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WILLIAMS AIR FORCE BASE

Site LF004 Landfill Remedial Action

BCT Conference Call
21 May 2019

Battle Ready…Built Right!

ED_005025_00010438-00001

LF004 Recent and Upcoming Activities

- Post remediation soil gas sampling is complete
- Post remediation PDB groundwater sampling for May 2019 is complete
- Draft annual landfill inspection report in production

ED_005025_00010438-00002

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Site FT002
Fire Training Area Remedial Action

BCT Conference Call
21 May 2019

Site FT002 Update

- AF approved keeping the DEUR in place Nov 2018
- AF will prepare Explanation of Significant Differences (ESD) document to add the land use control to the ROD
- AF response to EPA and ADEQ comments on Remedial Action Completion Report under AF review
- If necessary, a technical conference call with regulatory agencies to resolve comments can be scheduled

ED_005025_00010438-00004

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Site SS017

Old Pesticide/Paint Shop

BCT Conference Call

21 May 2019

Battle Ready…Built Right!

ED_005025_00010438-00005

Site SS017 Groundwater Monitoring Update Path Forward

- Final May 2018 data summary report submitted 5 Apr 2019. Final May 2018 data summary hard copies reissued 30 Apr 2019.
- Aug 2018 data summary report submitted 12 Apr 2019
- Nov (Annual) 2018 groundwater report submitted 18 Apr 2019. Reissued hard copy reports on 30 Apr 2019.
- Revised contract modification proposal for 2019/2020 groundwater sampling under AF review

Parcel K-1-2 Property Transfer

- Draft FOST and SEBS issued 30 November 2018
- ADEQ comments received 3 and 7 January 2019
- Draft final FOST and SEBS including RTC to ADEQ comments posted for public comment. Comment period end 25 Mar 2019; no comments received.
- EPA comments received 11 Mar 2019
- Draft final FOST and SEBS issued to ASU for coordination
- Revised Draft Final FOST to be issued for regulatory concurrence
- Final FOST to be routed for AF signature after regulatory concurrence
- Draft DEUR and deed to be prepared

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Site ST035
Former Building 760

BCT Conference Call
21 May 2019

ST035 Update

- SVE system and enclosure decommissioning in progress. ASU has indicated that the concrete pad, walls, and fencing may be retained for use by facilities management.
- Procurement of monitoring well abandonment in progress. Well abandonment tentatively scheduled in the Jul-Aug 2019 time frame.

Partial Deletion

BCT Conference Call

21 May 2019

PARTIAL DELETION UPDATE

- Draft table and figure submitted for regulatory review on 29 Sep 2014
- Comments received by ADEQ during Sep 2014 BCT meeting addressed in follow on email. No comments received from EPA.
- Deletion on hold during SS017 and ST012 informal disputes
- Final deletion tables and figure ready for submittal and provided to BCT in April 2019 BCT meeting
- EPA to provide input on whether PCOR will be required for the partial deletion docket.

ED_005025_00010438-00011

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Site ST012

Former Liquid Fuel Storage Area

BCT Conference Call

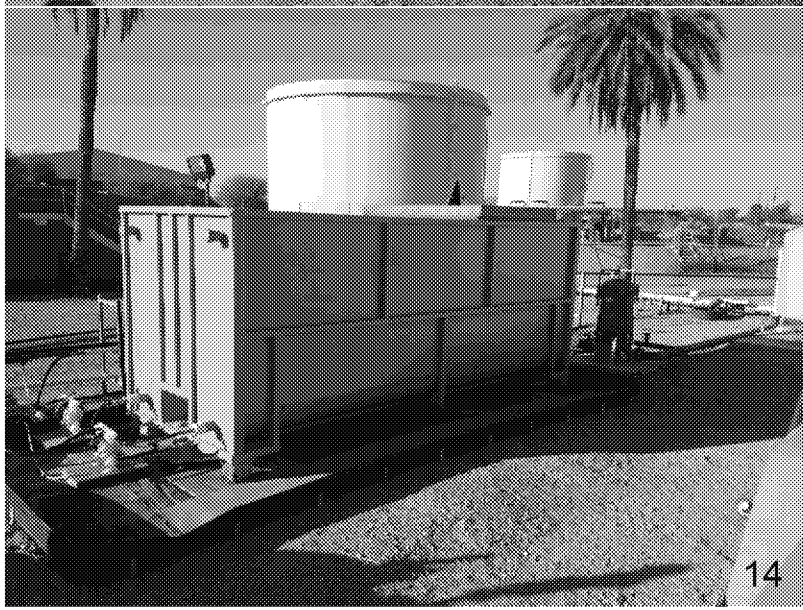
21 May 2019

Site ST012 Outline

- Summary of activities since April BCT meeting
- Update on SVE system
- LNAPL monitoring/removal update
- Pilot study extraction/injection update
- Path forward

Site ST012 Activities Since April

- **Continued SVE operation**
- **Continued LNAPL screening in accessible wells**
- **Operation of Extraction and Treatment**
  - **Pump repairs**
    - CZ21 replacement motor installed
- **Sodium sulfate injections (detail on later slides)**



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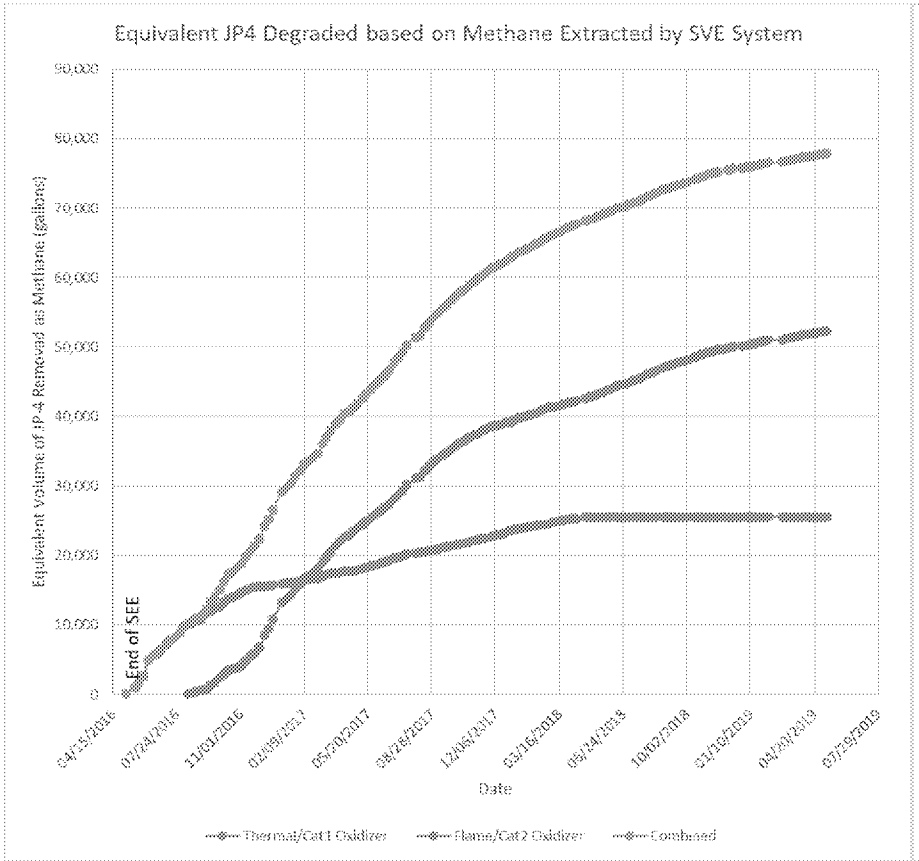
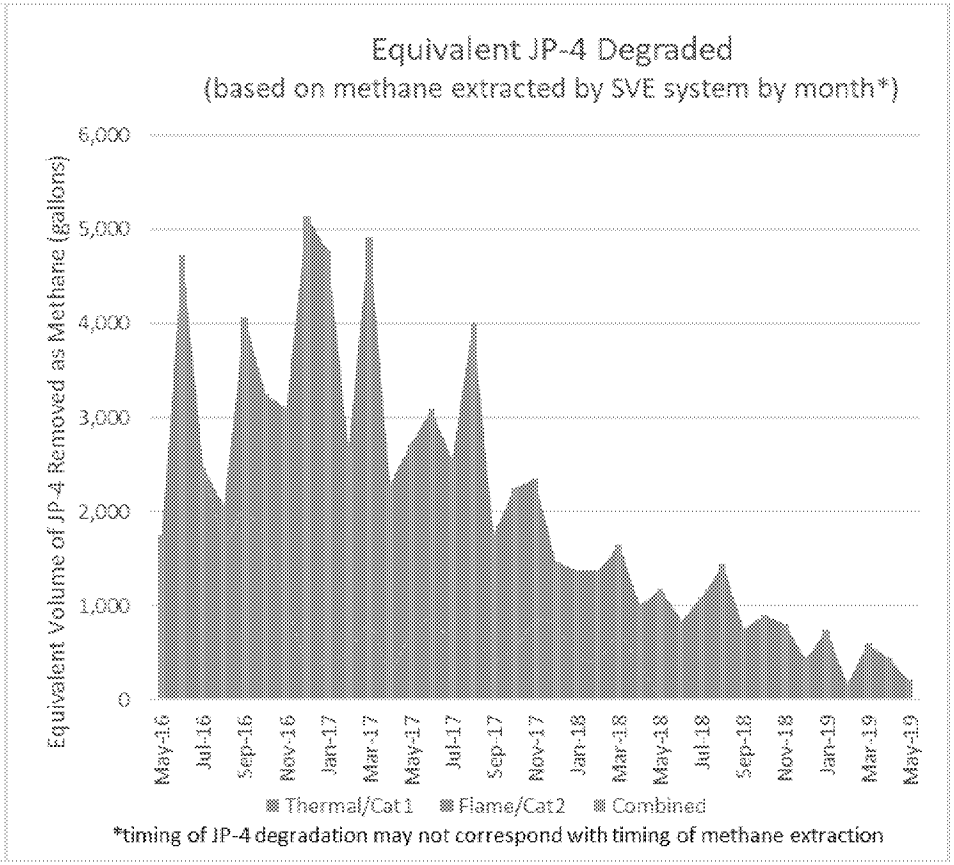
SVE Update

ED_005025_00010438-00015

Site ST012 SVE System Equivalent JP-4 Degradation Based on Methane Removed





- Estimates through 09 May 2019
- Estimated JP-4 degradation as methane is in addition to JP-4 removal reported for SVE
- Thermal/Cat1 oxidizer changed from SVE to groundwater treatment end of Apr
- Flame oxidizer treating combined SVE and air stripper intermittently in Nov 2018 – Jan 2019
- Flame oxidizer replaced by catalytic oxidizer (Cat2) 7 Feb to 26 Feb 2019

Supplemental SVE Optimization Information

- **Table of Optimization Changes (requested at Apr BCT meeting)**
- **Changes were implemented 5 Apr 2019**

Well	Action	Notes
SVE01S	Leave Open	Leave open and vent SVE02S and SVE03S to see if improved airflow and mass recovery are achieved
SVE02S	Vent	See SVE01S above
SVE03S	Vent	See SVE01S above
SVE04S	Open	Open SVE04S and vent SVE05S to improve airflow and sweep area between two wells
SVE05S	Vent	See SVE04S above
SVE06S	Open	Open SVE06S and SVE05S to see if concentrations increase
SVE07S	Open	Open SVE07S and vent SVE05S to see if concentrations increase
SVE08S	Leave Closed	No change
SVE09S	Leave Closed	No change
SVE01M	Leave Open	Leave SVE01M open and vent SVE02M to see if increase in ROI between two wells
SVE02M	Vent	See SVE01M above
SVE03M	Vent	Vent SVE03M and leave SVE01M open to clear stagnant zone between two wells
SVE04M	Leave Open	Leave SVE04M open and vent SVE03M to clear stagnant zone between two wells
SVE05M	Vent	Vent SVE05M and open SVE06M to promote airflow through area between two wells
SVE06M	Open	See SVE05M above
SVE07M	Open	Open SVE07M and vent SVE13M to promote airflow through area between two wells
SVE08M	Leave Closed	No change
SVE09M	Close	Close SVE09M to test for rebound
SVE10M	Leave Open	Leave SVE10M open and vent SVE05M to promote airflow between two wells and close SVE12M to eliminate stagnant zone between two wells
SVE11M	Leave Open	Leave SVE11M open with SVE02M vented to promote airflow
SVE12M	Close	See SVE10M above
SVE13M	Vent	See SVE07M above
SVE14M	Close	Close SVE14M and with SVE03M vented and SVE01M open to promote airflow in area
SVE01D	Leave Open	Leave SVE01D Open and close SVE02D to remove stagnant zone between two wells
SVE02D	Close	See SVE01D above
SVE03D	Close	Close SVE03D and leave SVE01D open to eliminate stagnant zone between two wells
SVE04D	Vent	Vent SVE04D and leave SVE05D open to eliminate stagnant zone between two wells
SVE05D	Leave Open	See SVE04D above
SVE06D	Close	Vent SVE06D and leave SVE05D open to eliminate stagnant zone between two wells
SVE07D	Vent	Vent SVE07D and leave SVE05D and SVE01D open to eliminate stagnant zone between two wells and promote airflow
SVE08D	Leave Closed	No change
SVE09D	Leave Closed	No change

Supplemental SVE Optimization Information

- **PID/FID readings to track effect of optimization**
  - **Most PID/FID readings do not indicate increases in concentrations**
  - **SVE05D may have increased FID (see table below)**

SVE-05 Deep						
Date	VOC Concentration via PID [ppmv]	VOC Concentration via FID [ppmv]	O_2 [%]	CH_4 [% LEL]	CO [ppmv]	CO_2 [%]
1/4/2019	1905	13492	3.3	>100	41	3.8
1/17/2019	1460	5607	12.2	>100	19	2.7
1/31/2019	1322	3861	7.8	>100	38	2.3
3/1/2019	1427	3430	15.2	>100	10	2.1
3/7/2019	1392	3634	15.3	>100	26	1.7
3/21/2019	1312	2052	18.5	>100	32	1.5
4/4/2019	1489	2453	8.9	>100	22	1.6
4/19/2019	1563	8329	9.7	>>>	41	2.2
5/2/2019	979	5410	1.6	>>>	47	2.3

Optimization implemented on 5 Apr 2019

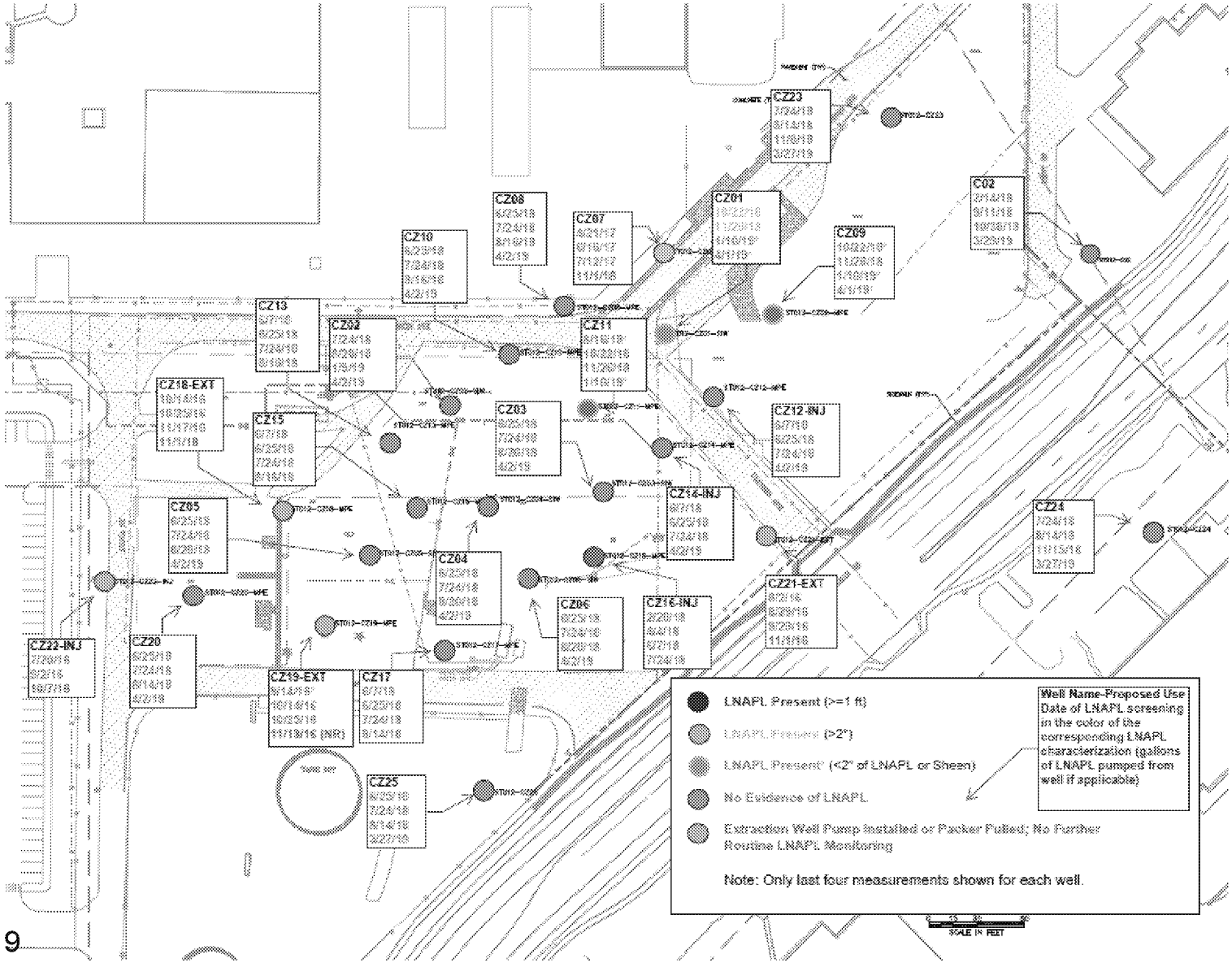
LNAPL Monitoring Update (through 10 May)

ED_005025_00010438-00019

Site ST012 CZ Groundwater Elevations Relative to CZ screens

- Most CZ wells all have a nominal top of screen depth of 145 ft bgs (except perimeter well CZ23 which is 140 ft, and perimeter wells C01 through C05 have varying screen depths but are generally too distant from potential LNAPL)
- CZ groundwater elevations measured during LNAPL screening range from 146 to 148 ft BTOC. TOC is a nominal 1.5 feet above ground surface.
- CZ groundwater elevations are 0.5 to 1.5 ft below top of screen in the following CZ wells: CZ02, CZ03, CZ04, CZ05, CZ06, CZ07, CZ08, CZ09, CZ10, CZ11, CZ13, CZ15, CZ16, CZ17, CZ18, CZ23
- CZ groundwater elevations may be at or above the top of screen in the following wells: CZ01, CZ12, CZ14, CZ20, CZ21, CZ22

LNAPL Monitoring/Removal Status
Cobble Zone



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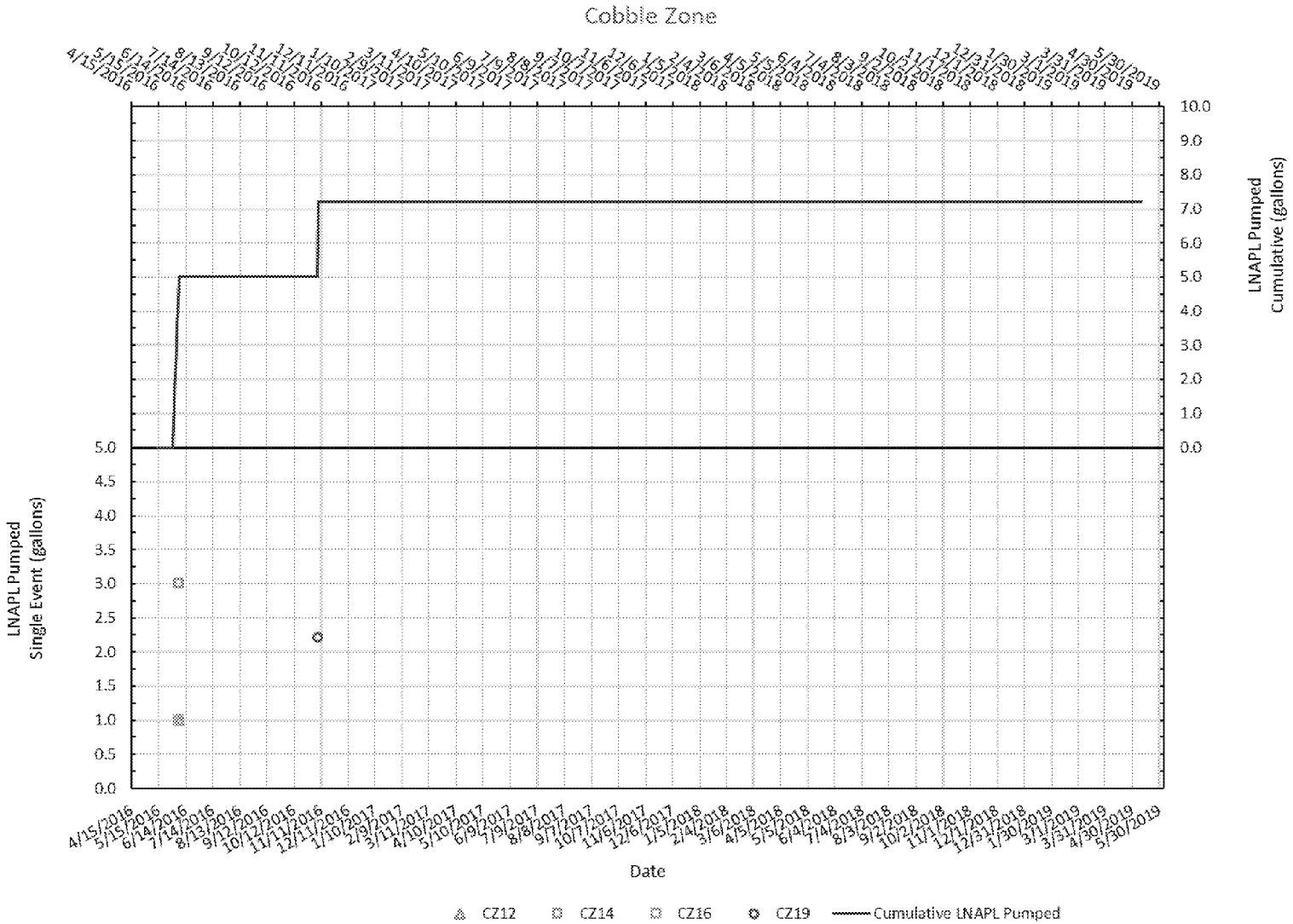
LNAPL Monitoring/Removal Status
Cobble Zone



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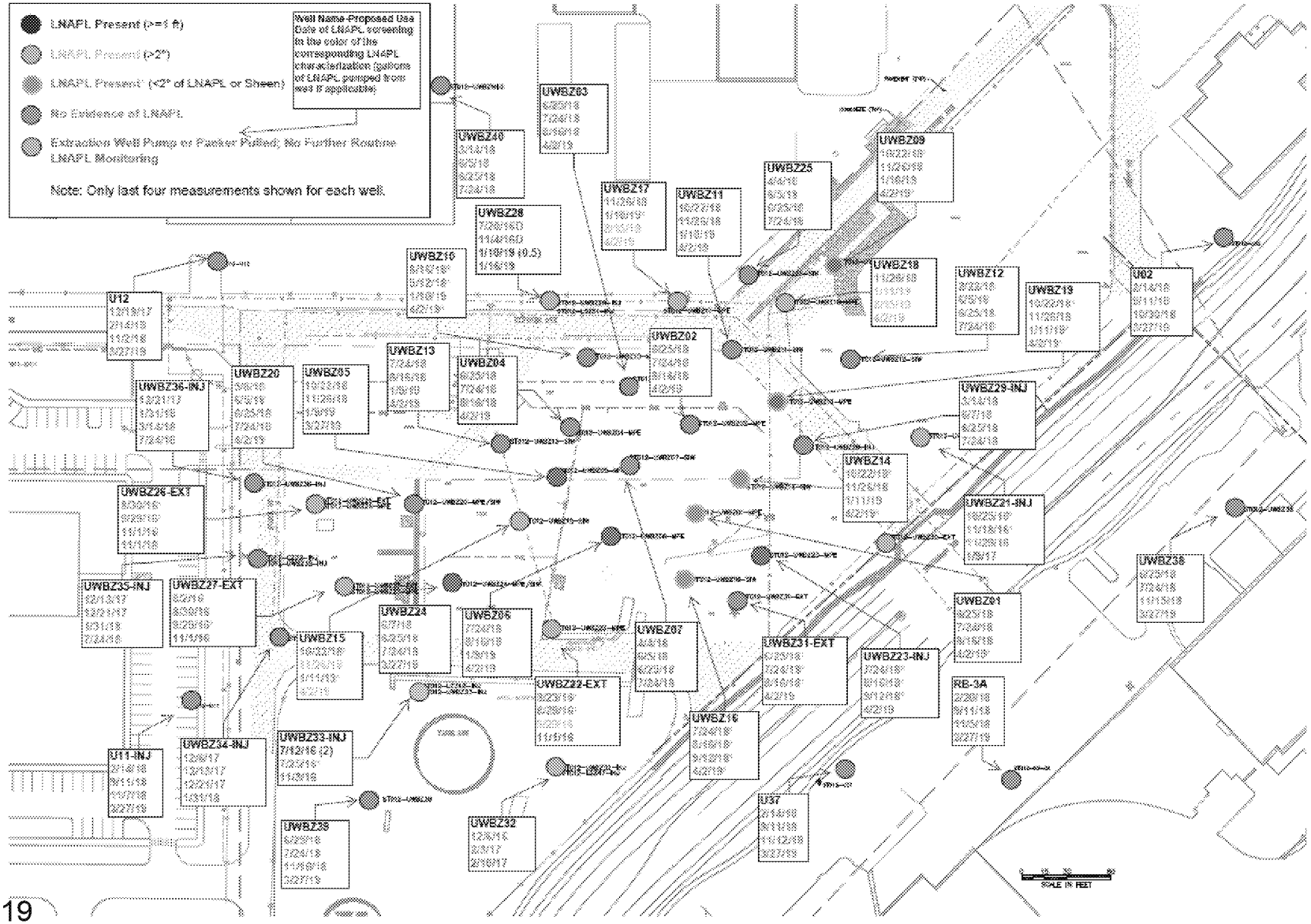
LNAPL Monitoring/Removal Status
Upper Water Bearing Zone



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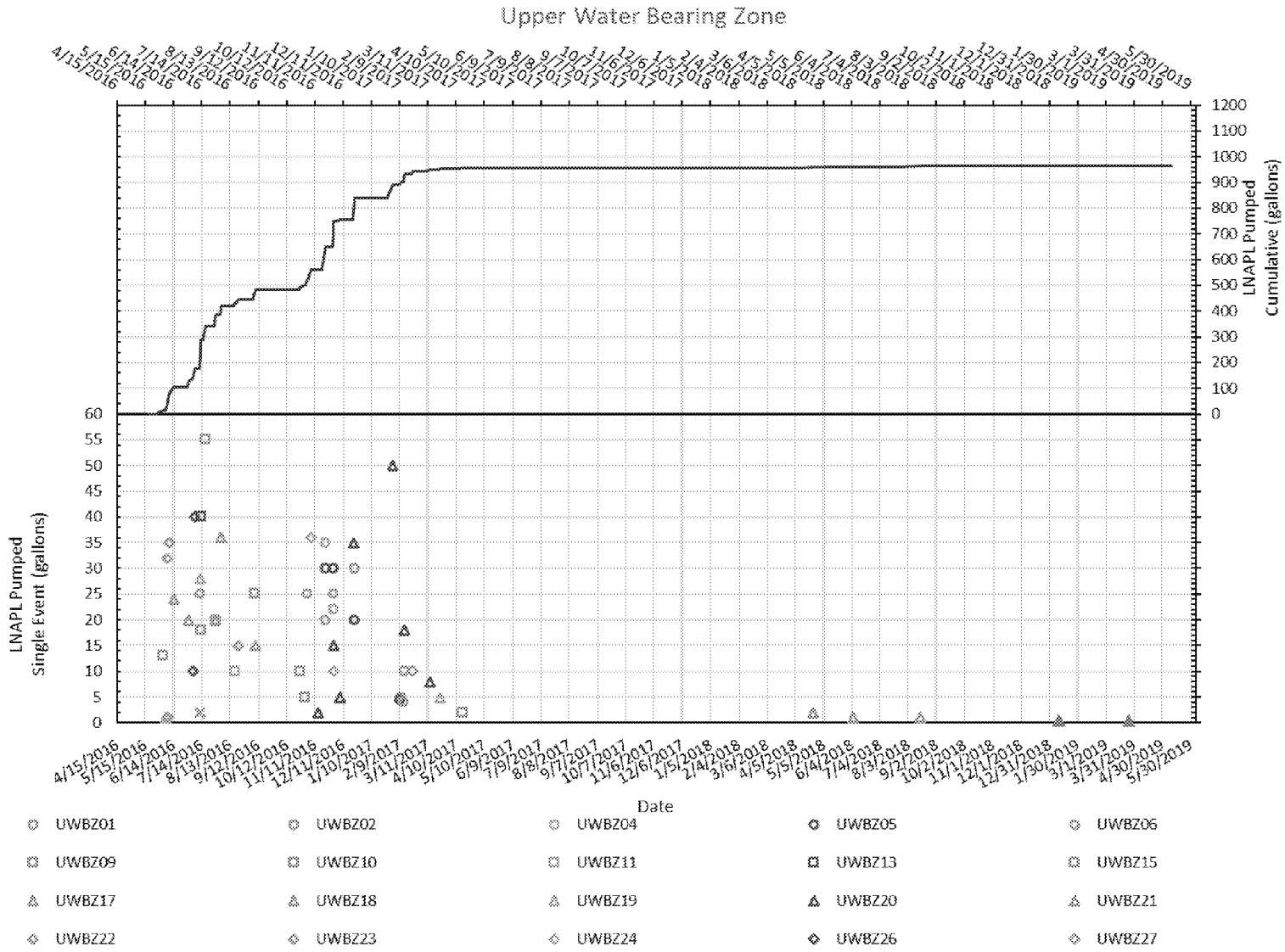
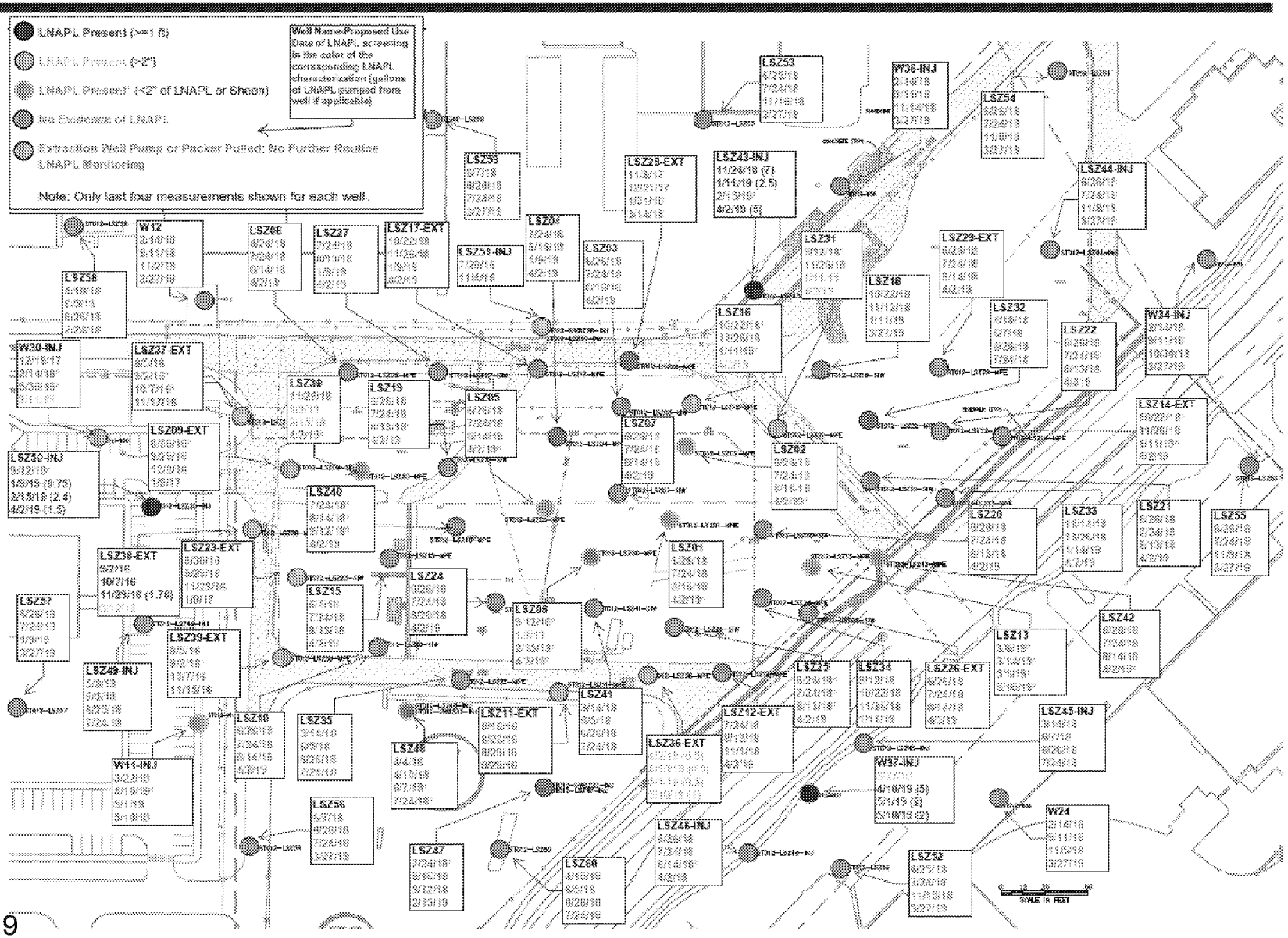
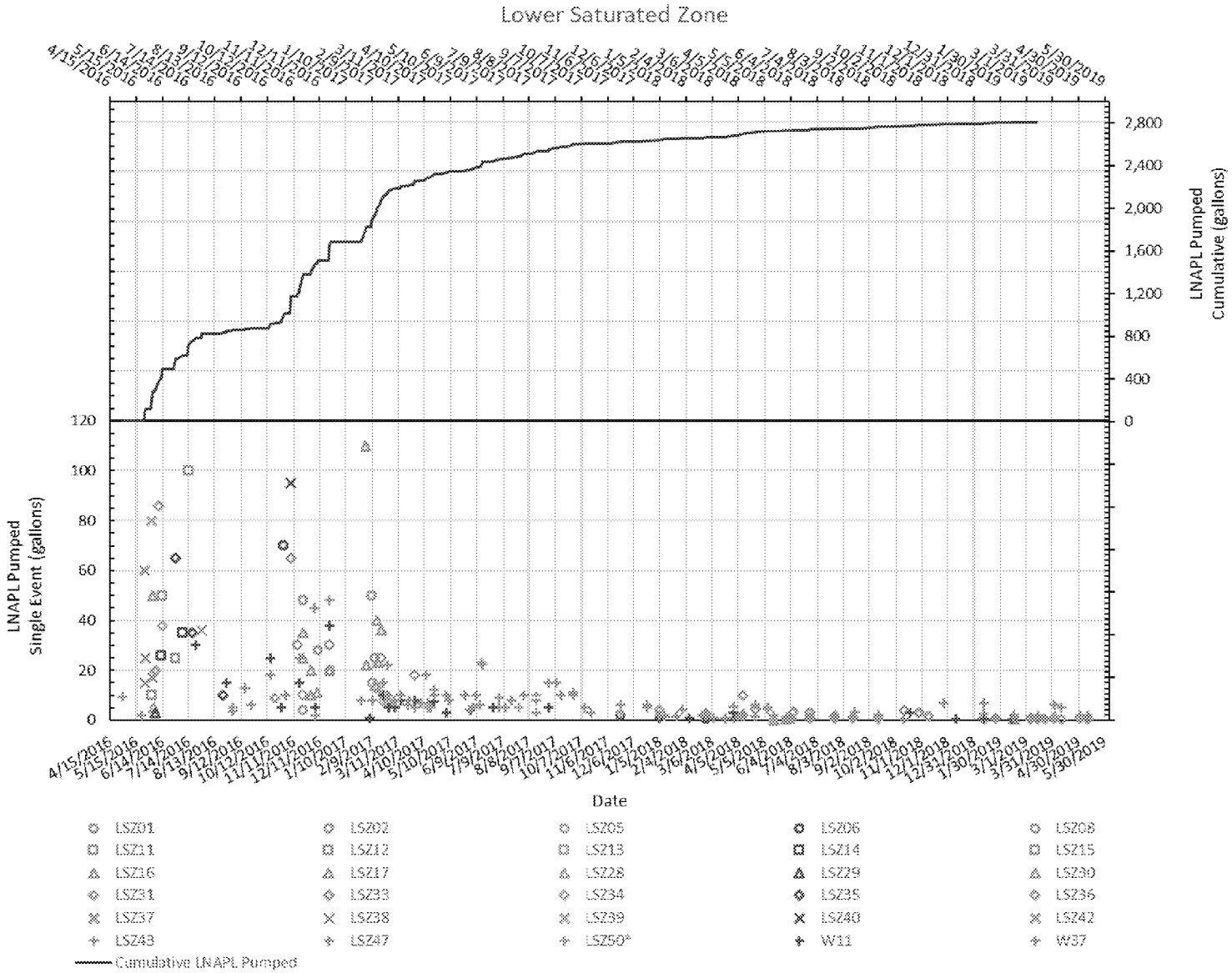
LNAPL Monitoring/Removal Status
Upper Water Bearing Zone



LNAPL Monitoring/Removal Status
Lower Saturated Zone

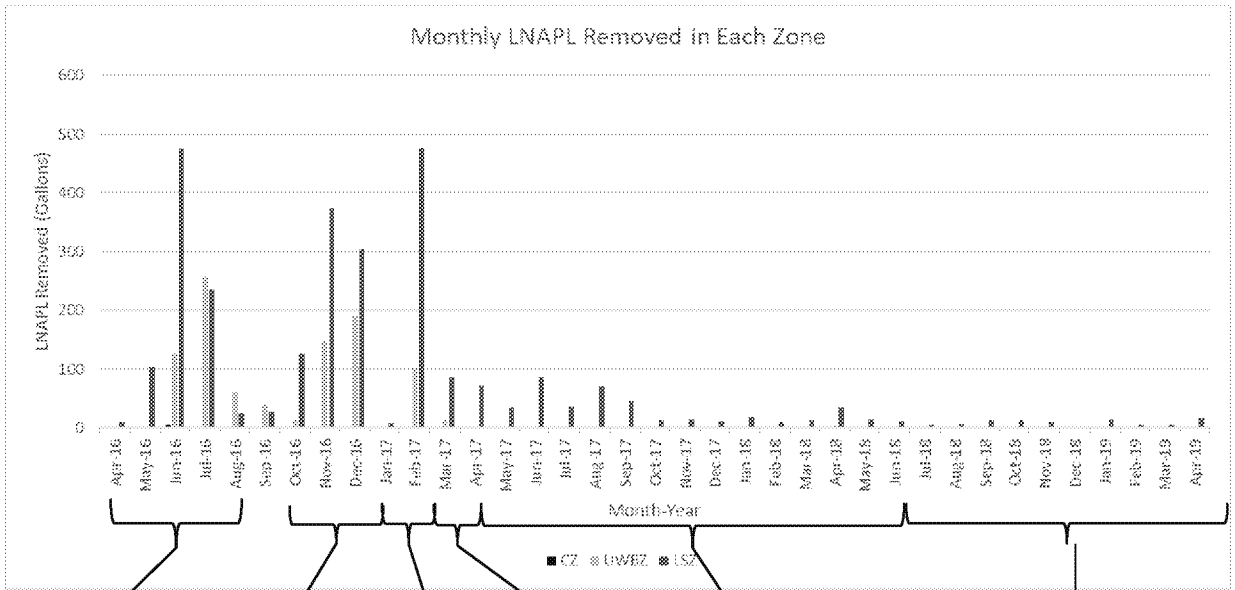


LNAPL Monitoring/Removal Status
Lower Saturated Zone



ST012 LNAPL Monitoring/Removal Summary

- CZ – 7 gallons of LNAPL removed. None since Nov 2016
- UWBZ - 963 gallons of LNAPL removed. None since Apr update.
- LSZ - 2,832 gallons of LNAPL removed. 6 gallons removed since Apr update (W37 and LSZ36).



Removal following initial eductor removals

Removal following remaining eductor removals

Diminished removal due to pump failure

Recovery following pump replacement

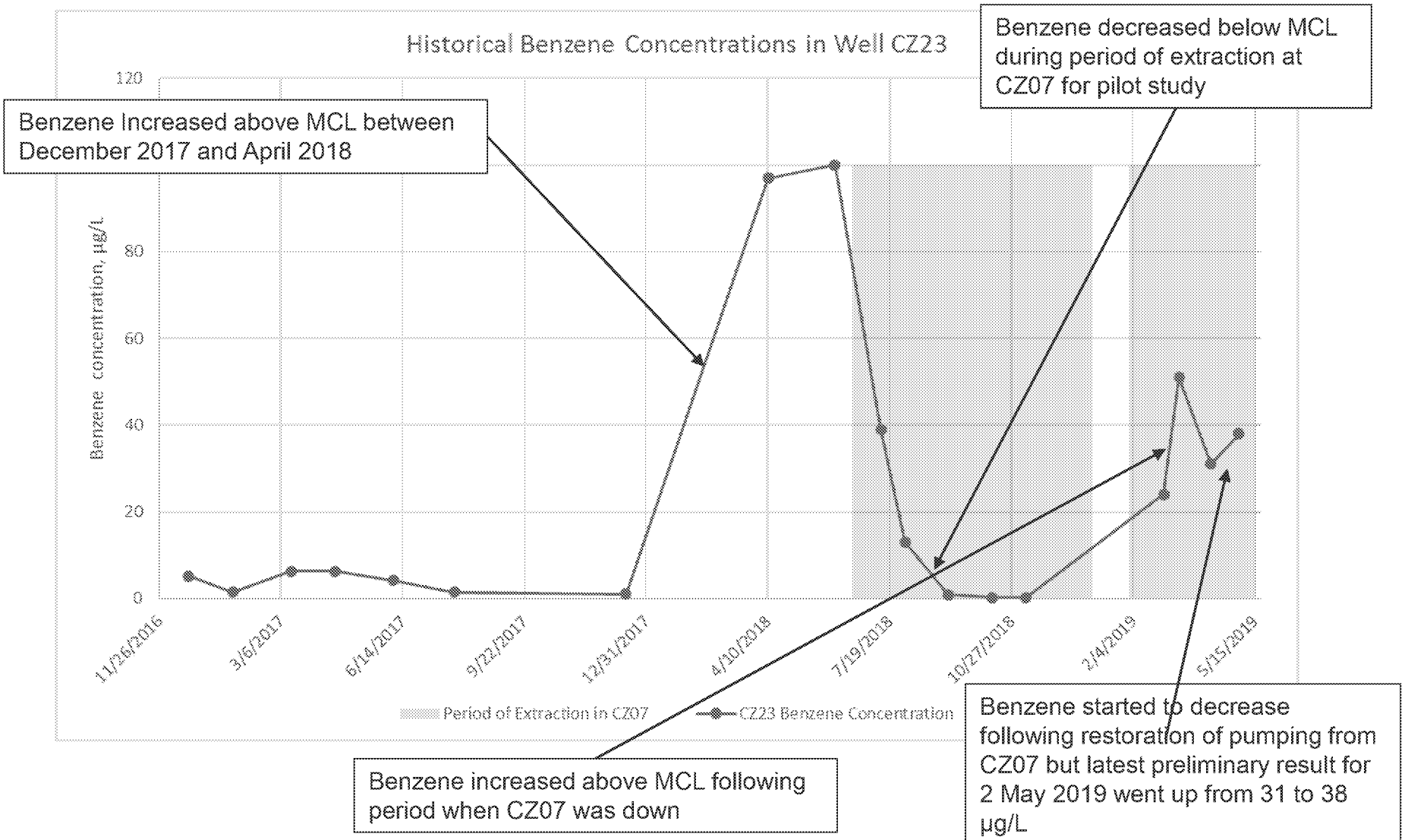
<100 gal/mo

<20 gal/mo

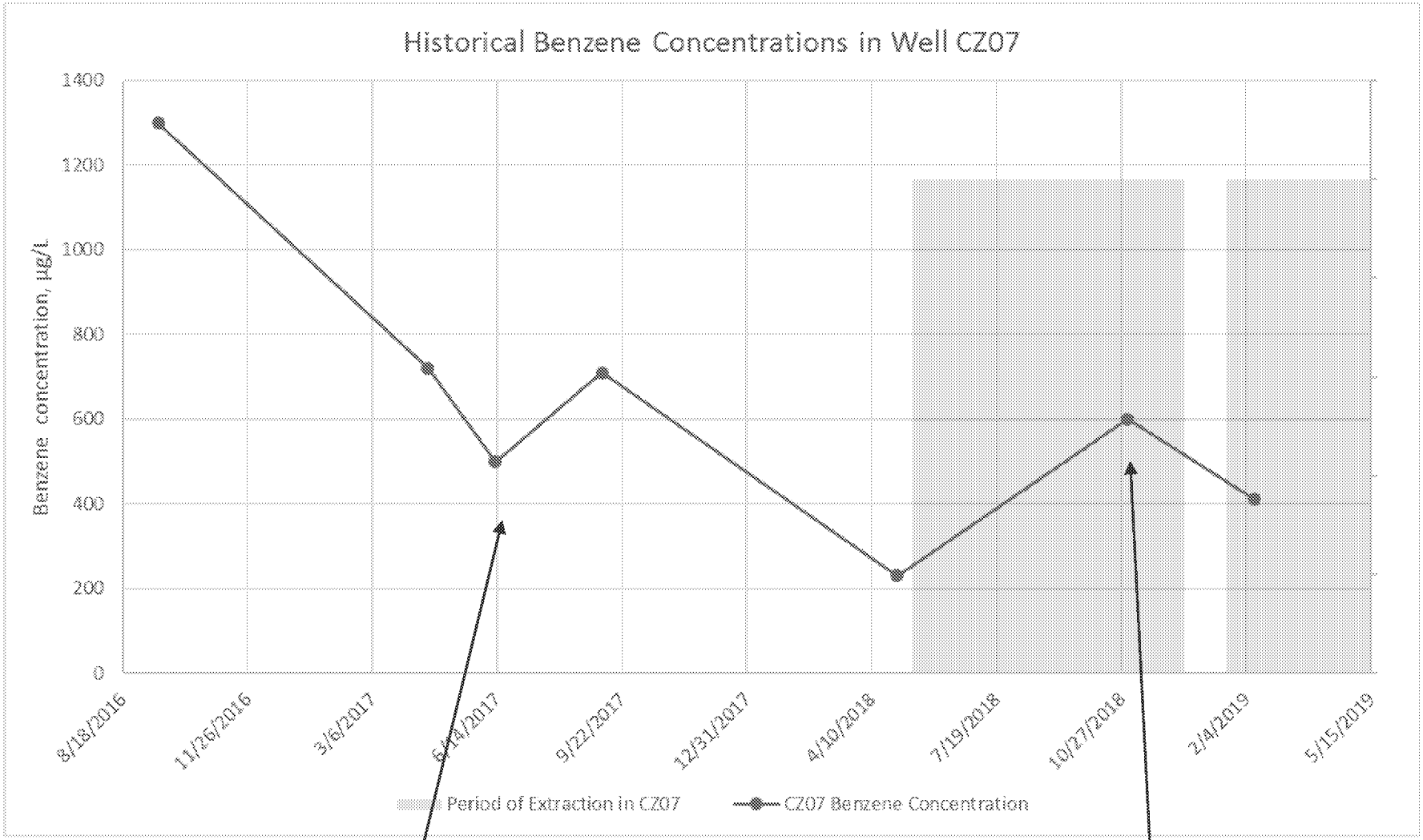
Update on Benzene Concentration in ST012-CZ23 (includes preliminary results from 2 May 2019)

ED_005025_00010438-00028

CZ23 Sampling Summary



CZ07 Sampling Summary



Benzene decreased between end of SEE and April 2018

Benzene has fluctuated between 230 and 600 µg/L during extraction for pilot study

ED_005025_00010438-00030

Pilot Study Injection/Extraction Update

ED_005025_00010438-00031

Site ST012 Extraction System Performance

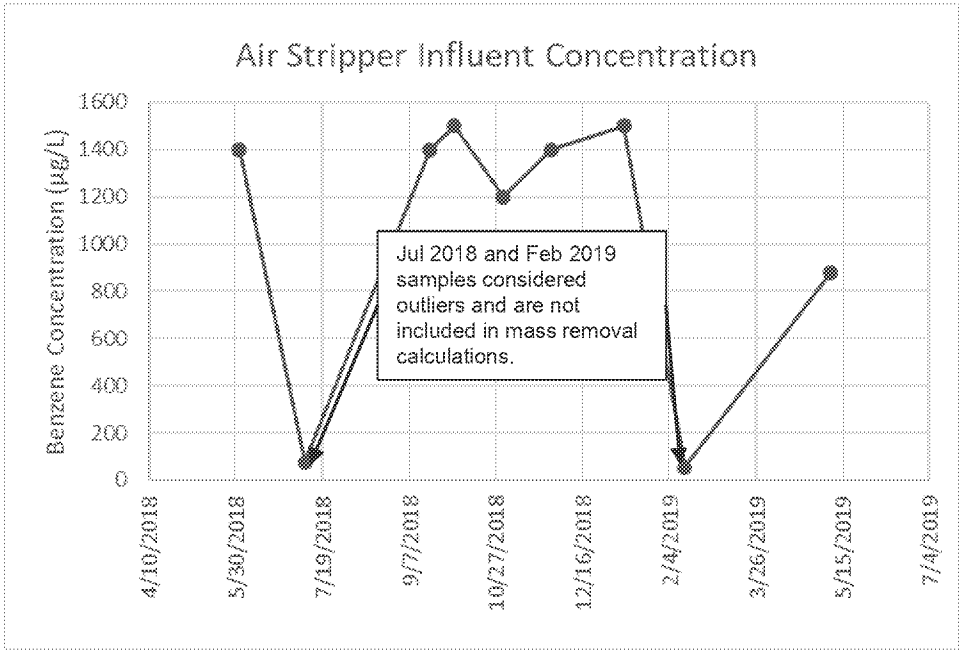
Extraction System Status Summary – May 2019

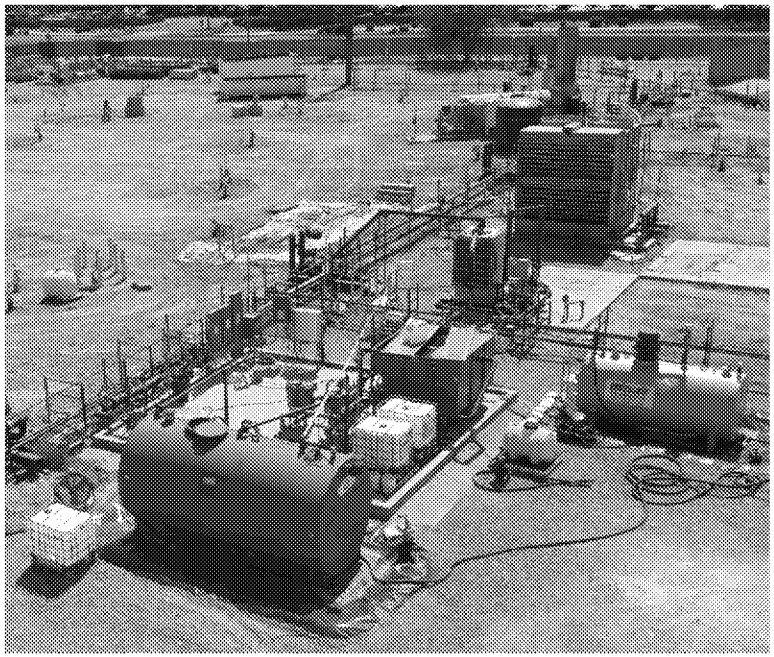
Extraction Well	Recent Instantaneous Measured Extraction Rate gpm	Calculated Average Extraction Rate in Period gpm	Maximum Temperature °F	Most Recent Temperature °F	Cumulative Extraction gallons	Note
ST012-CZ07	16.2		175	140	2,789,404	Pump was down for repairs, back running
ST012-CZ18	4.3		136	100	1,761,971	Pump is off, last reading for 3/27/19 listed
ST012-CZ19						Eliminated as an extraction well by FVM#7
ST012-CZ21	9	7.2	150	122	246,160	
ST012-UWBZ21		0.2	162	142	413,399	Pneumatic pump
ST012-UWBZ22			146	136	411,754	Recently changed to electric. Pump down
ST012-UWBZ26	5.6	3.2	133	120	1,860,504	
ST012-UWBZ27			128	94	129,197	Pneumatic pump, counter not working, extraction stopped
ST012-UWBZ30		0.1	172	72	1,396,565	Pneumatic pump
ST012-LSZ09	4	3.0	140	132	1,843,013	
ST012-LSZ11	7.1		139	76	1,212,815	Flow meter troubleshooting
ST012-LSZ12	4.4	1.6	130	108	1,362,026	
ST012-LSZ23	6.9	4.4	113	98	2,613,445	
ST012-LSZ28			162		18,899	Eliminated as an extraction well by FVM#7
ST012-LSZ29			>170		17	Eliminated as an extraction well by FVM#7
ST012-LSZ37	12.5	7.7	132	88	3,652,603	
ST012-LSZ38	2.6	1.7	160	90	595,391	
ST012-LSZ39	3.3	2.3	92	78	1,250,933	extraction stopped
ST012-UWBZ28/LSZ51	6.7	3.6	146	126	1,856,619	
Total of Wells		34.9			23,414,715	
Treatment System		48.8			17,828,798	

Data is preliminary

Site ST012 Extraction System Performance

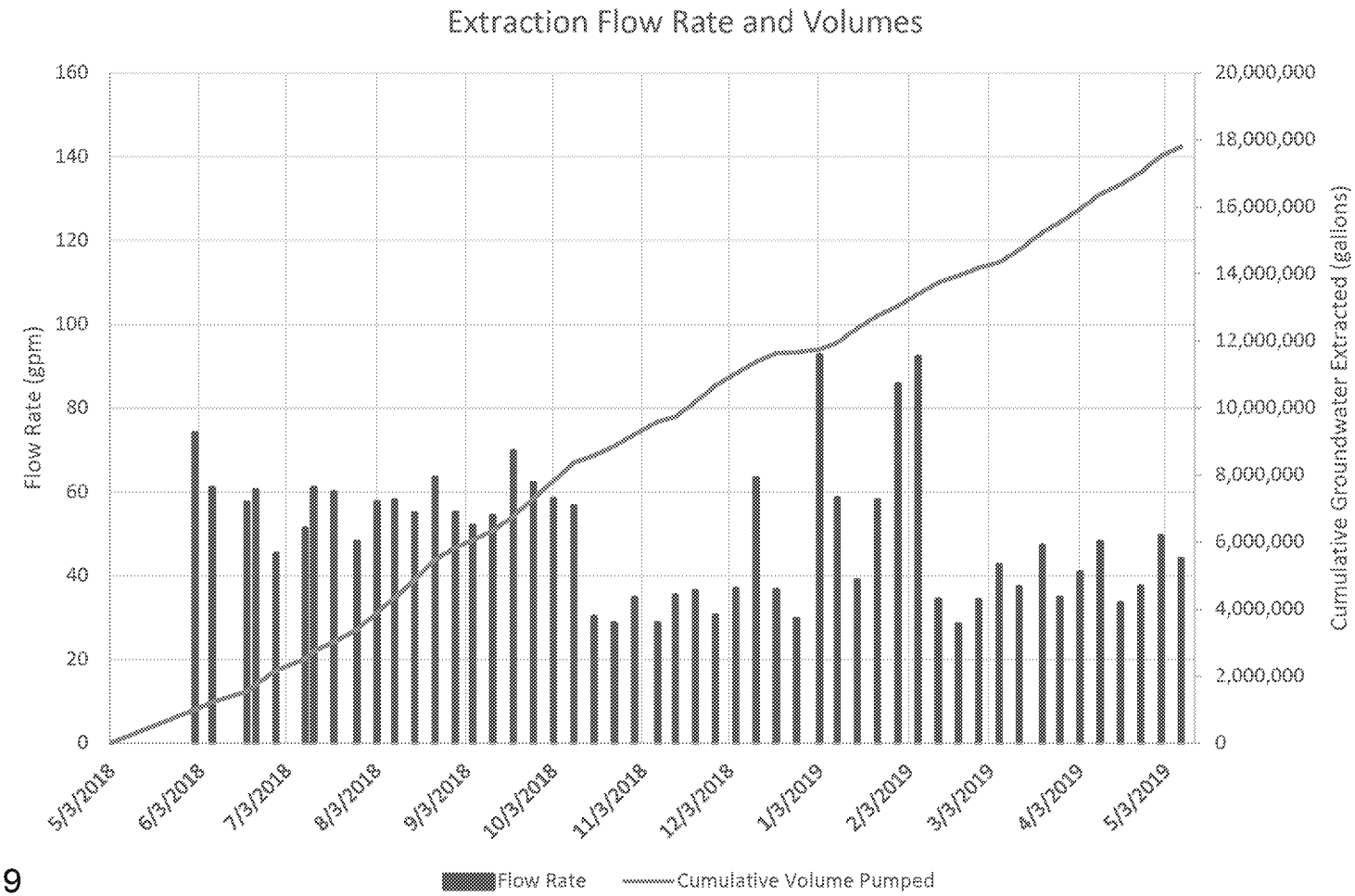
- No LNAPL has been recovered since extraction started up
- CZ18 and UWBZ22 currently down
- Benzene air stripper influent at ~880 µg/L for 24 Apr sample





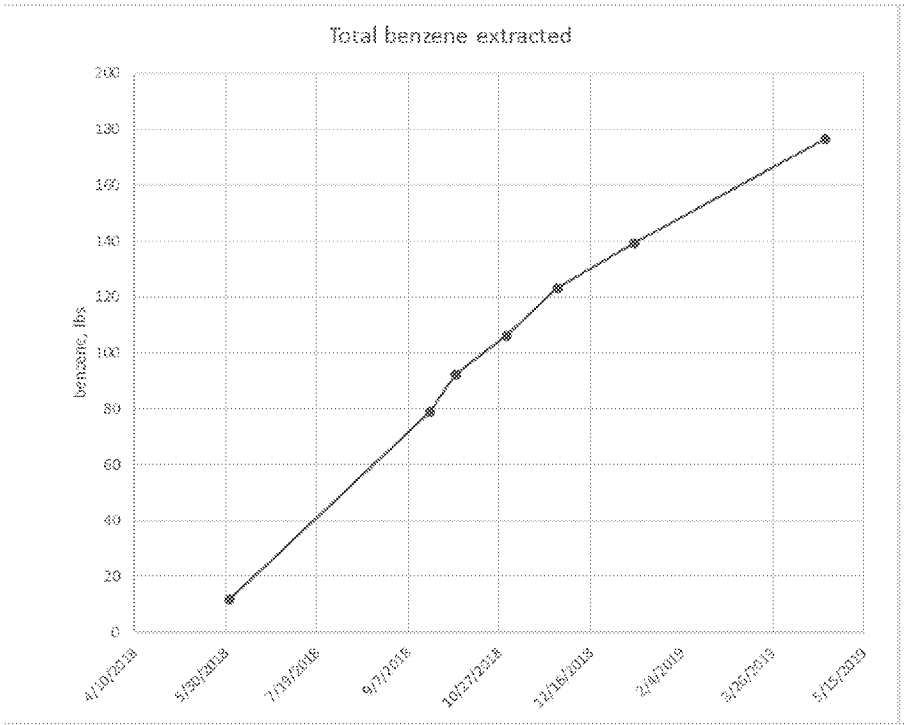
Site ST012 Extraction System Performance

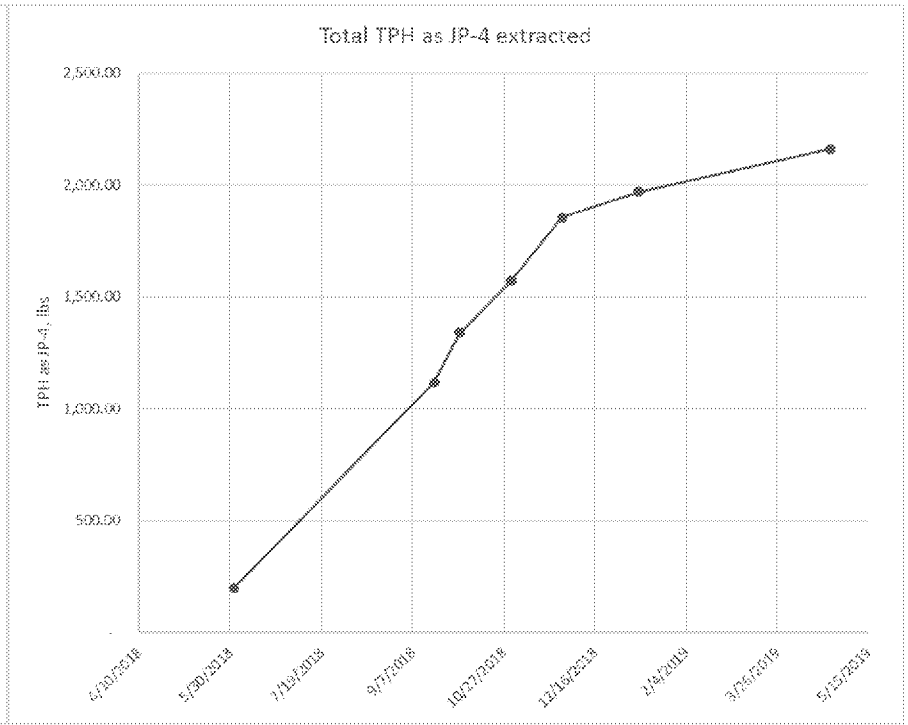
- **Overall Extraction Rates and Cumulative Volume Extracted**



Site ST012 Extraction System Performance

- **Estimated Mass Removal by Extraction**
- **Recent lower mass extraction is due to reduced benzene influent concentration in February. February sample was removed as an outlier in calculations. Most recent JP-4 mass was calculated based on GRO only**





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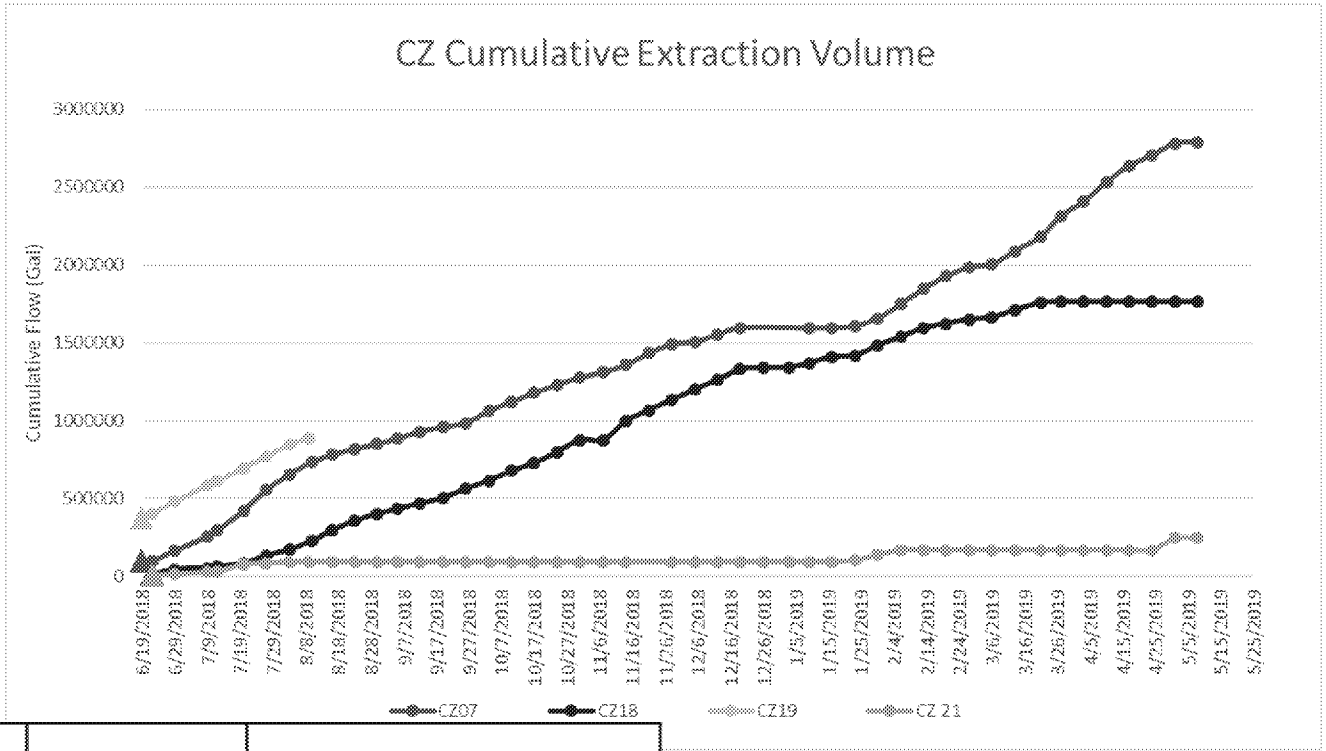
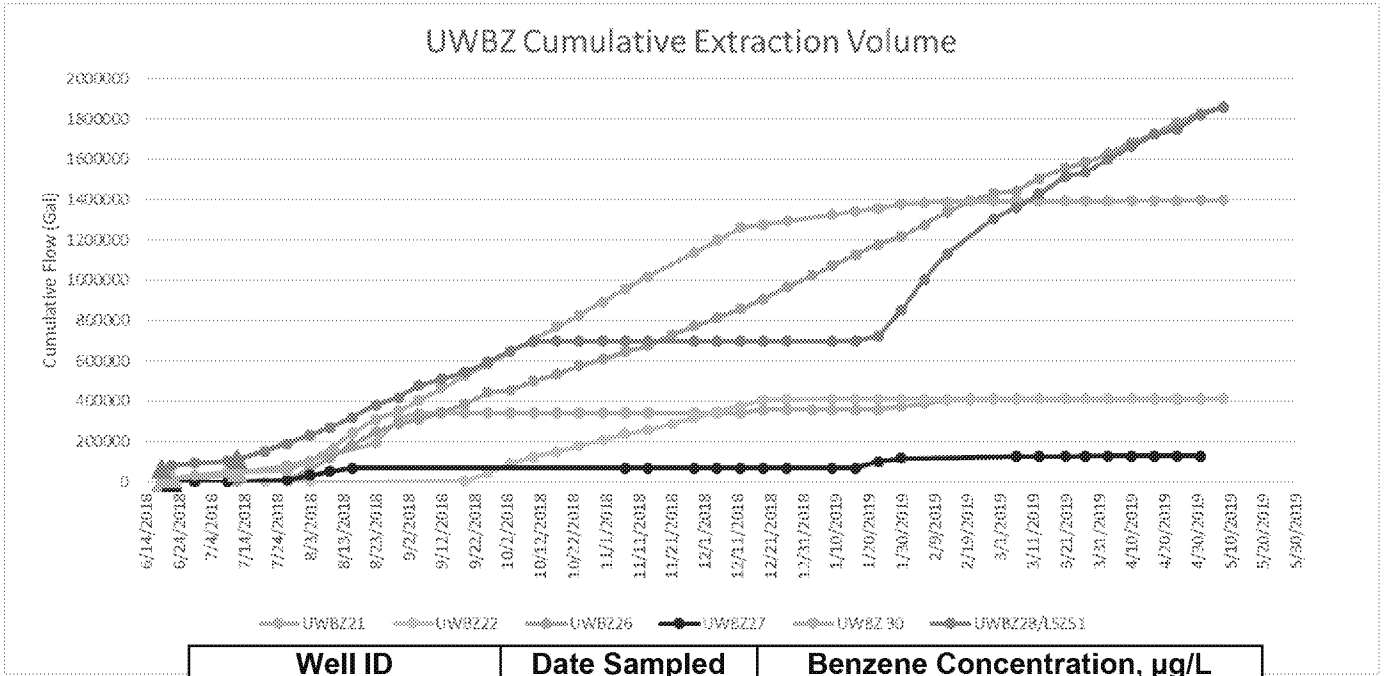
Cumulative Extraction Volume and Analytical Data by Well - Cobble Zone



Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-CZ07	4/30/2018	230
	11/1/2018	600
	2/11/2019	410
ST012-CZ18	4/3/2018	1200
	11/1/2018	260
	2/11/2019	260
ST012-CZ19	5/9/2018	3.1
ST012-CZ21	4/12/2018	680

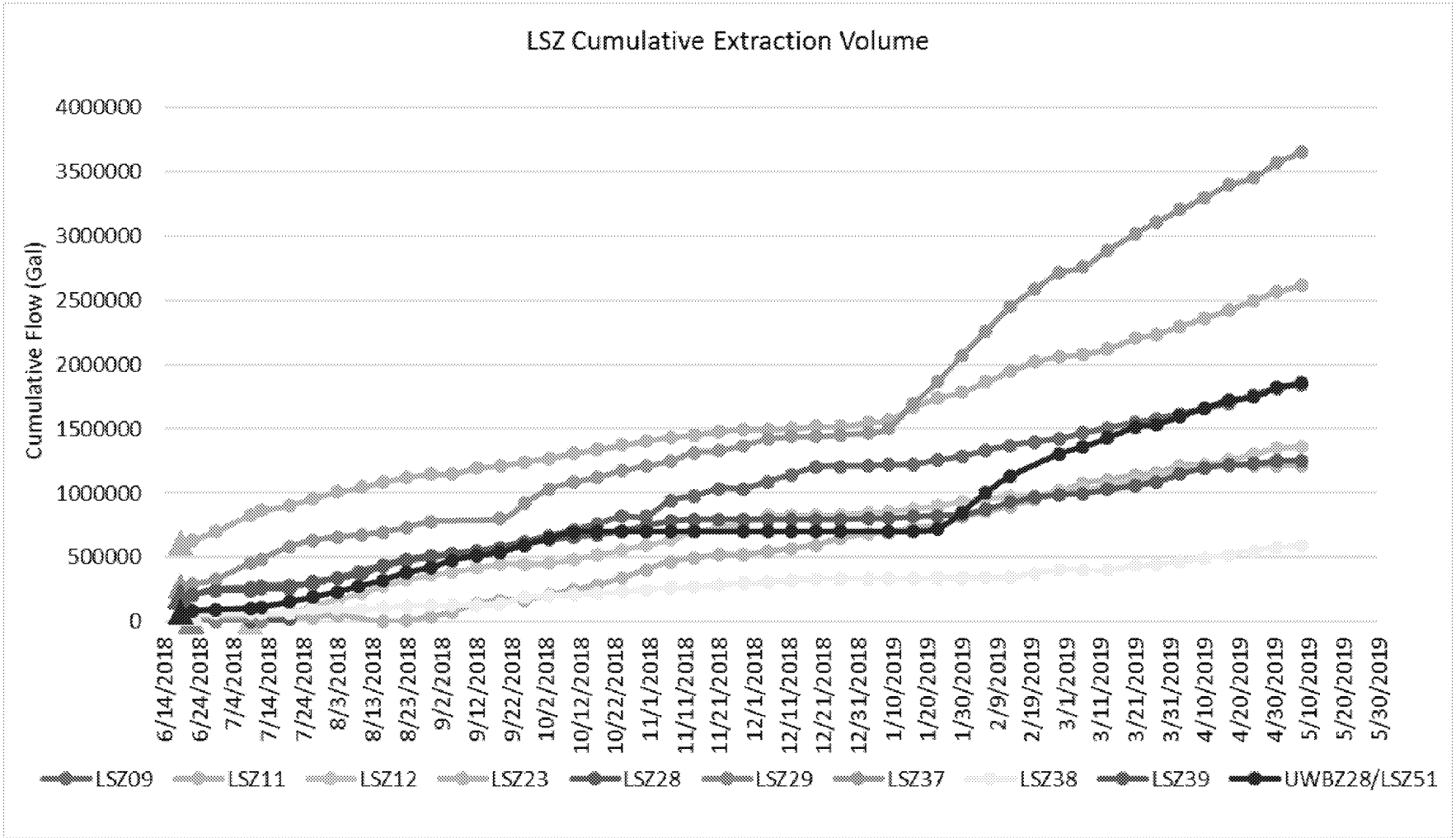
- Most recent baseline and operating (when available) benzene analytical result listed (Feb 2019 added)
- Individual well concentrations may be reduced with pumping

Cumulative Extraction Volume and Analytical Data by Well - Upper Water Bearing Zone



Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-UWBZ21	8/9/2017	3400
ST012-UWBZ22	5/9/2018	1900
	2/11/2019	2800
ST012-UWBZ26	4/3/2018	3500
	4/3/2018	3700
	2/12/2019	2900
ST012-UWBZ27	4/3/2018	1500
	2/12/2019	460
ST012-UWBZ28/LSZ51	5/9/2018	1700
	3/25/2019	650
ST012-UWBZ30	5/9/2018	6000
	2/13/2019	21

Cumulative Extraction Volume by Well
Lower Saturated Zone



Analytical Data by Extraction Well
Lower Saturated Zone

Well ID	Date Sampled	Benzene Concentration, µg/L
ST012-LSZ09	4/3/2018	2100
	2/12/2019	1000
ST012-LSZ11	5/9/2018	2100
	2/12/2019	3500
ST012-LSZ12	5/9/2018	1400
	11/1/2018	420
	2/12/2019	470
ST012-LSZ23	4/3/2018	1600
	2/12/2019	790
ST012-LSZ28	12/1/2016	110
ST012-LSZ29	4/10/2018	2.1
ST012-LSZ37	4/12/2018	2700
	2/12/2019	460
ST012-LSZ38	4/3/2018	3000
	11/1/2018	1300
	2/12/2019	2100
ST012-LSZ39	4/12/2018	3100/5500
	2/12/2019	130
ST012-UWBZ28/LSZ51	5/9/2018	1700
	3/25/2019	650

Site ST012 Injection Progress

- Injections continued in Apr-May
- Initial injections in UWBZ33, UWBZ34, UWBZ35, UWBZ36, W11, LSZ08, LSZ47, LSZ48, LSZ49, and SVE04D complete
- 124 tons injected through 10 May 2019 (of 169 tons planned for Subphase 1 – 73%)
- 45 tons injected since last update

Date	Volume (gallons)	Number of Bags of Sulfate Added	Calculated Na2SO4 Conc. g/L	Calculated SO4 Conc. g/L	Locations(% of volume if multiple locations)
4/18/2019	9,800	5	115	78	LSZ08
4/25/2019	6,000	3	113	76	LSZ08 (88%), LSZ47 (12%)
4/26/2019	6,000	3	113	76	LSZ47
4/29/2019	9,800	5	115	78	LSZ47
4/30/2019	9,800	5	115	78	LSZ48
5/1/2019	6,000	3	113	76	LSZ48 (42%), LSZ49 (58%)
5/1/2019	6,000	3	113	76	
5/3/2019	4,000	2	113	76	LSZ49
5/6/2019	6,000	3	113	76	LSZ49 (71%), CZ22 (29%)
5/7/2019	9,800	5	115	78	SVE04D
5/9/2019	9,800	5	115	78	data pending
5/10/2019	6,000	3	113	76	data pending

Site ST012 Injection Progress

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- Initial injections in UWBZ33, UWBZ34, UWBZ35, UWBZ36, W11, LSZ08, LSZ47, LSZ48, LSZ49, and SVE04D complete
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4/25/2019	6,000	3	113	76	LSZ08 (88%), LSZ47 (12%)
4/26/2019	6,000	3	113	76	LSZ47
4/29/2019	9,800	5	115	78	LSZ47
4/30/2019	9,800	5	115	78	LSZ48
5/1/2019	6,000	3	113	76	LSZ48 (42%), LSZ49 (58%)
5/1/2019	6,000	3	113	76	
5/3/2019	4,000	2	113	76	LSZ49
5/6/2019	6,000	3	113	76	LSZ49 (71%), CZ22 (29%)
5/7/2019	9,800	5	115	78	SVE04D
5/9/2019	9,800	5	115	78	data pending
5/10/2019	6,000	3	113	76	data pending

Site ST012 Sulfate Method Comparison

- **Sulfate concentrations compared:**
  - Calculated concentration based on batch mixes
  - Field screening concentration based on test kit
  - Laboratory concentration based on EPA method 9056
- **Initially, field screening methods were lower when compared to the calculated and lab results. Increased measurement precision for sample dilution has improved accuracy.**
- **Lab results fluctuate slightly above and below calculated concentrations but generally confirm calculated mix concentrations**

Date	Calculated SO4 Conc. g/L	SO4 Conc. g/L	Lab SO4 Conc. g/L
11/12/2018	97		
12/4/2016	65		63
1/9/2019	65		46
1/16/2019	81		43
1/24/2019	65		50
1/29/2019	65	2.97	46
2/5/2019	65	69.5	40
2/6/2019	65	115.2	44
2/18/2019	65	85.2	39
2/27/2019	65	80.4	68
2/28/2019	65	88	44
3/5/2019	65	103	37
3/6/2019	65	72.6	
3/15/2019	65	77.6	80
3/19/2019	65	84.8	
3/20/2019	70	88.1	
3/21/2019	65	88.4	75
3/27/2019	68	103.2	
3/28/2019	65	119.7	76
3/29/2019	66	97.2	
4/8/2019	97	114.4	
4/9/2019	81	104	
4/10/2019	57	73	
4/11/2019	82	108.8	83
4/17/2019	80	8.5	
4/18/2019	78	99	82
4/25/2019	76	100	
4/26/2019	76	101	
4/29/2019	78	95	
4/30/2019	78	113	
5/1/2019	76	99	
5/1/2019	76	94.5	
5/3/2019	76	95	
5/6/2019	76	78.3	
5/7/2019	78	110	
5/9/2019	78	88	
5/10/2019	76	110	

Site ST012 Sulfate Field Screening

- **Estimated travel times (from work plan, App F figures)**
  - UWBZ33 to UWBZ22 (130 ft): up to 10 months
  - UWBZ33 to UWBZ27 (115 ft): up to 15 months
  - UWBZ36 to UWBZ26 (60 ft): 1-2 months
  - W11 to LSZ39 (60 ft): 4-7 months
- **Model predicts sulfate concentrations would increase at extraction locations for several months before decreasing**
- **Sulfate field tests completed ~weekly in wells in proximity to injections**

Site ST012 Sulfate Field Screening

Injection Points	Extraction Well	Date	Sulfate (mg/L)
UWBZ33	UWBZ22 (average pre-injection laboratory sulfate = 11 mg/L)	12/17/2018	*30*
		12/21/2018	*45*
		12/26/2018	146
		1/15/2019	45
		1/18/2019	40
		1/21/2019	38
		1/24/2019	41
		1/25/2019	250
		1/28/2019	10
		1/29/2019	35
		1/31/2019	89
		2/1/2019	57
		2/5/2019	37
		2/11/2019	37
		2/15/2019	36
		2/18/2019	40
		2/22/2019	pump down
		2/25/2019	pump down
		3/1/2019	pump down
		3/4/2019	pump down
		3/8/2019	pump down
LSZ47	LSZ11	5/1/2019	630

Injection Points	Extraction Well	Date	Sulfate (mg/L)
UWBZ33 UWBZ34	UWBZ27 (average pre-injection laboratory sulfate = 108 mg/L)	12/17/2018	*15*
		12/21/2018	*30*
		12/26/2018	>150
		1/15/2019	71
		1/18/2019	57
		1/21/2019	66
		1/24/2019	48
		1/25/2019	50
		2/11/2019	54
		2/15/2019	48
		3/1/2019	94
		3/4/2019	112
		3/15/2019	119
		3/20/2019	97
		3/29/2019	350
		4/8/2019	297
		4/16/2019	520
		4/23/2019	1140
		4/26/2019	570
		5/1/2019	1110
W11	LSZ39 (average pre-injection sulfate = 132 mg/L)	3/29/2019	850
		4/9/2019	153
		4/16/2019	210
		4/23/2019	1220
		4/26/2019	1230
		5/1/2019	1180

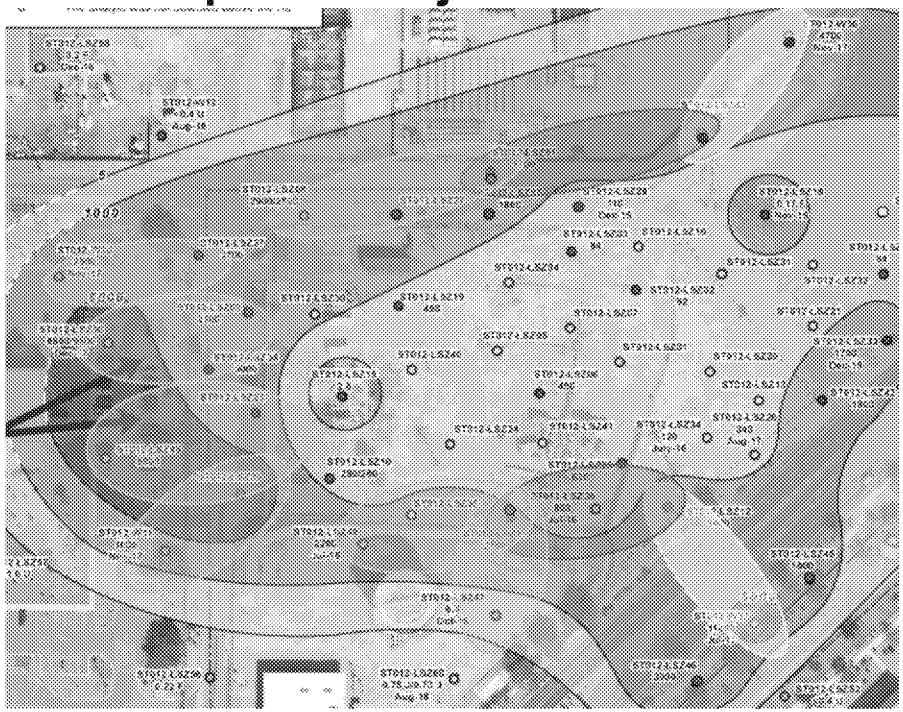
Injection Points	Extraction Well	Date	Sulfate (mg/L)
UWBZ36	UWBZ26 (average pre-injection sulfate = 3.6 mg/L)	1/31/2019	22
		2/1/2019	9
		2/5/2019	25
		2/11/2019	10
		2/15/2019	12
		2/18/2019	16
		2/22/2019	22
		2/25/2019	38
		3/1/2019	66
		3/4/2019	67
		3/8/2019	104
		3/15/2019	101
		3/29/2019	99
		4/9/2019	81
		4/16/2019	150
LSZ08	LSZ37	4/23/2019	20
		4/26/2019	70
		5/1/2019	77
	LSZ51	4/23/2019	6
		4/26/2019	18
		5/1/2019	12

Site ST012 Sulfate Field Screening

- Extraction pumps turned off in UWBZ27 and LSZ39 in response to obtaining adequate sulfate concentration in groundwater
- Field screening test for sulfate reducing bacteria at extraction well conducted at shut down (supplemental to Pilot Study Work Plan)
  - UWBZ27 1.15×10^5 cfu/ml
  - LSZ39 325 to 1400 cfu/ml
- Sampling each extraction well ~2 weeks after shutdown for VOCs, sulfate, and field screening SRB test
- Sulfate screening at UWBZ24 and LSZ10 (downgradient of extraction wells UWBZ27 and LSZ39) will be initiated

Site ST012 Path Forward May-Jun

- Continued SVE operation
- Continue pump repairs
- Pilot Study Implementation
  - Continue mixing sulfate batches and inject according to plan (FVM7) May – Jun
  - Remaining injection wells UWBZ23, LSZ50, W30, W36, W37
  - Begin Phase 1 subphase 2 injections



Air Force Civil Engineer Center

BCT GENERAL UPDATE

BCT Conference Call

21 May 2019

Air Force Civil Engineer Center

2019 BCT MEETINGS/CONFERENCE CALLS SCHEDULE DELIVERABLE TRACKING

BCT Conference Call

21 May 2019

ACTION ITEMS

BCT Conference Call
21 May 2019