Florida Department of Environmental Protection

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Secretary

July 20, 2017

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 6/29/2017.

This project began with the construction of a new drainfield and installation of a reactive media layer composed of hardwood mulch in the backyard of the park manager's home on 3/7/2014. When the system was constructed, 6 deep lysimeters were installed adjacent to the rows of infiltrators and an effluent sampling sump was installed in line between the septic tank and experimental drainfield. The new drainfield began receiving effluent on 3/18/2014. On 4/8/2014, the 2 drainfield monitoring wells, the piezometer, and the 6 shallow lysimeters were installed.

During the study, several of the lysimeters were replaced in February 2016, and two new deep lysimeters were installed along the outside edge of the mulch layer to evaluate lateral transport of nitrogen within the vadose zone above and within the mulch layer. The two-additional deep lysimeters (L-7D and L-8D) are adjacent to the edge of the mulch layer in line with the westernmost row of lysimeters that are closest to the header. The purpose of these new lysimeters was to evaluate the potential for lateral movement of effluent along the top of the mulch layer.

There have been 19 sampling events since this project began. The year 1 monitoring report provided the results from monthly sampling that occurred during the first year of operation. Since then, monitoring frequency has been reduced to quarterly sampling, and this report includes data for the monthly sampling plus eight quarterly monitoring events. **Figure 1** shows the experimental drainfield and monitoring stations, and **Tables 1** and **2** provide a summary of the monitoring results. 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 63 and 59 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.

The decrease in STE concentrations appears to be reflected in lower concentrations in the lysimeter samples. Denitrification in the mulch layer may also have been enhanced by increased water use which would increase moisture content in the mulch. The lysimeter data from this most recent sampling event and the previous quarterly monitoring event seem to indicate more consistent values in the deep lysimeters, which could be related to more uniform infiltration of water through the mulch layer. Lower values in the deep lysimeters in the June 2017 data correlated with lower chloride values, indicating the reductions are mainly due to dilution and not denitrification (**Table 1)**. This sampling event occurred within a period of frequent rainfall (**Figure 2)**.

Figures 9 through **12** compare monthly rainfall to TN concentrations found within the shallow and deep lysimeters. A correlation between lower TN concentrations and higher seasonal rains observed during the summer months is monitored for any potential dilution factor. A rain gauge located within the park at the south entrance and adjacent to the park manager's home recorded approximately 12 inches of rain for June 2017 **(Figure 2)**. Conversely, dryer months as seen in October 2016 and November 2016 could be affecting higher TN concentrations observed in the shallow lysimeters during those sampling periods (**Figures 9 and 10).** Continued monitoring of rainfall and water quality data is necessary.

The monitoring well data from the June 2017 event shows an increase in nitrate concentration in W-2. This may indicate that the nitrate plume beneath the drainfield may have extended eastward which may be related to the increased water use and greater mounding of groundwater beneath the active end of the drainfield.

Depth to ground water in one of the monitoring wells on June 29, 2017 (W-1) was approximately 27 feet below land surface **(Table 2)**. A water level was not measured in

well W-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 has been observed, and required documenting to verify any additional settling that may occur. On July 12, 2017, DEP staff conducted a survey 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. 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. Diagrams showing the results of the topographic survey and cross-sectional diagrams of the three infiltration chamber rows are provided in **Figures 13** and **14**. Photographs of mulch samples from construction (March 2014), slightly less than one year after construction (January 2015) and the day of the survey (July 2017) are shown in **Figure 15**.

Over the study period, small localized depressions were noticed in the drainfield area. In addition, during the study period several of the plastic vaults containing the lysimeter valves had to be lowered a few inches due to soil subsidence. The land elevation survey was conducted to establish background elevations of land surface on top of the drainfield to help quantify future subsidence at land surface. Elevations shown in **Figures 13** and **14** are in feet relative to the bench mark originally established during the soil survey for drainfield siting. The tops of the infiltrator rows were surveyed by placing the survey rod on the handle of a drain tile probe touching the tops of the infiltration chambers at intervals along the rows. The survey of the infiltration chamber rows did identify some undulations that could be related to subsidence, but no significant issues were found except at one location. An apparent 0.5-foot deflection at the upgradient (western) end of the northernmost drainfield row (A-A' cross section in **Figure 13**) could have occurred at construction during backfilling. Subsidence of the soil surface at this location was not evident, which causes us to believe that the deformation, if it occurred, would have occurred before construction was finished. Ponding of effluent near the header in this row could explain anomalously high nitrogen and chloride results from lysimeters near that location early in the study (L1S and L1D in **Figure 1** and **Table 1**). During the next quarterly visit, this potential issue will be confirmed with additional resurvey.

An inspection of the mulch samples collected in July 2017 shows that the material seems to have degraded slightly, but generally it remains in good condition. As noted from the photographs in **Figure 15**, the mulch is now black in color and was saturated with water when the sample was taken. The dark color indicates that the material has been under saturated, reducing conditions for an extended period of time. Reducing conditions, which contribute to the black color, are most favorable for denitrification as well as preservation of the wood material. It is possible that increased water use in the residence has contributed to a continuing source of moisture for the mulch layer. Our expectation is that will result in improved treatment of nitrogen and greater longevity of the mulch.

The park manager had the septic tank pumped prior to fiscal year end for maintenance purposes, but it is unlikely that pumping would influence water quality results for the effluent unless pumping occurred a short time before sampling.

Please let me know if you have any questions.

Sincerely,

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

cc: Dr. Eberhard Roeder
Erin Rasnake
Richard Hicks

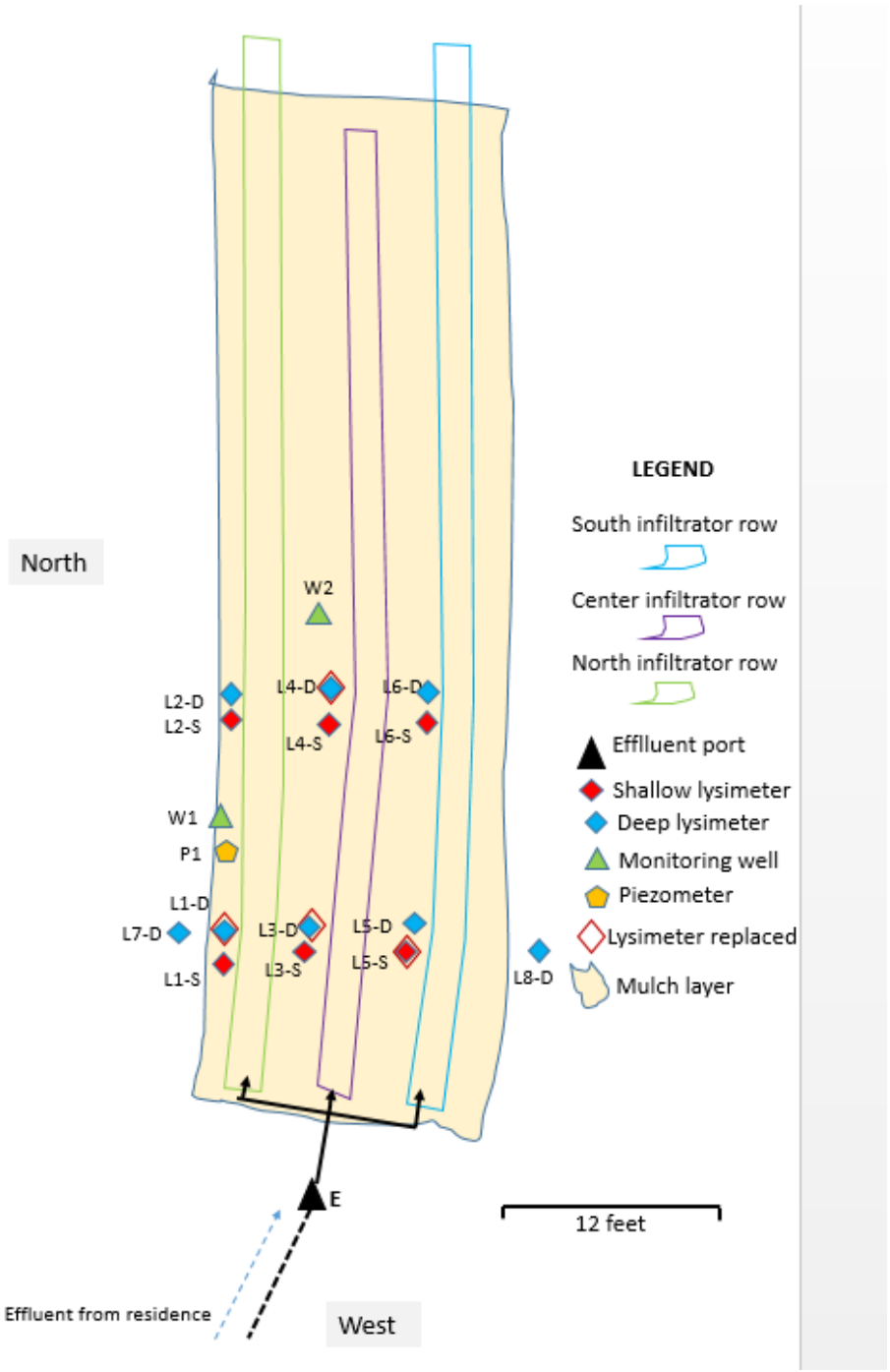

Figure 1. Drainfield diagram and monitoring stations

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
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
	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

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-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
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
	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

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	6/29/2017	0.6	0.006	0.7	0.7	0.4	1	0.03
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
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							
L-3D(2)	1/27/2015	85	0.018	0.87	0.85	42	43	3.5

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)	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
	6/29/2017	30	0.008	0.54	0.53	3.4	3.9	0.33
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
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
	5/3/2016		0.011	0.51	0.50	5.0	5.5	0.18

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)	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
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
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
	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

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	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							
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
	6/29/2017							
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

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-6D	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
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
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
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
W-2	4/17/2014							
	6/4/2014	1.8	0.003	2.5	2.5	0.18	2.7	0.62
	6/25/2014		0.005	12	12	0.11	12	3.6
	8/19/2014							

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	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

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.

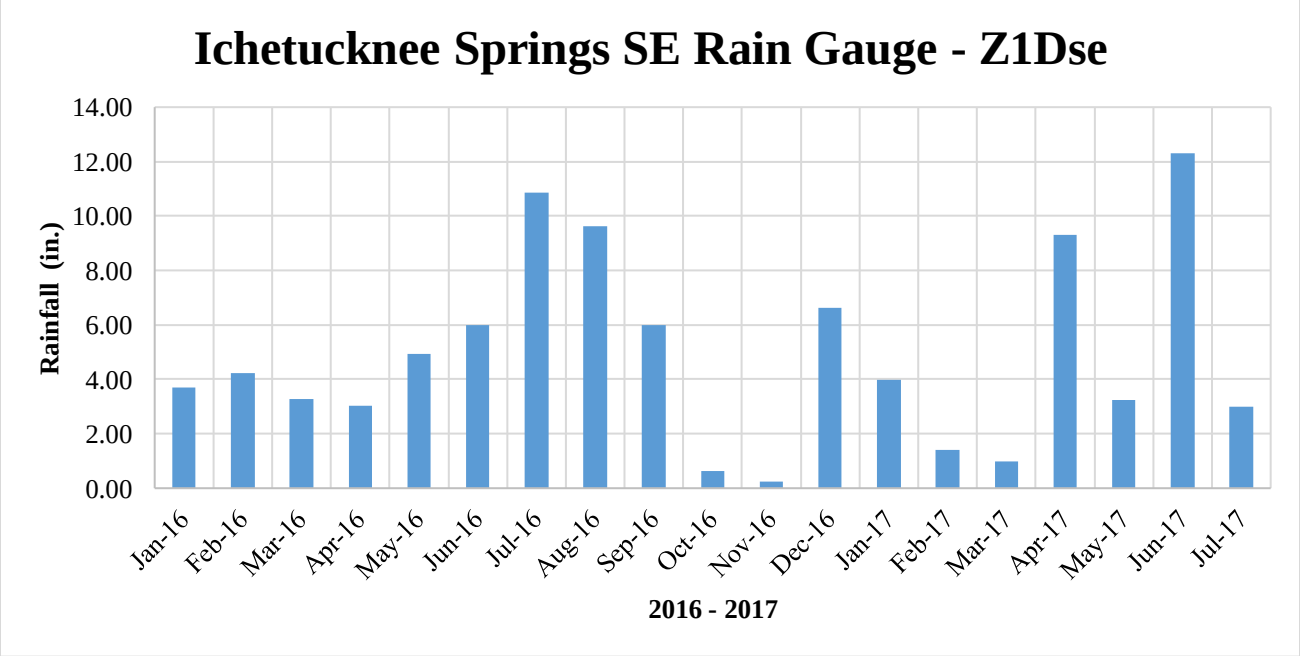

Figure 2. Monthly Rainfall Data 2016 - 2017 Park Ranger's Residence

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

N/A=Not able to measure

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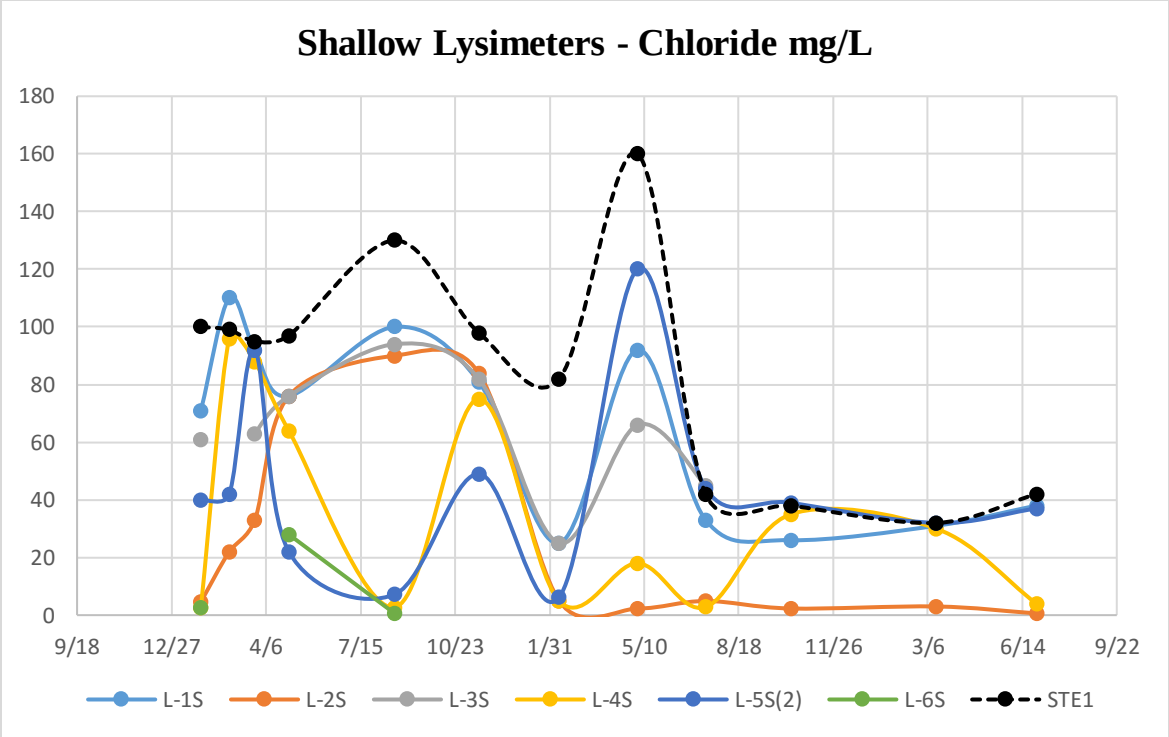

Figure 3. Shallow Lysimeters – Chloride mg/L 2015-2017

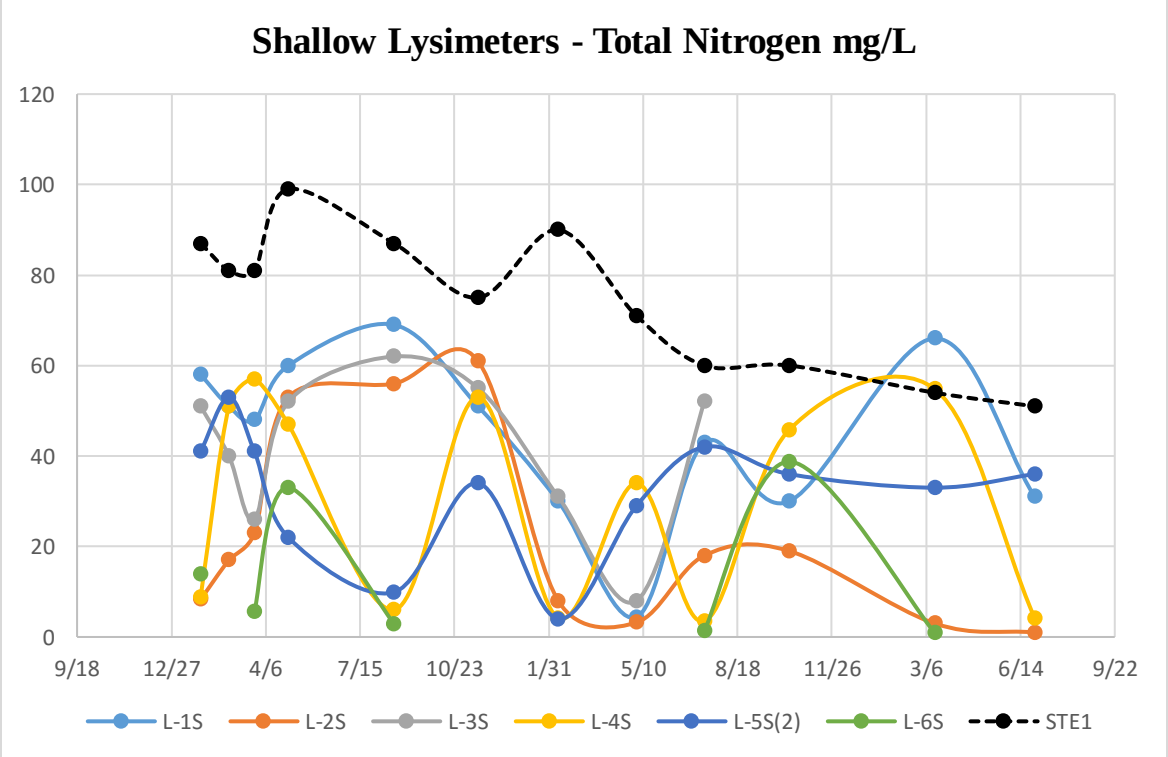

Figure 4. Shallow Lysimeters – Total Nitrogen mg/L 2015-2017

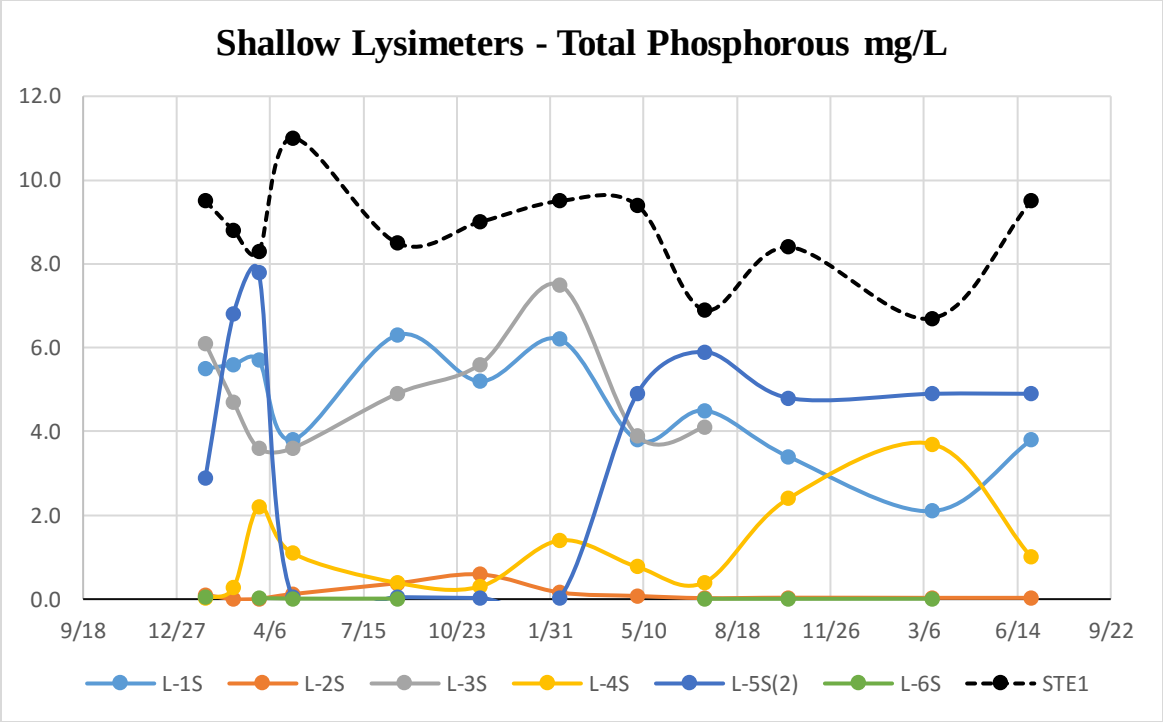

Figure 5. Shallow Lysimeters – Total Phosphorous mg/L 2015-2017

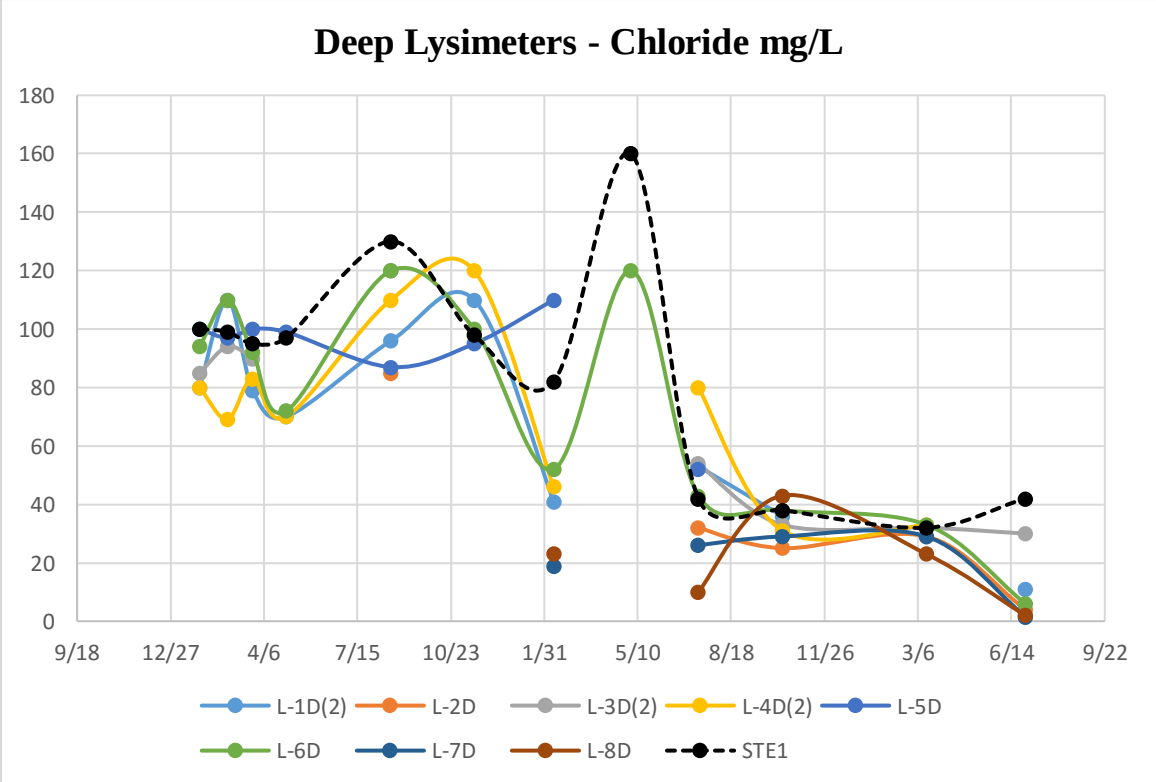

Figure 6. Deep Lysimeters – Chloride mg/L 2015-2017

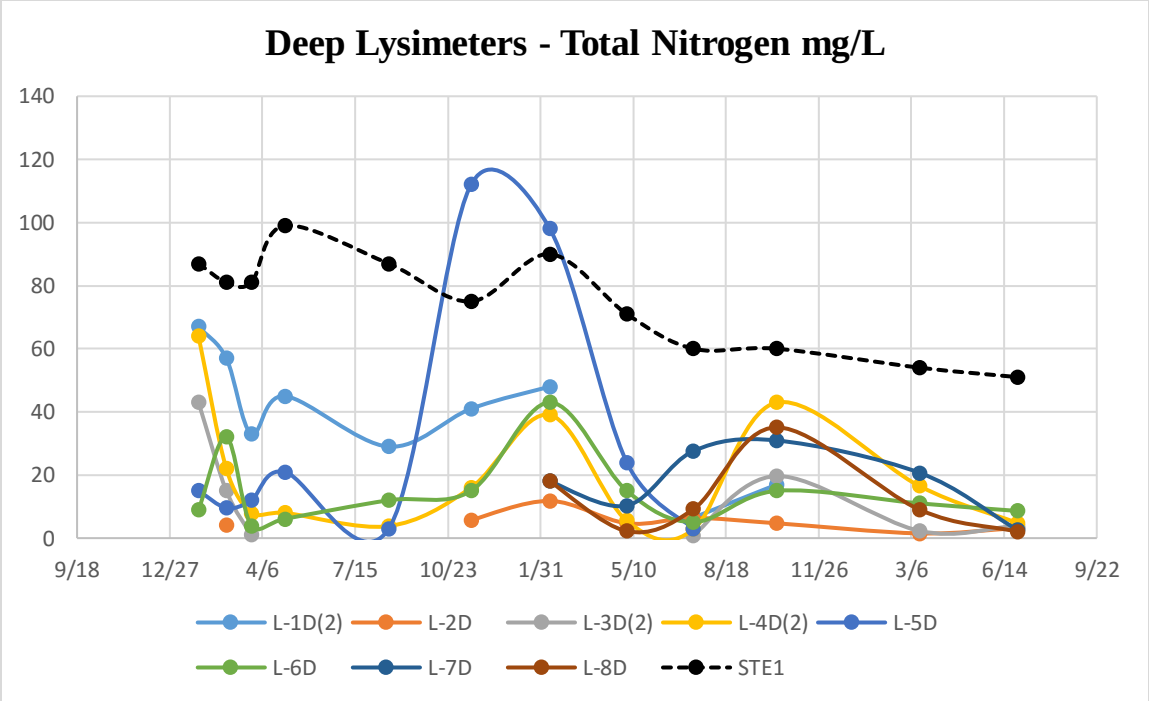

Figure 7. Deep Lysimeters – Total Nitrogen mg/L 2015-2017

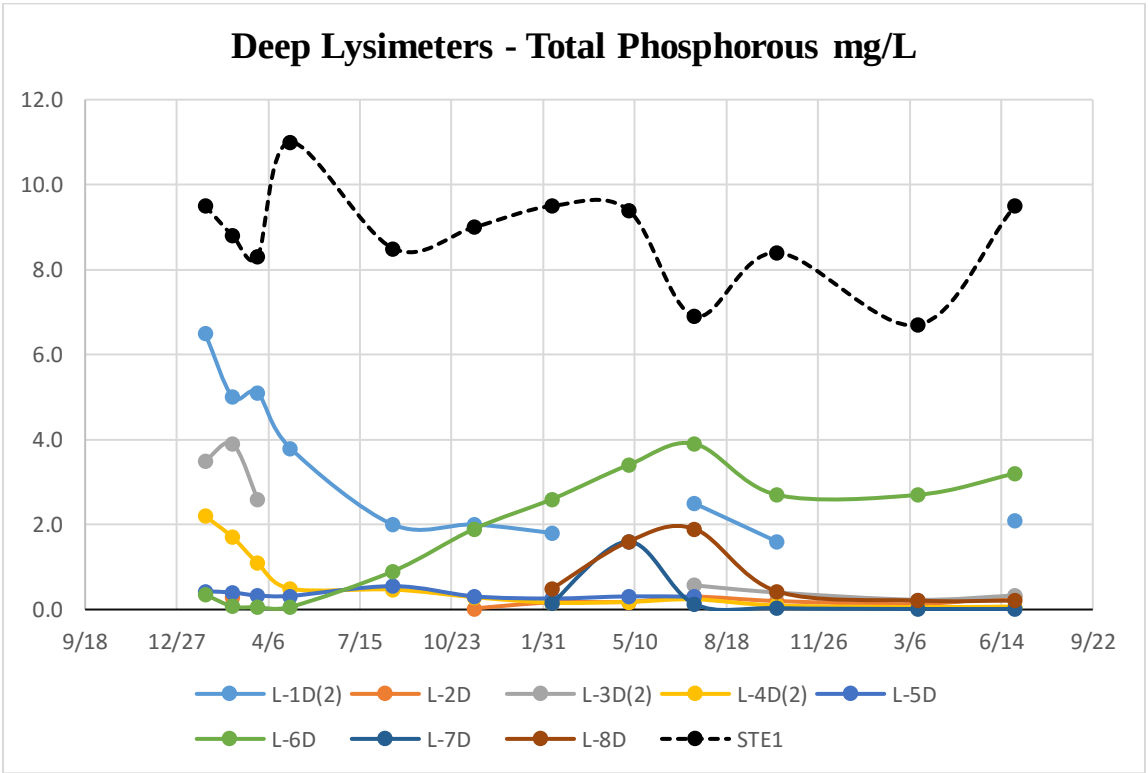

Figure 8. Deep Lysimeters – Total Phosphorous mg/L 2015-2017

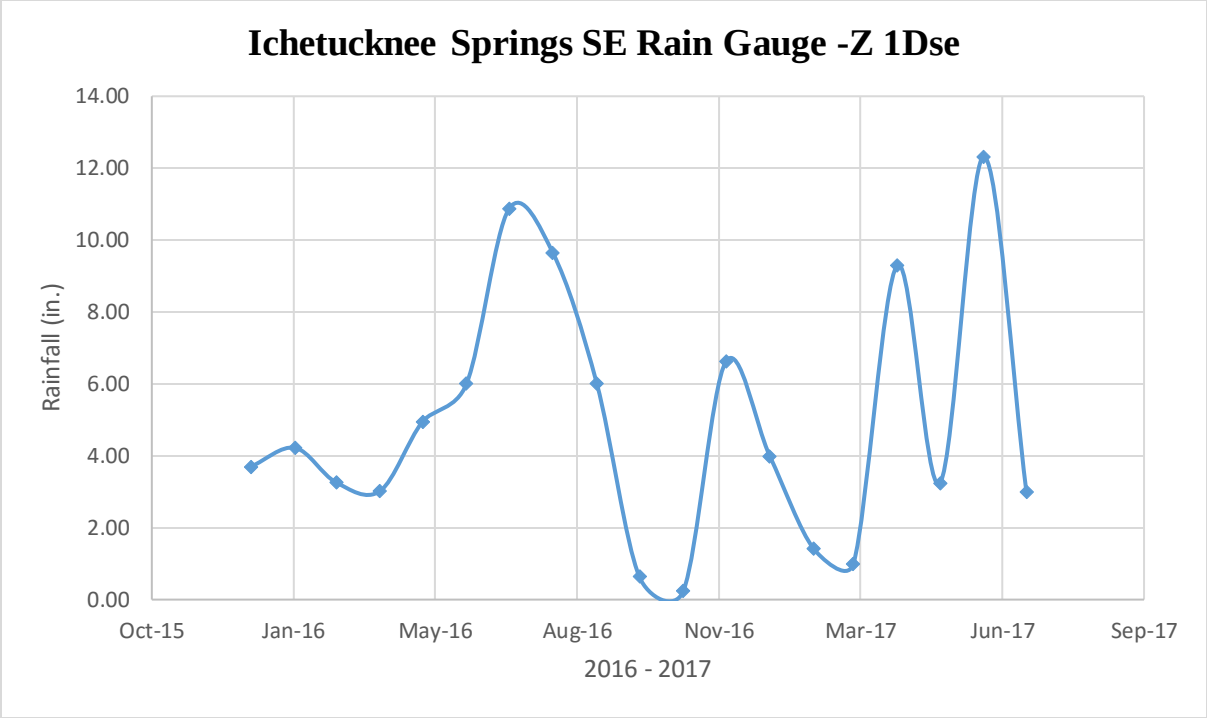

Figure 9. Monthly Rainfall Data Park Ranger's Residence 2016 - 2017

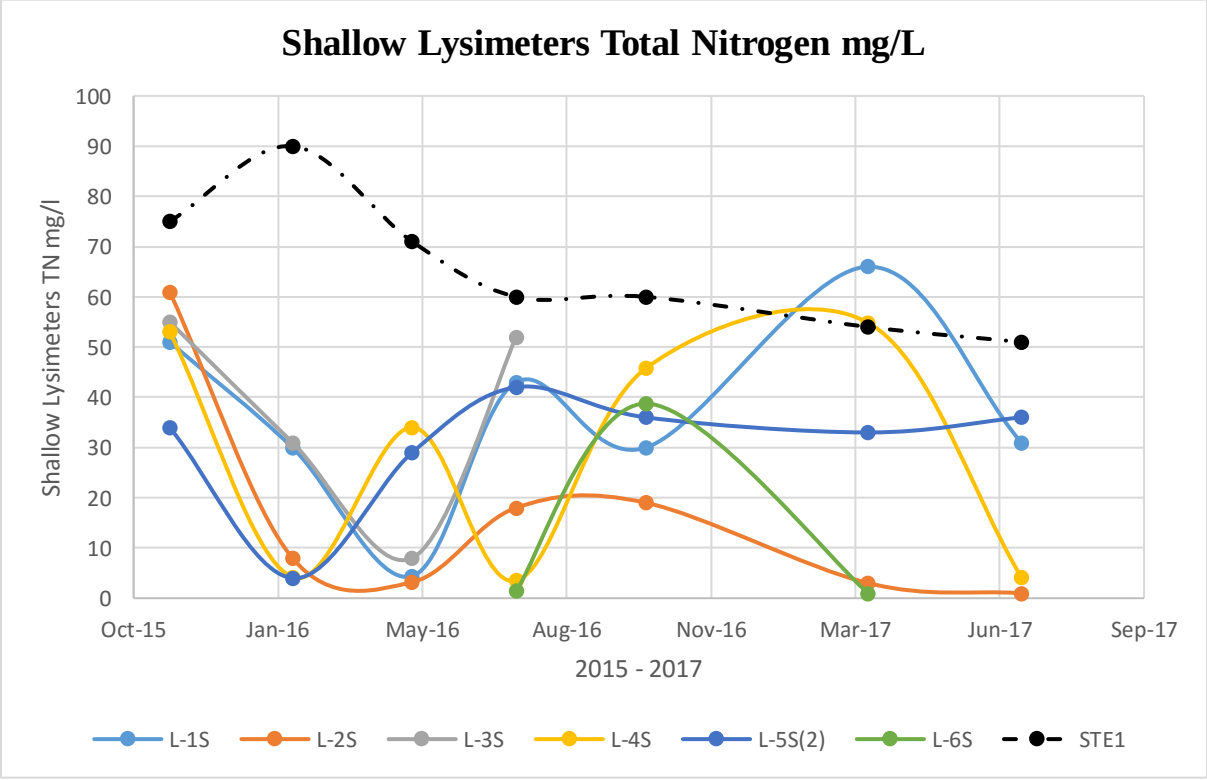

Figure 10. Shallow Lysimeters – Total Nitrogen mg/L 2015-2017

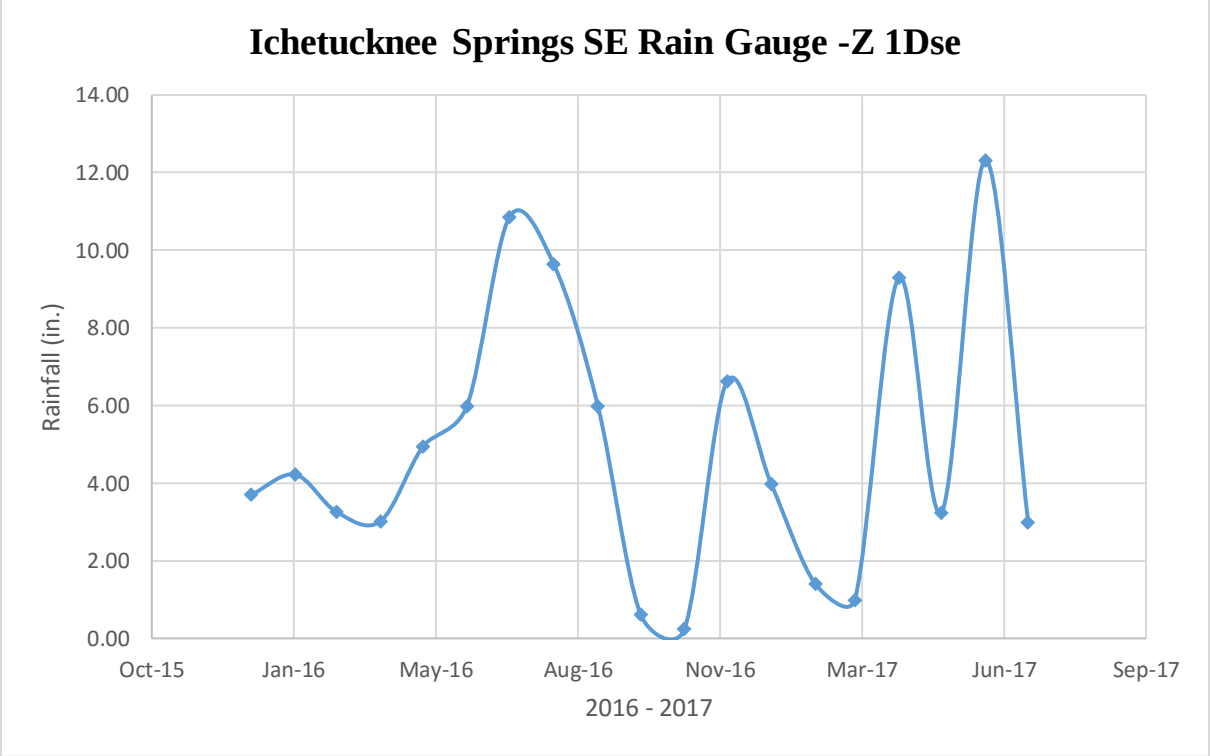

Figure 11. Monthly Rainfall Data Park Ranger's Residence 2016 -2017

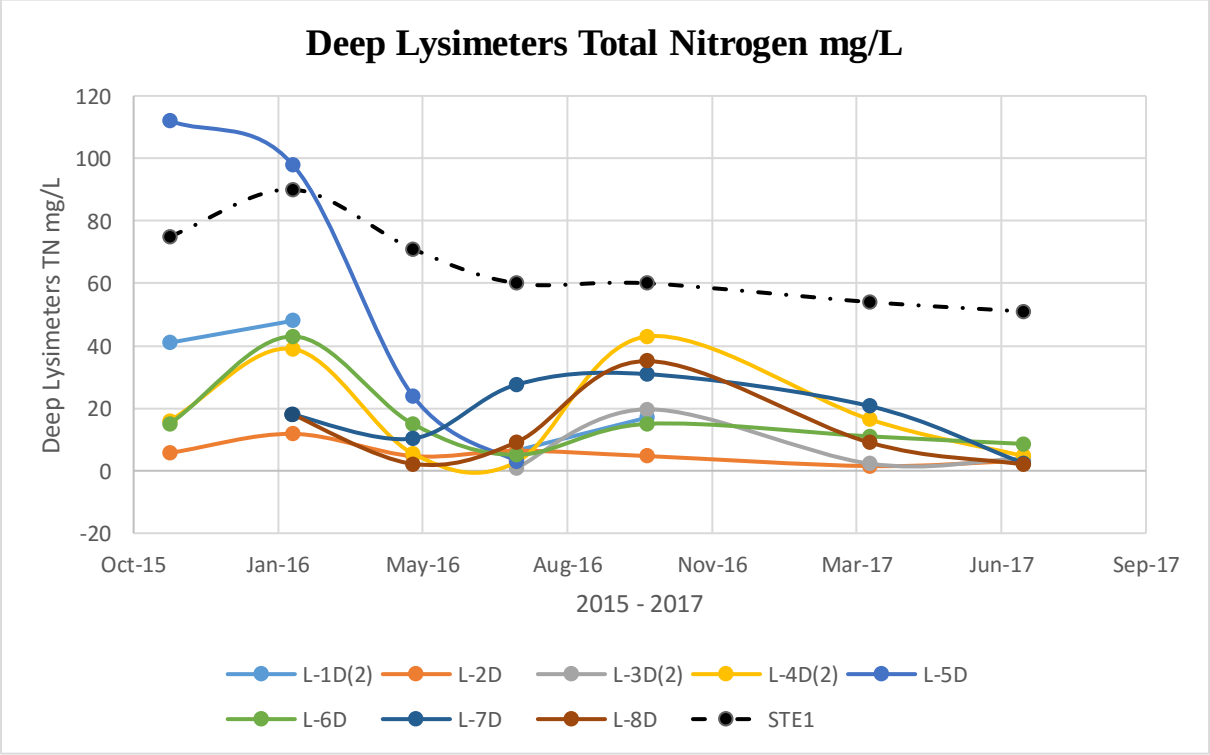

Figure 12. Deep Lysimeters – Total Nitrogen mg/L 2015-2017

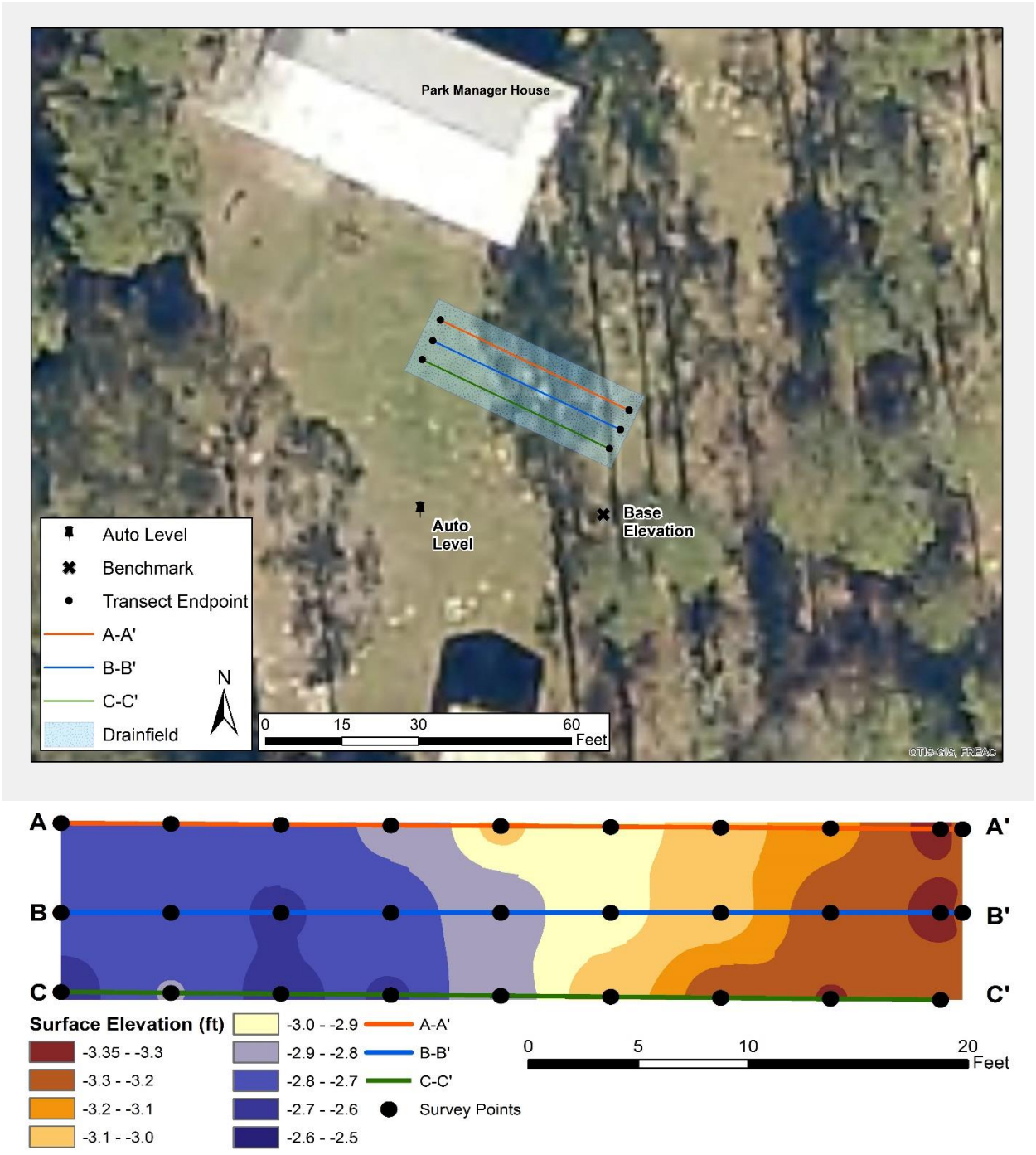

Figure 13. Land Surface Elevation (LSE) Survey of Drainfield July 2017

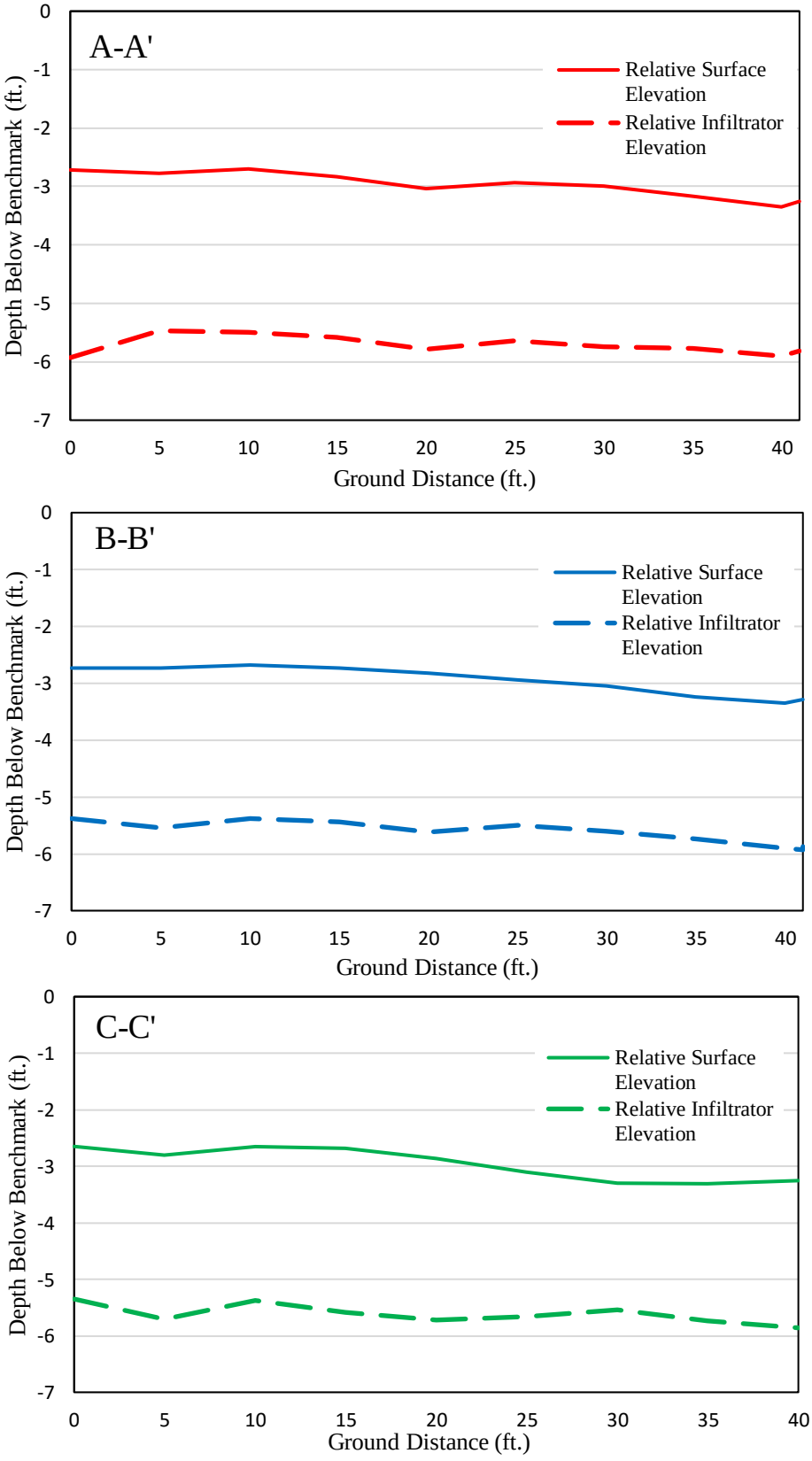

Figure 14. Cross Sections of Relative Surface Elevations & Infiltrators July 2017

March 2014

January 2015

July2017

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