATION AND REPORTING

Field data collected from the SVE system will be evaluated on a weekly basis to track and optimize system performance and to estimate VOC mass removal. The extracted VOC concentration and mass removal levels over time will be used to assess system performance. Operation of the system will be modified or discontinued once mass removal rates reach asymptotic levels.

System performance data, along with recommendations for system modifications, continued operation of the system, and/or termination of system operation, will be included in the 2018 TSA annual report. Bimonthly/quarterly groundwater sample results will also be included in the 2018 TSA annual report.

CLOSURE

We look forward to your review and approval of this Work Plan. Please contact us at (503) 222-9518 with any questions regarding this Work Plan or if you need additional information.

Sincerely,

Geosyntec Consultants, Inc.

Cindy Bartlett, R.G.
Senior Geologist/Project Manager

Brent A. Miller, P.E.
Senior Principal

Cc: Jason Hegdahl, Cascade Corporation
Nick Garson, The Boeing Company
Chris Kimmel, Landau Associates

References:

Geosyntec, 2014. Work Plan for Soil Vapor Extraction System Installation and Operation, East Multnomah County Troutdale Sandstone Aquifer Remediation, Fairview, Oregon, 3 December 2014.

Geosyntec, 2016. Work Plan for Soil Vapor Extraction System Expansion, East Multnomah County Troutdale Sandstone Aquifer Remediation, Fairview, Oregon, 9 September 2016.

Oregon Department of Environmental Quality (DEQ), 2017. Email from B. Williams, Approval of 2016 TSA Annual Report. 16 June 2017.

Attachments:

Table 1	SVE Well cVOC Vapor Concentrations
Figure 1	Site and Well Locations
Figure 2	SVE Extracted Vapor Flow
Figure 3	SVE Effluent cVOC Vapor Concentration
Figure 4	SVE Well cVOC Vapor Concentrations
Figure 5	SVE System Mass Removal
Figure 6	TCE Concentration Profile CMW-17(ds)
Figure 7	Well Cross Section
Figure 8	Expanded SVE Equipment Diagram
Attachment A	SVE Process Data

Tables

Table 1. SVE System Vapor Sampling Results (Cascade Corporation, Fairview, OR)

	System Outlet																
Compound	4/28/15	5/26/15	6/30/15	7/28/15	9/10/15	9/29/15	10/27/15	11/30/15	12/28/15	1/26/16	2/23/16	3/15/16	4/27/16	5/24/16	6/21/16	7/26/16	8/24/16
cis-1,2-Dichloroethene	520	350	310	270	220	230	200	210	67	160	160	140	140	140	150	75	96
Trichloroethene	6,000	6,000	4,900	3,700	3,100	3,300	2,500	2,900	760	2,100	1,700	1,800	1,800	1,900	1,700	940	1,100
Tetrachloroethene	370	490	360	270	230	220	210	200	57	170	120	140	130	170	110	69	84
TOTAL cVOCs	6,890	6,840	5,570	4,240	3,550	3,750	2,910	3,310	884	2,430	1,980	2,080	2,070	2,210	1,960	1,084	1,280

	System Outlet															
Compound	6/4/16	6/4/16	12/14/16	1/10/17	2/7/17	3/7/17	4/11/17	5/9/17	6/6/17	7/11/17	8/8/17	9/12/17	10/10/17	11/7/17	12/12/17	1/9/18
cis-1,2-Dichloroethene	0	0	0	160	110	99	130	96	100	76	65	60	61	68	60	38
Trichloroethene	0	0	0	2,000	1,400	1,400	1,400	1,400	1,300	1,100	1,000	770	870	970	860	490
Tetrachloroethene	0	0	0	140	120	160	140	140	140	110	110	73	88	84	88	58
TOTAL cVOCs	0	0	0	2,300	1,630	1,659	1,670	1,636	1,540	1,286	1,175	903	1,019	1,122	1,008	586

	Well VW17D-42.5							Well VW17D-75						
Compound	4/28/15	7/28/15	10/27/15	11/30/15	1/26/16	3/15/16	6/21/16	4/28/15	7/28/15	10/27/15	11/30/15	1/26/16	3/16/16	6/21/16
cis-1,2-Dichloroethene	390	150	130	4	*1.1*	3	72	400	150	70	53	58	52	*1.1*
Trichloroethene	2,800	1,200	1,200	31	*1.1*	17	440	4,500	950	520	710	1,600	550	*1.1*
Tetrachloroethene	97	54	53	*1.9*	*1.1*	13	25	260	140	120	120	120	93	*1.1*
TOTAL cVOCs	3,287	1,404	1,383	37	3	33	537	5,160	1,240	710	883	1,778	695	3

	Well VW17D-95.5												
Compound	4/28/15	7/28/15	10/27/15	11/30/15	1/26/16	3/15/16	6/21/16	9/27/16	12/14/16	1/10/17	2/7/17	5/9/17	8/8/17	11/7/17
cis-1,2-Dichloroethene	750	180	44	140	160	160	170	150	7	110	86	76	54	65
Trichloroethene	11,000	2,500	530	2,000	2,100	2,100	1,800	1,200	71	830	590	560	410	370
Tetrachloroethene	660	200	49	150	170	140	140	99	5	54	45	35	26	25
TOTAL cVOCs	12,410	2,880	623	2,290	2,430	2,400	2,110	1,449	83	994	721	671	490	460

	Well VMW-A							Well VMW-B						Well VMW-C						Well VMW-D					
Compound	12/14/16	1/10/17	2/7/17	2/7/17	5/9/17	8/8/17	11/7/17	12/14/16	1/10/17	2/7/17	5/9/17	8/8/17	11/7/17	12/14/16	1/10/17	2/7/17	5/9/17	8/8/17	11/7/17	12/14/16	1/10/17	2/7/17	5/9/17	8/8/17	11/7/17
cis-1,2-Dichloroethene	590	67	37	37	*1.1*	15	10	49	140	48	*1.2*	*1.1*	*1.0*	6	260	*1.0*	200	140	140	360	290	250	110	140	*1.0*
Trichloroethene	9,000	680	500	530	*1.1*	430	120	1,000	1,600	580	2.7	2.5	*1.0*	73	3,000	*1.0*	3,000	2,700	2,500	*9.5*	6,600	3,600	1,600	2,300	*1.0*
Tetrachloroethene	350	54	56	58	*1.1*	64	17	71	110	53	*1.2*	*1.1*	*1.0*	4	200	*1.0*	390	320	210	440	430	330	160	190	*1.0*
TOTAL cVOCs	9,940	801	593	625	3	509	147	1,120	1,850	681	5	5	3	82	3,460	3	3,590	3,160	2,850	810	7,320	4,180	1,870	2,630	3

All values are in micrograms per cubic meter (ug/m^3)

Notes:

cVOCs	=	Chlorinated volatile organic compounds
1.9	=	Red, underlined values shown as U flagged
1.1	=	Blue, underlined values shown as 1/2 MRL

Figures

SantaBarbara-01\Data P:\GIS\PNG\0564 - Cascade\Projects\2018\SVE WP\Fig00 SVE Angled Borings Proposed Locations.mxd (Author: SAntonelli) 2018/2/2

Site and Well Locations - East Multnomah County Troutdale Sandstone Aquifer Remedy

East Multnomah County

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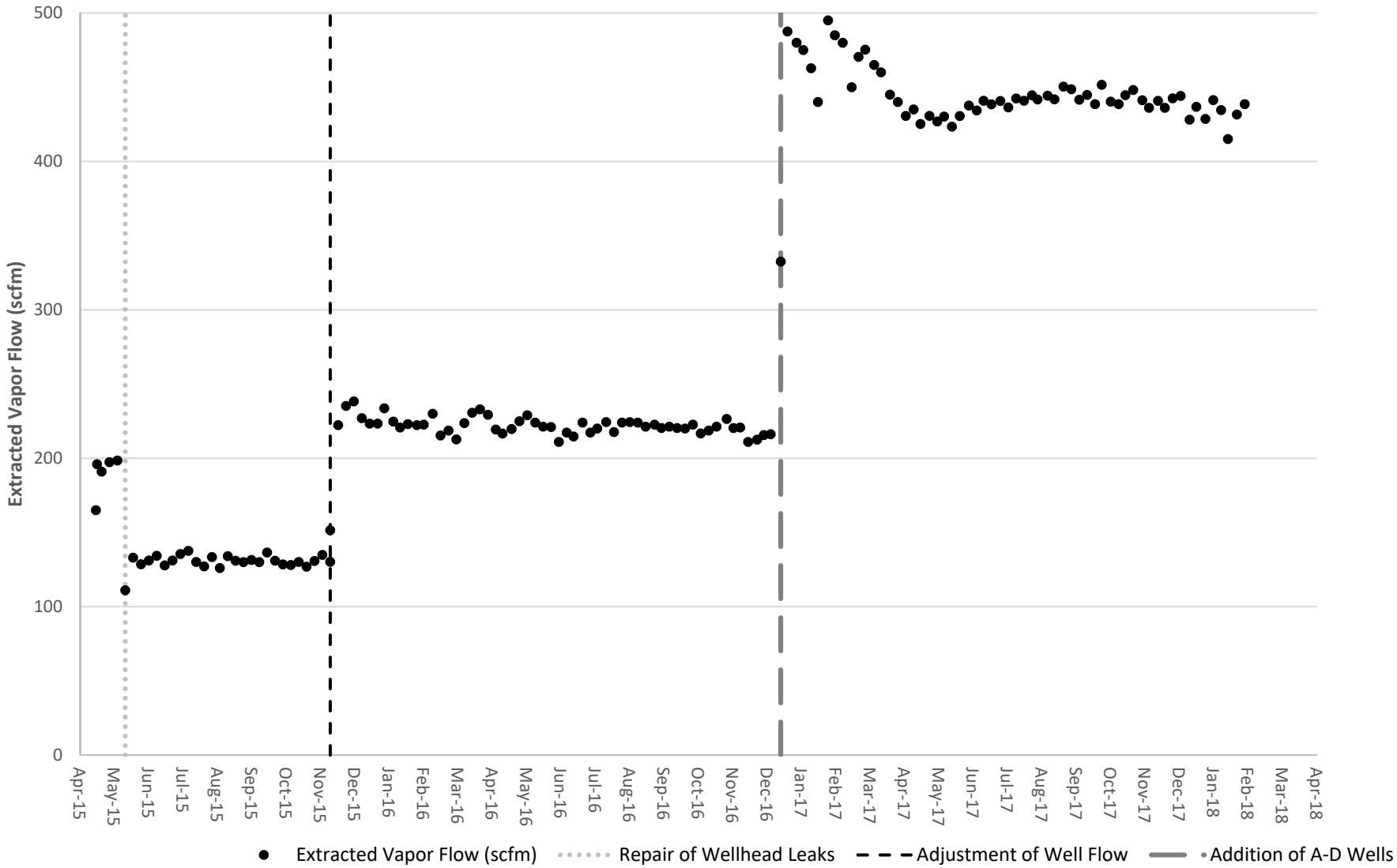
Figure 1



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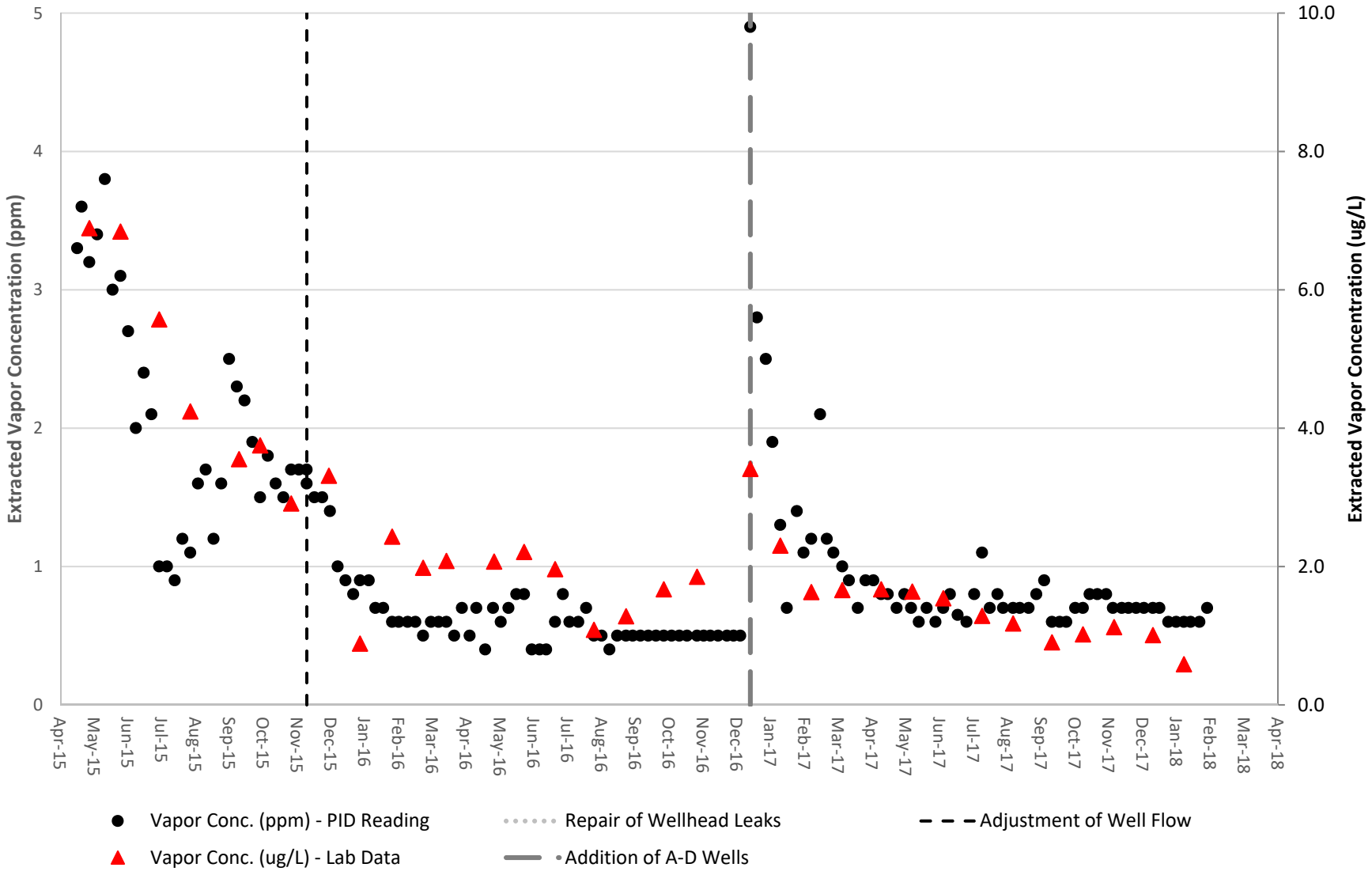
Cascade Corporation Gresham, Oregon	**SVE Extracted Vapor Flow (Weekly Average)** **TSA Remedy**	Figure 2



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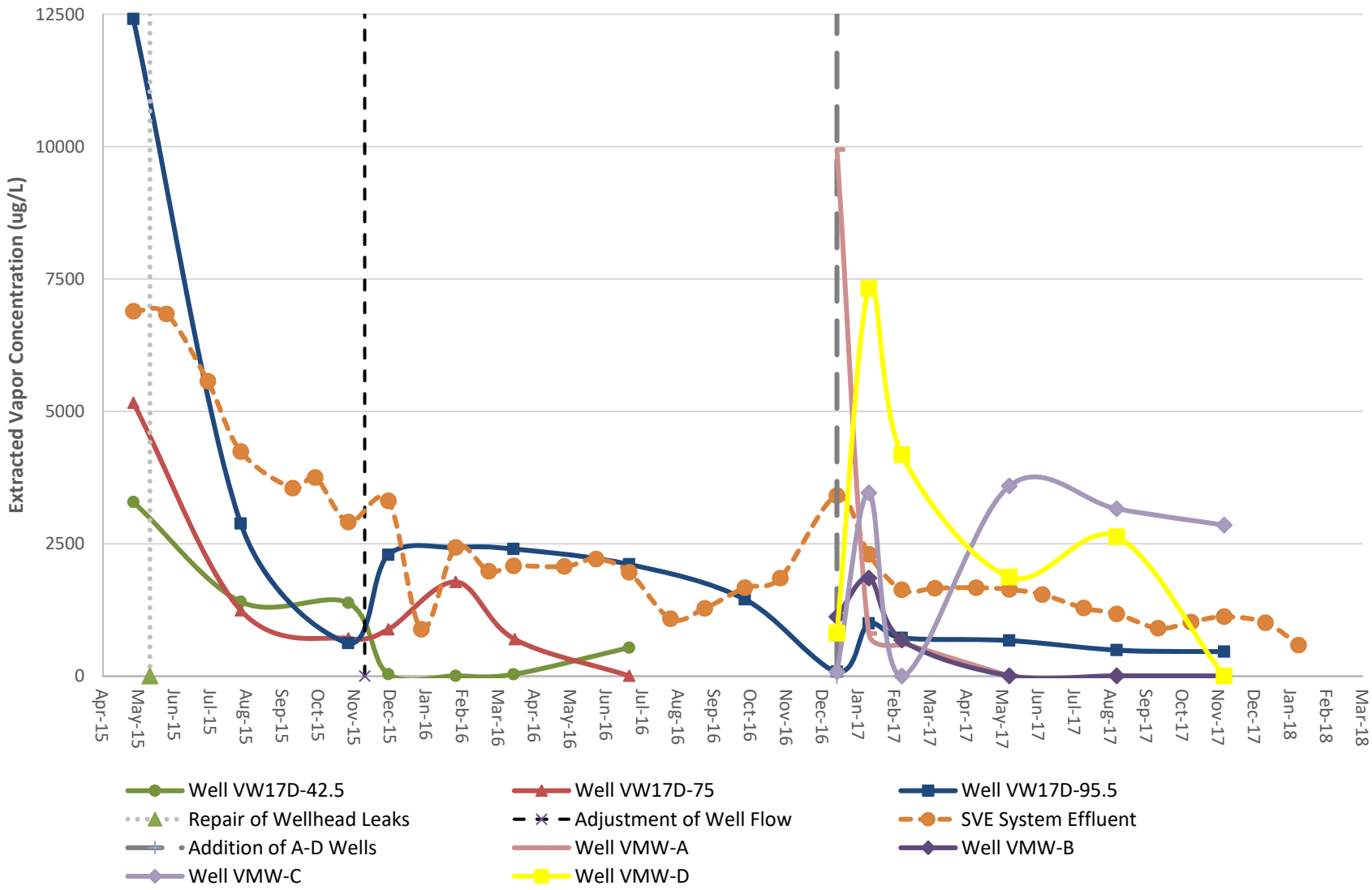
Cascade Corporation Gresham, Oregon	**SVE Effluent cVOC Vapor Concentration** **TSA Remedy**	Figure 3



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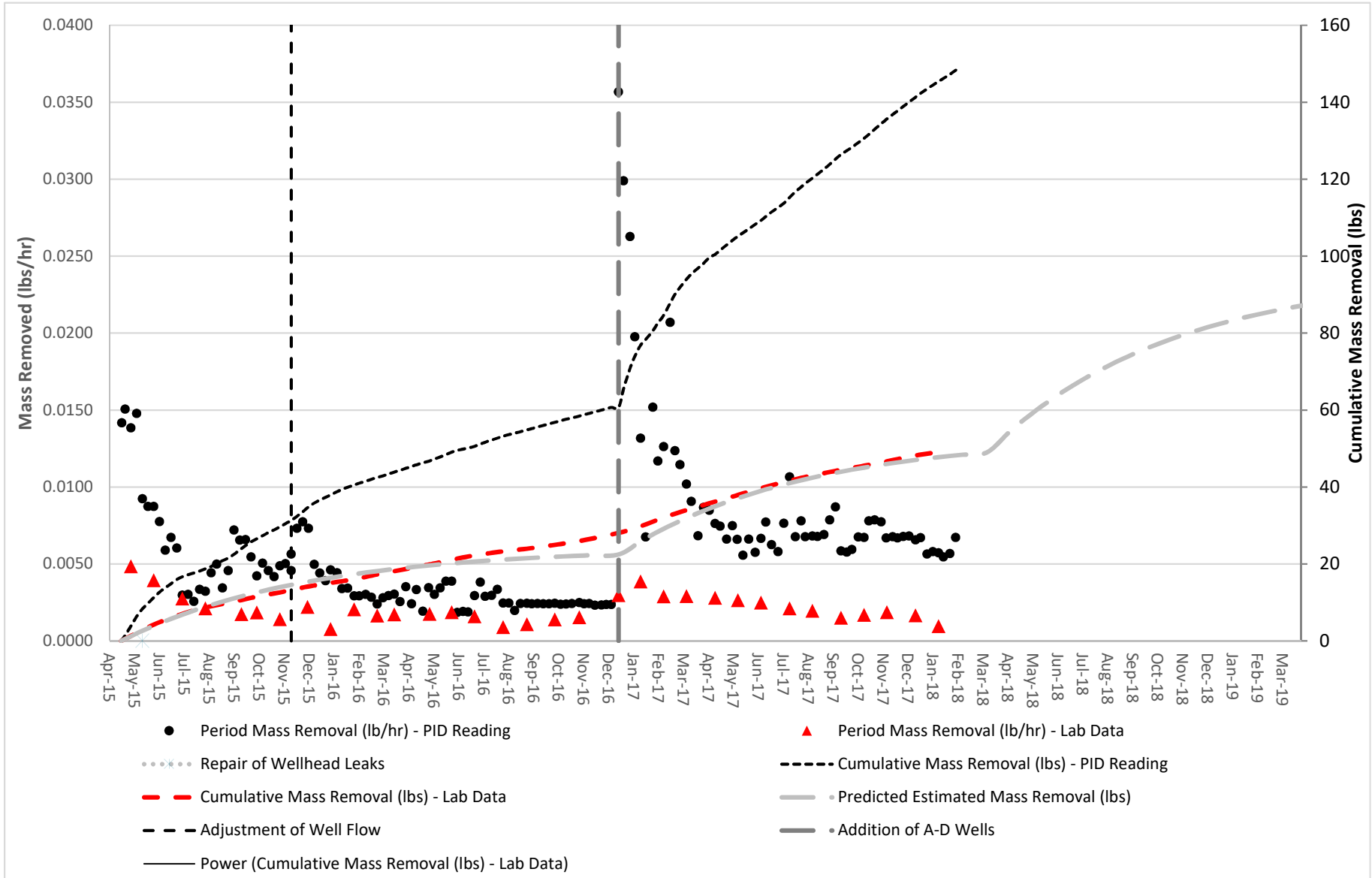
Cascade Corporation Gresham, Oregon	**SVE Well cVOC Vapor Concentrations** **TSA Remedy**	Figure 4



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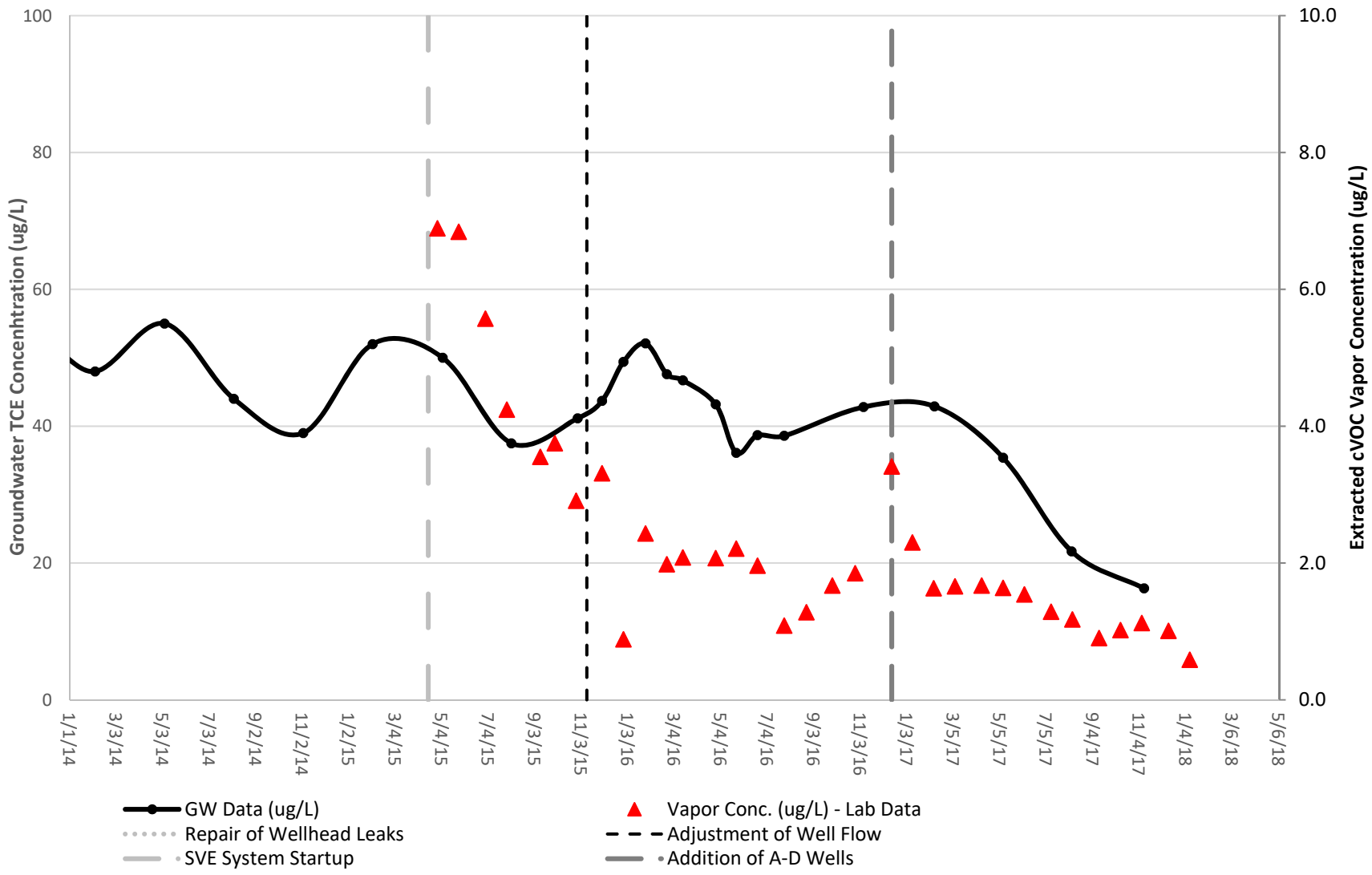
Cascade Corporation Gresham, Oregon	**SVE System Mass Removal** **TSA Remedy**	Figure 5



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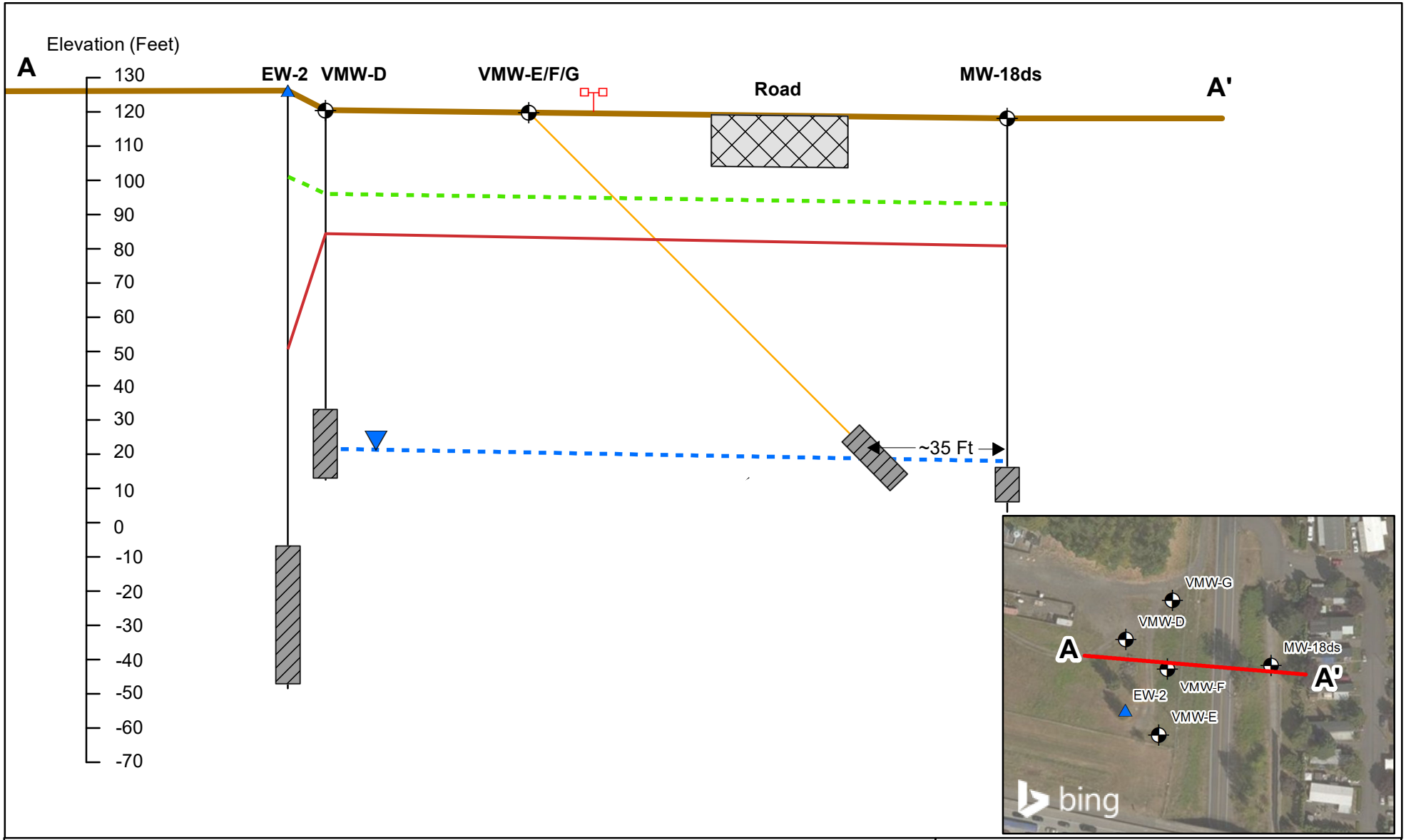
Cascade Corporation Gresham, Oregon	**SVE Vapor Concentration versus Grondwater Concentration** **CMW-17(ds)** **TSA Remedy**	Figure 6



Legend

- Boring Location
- Well location
- Powerlines
- Well Screen
- Utility Location
- Ground Surface
- CU1
- Top TSA
- Ground Water Elevation
- Well Borehole
- 30 Degree Boring
- 45 Degree Boring

0 25 50 100 Feet

Schematic Cross Section, SVE Angle Borings

Cascade Corporation, 2525 NE 201st Ave, Fairview, OR

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Figure 7

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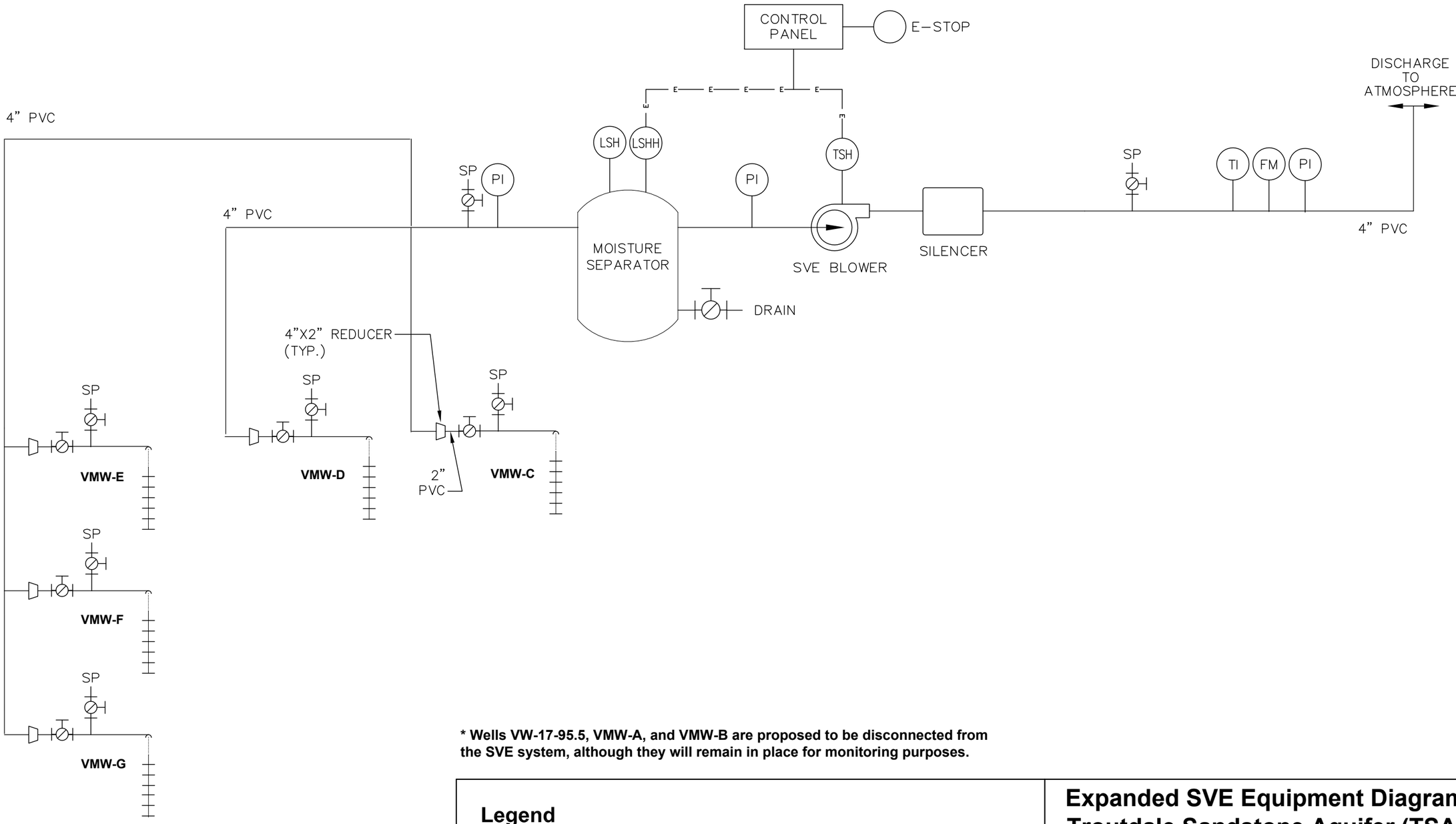

*** Wells VW-17-95.5, VMW-A, and VMW-B are proposed to be disconnected from the SVE system, although they will remain in place for monitoring purposes.**

Legend

TI	=	Temperature Indicator	LSHH	=	Level Switch - High-High
FM	=	Flow Meter	SP	=	Sample Point
PI	=	Pressure Indicator	TSH	=	Temperature Switch - High
LSH	=	Level Switch - High	E-Stop	=	Emergency Stop

Expanded SVE Equipment Diagram Troutdale Sandstone Aquifer (TSA)

East Multnomah County

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FIGURE 8

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Attachment A
SVE Process Data

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	Target	4/16/2015	4/17/2015	4/21/2015	4/28/2015	5/5/2015	5/12/2015	5/19/2015	5/26/2015	6/2/2015	6/9/2015	6/16/2015	6/23/2015	6/30/2015	7/7/2015	7/14/2015	7/21/2015	7/28/2015	8/4/2015	8/11/2015	8/18/2015	8/25/2015	9/1/2015
Time	---	---	12:30	15:30	10:00	11:45	16:00	12:30	13:30	12:30	13:20	12:10	10:10	8:40	10:05	13:00	11:30	9:30	14:30	7:15	12:00	11:30	14:40	13:20
System shutdown time	hrs	---	0	0	18	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Vacuums																								
SVE System Inlet	in Hg	~9	4	3.03	3.2	3.9	3.3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
VW-17d-42.5	in Hg	6-7	<1	0.03	0.02	2	1.8	1.2	1.2	2.52	1	1.1	1	1	1	0.9	0.08	1	1	1	1	1	1	1
VW-17d-75	in Hg	6-7	1	1	1	2.9	2.1	5	5	5.11	5	5	5	4.9	5	4.9	4.8	4.6	4.8	4.7	4.8	4.7	4.8	4.8
VW-17d-95.5	in Hg	5-6	2	2	2	3.5	3.1	1.4	2	2.65	1.9	1.8	1.4	1.4	1.3	1.2	1	1	1	1	1	1	1	1.2
VMW-A	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	PSI	--	--	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Temperatures																								
Ambient	Degrees F	--	NA	NA	NA	60	61	57	60	63	60	81	68	63	74	82	75	71	82	60	73	79	77	78
SVE System Inlet	Degrees F	--	--	NA	74.4	68.9	69.8	63.1	64.7	66.9	65.3	90.2	74.5	77.8	76.3	81	76	73	76	66.8	72	75	74	76
VW-17d-42.5	Degrees F	--	--	76.1	74.2	77.1	70.5	62.9	68.7	70.1	67.1	90.1	75.6	76.4	75.1	78	74	70	74	74.3	78	79	77	77
VW-17d-75	Degrees F	--	--	75.5	73.3	77.8	72.1	63.1	70.6	72	69.9	90.2	75.2	77.3	76.9	80	77	73	77	70.6	81	80	79	78
VW-17d-95.5	Degrees F	--	--	73.3	70.4	77.9	73.4	63.2	64	68.1	62.8	88.8	74.8	76.4	76	74	70	70	74	69.3	73	74	73	73
VMW-A	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	Degrees F	--	126	145	140	118.8	118	124	180	148.1	180	190	185	188	180	190	138	140	145	160	150	180	185	160
Concentrations																								
SVE System Outlet: Field Data	ppm	--	--	3.3	3.6	3.2	3.4	3.8	3	3.1	2.7	2	2.4	2.1	1	1	0.9	1.2	1.1	1.6	1.7	1.2	1.6	2.5
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	150-160	165	159	168	164.1	174.1	130	133.1	130.3	129.8	130.3	129.2	129.8	133.1	130.4	127.8	124.1	128.9	127	131	128	134	130.5
VW-17d-42.5 (2" pipe)	scfm	15-20	16.5	15.1	15.8	18.5	18.2	17	17.5	17	17.1	19.8	19.1	22.2	24.2	22.1	19.9	18	21.1	17.2	18	17.5	18.1	17.5
VW-17d-75 (2" pipe)	scfm	65-75	73	72.5	67.5	67.5	69.1	70.3	65.2	64.1	65.8	68.5	68.1	70.5	72.5	70.8	66.1	65	68.1	66.5	65.5	65	66	60.5
VW-17d-95.5 (2" pipe)	scfm	70-80	72	72.1	79.5	72.5	74.1	74.5	78	75.3	76.5	79.5	72.3	80.3	78.1	76.3	73.4	72.1	75.4	76.5	77.1	78.5	80	78.5
VMW-A (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	scfm	150-160	165	196	191	197.4	198.5	111	133	128.6	131.1	134.3	127.8	131.1	135.5	137.6	130.1	127.1	133.4	126	134	131	130	131.5
Calculations																								
Operating Time																								
Period Operating Time	hrs	---	---	27.00	72.50	169.75	172.25	163.50	169.00	167.00	168.83	166.83	166.00	166.50	169.42	170.92	166.50	166.00	173.00	160.75	172.75	167.50	171.17	164.67
Period Time	hrs	---	---	27.00	90.50	169.75	172.25	164.50	169.00	167.00	168.83	166.83	166.00	166.50	169.42	170.92	166.50	166.00	173.00	160.75	172.75	167.50	171.17	166.67
Period Operating %	%	---	---	100%	80%	100%	100%	99%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%
Cumulative Operating Time	hrs	---	---	27.00	99.50	269.25	441.50	605.00	774.00	941.00	1109.83	1276.67	1442.67	1609.17	1778.58	1949.50	2116.00	2282.00	2455.00	2615.75	2788.50	2956.00	3127.17	3291.83
Cumulative Time Since Startup	hrs	---	---	27.00	117.50	287.25	459.50	624.00	793.00	960.00	1128.83	1295.67	1461.67	1628.17	1797.58	1968.50	2135.00	2301.00	2474.00	2634.75	2807.50	2975.00	3146.17	3312.83
Cumulative Operating %	%	---	---	100.0%	84.7%	93.7%	96.1%	97.0%	97.6%	98.0%	98.3%	98.5%	98.7%	98.8%	98.9%	99.0%	99.1%	99.2%	99.2%	99.3%	99.3%	99.4%	99.4%	99.4%
Flow Rates																								
Well Flow Rate	scfm			159.70	162.80	158.50	161.40	161.80	160.70	156.40	159.40	167.80	159.50	173.00	174.80	169.20	159.40	155.10	164.60	160.20	160.60	161.00	164.10	156.50
Outlet Flow Rate	scfm			196.00	191.00	197.40	198.50	111.00	133.00	128.60	131.10	134.30	127.80	131.10	135.50	137.60	130.10	127.10	133.40	126.00	134.00	131.00	130.00	131.50
Well/Outlet Comparison	%			81%	85%	80%	81%	146%	121%	122%	122%	125%	125%	132%	129%	123%	123%	122%	123%	127%	120%	123%	126%	119%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	--	--	19.29	21.04	18.71	19.88	22.21	17.54	18.12	15.78	11.69	14.03	12.28	5.85	5.85	5.26	7.01	6.43	9.35	9.94	7.01	9.35	14.61
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	--	--	0.0142	0.0151	0.0138	0.0148	0.0092	0.0087	0.0087	0.0078	0.0059	0.0067	0.0060	0.0030	0.0030	0.0026	0.0033	0.0032	0.0044	0.0050	0.0034	0.0046	0.0072
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	--	--	0.38	1.06	2.45	2.46	1.96	1.52	1.46	1.39	1.14	1.05	1.06	0.76	0.51	0.46	0.49	0.57	0.61	0.81	0.71	0.68	0.97
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	--	--	0.38	1.44	3.89	6.36	8.32	9.84	11.30	12.69	13.83	14.87	15.93	16.69	17.20	17.67	18.16	18.73	19.34	20.15	20.86	21.54	22.51

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	9/8/2015	9/15/2015	9/22/2015	9/29/2015	10/6/2015	10/13/2015	10/20/2015	10/27/2015	11/3/2015	11/10/2015	11/10/2015	11/17/2015	11/24/2015	12/1/2015	12/8/2015	12/15/2015	12/22/2015	12/28/2015	1/5/2016	1/11/2016	1/18/2016	1/26/2016	2/1/2016
Time	---	10:45	12:00	14:00	9:00	11:55	13:20	8:05	8:00	10:00	12:40	13:55	14:15	12:50	12:50	8:15	13:40	12:40	12:40	9:30	14:10	17:15	12:00	13:55
System shutdown time	hrs	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0
Vacuums																								
SVE System Inlet	in Hg	5	4.9	5	5	4.9	5	4.9	5	5	5	4	4	4.2	4	4	4	4	4.2	4.2	4.1	4.1	4	4
VW-17d-42.5	in Hg	1	0.8	0.6	0.8	1	1	1	1	1	1.1	1.2	1.1	2	2	2	2	2.1	2.2	2.1	2.1	2	1.9	2
VW-17d-75	in Hg	4.9	4.7	4.8	4.8	4.9	4.7	4.9	5	4.8	4.8	3.2	3.1	4.2	4	4	4	4	4.2	4	4.1	4	4	4
VW-17d-95.5	in Hg	1.1	1.2	1.1	1	1	1	1	1	1	1.3	3.2	3	4.1	4	4	4	4	4.2	4	4.1	4.1	1	4
VMW-A	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Temperatures																								
Ambient	Degrees F	63	60	69	62	69	71	56	46	47	47	47	57	40	33	57	40	44	38	36	48	48	50	41
SVE System Inlet	Degrees F	72	70	74	64	70	72	60	55	56	56	56	56	50	40	51	50	48	47	49	51	48	49	48
VW-17d-42.5	Degrees F	69	62	70	62	68	70	58	54	56	55	56	56	50	40	50	50	48	49	47	51	49	48	48
VW-17d-75	Degrees F	70	68	77	66	72	75	62	56	52	55	56	56	48	38	52	47	48	48	45	48	47	48	48
VW-17d-95.5	Degrees F	68	60	65	62	67	70	62	58	56	56	56	56	50	43	50	50	48	48	47	51	50	50	50
VMW-A	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	Degrees F	158	162	184	160	170	170	135	128	170	130	148	125	150	138	130	135	135	138	135	138	148	140	145
Concentrations																								
SVE System Outlet: Field Data	ppm	2.3	2.2	1.9	1.5	1.8	1.6	1.5	1.7	1.7	1.6	1.7	1.5	1.5	1.4	1	0.9	0.8	0.9	0.9	0.7	0.7	0.6	0.6
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	128.5	128	132	126	130	128.3	126.5	128.3	127.6	128.1	135.1	213.0	229.1	225.1	218.0	219.0	215.7	222.0	215.0	209.0	210.0	213.0	214.7
VW-17d-42.5 (2" pipe)	scfm	16.5	18.5	17.5	17	16.5	17.5	16.3	15.8	23.7	18.6	26.1	25.2	26.3	25.2	25.2	24.8	24.7	25.1	25	25	24.8	24.6	24.5
VW-17d-75 (2" pipe)	scfm	68	73	74.5	71.3	70.5	74	70.1	68.8	68	68.7	101.4	100.8	96.8	95.4	98.7	97.7	98.3	99.6	97.55	96.35	96.1	97.8	96.3
VW-17d-95.5 (2" pipe)	scfm	74.5	78	80	78.5	75.8	77.3	72	75.1	72.5	71.5	103.6	102.1	103.1	101.5	104	101.2	100.5	103.1	100.3	99.8	99.1	100.3	99.8
VMW-A (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	scfm	130	136.5	131	128.5	128.1	130.1	127	130.8	134.9	130.2	151.5	222.3	235.3	238.3	227.0	223.3	223.3	233.7	224.7	220.7	223.0	222.3	222.7
Calculations																								
Operating Time																								
Period Operating Time	hrs	165.42	169.25	170.00	163.00	170.92	169.42	162.75	167.92	170.00	170.67	1.25	168.33	154.58	168.00	163.42	173.42	167.00	144.00	188.83	148.67	171.08	186.75	145.92
Period Time	hrs	165.42	169.25	170.00	163.00	170.92	169.42	162.75	167.92	170.00	170.67	1.25	168.33	166.58	168.00	163.42	173.42	167.00	144.00	188.83	148.67	171.08	186.75	145.92
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	93%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	3457.25	3626.50	3796.50	3959.50	4130.42	4299.83	4462.58	4630.50	4800.50	4971.17	4972.42	5140.75	5295.33	5463.33	5626.75	5800.17	5967.17	6111.17	6300.00	6448.67	6619.75	6806.50	6952.42
Cumulative Time Since Startup	hrs	3478.25	3647.50	3817.50	3980.50	4151.42	4320.83	4483.58	4651.50	4821.50	4992.17	4993.42	5161.75	5328.33	5496.33	5659.75	5833.17	6000.17	6144.17	6333.00	6481.67	6652.75	6839.50	6985.42
Cumulative Operating %	%	99.4%	99.4%	99.4%	99.5%	99.5%	99.5%	99.53%	99.55%	99.56%	99.58%	99.58%	99.59%	99.38%	99.40%	99.42%	99.43%	99.45%	99.46%	99.48%	99.49%	99.50%	99.52%	99.53%
Flow Rates																								
Well Flow Rate	scfm	159.00	169.50	172.00	166.80	162.80	168.80	158.40	159.70	164.20	158.80	231.10	228.10	226.20	222.10	227.90	223.70	223.50	227.80	222.85	221.15	220.00	222.70	220.60
Outlet Flow Rate	scfm	130.00	136.50	131.00	128.50	128.10	130.10	127.00	130.80	134.90	130.20	151.50	222.33	235.30	238.30	227.00	223.33	223.33	233.67	224.67	220.67	223.00	222.33	222.67
Well/Outlet Comparison	%	122%	124%	131%	130%	127%	130%	125%	122%	122%	122%	153%	103%	96%	93%	100%	100%	100%	97%	99%	100%	99%	100%	99%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	13.44	12.86	11.11	8.77	10.52	9.35	8.77	9.94	9.94	9.35	9.94	8.77	8.77	8.18	5.85	5.26	4.68	5.26	5.26	4.09	4.09	3.51	3.51
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	0.0065	0.0066	0.0054	0.0042	0.0050	0.0046	0.0042	0.0049	0.0050	0.0046	0.0056	0.0073	0.0077	0.0073	0.0050	0.0044	0.0039	0.0046	0.0044	0.0034	0.0034	0.0029	0.0029
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	1.14	1.11	1.02	0.79	0.79	0.81	0.71	0.76	0.84	0.82	0.01	1.09	1.16	1.26	1.00	0.81	0.69	0.61	0.85	0.58	0.58	0.59	0.43
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	23.65	24.76	25.78	26.57	27.36	28.17	28.88	29.64	30.48	31.30	31.31	32.40	33.56	34.82	35.82	36.64	37.33	37.94	38.80	39.38	39.96	40.55	40.98

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	2/9/2016	2/16/2016	2/23/2016	3/1/2016	3/8/2016	3/15/2016	3/22/2016	3/29/2016	4/5/2016	4/11/2016	4/19/2016	4/26/2016	5/3/2016	5/10/2016	5/17/2016	5/24/2016	5/31/2016	6/7/2016	6/13/2016	6/21/2016	6/28/2016	7/4/2016	7/12/2016
Time	---	9:40	10:00	10:30	8:10	10:00	11:40	9:40	9:50	9:30	15:00	8:15	8:30	9:50	12:00	9:00	10:50	9:40	8:00	8:00	7:30	6:50	13:00	14:00
System shutdown time	hrs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0
Vacuums																								
SVE System Inlet	in Hg	4.1	4	4.5	4.1	4.2	4.1	4	4.1	4.1	4	4	4	4	4	4.1	4	4.1	4	4	4.1	4	4.1	3.9
VW-17d-42.5	in Hg	2	2	2.1	2	2	2	2	2.1	2.1	2	2.1	2	2.1	2	2	2.1	2	2	1.9	1.9	2	1.9	1.8
VW-17d-75	in Hg	4	4	4.1	4	4.1	4	4	4	4	4	4	4	4	4	4	4	3.9	4	3.9	3.9	3.8	4	3.8
VW-17d-95.5	in Hg	4.1	4	4.1	4	4.1	4	4	4	4.1	4	4.1	4	4..1	4	4	4	4	4	4	4	4	4.1	3.8
VMW-A	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Temperatures																								
Ambient	Degrees F	51	57	51	48	43	44	48	52	50	63	62	50	65	70	63	60	66	61	60	60	58	64	73
SVE System Inlet	Degrees F	54	52	50	48	45	47	49	50	50	54	56	54	57	68	59	54	55	56	54	52	53	56	68
VW-17d-42.5	Degrees F	52	54	52	50	45	48	49	50	50	54	56	54	54	58	54	52	54	54	52	50	52	56	59
VW-17d-75	Degrees F	56	52	51	50	46	48	50	52	52	56	57	55	65	69	60	56	62	58	57	54	57	62	70
VW-17d-95.5	Degrees F	50	50	50	50	47	49	50	51	52	55	56	51	54	58	56	52	54	52	50	50	52	54	58
VMW-A	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet	Degrees F	154	145	130	128	125	125	128	134	130	138	150	138	150	152	138	138	147	135	128	130.1	130	140	144
Concentrations																								
SVE System Outlet: Field Data	ppm	0.6	0.6	0.5	0.6	0.6	0.6	0.5	0.7	0.5	0.7	0.4	0.7	0.6	0.7	0.8	0.8	0.4	0.4	0.4	0.6	0.8	0.6	0.6
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	220.3	218.7	222.7	218.7	221.0	218.3	219.0	223.7	215.7	217.7	216.0	216.0	220.7	216.3	217.7	220.7	215.7	211.7	208.7	218.0	216.7	216.3	213.7
VW-17d-42.5 (2" pipe)	scfm	25.1	24.9	25.2	24.8	24.3	25.1	25	24.95	24.3	23.8	24.1	25.1	25.2	24.8	25.1	25.2	25	25.1	24.8	24.3	25.1	25.1	24.8
VW-17d-75 (2" pipe)	scfm	99.8	97.8	99.9	98.9	99.1	99.4	98.5	99.9	99.5	98.9	99.4	100.3	100.4	98.9	100.1	100.2	99.3	100.1	97.8	100.1	98.8	100.0	99.6
VW-17d-95.5 (2" pipe)	scfm	100.1	99.7	100.8	100.1	99.9	100.1	100.6	100.1	100.9	99.9	100.3	100.6	100.6	100.1	100.4	100.4	100.3	100.4	99.8	102.1	101.2	100.1	100
VMW-A (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-B (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-C (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
VMW-D (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SVE System Outlet (3" pipe)	scfm	230.0	215.3	218.7	212.7	223.7	230.7	233.0	229.3	219.3	216.6	219.7	225.0	229.0	224.0	221.3	221.0	211.0	217.3	214.7	224.0	217.3	220.0	224.3
Calculations																								
Operating Time																								
Period Operating Time	hrs	187.75	168.33	168.50	165.67	169.83	169.67	166.00	168.17	167.67	149.50	185.25	168.25	169.33	170.17	165.00	169.83	166.83	156.33	144.00	191.50	167.33	150.17	193.00
Period Time	hrs	187.75	168.33	168.50	165.67	169.83	169.67	166.00	168.17	167.67	149.50	185.25	168.25	169.33	170.17	165.00	169.83	166.83	166.33	144.00	191.50	167.33	150.17	193.00
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	94%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	7140.17	7308.50	7477.00	7642.67	7812.50	7982.17	8148.17	8316.33	8484.00	8633.50	8818.75	8987.00	9156.33	9326.50	9491.50	9661.33	9828.17	9984.50	10128.50	10320.00	10487.33	10637.50	10830.50
Cumulative Time Since Startup	hrs	7173.17	7341.50	7510.00	7675.67	7845.50	8015.17	8181.17	8349.33	8517.00	8666.50	8851.75	9020.00	9189.33	9359.50	9524.50	9694.33	9861.17	10027.50	10171.50	10363.00	10530.33	10680.50	10873.50
Cumulative Operating %	%	99.54%	99.55%	99.56%	99.57%	99.58%	99.59%	99.60%	99.60%	99.61%	99.62%	99.63%	99.63%	99.64%	99.65%	99.65%	99.66%	99.67%	99.57%	99.58%	99.59%	99.59%	99.60%	99.60%
Flow Rates																								
Well Flow Rate	scfm	225.00	222.40	225.90	223.80	223.30	224.63	224.05	224.90	224.70	222.55	223.75	226.00	226.20	223.80	225.60	225.80	224.55	225.60	222.40	226.50	225.10	225.20	224.40
Outlet Flow Rate	scfm	230.00	215.33	218.67	212.67	223.67	230.67	233.00	229.33	219.33	216.60	219.67	225.00	229.00	224.00	221.33	221.00	211.00	217.33	214.67	224.00	217.33	220.00	224.33
Well/Outlet Comparison	%	98%	103%	103%	105%	100%	97%	96%	98%	102%	103%	102%	100%	99%	100%	102%	102%	106%	104%	104%	101%	104%	102%	100%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	3.51	3.51	2.92	3.51	3.51	3.51	2.92	4.09	2.92	4.09	2.34	4.09	3.51	4.09	4.68	4.68	2.34	2.34	2.34	3.51	4.68	3.51	3.51
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	0.0030	0.0028	0.0024	0.0028	0.0029	0.0030	0.0026	0.0035	0.0024	0.0033	0.0019	0.0034	0.0030	0.0034	0.0039	0.0039	0.0018	0.0019	0.0019	0.0029	0.0038	0.0029	0.0029
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	0.56	0.49	0.44	0.43	0.49	0.51	0.46	0.51	0.50	0.43	0.49	0.45	0.55	0.55	0.60	0.66	0.48	0.29	0.27	0.46	0.56	0.50	0.56
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	41.53	42.03	42.47	42.90	43.38	43.89	44.35	44.86	45.36	45.79	46.27	46.72	47.27	47.82	48.42	49.08	49.56	49.85	50.12	50.58	51.15	51.65	52.22

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	7/19/2016	7/26/2016	8/2/2016	8/9/2016	8/16/2016	8/24/2016	8/30/2016	9/6/2016	9/13/2016	9/20/2016	9/27/2016	10/4/2016	10/11/2016	10/18/2016	10/27/2016	11/2/2016	11/8/2016	11/15/2016	11/23/2016	11/29/2016	12/5/2016	12/14/2016	12/20/2016
Time	---	8:10	11:40	9:50	10:10	9:40	13:30	10:40	9:50	14:00	10:00	9:10	10:40	9:40	17:00	13:30	8:30	9:00	11:50	11:30	10:50	13:00	11:10	13:00
System shutdown time	hrs	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	212	0
Vacuums																								
SVE System Inlet	in Hg	3.9	4.4	4.2	4.1	4	3.9	4.1	4	4	4	4	4	3.9	4.1	4	4.1	4	3.9	4.1	3.9	4	3.8	4
VW-17d-42.5	in Hg	2	2.2	2	1.9	2	1.9	2	1.9	2	1.9	2	1.9	2	2.1	1.9	1.8	1.8	1.7	2	1.9	2	---	---
VW-17d-75	in Hg	4	4	4.1	4	4	3.9	4	3.9	4	3.9	4	4	4	3.9	4	3.8	3.9	3.8	3.9	3.9	3.8	---	---
VW-17d-95.5	in Hg	4	4.2	5.1	4	4	3.9	4	3.9	4	3.9	3.9	4	4	4	3.8	3.8	4	3.8	4	4	4	2.2	3.4
VMW-A	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.2	2.8
VMW-B	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.8	3
VMW-C	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	2.8
VMW-D	in Hg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.8	3
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.5	1.5
Temperatures																								
Ambient	Degrees F	63	70	64	64	61	86	60	56	80	65	61	57	58	62	50	52	54	45	43	48	48	30	48
SVE System Inlet	Degrees F	58	60	54	52	50	80	54	53	70	55	55	56	54	56	54	52	54	50	48	50	50	48	57
VW-17d-42.5	Degrees F	57	54	54	52	50	54	52	52	52	52	52	52	52	54	52	52	52	50	48	50	50	---	---
VW-17d-75	Degrees F	62	64	60	61	60	86	57	55	74	64	58	57	56	60	50	52	54	50	47	50	50	---	---
VW-17d-95.5	Degrees F	57	52	52	53	51	54	52	52	52	52	52	52	52	54	52	52	52	50	48	50	50	50	55
VMW-A	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	46	54
VMW-B	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	46	58
VMW-C	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	47	55
VMW-D	Degrees F	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	48	55
SVE System Outlet	Degrees F	130	145	135	138	140	160	130	130	150	138	135	130	135	125	125	125	125	124	118	115	115	110	125
Concentrations																								
SVE System Outlet: Field Data	ppm	0.7	0.5	0.5	0.4	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***	***0.5***	***0.5***	4.9	2.8
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	218.7	216.3	221.7	222.0	215.0	217.7	216.3	218.0	223.3	215.7	217.3	215.3	215.0	220.3	213.7	215.2	209.5	202.0	202.6	204.2	212.6	292.5	485.0
VW-17d-42.5 (2" pipe)	scfm	25	25.1	25.1	25.3	24.9	24.9	25.1	24.8	25.1	24.8	25.1	24.8	25.1	25.3	27.3	25.3	24.8	27.3	20.9	19.8	19.7	---	---
VW-17d-75 (2" pipe)	scfm	100.1	102.4	100.0	99.7	99.8	98.8	100.0	99.6	99.8	99.7	100.1	99.7	100.0	95.0	101.2	99.0	106.7	101.8	103.5	104.6	110.4	---	---
VW-17d-95.5 (2" pipe)	scfm	100.4	102.8	101.1	102.1	100.3	99.1	100.3	100.2	100.4	100.1	100.4	100.6	100.1	100.5	101.5	103.1	100.1	103.1	105.1	105.1	102.3	103.7	114.4
VMW-A (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	139.0	120.6
VMW-B (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	132.8	125.4
VMW-C (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	142.6	136.8
VMW-D (2" pipe)	scfm	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	141.4	140.5
SVE System Outlet (3" pipe)	scfm	217.7	224.0	224.3	224.0	221.3	222.7	220.3	221.3	220.3	220.0	222.7	216.7	218.7	221.3	226.5	220.4	220.7	211.0	212.5	215.6	216.2	332.5	487.5
Calculations																								
Operating Time																								
Period Operating Time	hrs	162.17	171.50	166.17	168.33	167.50	195.83	141.17	167.17	172.17	164.00	167.17	169.50	167.00	135.33	212.50	139.00	144.50	170.83	191.67	143.33	146.17	2.17	145.83
Period Time	hrs	162.17	171.50	166.17	168.33	167.50	195.83	141.17	167.17	172.17	164.00	167.17	169.50	167.00	175.33	212.50	139.00	144.50	170.83	191.67	143.33	146.17	214.17	145.83
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	77%	100%	100%	100%	100%	100%	100%	100%	1%	100%
Cumulative Operating Time	hrs	10992.67	11164.17	11330.33	11498.67	11666.17	11862.00	12003.17	12170.33	12342.50	12506.50	12673.67	12843.17	13010.17	13145.50	13358.00	13497.00	13641.50	13812.33	14004.00	14147.33	14293.50	14295.67	14441.50
Cumulative Time Since Startup	hrs	11035.67	11207.17	11373.33	11541.67	11709.17	11905.00	12046.17	12213.33	12385.50	12549.50	12716.67	12886.17	13053.17	13228.50	13441.00	13580.00	13724.50	13895.33	14087.00	14230.33	14376.50	14590.67	14736.50
Cumulative Operating %	%	99.61%	99.62%	99.62%	99.63%	99.63%	99.64%	99.64%	99.65%	99.65%	99.66%	99.66%	99.67%	99.67%	99.37%	99.38%	99.39%	99.40%	99.40%	99.41%	99.42%	99.42%	97.98%	98.00%
Flow Rates																								
Well Flow Rate	scfm	225.50	230.30	226.20	227.05	225.00	222.80	225.40	224.60	225.30	224.60	225.60	225.10	225.20	220.80	229.95	227.40	231.57	232.20	229.50	229.50	232.35	659.40	637.60
Outlet Flow Rate	scfm	217.67	224.00	224.33	224.00	221.33	222.67	220.33	221.33	220.33	220.00	222.67	216.67	218.67	221.33	226.50	220.35	220.67	211.00	212.50	215.60	216.15	332.50	487.50
Well/Outlet Comparison	%	104%	103%	101%	101%	102%	100%	102%	101%	102%	102%	101%	104%	103%	100%	102%	103%	105%	110%	108%	106%	107%	198%	131%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	4.09	2.92	2.92	2.34	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92	28.64	16.37
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	0.0033	0.0025	0.0025	0.0020	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0025	0.0024	0.0024	0.0023	0.0023	0.0024	0.0024	0.0357	0.0299
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	0.51	0.50	0.41	0.37	0.37	0.48	0.34	0.40	0.42	0.40	0.41	0.41	0.40	0.33	0.52	0.34	0.35	0.40	0.44	0.34	0.35	0.04	4.78
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	52.73	53.22	53.63	54.00	54.37	54.84	55.19	55.59	56.01	56.40	56.81	57.22	57.61	57.94	58.46	58.80	59.15	59.55	60.00	60.33	60.68	60.72	65.50

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	12/28/2016	1/3/2017	1/10/2017	1/16/2017	1/25/2017	1/31/2017	2/7/2017	2/15/2017	2/21/2017	2/27/2017	3/7/2017	3/13/2017	3/21/2017	3/28/2017	4/4/2017	4/11/2017	4/17/2017	4/25/2017	5/2/2017	5/8/2017	5/15/2017	5/22/2017	5/30/2017
Time	---	11:30	7:40	11:00	11:30	10:40	15:00	10:15	9:30	8:10	11:40	14:30	14:30	8:20	8:30	14:00	12:20	***12:00***	13:50	15:50	***12:00***	11:20	9:45	8:45
System shutdown time	hrs	0	0	0	0	3.5	0	0	2	0	0	0	0	0	0	0	66.5	0	0	0	3.5	0	0	0
Vacuums																								
SVE System Inlet	in Hg	4	4	4	3.8	4	4	4.8	4.1	4	4	4.1	4	4.1	4	4	4.1	4	4	4	4.1	4.1	4	4.1
VW-17d-42.5	in Hg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	in Hg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	in Hg	3.5	3.6	3.4	3.5	3.8	3.9	4	4	4	3.4	3.8	3.9	4	4	3.7	3.8	3.7	3.7	3.6	3.3	3.2	3.2	3.3
VMW-A	in Hg	2.7	3	3.1	3.2	2.8	3	3.8	3.7	3.8	3.2	3.4	3.4	3.6	3.5	3.4	3.2	3.3	3.2	3.2	3.2	3.2	3.1	3.1
VMW-B	in Hg	2.8	2.8	2.8	3	2.8	3	3.8	3.7	3.8	3.1	3.2	3.2	3.4	3.5	3.4	3.2	3.3	3.2	3.2	3.3	3.2	3.1	3
VMW-C	in Hg	2.5	2.8	2.8	2.8	2.8	3	3.3	3.4	3.5	3.1	3.2	3.3	3.4	3.4	3.2	3	3.1	3	3	3.1	3.1	3.2	3.1
VMW-D	in Hg	2.8	2.7	2.8	2.8	2.8	2.8	3.4	3.4	3.4	3.2	3.2	3.3	3.3	3.4	3.4	3.2	3.3	3.2	3.2	3.1	3.1	3.2	3.1
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Temperatures																								
Ambient	Degrees F	41	27	33	25	46	39	37	37	40	37	45	53	48	53	55	60	54	53	50	68	57	63	60
SVE System Inlet	Degrees F	54	43	40	27	53	50	48	45	***47***	***44***	43	52	52	54	54	56	52	53	59	62	57	57	57
VW-17d-42.5	Degrees F	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	Degrees F	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	Degrees F	52	45	41	34	50	48	45	40	42	40	43	50	52	54	54	56	52	54	58	60	56	58	56
VMW-A	Degrees F	52	46	44	32	52	48	46	44	42	40	42	52	50	53	52	58	52	52	58	58	56	58	51
VMW-B	Degrees F	53	46	44	32	52	50	46	44	42	40	42	52	50	53	52	58	52	52	58	58	56	58	51
VMW-C	Degrees F	52	46	45	32	54	50	46	44	42	40	40	52	50	54	52	58	52	52	58	58	56	57	51
VMW-D	Degrees F	52	45	43	33	53	50	46	45	42	40	40	52	50	54	52	58	52	52	58	58	56	58	51
SVE System Outlet	Degrees F	120	105	100.3	120	115	110	120	110	118	112	118	118	115	130	110	112	110	115	120	130	120	120	115
Concentrations																								
SVE System Outlet: Field Data	ppm	2.5	1.9	1.3	0.7	1.4	1.1	1.2	2.1	1.2	1.1	1	0.9	0.7	0.9	0.9	0.8	0.8	0.7	0.8	0.7	0.6	0.7	0.6
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	475.0	456.0	436.7		465.0	435.0	460.0	450.0	460.4	450.0	450.0	430.0	430.0	440.0	430.0	425.0	440.1	420.3	410.1	420.1	418.0	421.4	426.4
VW-17d-42.5 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5 (2" pipe)	scfm	112.8	109.1	112.2	114.5	109.5	105.1	109.5	115.3	105.1	114.0	110.0	117.5	107.0	104.6	106.8	102.7	102.8	102.6	101.1	101.6	99.2	101.0	101.3
VMW-A (2" pipe)	scfm	122.5	118.5	114.1	127.0	130.0	122.5	132.5	133.9	130.2	127.5	124.0	125.0	130.0	125.5	126.9	121.5	123.3	122.7	126.5	127.9	124.8	123.4	125.6
VMW-B (2" pipe)	scfm	125.5	126.0	118.2	138.0	130.0	122.5	130.0	130.5	130.0	130.0	125.0	130.0	131.5	127.4	127.8	122.5	127.7	122.1	121.2	122.6	127.7	126.8	124.9
VMW-C (2" pipe)	scfm	132.5	130.0	123.0	128.5	135.0	130.0	135.0	132.8	125.6	130.0	130.0	122.5	124.0	128.1	123.2	122.0	128.4	123.2	124.1	125.1	123.6	124.4	122.6
VMW-D (2" pipe)	scfm	133.0	125.0	120.7	141.5	132.5	132.5	135.0	132.8	128.4	125.0	125.0	127.5	122.5	126.5	126.7	117.5	123.1	121.4	122.3	121.6	124.3	124.4	123.5
SVE System Outlet (3" pipe)	scfm	480.0	475.0	462.8	440.0	495.0	485.0	480.0	450.0	470.4	475.3	465.0	460.0	445.0	440.0	430.7	435.0	425.2	430.6	427.0	430.2	423.5	430.6	437.7
Calculations																								
Operating Time																								
Period Operating Time	hrs	190.50	140.17	171.33	144.50	211.67	148.33	163.25	189.25	142.67	147.50	194.83	144.00	185.83	168.17	173.50	99.83	143.67	193.83	170.00	136.67	167.33	166.42	191.00
Period Time	hrs	190.50	140.17	171.33	144.50	215.17	148.33	163.25	191.25	142.67	147.50	194.83	144.00	185.83	168.17	173.50	166.33	143.67	193.83	170.00	140.17	167.33	166.42	191.00
Period Operating %	%	100%	100%	100%	100%	98%	100%	100%	99%	100%	100%	100%	100%	100%	100%	100%	60%	100%	100%	100%	98%	100%	100%	100%
Cumulative Operating Time	hrs	14632.00	14772.17	14803.33	14947.83	15159.50	15307.83	15471.08	15660.33	15803.00	15950.50	16145.33	16289.33	16475.17	16643.33	16816.83	16916.67	17060.33	17254.17	17424.17	17560.83	17728.17	17894.58	18085.58
Cumulative Time Since Startup	hrs	14927.00	15067.17	15098.33	15242.83	15458.00	15606.33	15769.58	15960.83	16103.50	16251.00	16445.83	16589.83	16775.67	16943.83	17117.33	17283.67	17427.33	17621.17	17791.17	17931.33	18098.67	18265.08	18456.08
Cumulative Operating %	%	98.02%	98.04%	98.05%	98.06%	98.07%	98.09%	98.11%	98.12%	98.13%	98.15%	98.17%	98.19%	98.21%	98.23%	98.24%	97.88%	97.89%	97.92%	97.94%	97.93%	97.95%	97.97%	97.99%
Flow Rates																								
Well Flow Rate	scfm	626.30	608.60	588.15	649.50	637.00	612.60	642.00	645.15	619.15	626.50	614.00	622.50	615.00	612.05	611.25	586.15	605.15	591.85	595.05	598.70	599.40	599.83	597.85
Outlet Flow Rate	scfm	480.00	475.00	462.75	440.00	495.00	485.00	480.00	450.00	470.40	475.30	465.00	460.00	445.00	440.00	430.70	435.00	425.20	430.64	426.95	430.20	423.45	430.55	437.65
Well/Outlet Comparison	%	130%	128%	127%	148%	129%	126%	134%	143%	132%	132%	132%	135%	138%	139%	142%	135%	142%	137%	139%	139%	142%	139%	137%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	14.61	11.11	7.60	4.09	8.18	6.43	7.01	12.28	7.01	6.43	5.85	5.26	4.09	5.26	5.26	4.68	4.68	4.09	4.68	4.09	3.51	4.09	3.51
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	0.0263	0.0198	0.0132	0.0067	0.0152	0.0117	0.0126	0.0207	0.0124	0.0114	0.0102	0.0091	0.0068	0.0087	0.0085	0.0076	0.0074	0.0066	0.0075	0.0066	0.0056	0.0066	0.0057
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	5.35	3.23	2.82	1.44	2.32	1.99	1.98	3.15	2.36	1.76	2.11	1.39	1.48	1.30	1.49	0.80	1.08	1.36	1.20	0.96	1.02	1.01	1.18
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	70.85	74.08	76.90	78.34	80.66	82.65	84.63	87.78	90.14	91.90	94.00	95.39	96.86	98.17	99.65	100.46	101.54	102.90	104.10	105.06	106.08	107.09	108.27

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	6/6/2017	6/12/2017	6/19/2017	6/27/2017	7/4/2017	7/11/2017	7/18/2017	7/25/2017	7/30/2017	8/8/2017	8/14/2017	8/22/2017	8/29/2017	9/5/2017	9/12/2017	9/19/2017	9/25/2017	10/3/2017	10/10/2017	10/16/2017	10/23/2017	10/31/2017	11/6/2017
Time	---	7:45	9:30	15:00	16:10	11:00	9:10	8:10	9:10	13:00	7:40	10:30	12:50	14:00	8:10	12:20	13:20	12:00	15:00	13:50	9:35	12:20	7:10	9:00
System shutdown time	hrs	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vacuums																								
SVE System Inlet	in Hg	4	4.1	4	4	4.1	4	3	4.1	4	4.1	4.1	4	4	4.1	4	4	4	4	4	4.1	4.1	4	4
VW-17d-42.5	in Hg	---	---	---	---	---	---	---	---	---		---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	in Hg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	in Hg	3.2	3.2	3.1	3.1	3.1	3.1	3	3	3.1	3.9	3.9	3.8	3.8	3.7	3.6	3.5	3.6	3.6	3.4	3.2	3.2	3.1	3
VMW-A	in Hg	3.2	3.1	3	3.1	3	3.1	3	3.1	3	3.3	3.2	3.2	3.1	3.1	3.1	3	3.1	3.1	3.1	3.2	3.2	3.2	3
VMW-B	in Hg	3.1	3.2	3	3	3	3	3.1	3.3	3	3.2	3.3	3.2	3.1	3.1	3.1	3	3	3.1	3	3.1	3.1	3.1	3
VMW-C	in Hg	3.1	3.1	3.1	3	3.1	3	3.1	3	3.1	3.2	3.3	3.2	3.1	3.1	3.1	3	3.1	3.1	3	3	3.2	3.1	3
VMW-D	in Hg	3	3	3	3	3.1	3.1	3.1	3	3	3.1	3.2	3.3	3.2	3.1	3.1	3	3.1	3.1	3	3.1	3.1	3.1	3
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
Temperatures																								
Ambient	Degrees F	58	54	78	74	73	61	68	66	72	63	64	76	88	70	78	60	61	71	57	42	60	40	58
SVE System Inlet	Degrees F	57	55	59	58	57	54	56	56	58	55	55	56	60	56	60	57	57	58	57	52	54	50	54
VW-17d-42.5	Degrees F	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	Degrees F	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	Degrees F	56	56	57	56	55	52	54	53	56	53	53	53	57	54	56	56	56	56	55	54	54	52	53
VMW-A	Degrees F	56	56	56	56	55	53	54	54	54	53	52	53	55	55	55	56	57	56	55	53	53	52	52
VMW-B	Degrees F	56	56	56	56	55	53	54	53	54	53	53	53	54	54	55	56	56	56	55	53	52	52	52
VMW-C	Degrees F	56	56	56	56	55	53	54	54	54	53	52	52	54	55	55	56	57	56	55	53	53	52	53
VMW-D	Degrees F	56	56	56	56	55	53	54	54	54	53	52	52	54	55	55	56	57	56	55	53	53	52	52
SVE System Outlet	Degrees F	124	***122***	138	145	135	125	130	128	136	130	125	130	144	140	138	128	128	125	128	122	125	119	128
Concentrations																								
SVE System Outlet: Field Data	ppm	0.7	0.8	0.65	0.6	0.8	1.1	0.7	0.8	0.7	0.7	0.7	0.7	0.8	0.9	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.8	0.7
Flow Rates																								
SVE System Inlet (3" pipe)	scfm	422.3	426.4	421.2	422.9	421.7	424.9	422.4	436.6	423.4	425.6	435.6	438.6	441.6	438.8	426.8	434.8	448.9	428.6	422.1	435.8	436.9	430.6	428.7
VW-17d-42.5 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5 (2" pipe)	scfm	102.1	101.2	101.8	102.5	101.0	101.4	101.2	101.5	101.5	100.3	101.1	100.6	99.8	100.1	100.3	100.5	101.9	102.1	101.8	101.9	101.1	99.8	99.5
VMW-A (2" pipe)	scfm	123.7	125.7	123.9	126.8	124.0	124.8	123.1	125.3	124.3	123.8	125.4	124.8	123.9	124.6	125.1	123.2	124.9	123.8	124.1	123.8	124.3	122.8	121.6
VMW-B (2" pipe)	scfm	124.5	125.2	121.8	126.3	124.9	124.6	123.1	122.6	124.1	124.6	124.1	124.1	124.6	124.4	124.6	128.1	128.2	126.8	125.4	125.6	123.3	123.5	122.3
VMW-C (2" pipe)	scfm	123.6	123.5	122.6	123.9	122.8	125.1	123.0	124.1	123.8	125.1	123.8	124.9	125.1	124.8	123.9	121.1	124.8	124.1	123.1	124.1	123.6	124.1	124.4
VMW-D (2" pipe)	scfm	126.4	125.1	123.4	124.4	124.9	125.9	123.2	122.4	122.7	124.6	125.3	125.6	125.4	125.3	124.7	122.4	125.1	123.7	123.8	124.3	124.8	122.9	123.2
SVE System Outlet (3" pipe)	scfm	434.4	440.9	438.5	440.7	436.4	442.5	440.9	444.5	441.7	444.3	441.8	450.4	448.6	441.6	444.8	438.6	451.6	440.3	438.6	444.6	448.1	441.2	436.1
Calculations																								
Operating Time																								
Period Operating Time	hrs	167.00	138.75	173.50	193.17	162.83	166.17	167.00	169.00	123.83	210.67	146.83	194.33	169.17	162.17	172.17	169.00	142.67	195.00	166.83	139.75	170.75	186.83	145.83
Period Time	hrs	167.00	145.75	173.50	193.17	162.83	166.17	167.00	169.00	123.83	210.67	146.83	194.33	169.17	162.17	172.17	169.00	142.67	195.00	166.83	139.75	170.75	186.83	145.83
Period Operating %	%	100%	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	18252.58	18391.33	18564.83	18758.00	18920.83	19087.00	19254.00	19423.00	19546.83	19757.50	19904.33	20098.67	20267.83	20430.00	20602.17	20771.17	20913.83	21108.83	21275.67	21415.42	21586.17	21773.00	21918.83
Cumulative Time Since Startup	hrs	18623.08	18768.83	18942.33	19135.50	19298.33	19464.50	19631.50	19800.50	19924.33	20135.00	20281.83	20476.17	20645.33	20807.50	20979.67	21148.67	21291.33	21486.33	21653.17	21792.92	21963.67	22150.50	22296.33
Cumulative Operating %	%	98.01%	97.99%	98.01%	98.03%	98.04%	98.06%	98.08%	98.09%	98.11%	98.13%	98.14%	98.16%	98.17%	98.19%	98.20%	98.22%	98.23%	98.24%	98.26%	98.27%	98.28%	98.30%	98.31%
Flow Rates																								
Well Flow Rate	scfm	600.15	600.60	593.40	603.70	597.40	601.65	593.40	595.90	596.35	598.40	599.70	600.00	598.80	599.20	598.60	595.30	604.90	600.50	598.20	599.70	597.10	593.10	590.95
Outlet Flow Rate	scfm	434.35	440.90	438.50	440.70	436.35	442.45	440.90	444.50	441.70	444.30	441.80	450.40	448.60	441.60	444.80	438.60	451.60	440.30	438.60	444.60	448.10	441.20	436.10
Well/Outlet Comparison	%	138%	136%	135%	137%	137%	136%	135%	134%	135%	135%	136%	133%	133%	136%	135%	136%	134%	136%	136%	135%	133%	134%	136%
SVE Effluent VOC Conc.																								
SVE System Outlet (3" pipe)	ug/L	4.09	4.68	3.80	3.51	4.68	6.43	4.09	4.68	4.09	4.09	4.09	4.09	4.68	5.26	3.51	3.51	3.51	4.09	4.09	4.68	4.68	4.68	4.09
Mass Removal Rate																								
SVE System Outlet (3" pipe)	lb/hr	0.0067	0.0077	0.0062	0.0058	0.0076	0.0107	0.0068	0.0078	0.0068	0.0068	0.0068	0.0069	0.0079	0.0087	0.0058	0.0058	0.0059	0.0067	0.0067	0.0078	0.0078	0.0077	0.0067
Period Mass Removal																								
SVE System Outlet (3" pipe)	lbs	1.04	1.00	1.21	1.16	1.09	1.52	1.45	1.23	0.90	1.43	1.00	1.33	1.25	1.34	1.25	0.98	0.83	1.24	1.12	1.01	1.34	1.46	1.05
Cumulative Mass Removal																								
SVE System Outlet (3" pipe)	lbs	109.31	110.30	111.51	112.68	113.77	115.29	116.74	117.97	118.87	120.31	121.30	122.63	123.88	125.22	126.47	127.46	128.29	129.53	130.65	131.66	133.00	134.45	135.50

Attachment A - SVE Process Data
East Multnomah County Troutdale Sandstone Aquifer Remedy
Cascade Corporation, Gresham, OR

	Units	11/14/2017	11/20/2017	11/27/2017	12/4/2017	12/12/2017	12/18/2017	12/26/2017	1/2/2018	1/9/2018	1/15/2018	1/23/2018
Time	---	15:50	13:30	15:30	13:20	13:20	13:25	11:20	15:40	12:00	13:20	12:50
System shutdown time	hrs	0	0	0	0	0	0	0	0	0	0	0
Vacuums												
SVE System Inlet	in Hg	4	4.1	4	4	4.1	4	3.9	3.9	3.9	3.9	3.9
VW-17d-42.5	in Hg	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	in Hg	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	in Hg	3	3	3	3.1	3	3	2.8	2.9	3	3	2.9
VMW-A	in Hg	3	3.1	3	3	3	3	3	2.9	2.9	3	3
VMW-B	in Hg	3	3.1	3	3	3	3	3	3	3	3	3
VMW-C	in Hg	3	3	3	3	3	3	2.9	3	3	2.9	3
VMW-D	in Hg	3	3.1	3.1	3	3	3	2.9	2.9	2.9	2.9	3
SVE System Outlet	PSI	1	1	1	1	1	1	1	1	1	1	1
Temperatures												
Ambient	Degrees F	56	52	50	45	42	53	30	41	44	50	41
SVE System Inlet	Degrees F	54	52	50	52	52	53	38	46	44	52	50
VW-17d-42.5	Degrees F	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75	Degrees F	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5	Degrees F	53	52	52	52	52	52	40	50	52	52	50
VMW-A	Degrees F	53	52	52	52	52	52	40	47	52	52	50
VMW-B	Degrees F	53	52	52	52	52	52	42	48	52	52	50
VMW-C	Degrees F	53	52	52	52	52	52	40	47	52	52	50
VMW-D	Degrees F	53	52	52	52	52	52	40	47	52	52	50
SVE System Outlet	Degrees F	125	124	125	128	130	125	90	100	128	118	100.2
Concentrations												
SVE System Outlet: Field Data	ppm	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6
Flow Rates												
SVE System Inlet (3" pipe)	scfm	430.6	428.6	431.4	436.1	430.6	430.0	424.1	436.8	428.6	421.1	424.8
VW-17d-42.5 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---
VW-17d-75 (2" pipe)	scfm	---	---	---	---	---	---	---	---	---	---	---
VW-17d-95.5 (2" pipe)	scfm	100.1	99.8	100.3	99.8	100.3	99.7	98.6	100.2	99.6	99.1	102.8
VMW-A (2" pipe)	scfm	122.4	123.4	122.8	123.3	124.1	122.8	121.8	122.3	124.1	122.3	122.1
VMW-B (2" pipe)	scfm	124.2	123.8	123.6	123.6	122.5	124.3	122.3	122.8	123.2	121.8	124.1
VMW-C (2" pipe)	scfm	126.3	126.1	123.8	124.8	123.2	123.7	121.7	123.4	123.1	123.1	123.1
VMW-D (2" pipe)	scfm	125.3	125.6	124.7	125.3	123.5	124.3	122.3	123.8	122.8	122.1	123.6
SVE System Outlet (3" pipe)	scfm	440.8	436.1	442.5	444.1	428.1	436.8	428.6	441.3	434.6	415.1	431.6
Calculations												
Operating Time												
Period Operating Time	hrs	198.83	141.67	170.00	165.83	192.00	144.08	189.92	172.33	164.33	145.33	191.50
Period Time	hrs	198.83	141.67	170.00	165.83	192.00	144.08	189.92	172.33	164.33	145.33	191.50
Period Operating %	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Cumulative Operating Time	hrs	22117.67	22259.33	22429.33	22595.17	22787.17	22931.25	23121.17	23293.50	23457.83	23603.17	23794.67
Cumulative Time Since Startup	hrs	22495.17	22636.83	22806.83	22972.67	23164.67	23308.75	23498.67	23671.00	23835.33	23980.67	24172.17
Cumulative Operating %	%	98.32%	98.33%	98.34%	98.36%	98.37%	98.38%	98.39%	98.41%	98.42%	98.43%	98.44%
Flow Rates												
Well Flow Rate	scfm	598.30	598.70	595.20	596.80	593.60	594.80	586.70	592.50	592.80	588.40	595.70
Outlet Flow Rate	scfm	440.80	436.10	442.50	444.10	428.10	436.80	428.60	441.30	434.60	415.10	431.60
Well/Outlet Comparison	%	136%	137%	135%	134%	139%	136%	137%	134%	136%	142%	138%
SVE Effluent VOC Conc.												
SVE System Outlet (3" pipe)	ug/L	4.09	4.09	4.09	4.09	4.09	4.09	3.51	3.51	3.51	3.51	3.51
Mass Removal Rate												
SVE System Outlet (3" pipe)	lb/hr	0.0068	0.0067	0.0068	0.0068	0.0066	0.0067	0.0056	0.0058	0.0057	0.0055	0.0057
Period Mass Removal												
SVE System Outlet (3" pipe)	lbs	1.34	0.95	1.14	1.13	1.28	0.96	1.17	0.98	0.95	0.81	1.07
Cumulative Mass Removal												
SVE System Outlet (3" pipe)	lbs	136.84	137.79	138.94	140.06	141.35	142.30	143.47	144.46	145.40	146.21	147.28