



Florida Department of Environmental Protection

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Lt. Governor

Noah Valenstein
Secretary

November 29, 2018

Ms. Sallie Ford
Florida Department of Health
Environmental Health
135 NE Hernando Ave.
Lake City, FL 32055

RE: Quarterly monitoring report for Experimental Drainfield at
Ichetucknee Springs State Park, 12887 W S Hwy 27, Ft. White, FL 32308
(Permit 14-0156M)

Dear Sallie:

According to this project's study plan under the Memorandum of Understanding between the Department of Environmental Protection and the Department of Health, we would provide quarterly reports on the monitoring activities and results for the experimental drainfield study being conducted at the Park Manager's residence. This report provides findings for monthly and quarterly monitoring through September 2018.

There have been 24 sampling events since this project began. During the first year of operation, monitoring occurred monthly. Since then, monitoring frequency has been reduced to quarterly. **Figure 1** shows the experimental drainfield and monitoring stations, and **Tables 1** and **2** provide a summary of the monitoring results. **Figure 2** presents monthly rainfall for Ichetucknee Springs State Park. Graphs depicting chloride, Total Nitrogen (TN), and Total Phosphorous (TP) concentrations in the shallow/deep lysimeters and effluent are presented as **Figures 3** through **8**.

Effluent loading to the drainfield has changed since a change in occupancy of the residence. The number of residents has not changed, but the new park manager and his wife appear to have different water use practices than the previous residents which have resulted in an approximate 40% decrease in effluent chloride and TN concentrations since April 2016. Average chloride and TN concentrations in effluent for the monitoring period prior to the April 2016 were 108 and 100 mg/L, respectively. The average chloride and TN effluent concentrations for the period since April 2016 are 49 and 53

mg/L, respectively, and are now more consistent with typical STE concentrations from the literature. These decreases are most likely due to dilution from higher water use.

Figures 9 through 12 compare monthly rainfall to TN concentrations found within the shallow and deep lysimeters. TN concentrations and seasonal rains are monitored during the summer months for any potential dilution factor. A rain gauge located within the park at the south entrance and adjacent to the park manager's home is used to document rainfall (**Figure 2**). Rainfall data and TN trend plots continue to show no significant correlation between rainfall amounts and nutrient concentrations at any of the monitoring locations (**Figures 9 and 10**). Continued monitoring of rainfall and water quality data is necessary.

Depth to ground water in the monitoring wells on June 6, 2018 (W-2) was approximately 25 feet below land surface elevation (**Table 2**). There continues to be no measurable water in the piezometer (P1) placed below the drainfield at a depth just above the mulch layer.

As noted in previous quarterly reports, minor settling of the land surface in the areas of the drainfield have been observed. A second survey was conducted in December of 2017 to collect measurements of land surface on top of the drainfield infiltration chamber row and the actual tops of the drainfield infiltration chambers to evaluate and quantify subsidence. Those results are shown in **Figures 13 and 14**.

In addition, a hand auger was used to collect mulch samples to evaluate the condition of the lignocellulose treatment layer and to evaluate the decomposition of the material over time. Observed subsidence on the far end of the drainfield, furthest from the septic tank effluent, could be due to mulch decomposition and subsequent land surface elevation settling. Mulch samples continue to show slight degradation, but remains woody in a mostly saturated condition (**Figure 15**). Additional hand augured samples of the mulch will be taken during quarterly sampling events to document ongoing conditions.

Please let me know if you have any questions.

Sincerely,

Michael J. Dalsis, P.W.S.
Environmental Consultant
Groundwater Management Section

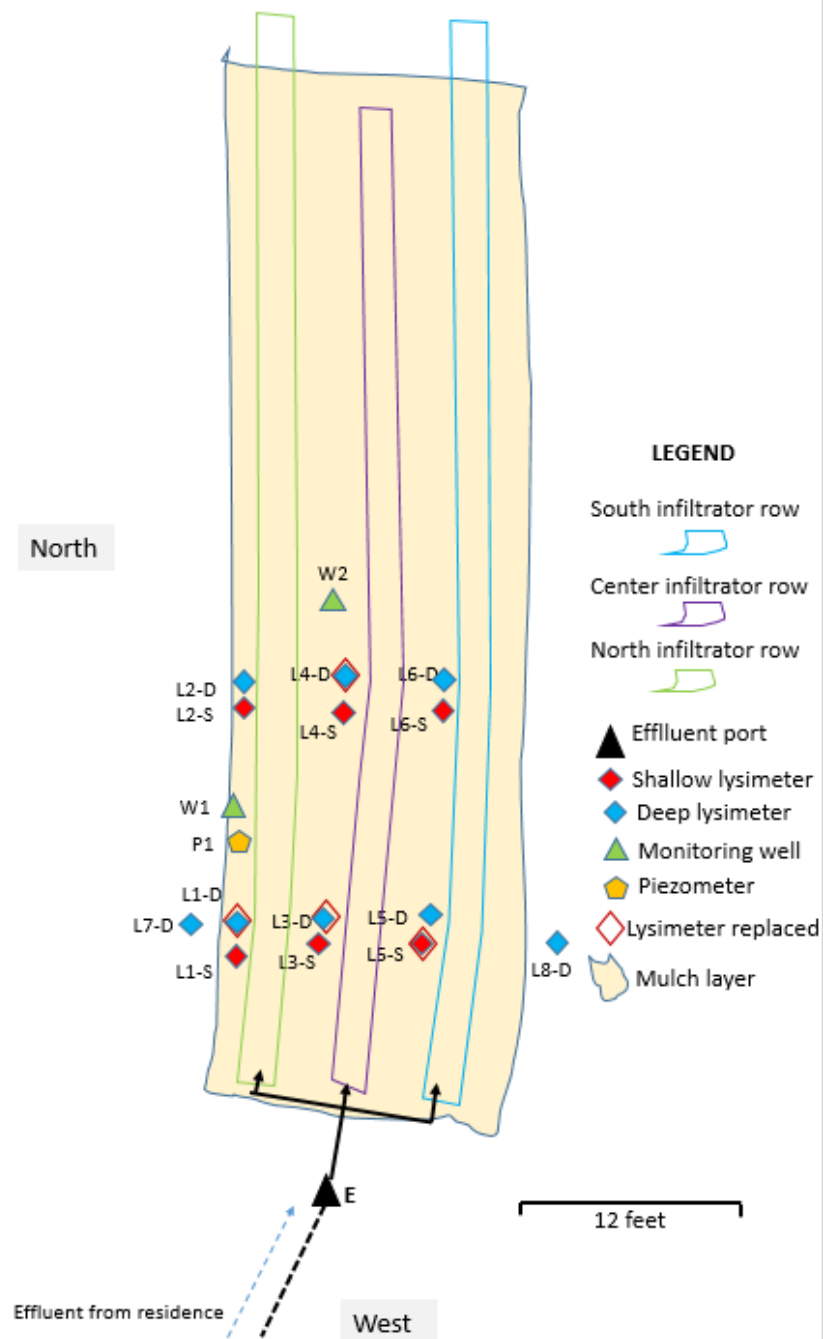


Figure 1. Drainfield diagram and monitoring stations

Table 1. Summary of monitoring results (see notes at end of table)

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
E	4/17/2014	93		89		0.014	89	9.9
	6/4/2014	160	96	100	4	BDL	100	13
	6/25/2014	130	85	100	15	0.008	100	13
	8/19/2014	54	64	65	1	0.006	65	7.7
	9/17/2014	90	87	110	23	BDL	110	9.9
	10/15/2014	110	74	81	7	BDL	81	8.1
	12/17/2015	170	67	260	193	0.032	260	44
	1/27/2015	100	84	87	3	BDL	87	9.5
	2/26/2015	99	60	81	21	BDL	81	8.8
	3/25/2015	95	72	81	9	BDL	81	8.3
	4/30/2015	97	83	99	16	BDL	99	11
	8/20/2015	130	72	87	15	0.005	87	8.5
	11/17/2015	98	70	75	5	BDL	75	9.0
	2/10/2016	82	68	90	22	BDL	90	10
	5/3/2016	160	62	71	9	0.059	71	9.4
	7/19/2016	42	52	60	8	0.008	71	6.9
	10/12/2016	38	52	60	8	BDL	60	8
	3/15/2017	32	46	54	8	BDL	54	6.7
	6/29/2017	42	4.4	51	47	BDL	51	9.5
	9/20/17	35	51	56	5	BDL	56	7.3
	12/7/2017	29	47	41	0	BDL	41	8.9
	2/28/2018	33	38	46	8	BDL	46	14.0
	6/6/2018	30	36	42	6	0.013	42	6.3
	9/6/2018	26	31	37	6	BDL	37	6.3
L-1S	4/17/2014	87		8.4		91	99	0.18
	6/4/2014	110	0.069	1.7	1.6	74	76	2.1
	6/25/2014	100	0.039	1.6	1.6	57	59	3.2
	8/19/2014	62	0.036	0.8	0.76	56	57	4.1
	9/17/2014	67	0.064	1.2	1.1	42	43	5.9
	10/15/2014	77	0.019	1.0	0.98	68	69	2.7
	12/17/2014	140	0.020	1.1	1.1	59	60	6.1
	1/27/2015	71	0.013	1.1	1.1	57	58	5.5
	2/26/2015	110	0.014	1.4	1.4	50	51	5.6
	3/25/2015	92	0.009	0.6	0.63	47	48	5.7
	4/30/2015	76	0.001	BDL	0.00	60	60	3.8
	8/20/2015	100	0.011	1.5	1.5	67	69	6.3
	11/17/2015	81	0.004	1.0	0.95	50	51	5.2
	2/10/2016	25	0.008	1.6	1.5	28	30	6.2

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-1S	5/3/2016	92	0.007	0.9	0.9	3.5	4.4	3.8
	7/14/2016	33	0.018	1.3	1.3	42	43	4.5
	10/12/2016	26	0.006	1.4	1.4	29	30	3.4
	3/15/2017	31	BDL	0.8	0.8	65	66	2.1
	6/29/2017	38	0.007	1.0	1.0	30	31	3.8
	9/20/2017							
	12/7/2017	31	0.004	0.8	0.8	43	44	3.6
	2/28/2018	30	0.013	0.7	0.7	26	27	3.7
	6/6/2018	7	0.006	0.9	0.9	11	12	4.8
	9/6/2018	22	BDL	0.6	0.6	30	31	2.7
L-1D	4/17/2014	94		15		9	24	0.26
	6/4/2014	120	0.13	2	1.9	36	38	0.18
	6/25/2014	140	0.054	1.6	1.5	37	39	0.16
	8/19/2014	64	0.20	1.7	1.5	34	36	0.17
	9/17/2014	58	0.17	1.3	1.1	19	20	0.12
	10/15/2014	71	0.09	1.2	1.1	43	44	0.10
	12/17/2014	120	0.02	0.8	0.78	56	57	0.19
	1/27/2015	86	0.01	1.1	1.1	60	61	0.97
	2/26/2015	98	0.00	BDL	BDL	50	50	1.6
L-1D(2)	1/27/2015	80	0.07	1.0	0.93	66	67	6.5
	2/26/2015	110	0.04	1.0	0.97	56	57	5.0
	3/25/2015	79	0.07	1.0	0.88	32	33	5.1
	4/30/2015	70	0.11	0.9	0.76	44	45	3.8
	8/20/2015	96	0.07	1.5	1.4	27	29	2.0
	11/17/2015	110	0.03	1.0	0.97	40	41	2.0
	2/10/2016	41	0.01	0.9	0.85	47	48	1.8
	5/3/2016							
	7/14/2016	53	0.01	0.7	0.65	5.8	6.5	2.5
	10/12/2016	36	BDL	0.6	0.62	16	17	1.6
	3/15/2017							
	6/29/2017	11	0.019	0.9	0.90	2	3	2.1
	9/20/2017							
	12/07/2017	31	0.005	0.6	0.55	25	26	2.5
	2/28/2018		0.005	0.6	0.64	34	35	4.4
	6/6/2018	17	0.004	0.7	0.68	8	8	4.6
	9/6/2018	22	0.005	0.5	0.54	32	33	4.0
L-2S	4/17/2014	6.5		1.6		12	14	0.13
	6/4/2014	17	0.092	1.1	1.0	24	25	0.13
	6/25/2014	2.3	0.028	1.1	1.1	21	22	0.21

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-2S	8/19/2014	0.6	0.032	1.3	1.3	1.3	2.6	0.86
	9/17/2014	24	0.029	1.1	1.1	12	13	0.16
	10/15/2014	81	0.160	1.2	1.0	48	49	0.13
	12/17/2014	130	0.034	1.0	0.97	58	59	0.26
	1/27/2015	5	0.010	0.5	0.44	7.8	8.3	0.10
	2/26/2015	22	0.130	0.9	0.74	16	17	0.001
	3/25/2015	33	0.150	0.8	0.65	22	23	0.009
	4/30/2015	76	0.013	BDL	BDL	53	53	0.12
	8/20/2015	90	0.560	2.2	1.6	54	56	0.38
	11/17/2016	84	0.004	1.2	1.2	60	61	0.59
	2/10/2016	5	0.130	1.0	0.8	7	8	0.16
	5/3/2016	2.3	0.089	0.8	0.68	2.4	3.2	0.08
	7/19/2016	4.9	0.320	1.0	0.65	17	18	0.024
	10/12/2016	2.3	0.009	1.4	1.4	18	19	0.04
	3/15/2017	3.0	0.010	0.8	0.8	2	3	0.03
	6/29/2017	0.6	0.006	0.7	0.7	0.4	1	0.03
	9/20/2017							
	12/7/2017	5.5	0.012	0.6	0.6	1.2	2	0.01
	2/28/2018	4.0	0.007	0.6	0.6	2.6	3	0.01
	6/6/2018	1.4	0.008	1.0	0.96	1.6	3	0.02
	9/6/2018	5.4	0.007	0.7	0.71	10	11	0.01
L-2D	4/17/2014	13		0.43		0.18	0.61	0.18
	6/4/2014	66	0.018	1.5	1.5	0.21	1.7	0.29
	6/25/2014							
	8/19/2014		0.26	4.2	3.9	BDL	4.2	0.41
	9/17/2014							
	10/15/2014							
	12/17/2014							
	2/26/2015		0.008	1.4	1.4	4.0	4.2	0.29
	3/25/2015							
	4/30/2015							
	8/20/2015							
	11/17/2015		0.005	1.4	1.4	4.3	5.7	0.03
	2/10/2016		0.028	2.6	2.6	9.2	11.8	0.17
	5/3/2016		0.019	2.3	2.3	2.4	4.7	0.18
	7/19/2016	32	0.017	2.2	2.2	4.2	6.4	0.30
	10/12/2016	25	0.013	1.0	0.9	3.7	4.7	0.20
	3/15/2017	29	BDL	0.5	0.5	0.9	1.5	0.13
	6/29/2017	4	0.011	1.5	1.5	1.7	3.2	0.32

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-2D	9/20/2017							
	12/07/2017	30	0.005	1.2	1.2	21	22	0.48
	2/28/2018	25	0.004	0.9	0.9	26	27	1.90
	6/6/2018	17	0.005	0.8	0.8	7	7	2.20
	9/6/2018	9	0.004	0.8	0.8	6	7	1.50
L-3S	4/17/2014	69		16		29	45	0.44
	6/4/2014	74	0.10	1.5	1.4	52	54	2.6
	6/25/2014	82	0.031	1.4	1.4	65	66	4.8
	8/19/2014							
	9/17/2014	64	0.034	1.2	1.2	53	54	3.5
	10/15/2014	78	0.005	0.8	0.80	70	71	3.0
	12/17/2014	140	0.015	0.8	0.78	59	60	4.0
	1/27/2015	61	0.012	1.4	1.4	50	51	6.1
	2/26/2015			0.9	0.89	39	40	4.7
	3/25/2015	63	0.008	0.9	0.89	25	26	3.6
	4/30/2015	76	0.010	1.6	1.6	50	52	3.6
	8/20/2015	94	0.009	1.2	1.2	61	62	4.9
	11/17/2015	82	0.004	1.0	1.0	54	55	5.6
	2/10/2016	25	0.010	1.1	1.1	30	31	7.5
	5/3/2016	66	0.009	1.1	1.1	6.9	8.0	3.9
	7/14/2016	45	0.010	1.1	1.1	51	52	4.1
	10/12/2016							
	3/15/2017							
	6/29/2017							
	9/20/2017							
	12/7/2017							
	2/28/2018							
	6/6/2018							
	9/6/2018							
L-3D(2)	1/27/2015	85	0.018	0.87	0.85	42	43	3.5
	2/26/2015	94	0.038	1.0	0.96	14	15	3.9
	3/25/2015	90	0.053	0.75	0.70	0.26	1.0	2.6
	4/30/2015							
	8/20/2015	120						
	11/17/2015							
	2/10/2016							
	7/14/2016	54	0.077	0.84	0.76	0.07	0.91	0.57
	10/12/2016	33	0.005	0.67	0.67	19	19.67	0.40
	3/15/2017	32	0.053	0.38	0.33	1.9	2.28	0.23

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-3D(2)	6/29/2017	30	0.008	0.54	0.53	3.4	3.9	0.33
	9/20/2017							
	12/07/2017		0.012	0.49	0.48	2.0	2	0.61
	2/28/2018							
	6/6/2018							
	9/6/2018							
L-4S	4/17/2014	3.9		0.63		11	12	0.11
	6/4/2014	1.2	0.013	0.93	0.92	12	13	0.18
	6/25/2014	0.43	0.007	0.87	0.86	6.0	6.9	0.11
	8/19/2014	0.25	0.047	0.87	0.82	3.2	4.1	0.12
	9/17/2014	0.32	0.045	0.57	0.53	2.7	3.3	0.07
	10/15/2014	0.91	0.030	0.53	0.50	13	14	0.05
	12/17/2014	4.2	0.028	0.47	0.44	15	15	0.03
	1/27/2015	2.7	2.000	2.20	0.20	6.7	8.9	0.03
	2/26/2015	96	13.000	15.00	2.00	36	51	0.27
	3/25/2015	88	2.200	3.10	0.90	54	57	2.2
	4/30/2015	64	0.008	0.84	0.83	46	47	1.1
	8/20/2015	2.7	0.008	0.97	0.96	5.0	6.0	0.39
	11/17/2015	75	0.004	BDL	0.004	53	53	0.30
	2/10/2016	5	0.004	0.60	0.60	3.6	4.2	1.40
	5/3/2016	18	0.005	0.99	0.99	33	34.0	0.77
	7/19/2016	2.8	0.004	0.55	0.55	2.90	3.5	0.40
	10/12/2016	35	0.006	0.81	0.80	45	45.8	2.40
	3/15/2017	30	BDL	0.80	0.80	54	54.8	3.70
	6/29/2017	4	BDL	0.82	0.82	3.4	4.2	1.00
	9/20/2017	17	BDL	0.68	0.68	19	19.7	0.26
	12/7/2017	31	0.008	0.81	0.80	38	38.8	3.90
	2/28/2018	33	0.025	0.65	0.63	44	44.7	7.60
	6/6/2018	18	0.003	0.62	0.62	22	22.6	4.20
	9/6/2018	16	BDL	0.49	0.49	20	20.5	1.60
L-4D	4/17/2014	12		0.70		0.09	0.79	0.02
	6/4/2014		0.046	2.50	2.45	0.31	2.8	0.15
L-4D(2)	1/27/2015	80	0.370	1.70	1.33	62	64	2.20
	2/26/2015	69	0.120	1.50	1.38	20	22	1.70
	3/25/2015	83	0.031	1.00	0.97	6.9	7.9	1.10
	4/30/2015	70	0.011	0.74	0.73	7.3	8.0	0.49
	8/20/2015	110	0.030	1.00	0.97	2.8	3.8	0.47
	11/17/2015	120	0.033	0.55	0.52	15	16	0.29
	2/10/2016	46	0.023	0.69	0.67	38.0	39	0.16

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-4D(2)	5/3/2016		0.011	0.51	0.50	5.0	5.5	0.18
	7/19/2016	80	0.007	0.73	0.72	2.1	2.83	0.24
	10/12/2016	31	BDL	0.97	0.97	42	42.97	0.10
	3/15/2017	33	BDL	0.45	0.45	16	16.45	0.06
	6/29/2017		0.008	0.42	0.41	4.3	4.72	0.07
	9/20/2017		0.013	0.64	0.63	13	13.64	0.08
	12/07/2017	33	0.006	0.40	0.39	35	35	0.06
	2/28/2018	28	0.003	0.43	0.43	36	36.43	0.04
	6/6/2018	28	0.003	0.41	0.41	33	33.41	0.04
	9/6/2018	27	0.005	0.40	0.40	30	30.40	0.10
L-5S	4/17/2014							
	6/4/2014	2	0.11	1.50	1.39	18	20	0.20
	6/25/2014							
	8/19/2014		0.16	1.80	1.64	34	36	0.21
	9/17/2014							
	10/15/2014	0.34	0.014	1.20	1.19	6.5	7.7	0.17
	12/17/2014	13	0.025	0.96	0.94	17	18	0.08
	1/27/2015	2.0	0.025	0.89	0.87	8.9	9.8	0.08
	2/26/2015	4.7	0.011	0.71	0.70	4.9	5.6	0.07
L-5S(2)	1/27/2015	40	0.023	1.40	1.38	40	41	2.9
	2/26/2015	42	0.015	1.20	1.19	52	53	6.8
	3/25/2015	92	0.049	1.00	0.95	40	41	7.8
	4/30/2015	22	0.001	0.81	0.81	21	22	0.05
	8/20/2015	7.2	0.028	1.30	1.27	8.6	9.9	0.05
	11/17/2015	49	0.016	0.77	0.75	33	34	0.03
	2/10/2016	6	0.013	0.72	0.71	3.60	4	0.03
	5/3/2016	120	0.032	1.10	1.07	28	29	4.9
	7/14/2016	44	0.014	1.00	0.99	41	42	5.9
	10/12/2016	39	0.006	0.70	0.69	35	36	4.8
	3/15/2017	32	0.007	0.49	0.48	33	33	4.9
	6/29/2017	37	0.017	0.85	0.83	35	36	4.9
	9/20/2017							
	12/7/2017	31	0.014	0.50	0.49	27	27.5	6.2
	2/28/2018	32	0.009	BDL	0.01	26	26	8.3
	6/6/2018	28	0.004	0.75	0.75	38	38.8	5.4
	9/6/2018	27	0.003	0.45	0.45	27	27.5	5.9
L-5D	4/17/2014	16		2.2		BDL	2.2	0.48
	6/4/2014	79	0.068	1.4	1.33	0.30	1.7	0.55
	6/25/2014	140	0.048	1.2	1.15	0.36	1.6	0.54

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-5D	8/19/2014	110	0.072	1.1	1.03	0.36	1.5	0.64
	9/17/2014	24	0.100	1.2	1.10	1.1	2.3	0.65
	10/15/2014	9.1	0.038	1.3	1.26	3.0	4.3	0.52
	12/17/2014	79	0.014	0.7	0.64	38	39	0.53
	1/27/2015	100	0.010	0.9	0.84	14	15	0.43
	2/26/2015	97	0.012	0.7	0.67	8.9	9.6	0.40
	3/25/2015	100	0.011	0.6	0.60	11	12	0.33
	4/30/2015	99	0.016	0.7	0.64	20	21	0.32
	8/20/2015	87	0.040	1.1	1.06	1.8	2.9	0.55
	11/17/2016	95	0.005	1.6	1.60	110	112	0.31
	2/10/2016	110	0.008	1.1	1.09	97.0	98	0.26
	5/3/2016		0.006	0.8	0.78	23.0	24	0.31
	7/14/2016	52	0.009	0.9	0.92	2.4	3	0.30
	10/12/2016							
	3/15/2017							
	6/29/2017							
	9/20/2017							
	12/07/2017							
	2/28/2018							
	6/6/2018							
	9/6/2018							
L-6S	4/17/2014	3.9		0.87		9.3	10	0.16
	6/4/2014	2.8	0.012	1	0.99	27	28	0.16
	6/25/2014							
	8/19/2014	0.43	0.10	1.5	1.40	9.80	11.3	0.14
	9/17/2014	0.58	0.051	0.82	0.77	3.90	4.7	0.12
	10/15/2014							
	12/17/2014							
	1/27/2015	2.7	0.015	0.75	0.74	13	14	0.04
	2/26/2015							
	3/25/2015		0.008	0.54	0.53	5.1	5.6	0.03
	4/30/2015	28	0.006	0.74	0.73	32	33	0.01
	8/20/2016	0.57	0.017	0.84	0.82	2.1	2.9	0.01
	11/17/2016							
	2/10/2016							
	5/3/2016							
	7/14/2016		0.018	0.52	0.50	0.91	1.43	0.01
	10/12/2016		0.014	0.75	0.74	38	38.75	0.01
	3/15/2017		BDL	0.34	0.34	0.61	0.95	0.01

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-6S	6/29/2017							
	9/20/2017							
	12/7/2017							
	2/28/2018							
	6/6/2018	29	0.004	0.43	0.43	3.80	4	5.80
	9/6/2018	26	0.002	0.56	0.56	4.10	5	6.40
L-6D	4/17/2014	17		1		0.004	1.0	0.34
	6/4/2014	21	0.073	2	1.93	0.49	2.5	0.53
	6/25/2014	23	0.028	1	1.37	0.15	1.6	0.34
	8/19/2014							
	9/17/2014	51	0.024	0.98	0.96	0.36	1.3	0.19
	10/15/2014	7.7	0.170	0.17	0.000	2.0	2.2	0.96
	12/17/2014	96	0.026	0.79	0.76	14	15	
	1/27/2015	94	0.019	0.79	0.77	8.2	9.0	0.35
	2/26/2015	110	5.2	6.5	1.3	25	32	0.08
	3/25/2015	92	0.010	0.76	0.75	3.1	3.9	0.06
	4/30/2015	72	0.005	0.70	0.70	5.4	6.1	0.06
	8/20/2015	120	0.023	1.1	1.1	11	12	0.90
	11/17/2015	100	0.010	0.74	0.73	14	15	1.90
	2/10/2016	52	0.021	0.77	0.75	42	43	2.60
	5/3/2016	120	0.005	0.83	0.83	14	15	3.40
	7/14/2016	43	0.014	0.81	0.80	4.3	5.1	3.90
	10/12/2016	38	0.014	0.74	0.73	14	15	2.70
	3/15/2017	33	0.011	0.57	0.56	10	11	2.70
	6/29/2017	6	0.006	0.68	0.67	7.9	8.6	3.20
	9/20/2017	14	0.006	0.70	0.69	6.8	8	5.00
	12/07/2017	25	0.012	0.77	0.76	10	10.8	3.80
	2/28/2018	28	0.003	0.34	0.34	3.3	3.6	4.40
	6/6/2018							
	9/6/2018							
L-7D	2/26/2016	19	0.01	1.0	0.99	17	18	0.15
	5/3/2016		0.061	1.1	1.04	9.2	10.3	1.60
	7/14/2016	26	0.014	1.6	1.59	1.6	3.2	0.13
	10/12/2016	29	0.01	0.93	0.92	30	30.93	0.033
	3/15/2017	29	BDL	0.68	0.68	20	20.68	0.013
	6/29/2017	1.6	0.013	0.66	0.65	1.8	2.5	0.013
	9/20/2017							
	12/7/2017	30	0.007	0.63	0.62	42	42.6	0.009
	2/28/2018							

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
L-7D	6/6/2018	0.7	0.008	0.56	0.55	1.5	2.1	0.009
	9/6/2018	1.4	0.009	0.65	0.64	10	11	0.006
L-8D	2/26/2016	23	0.007	1.20	1.19	17	18	0.49
	5/3/2016		0.066	1.40	1.33	0.83	2.2	1.60
	7/14/2016	10	0.028	1.60	1.57	7.6	9.2	1.90
	10/12/2016	43	0.022	1.10	1.08	34	35.1	0.43
	3/15/2017	23	0.014	0.81	0.80	8.2	9.0	0.21
	6/29/2017	2	0.008	1.20	1.19	0.8	2.0	0.21
	9/20/2017							
	12/07/2017	25	0.015	1.40	1.39	25	26	0.07
	2/28/2018	4	0.015	0.73	0.72	5	5.8	0.08
	6/6/2018	1	0.008	0.72	0.71	1	1.7	0.07
	9/6/2018		0.007	1.10	1.09	12	13.1	0.05
W-1	4/17/2014	1.9		0.14		3.3	3.4	0.01
	6/4/2014	1.9	0.003	0.10	0.097	2.6	2.7	0.03
	6/25/2014	2.9	0.008			3.1	3.1	0.20
	8/19/2014							
	9/17/2014	55	0.002	0.23	0.23	5.2	5.4	0.05
	10/15/2014	68	BDL	0.54	0.54	15	16	0.14
	12/17/2014	49	0.013	0.26	0.25	7.2	7.5	0.02
	1/27/2015	74	BDL	0.24	0.24	15	15	0.01
	2/26/2015	67	BDL	0.19	0.24	13	13	0.06
	3/25/2015	89	BDL	BDL	BDL	12	12	0.01
	4/30/2015	78	BDL	BDL	BDL	22	22	0.01
	8/20/2015	71	0.002	0.26	0.26	18	18	0.05
	11/17/2015	93	BDL	2.4	2.4	25	27	0.04
	2/10/2016	80	BDL	BDL	BDL	25	25	0.003
	5/3/2016	85	0.002	0.44	0.44	32	32	0.060
	7/19/2016	72	0.006	0.40	0.39	25	32	0.017
	10/12/2016	49	BDL	0.54	0.54	22	23	0.064
	3/15/2017	71	BDL	0.40	0.40	26	26	0.015
	6/29/2017	30	0.039	0.42	0.38	18	18	0.130
	9/20/2017	34	BDL	0.54	0.54	27	28	0.055
	12/7/2017							
	2/28/2018							
	6/6/2018							
	9/6/2018							
W-2	4/17/2014							
	6/4/2014	1.8	0.003	2.5	2.5	0.18	2.7	0.62

Station	Sample Date	Cl (mg/L)	NH4 (mg/L)	TKN (mg/L)	Org N (mg/L)	NO3+NO2 (mg/L)	TN (mg/L)	TP (mg/L)
W-2	6/25/2014		0.005	12	12	0.11	12	3.6
	8/19/2014							
	9/17/2014	4.3	0.002	1.2	1.2	0.77	2.0	0.24
	10/15/2014	4.6	0.003	0.97	1.0	0.34	1.3	0.23
	12/17/2014	3.7	0.003	1.3	1.3	0.13	1.4	0.27
	1/27/2015	3.7	0.002	0.85	0.8	0.24	1.1	0.19
	2/26/2015	8.8	BDL	1.4	1.4	0.87	2.3	0.32
	3/25/2015	24	0.004	0.56	0.6	7.2	7.8	0.062
	4/30/2015	6.1	0.003	1.2	1.2	0.34	1.5	0.24
	8/20/2015	6	0.009	1.4	1.4	0.47	1.9	0.22
	11/17/2015	8.2	BDL	1.4	1.4	0.52	1.9	0.21
	2/10/2016	16	0.004	0.39	0.39	0.52	0.9	0.06
	5/3/2016	32	0.002	1.1	1.1	4.40	5.5	0.18
	7/19/2016	31	0.014	1.1	1.1	3.6	4.7	0.14
	10/12/2016	50	BDL	1.5	1.5	6.8	8.3	0.18
	3/15/2017	48	BDL	2.3	2.3	3.7	6.0	0.34
	6/29/2017	62	0.020	0.81	0.8	15	15.8	0.12
	9/20/2017	31	BDL	2.7	2.7	13	15.7	0.32
	12/07/2017	53	BDL	0.84	0.8	13	13.8	0.20
	2/28/2018	54	0.002	0.33	0.3	10	10.3	0.05
	6/6/2018							
	9/6/2018	47	0.002	0.3	0.3	9.8	10.1	0.07

NOTES: E=effluent sample; L= lysimeter sample; W=monitoring well sample; BDL=below detection limit. Reported concentrations are in milligrams per liter. Empty field means that no sample was collected due to insufficient water sample.

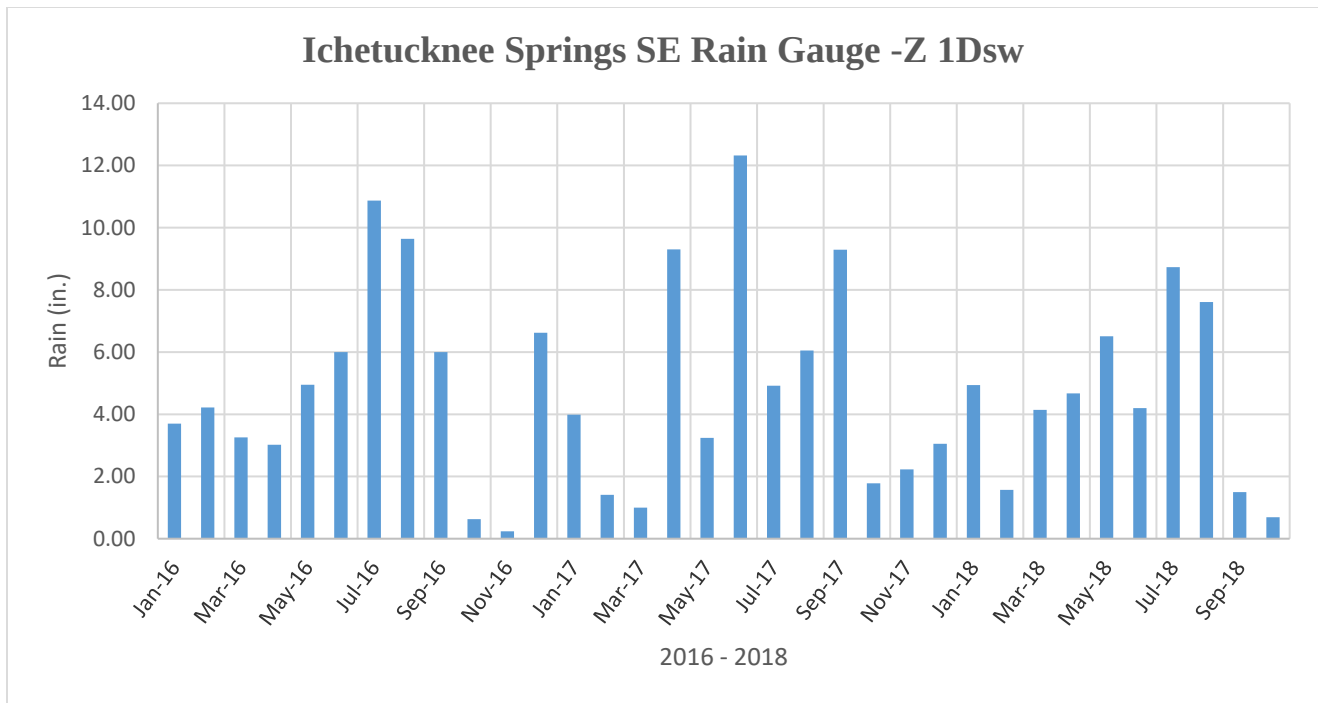


Figure 2. Monthly Rainfall Data 2016 - 2018 Park Manager's Residence

Table 2. Depth to Water (DTW) Monitoring Wells (ft.)

Station	Date	DTW (ft.)
W-1	1/27/2015	24.26
W-2	1/27/2015	24.14
W-1	2/26/2015	23.88
W-2	2/26/2015	23.80
W-1	3/25/2015	23.73
W-2	3/25/2015	23.57
W-1	4/30/2015	N/A
W-2	4/30/2015	N/A
W-1	8/20/2015	25.49
W-2	8/20/2015	25.33
W-1	11/17/2015	25.40
W-2	11/17/2015	25.21
W-1	2/10/2016	N/A
W-2	2/10/2016	N/A
W-1	5/3/2016	N/A
W-2	5/3/2016	24.90
W-1	7/19/2016	N/A
W-2	7/19/2016	25.20
W-1	10/12/2016	27.50
W-2	10/12/2016	27.10
W-1	3/15/2017	26.74
W-2	3/15/2017	26.95
W-1	6/29/2017	27.30
W-2	6/29/2017	N/A
W-1	9/20/2017	20.40
W-2	9/20/2017	20.25
W-1	12/7/2018	N/A
W-2	12/7/2018	24.50
W-1	2/28/2018	N/A
W-2	2/28/2018	23.60
W-1	6/6/2018	N/A
W-2	6/6/2018	27.70
W-1	9/6/2018	N/A
W-2	9/6/2018	25.35

N/A=Not able to measure

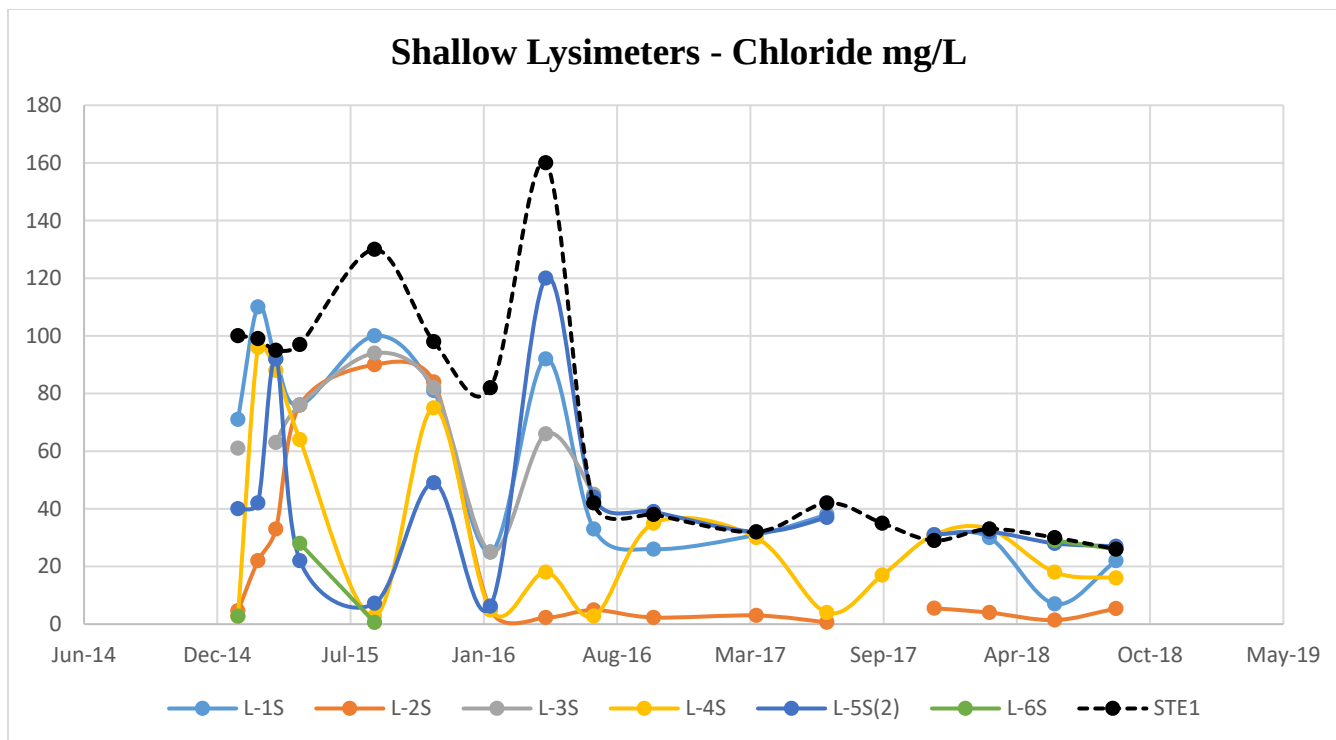


Figure 3. Shallow Lysimeters – Chloride mg/L

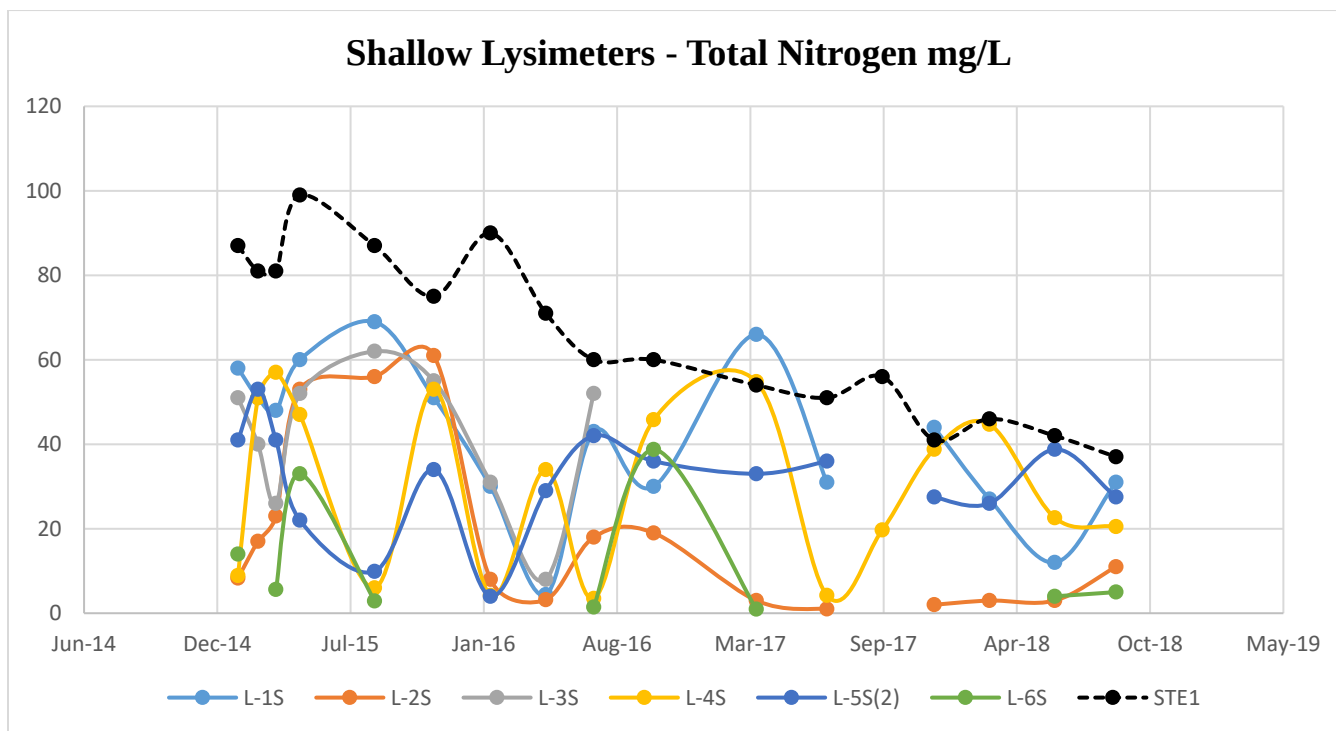


Figure 4. Shallow Lysimeters – Total Nitrogen mg/L

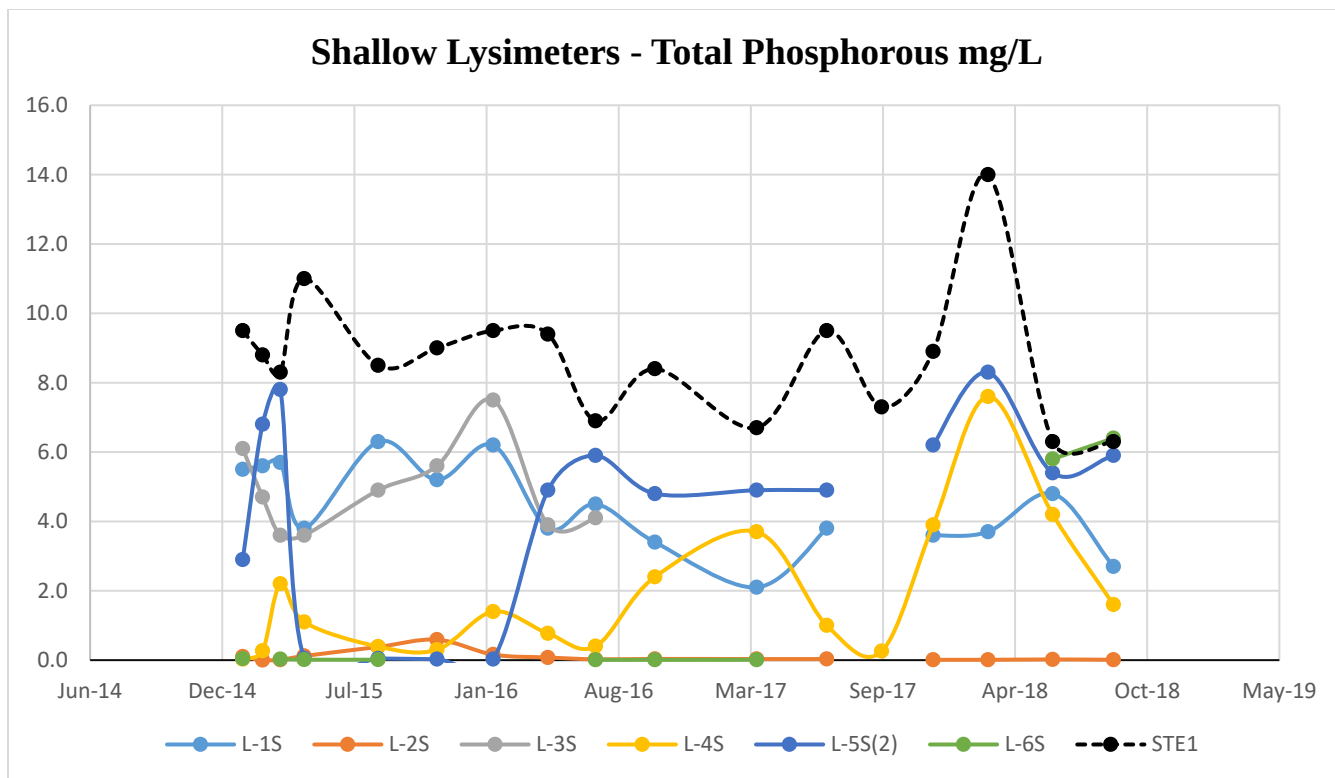


Figure 5. Shallow Lysimeters – Total Phosphorous mg/L

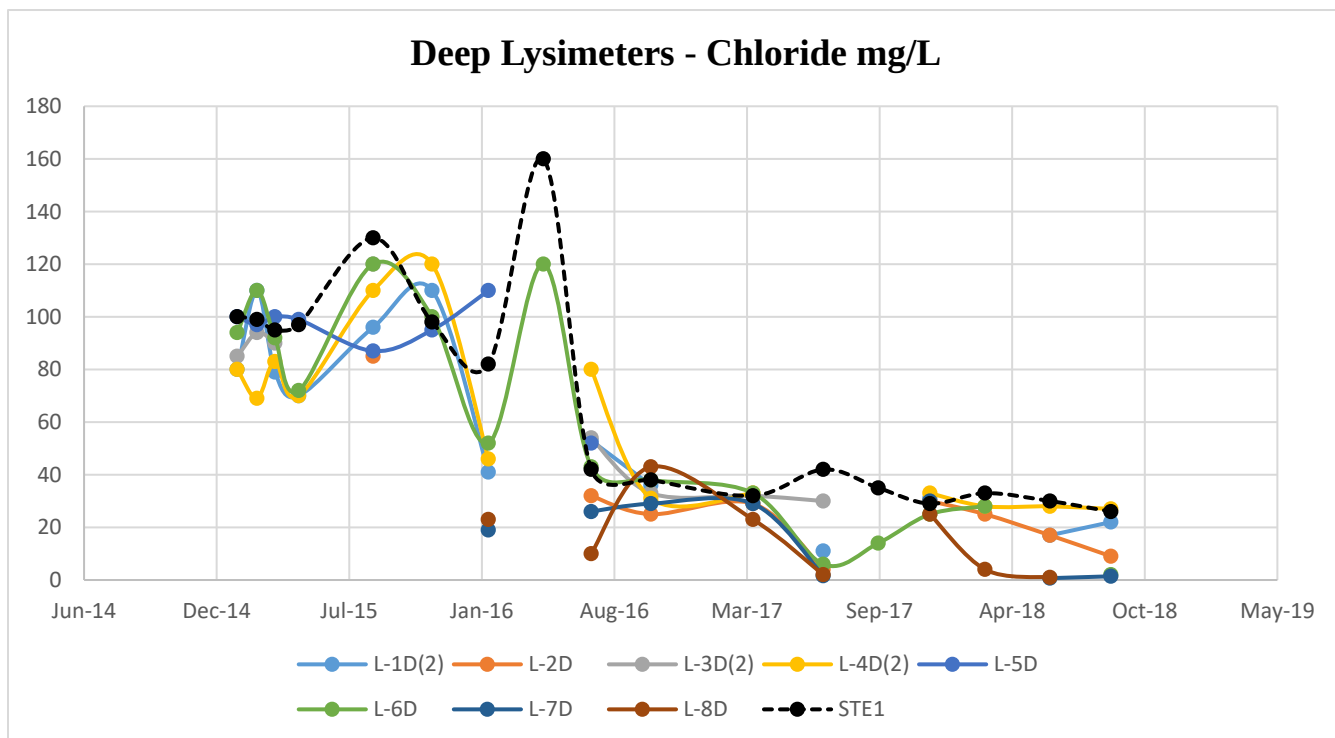


Figure 6. Deep Lysimeters – Chloride mg/L

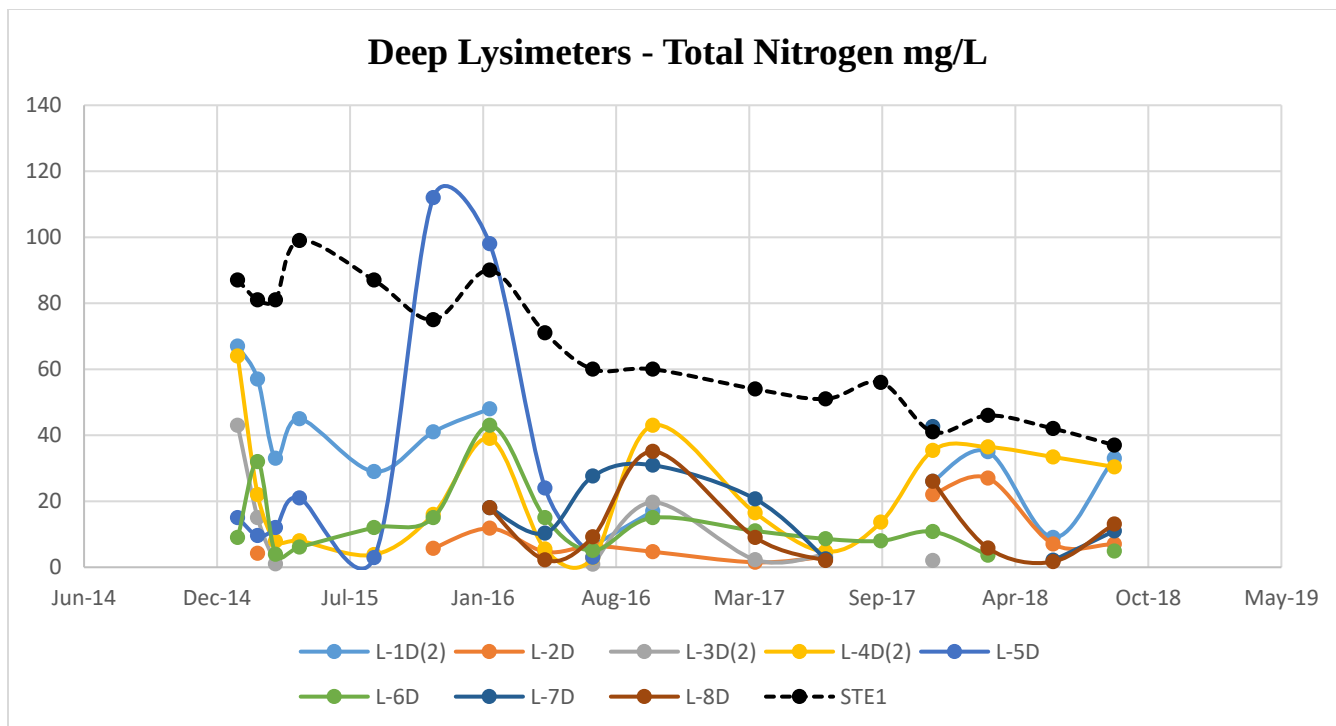


Figure 7. Deep Lysimeters – Total Nitrogen mg/L 2015-2018

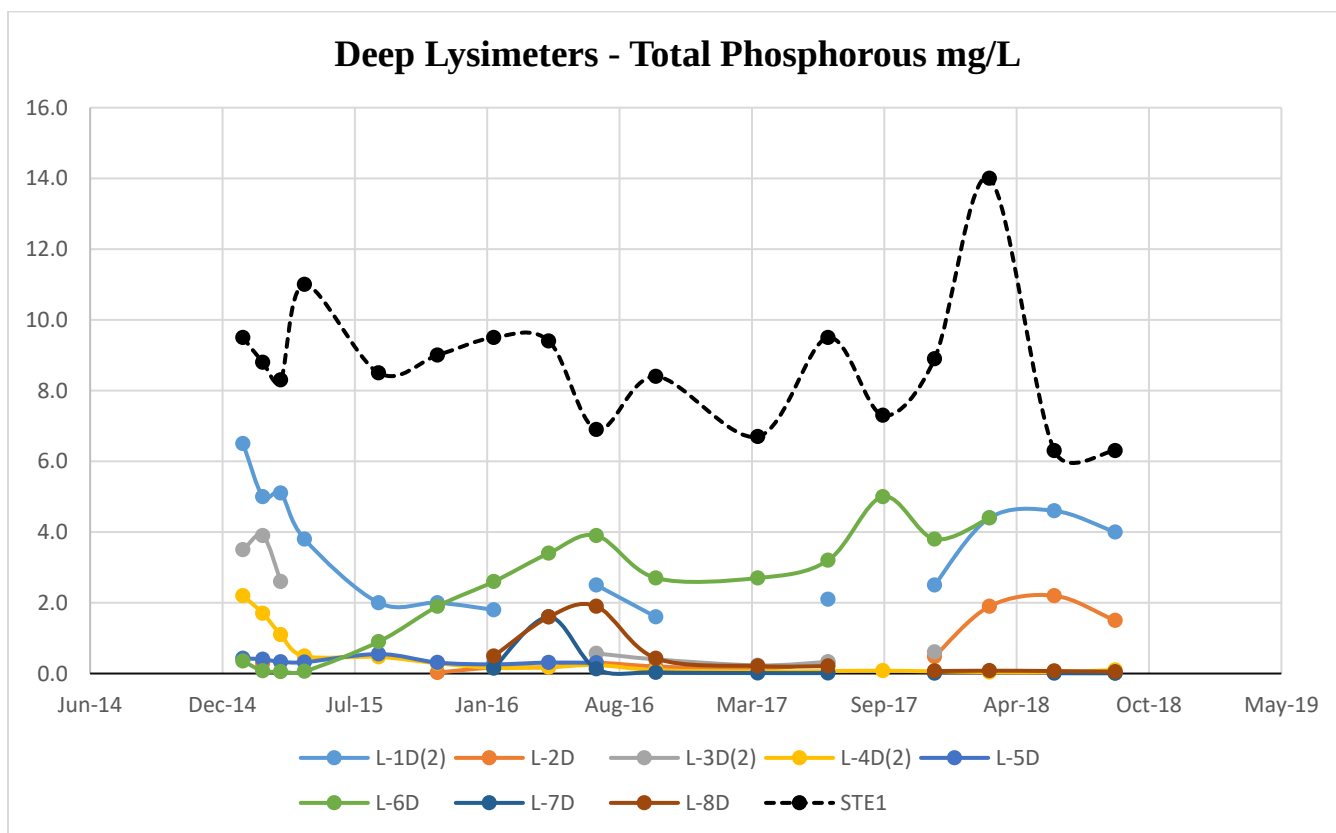


Figure 8. Deep Lysimeters – Total Phosphorous mg/L 2015-2018

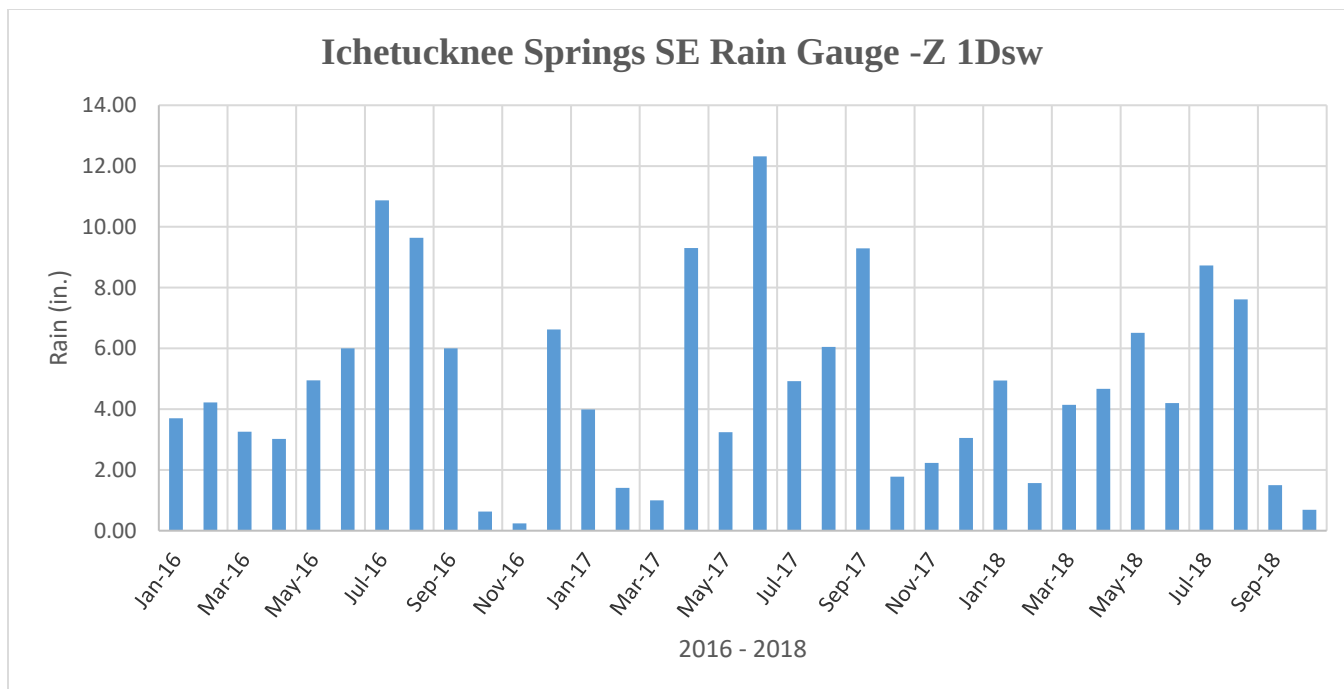


Figure 9. Monthly Rainfall (Inches) Park Manager's Residence 2016 - 2018

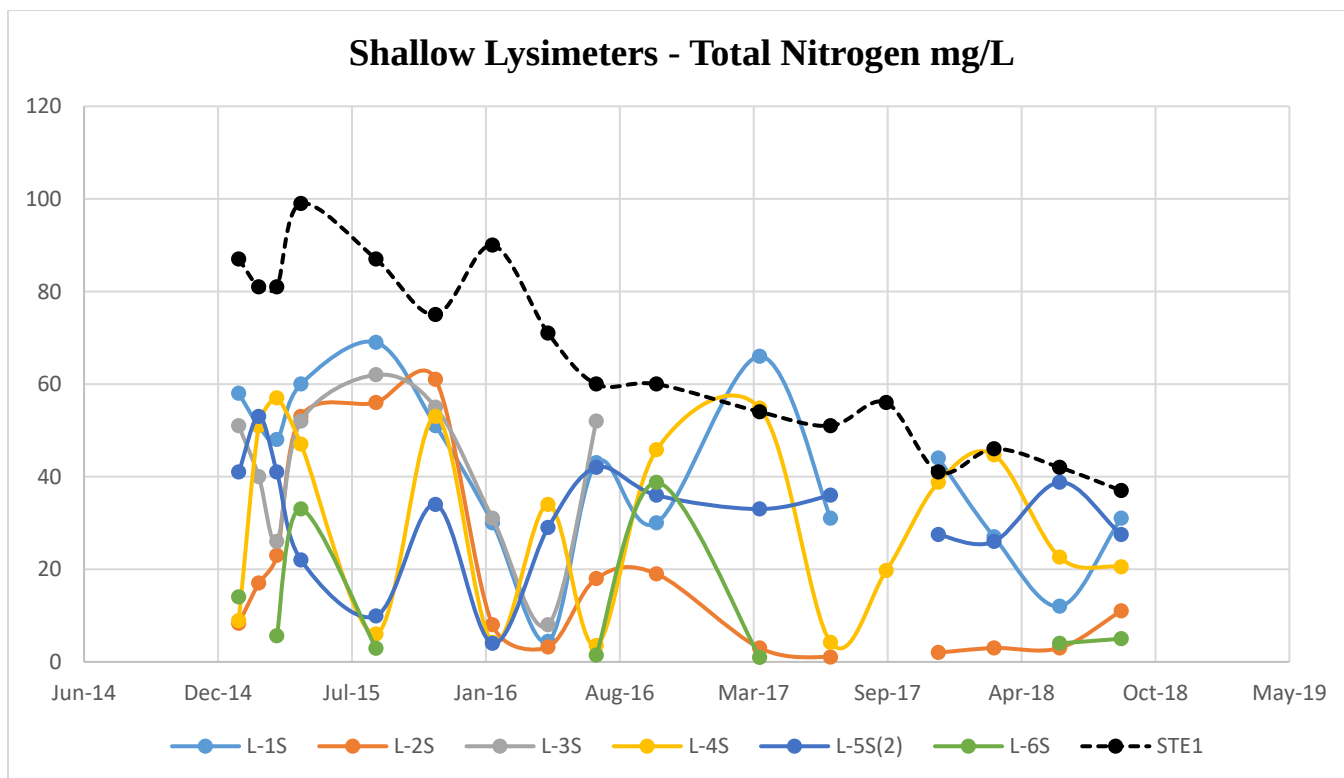


Figure 10. Shallow Lysimeters – Total Nitrogen mg/L 2016-2018

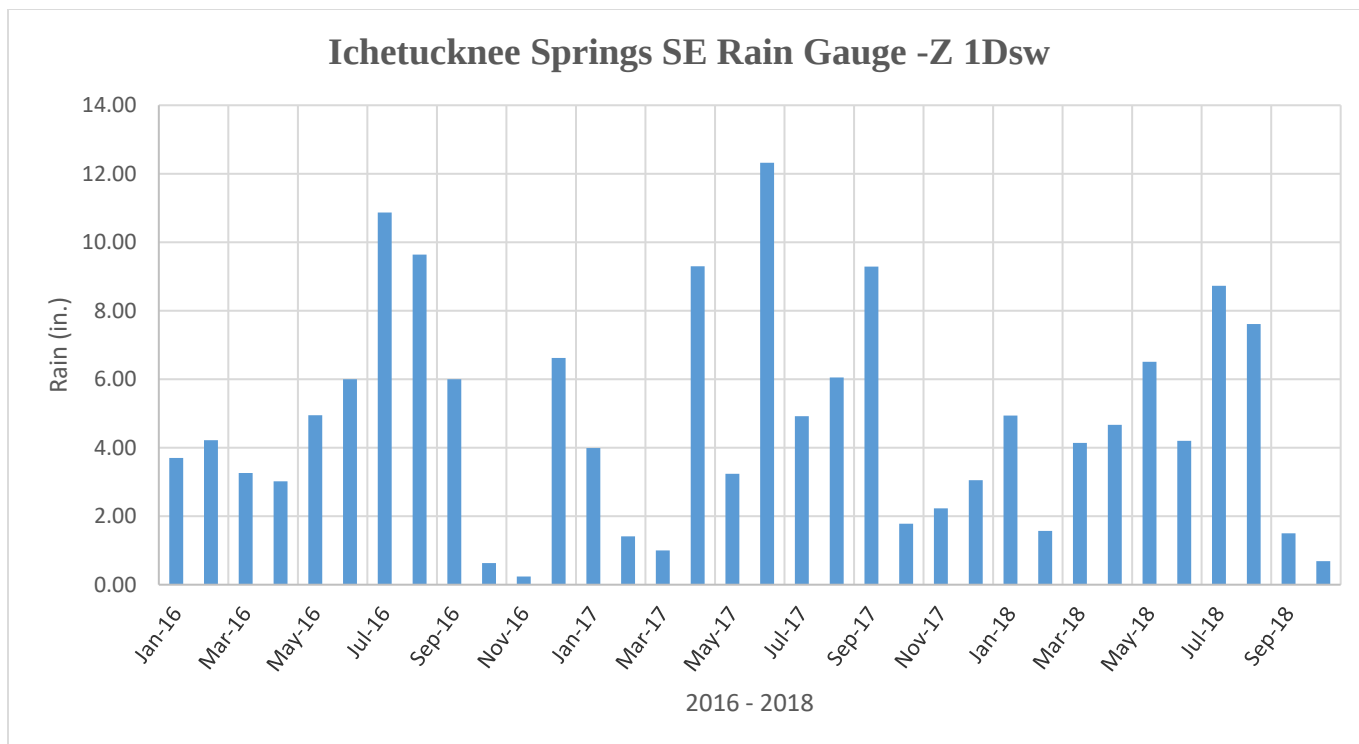


Figure 11. Monthly Rainfall (Inches) Park Manager's Residence 2016 -2018

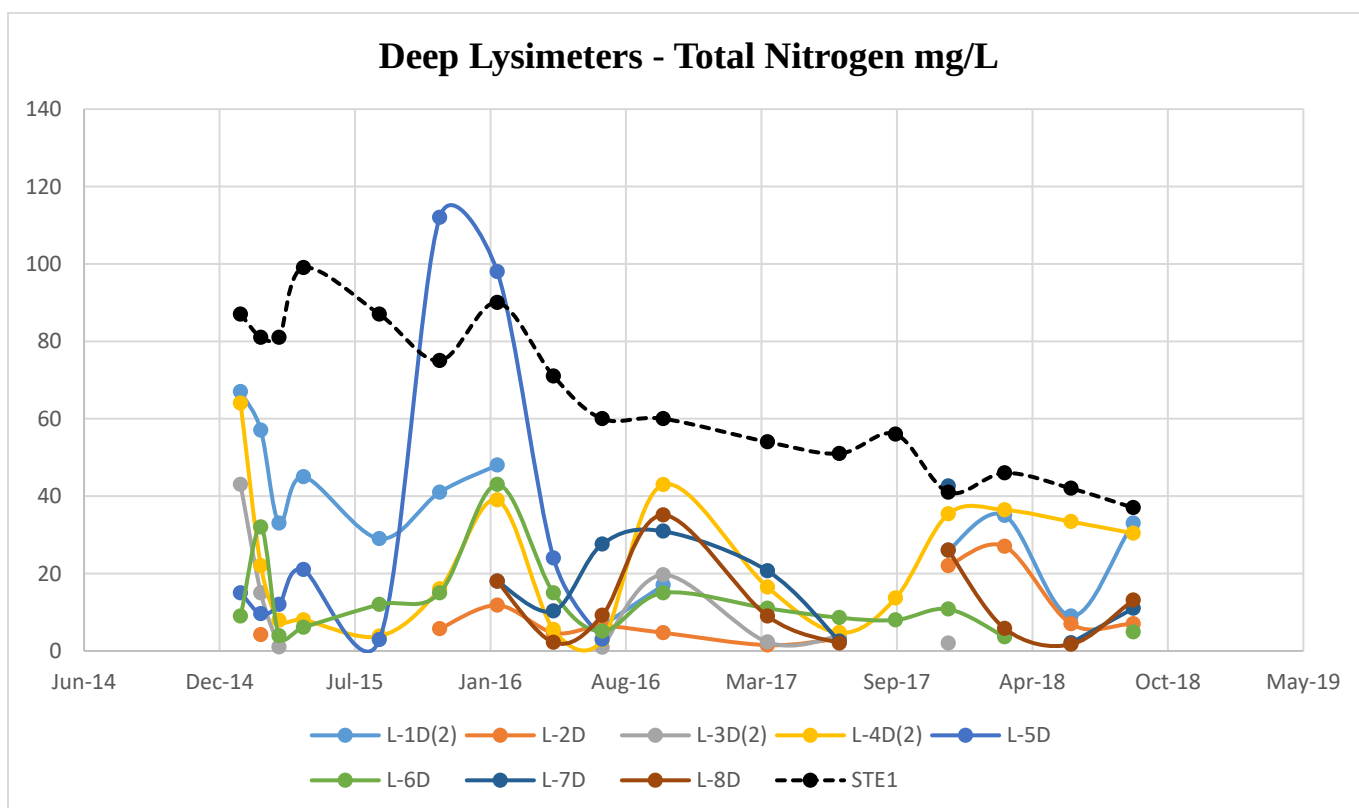


Figure 12. Deep Lysimeters – Total Nitrogen mg/L 2016-2018

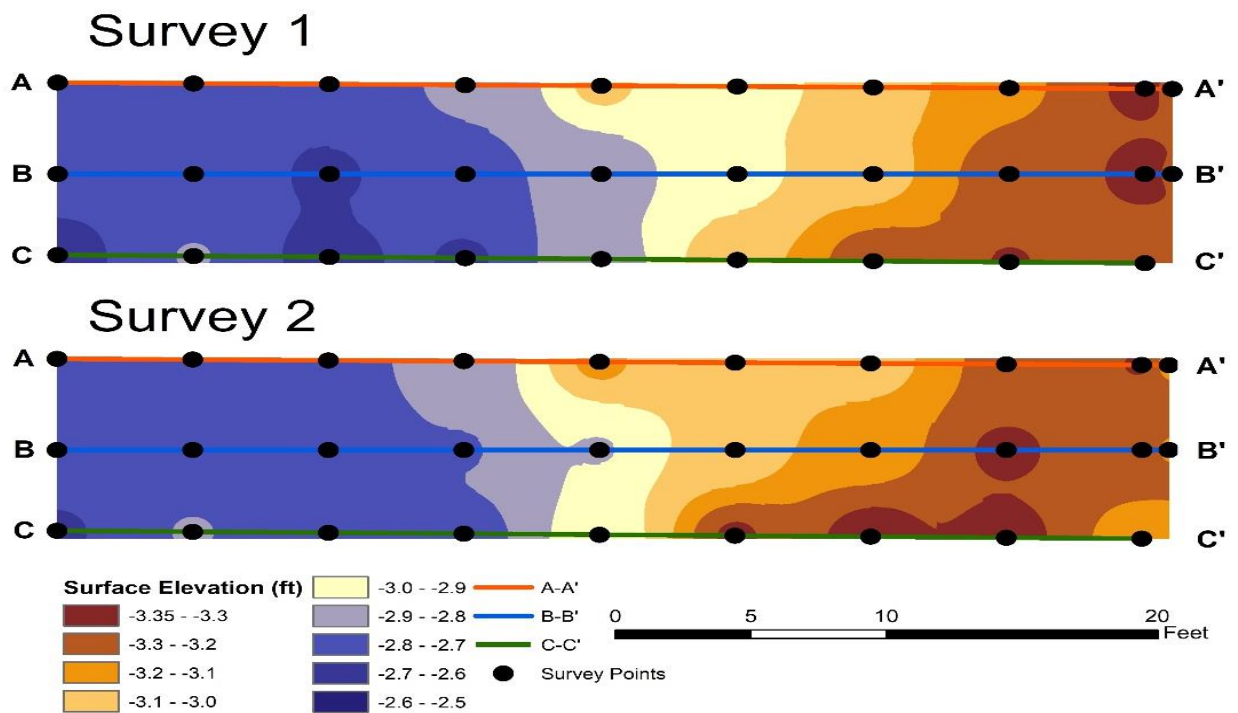


Figure 13. Land Surface Elevation (LSE) Survey of Drainfield December 2017

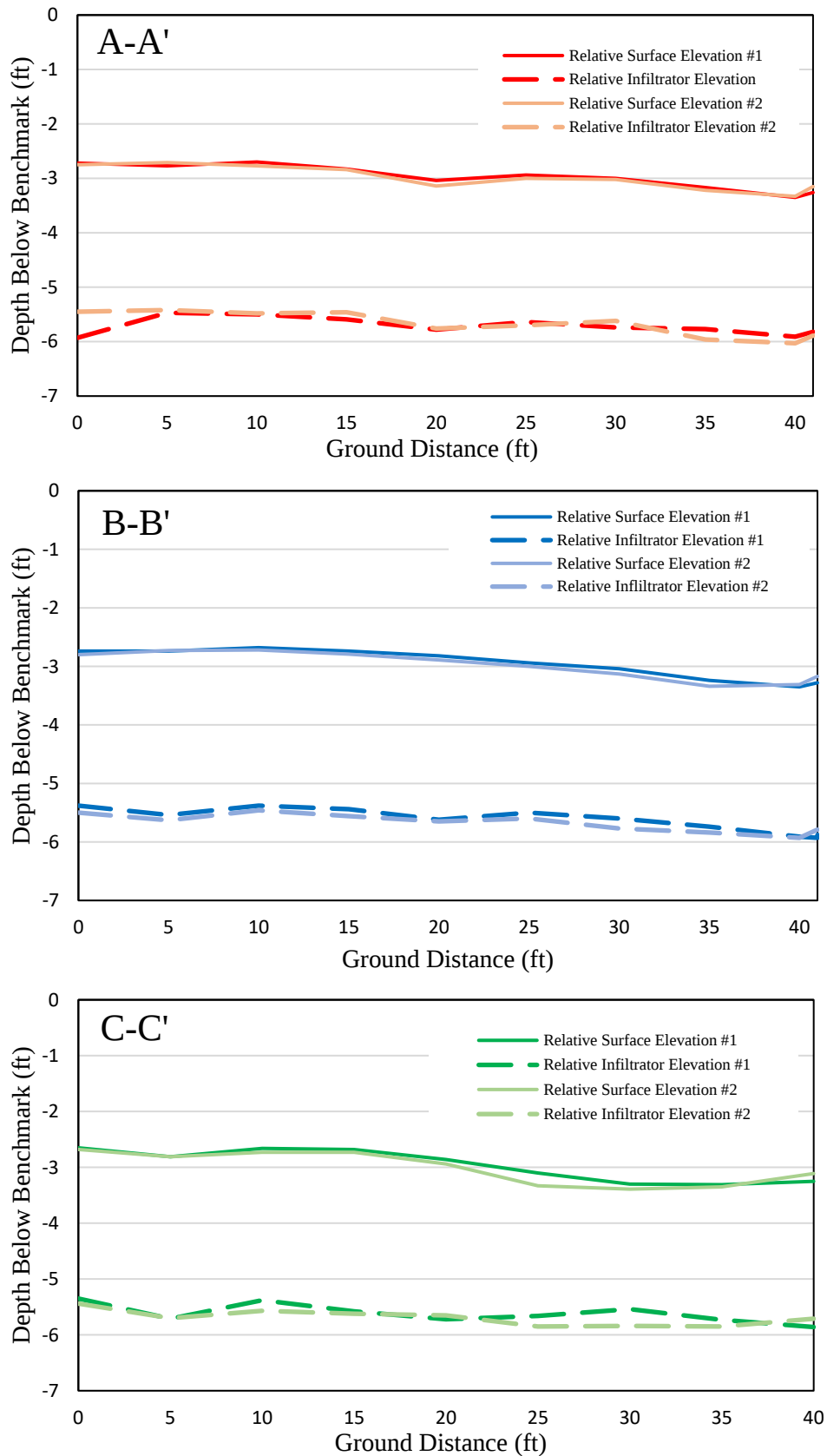


Figure 14. Cross Sections of Relative Surface Elevations & Infiltrators December 2017

March 2014



January 2015



July 2017



December 2017

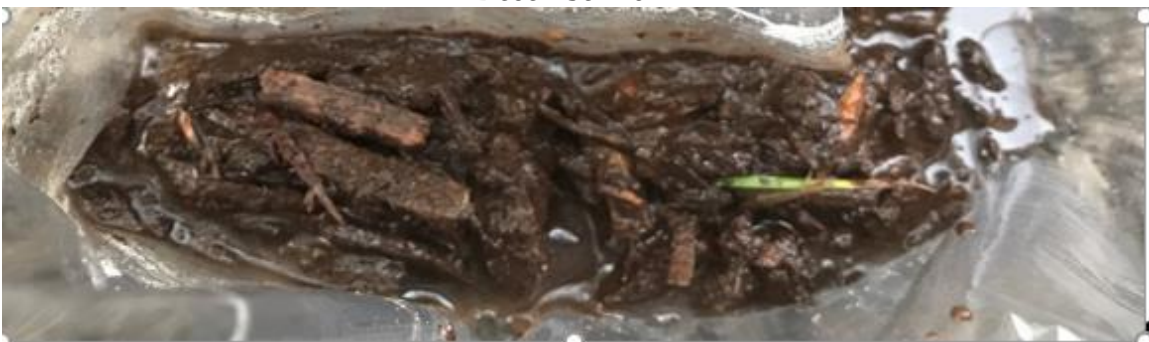


Figure 15. Photographs of mulch from March 2014(at installation), January 2015, July 2017, and December 2017



Figure 16. Photographs of drainfield facing West and North November 27, 2018.