

Contract No:

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Installation of Lysimeters and Monitoring Wells in Support of the Revised Approach to E-Area Performance Monitoring

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July 28, 2021

SRNL-STI-2021-00290, Revision 0

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Printed in the United States of America

**Prepared for
U.S. Department of Energy**

Keywords: *ELLWF, Lysimeter,
Tritium, CPT*

Retention: *Permanent*

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ACKNOWLEDGEMENTS

The authors thank Patti Bennett for her help with the GIS figures presented in this report.

EXECUTIVE SUMMARY

Savannah River Site (SRS) has developed a revised approach to performance monitoring of the E-Area Low Level Waste Facility (ELLWF) that adds a saturated zone component to the existing vadose zone monitoring program (Kubilius, 2019). The revised approach specifies modifications to the vadose zone monitoring program, the addition of new lysimeters at Engineered Trench 3 (ET3), and the installation of water table monitoring wells to complement the existing well network surrounding the ELLWF. This project summary report is intended to provide the final construction details and layout for the new vadose zone lysimeters at ET3 and the water table monitoring wells installed as part of the new saturated zone component of the revised performance monitoring program.

In October 2020, three new lysimeter stations were installed on the north rim of ET3 (Figure ES-1). These stations were designated as ET3-VL-3, ET3-VL-4, and ET3-VL-5. The stations were installed in a line with the two existing stations (ET3-VL-1 and ET3-VL-2) and spaced approximately 100 ft apart. Two lysimeters were installed at each station at the depths shown in Table ES-1. Lysimeter placement was based on borehole lithology and was comparable to the existing lysimeter stations. The deepest lysimeter at each of the three new lysimeter stations was designated as the action-level lysimeter (Dixon, 2020a).

With the addition of the new lysimeters at ET3, the E-Area Vadose Zone Monitoring System (VZMS) is now comprised of 307 suction lysimeters at 102 stations surrounding 14 waste trenches. At 93 of 102 lysimeter stations, a deep lysimeter is designated as an Action-Level (AL) lysimeter. The revised monitoring approach proposes reducing the number of lysimeters sampled and reducing the sampling frequency for some lysimeters from twice per year to once per year (Kubilius, 2019). However, all AL lysimeters will continue to be sampled twice per year. It is not uncommon for a small subset of AL lysimeters to fail to produce a sample during any given sampling event. Bi-annual sampling of the AL lysimeters increases the chances that all AL lysimeters will be successfully sampled at least once per year.

Finally, eight water table monitoring wells were installed in May/June 2021: four north of Engineered Trench 2 (ET2), two north of Slit Trench 1 (ST1), and two south of ST1 near well cluster BGX-2. Figure ES-2 shows the locations for the new wells and construction details are provided in Table ES-2. Each well was constructed of 4-inch diameter PVC casing. Wells ELF001D, ELF002D, ELF003D, and ELF004D were not equipped with pumps as these wells will be sampled using passive methods. This is because these wells are screened in a thin zone at the top of the water table aquifer determined to be free of Mixed Waste Management Facility (MWMF) contamination (Kubilius, 2019; Dixon, 2020b). Passive sampling methods will help ensure that MWMF contaminated water, which lies below this thin layer, will not be drawn into the well by pumping for sampling activities. Wells ELF005D, ELF006D, ELF007D, and ELF008D will be equipped with bladder pumps since the upper portion of the water table aquifer at these locations is impacted by MWMF contamination and passive sampling methods are unnecessary.

Installation of the three lysimeters along the north rim of ET3 and installation of the eight new water table monitoring wells completes the field work required for the revised approach to performance monitoring (Kubilius, 2019). As a result, the performance assessment monitoring plan (Millings, 2012) will be updated to reflect the revised monitoring approach.

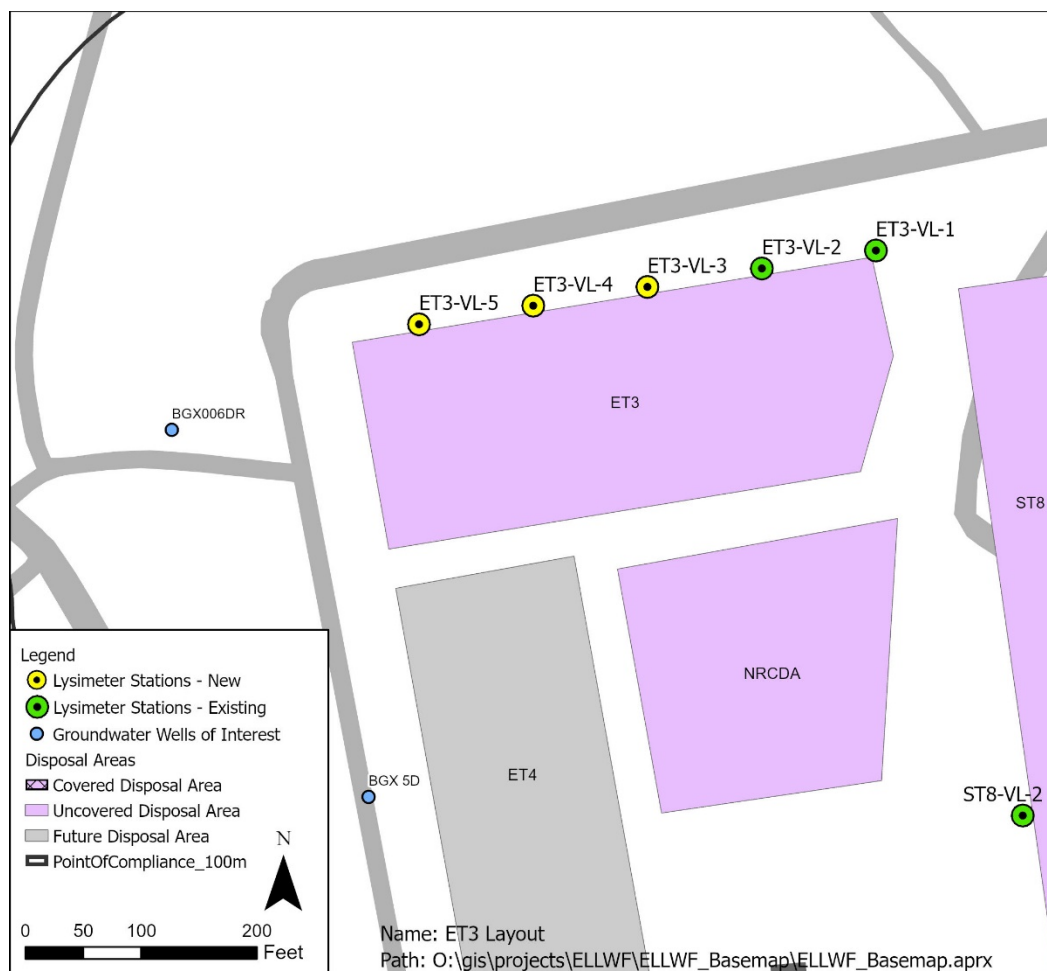


Figure ES-1. New Lysimeter Locations at ET3

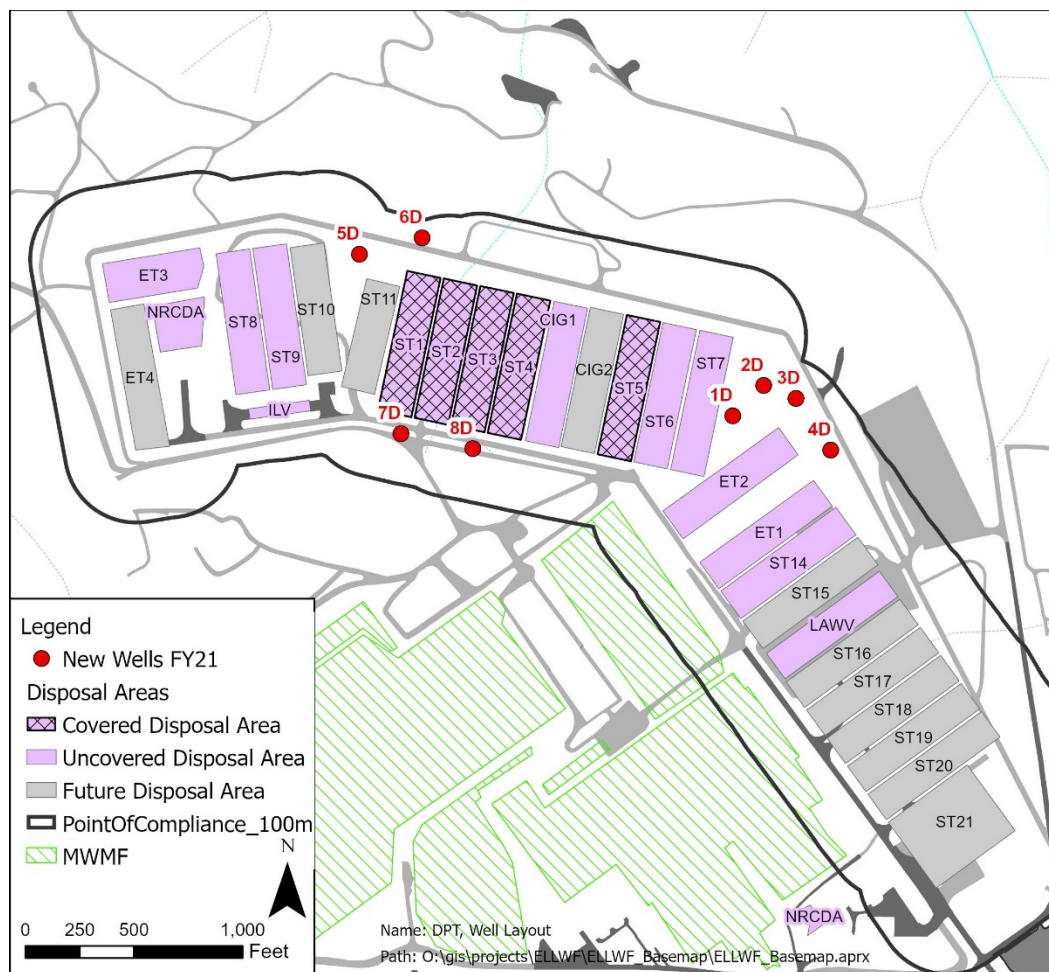


Figure ES-2. New ELLF Water Table Wells (red symbols)

Table ES-1. Construction Details for New ET3 Lysimeters.

Station Name	SRS North (ft)	SRS East (ft)	Ground Elevation (ft msl)	Lysimeter Elevation (ft msl)	Lysimeter Depth (ft bgs)	Action Level (pCi/ml)	Tritium Concentration (pCi/ml)
ET3-VL-3 (236)	78614.41	57764.17	275.9	236	40	43.7	2.26
ET3-VL-3 (222) ¹	78614.41	57764.17	275.9	222	54	43.7	1.68
ET3-VL-4 (233)	78659.91	57674.15	275.2	233	42	43.7	0.95
ET3-VL-4 (224) ¹	78659.91	57674.15	275.2	224	51	43.7	1.67
ET3-VL-5 (236)	78705.96	57584.55	274.9	236	39	43.7	0.83
ET3-VL-5 (222) ¹	78705.96	57584.55	274.9	222	53	43.7	27.5

¹Action-Level Lysimeter**Table ES-2. Construction Details for New Water Table Monitoring Wells.**

Well Name ¹	SRS North (ft)	SRS East (ft)	Ground Elevation (ft msl)	Top of Casing (ft msl)	Water Table (ft msl)	Top of Screen (ft msl)	Bottom of Screen (ft msl)	Pump
ELF001D	76452.42	59464.49	286.38	286.78	226	230	215	No
ELF002D	76480.48	59661.53	277.59	277.80	225	231	216	No
ELF003D	76344.35	59747.24	274.95	275.14	224	230	220	No
ELF004D	76058.15	59737.53	275.19	275.43	226	230	215	No
ELF005D	78066.88	58512.30	276.17	276.49	204	215	195	Yes
ELF006D	77957.22	58790.48	268.19	268.45	204	209	189	Yes
ELF007D	77285.60	58180.25	288.15	288.70	212	211	191	Yes
ELF008D	77034.00	58406.55	288.07	288.57	213	188	178	Yes

¹All wells are 4 inches in diameter.

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LIST OF ABBREVIATIONS

AL	Action Level
bgs	Below ground surface
CIG	Component-In-Grout
CPT	Cone Penetrometer Technology
DOE	Department of Energy
ELLWF	E-Area Low Level Waste Facility
EPA	Environmental Protection Agency
ET	Engineered Trench
ft	Feet
FY	Fiscal Year
GSA	General Separations Area
ILV	Intermediate Level Vault
LAWV	Low Activity Waste Vault
MCL	Maximum Contaminant Level
msl	Mean sea level
MWMF	Mixed Waste Management Facility
NRCDA	Naval Reactor Component Disposal Area
NTU	Nephelometer Turbidity Units
PA	Performance Assessment
pCi/ml	Picocurie per milliliter
PVC	Polyvinyl chloride
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SRS	Savannah River Site
ST	Slit Trench
SWM	Solid Waste Management
VZMS	Vadose Zone Monitoring System
WSRC	Westinghouse Savannah River Company

1.0 Introduction

The E-Area Low-Level Waste Facility (ELLWF) is a radioactive waste disposal site at the Savannah River Site (Figure 1). It is approximately 200 acres in size with a 100m buffer zone that extends out to the point of compliance. Disposal units within the footprint of the low-level waste facilities include the Slit Trenches (ST), Engineered Trenches (ET), Component-in-Grout Trenches (CIG), the Low-Activity Waste Vault (LAWV), the Intermediate-Level Vault (ILV), and the Naval Reactor Component Disposal Area (NRCDA) (WSRC, 2007). The facility provides disposal capacity for solid, low-level, non-hazardous radioactive waste and has been accepting waste since 1994 (WSRC, 2007). The ELLWF is situated within the General Separations Area (GSA) of the Savannah River Site (SRS) immediately north of the Mixed Waste Management Facility (MWMF).

The ELLWF is regulated under Department of Energy (DOE) Order 435.1 (DOE 1999) and is operated in accordance with a DOE approved Performance Assessment (PA) (WSRC, 2007). The E-Area Performance Monitoring Program provides assurance that the facility is operating as expected and predicted by the PA. The performance monitoring program includes a vadose zone monitoring system (VZMS) used to monitor tritium migrating from waste disposal trenches. The VZMS is comprised of about 307 active lysimeters at 102 lysimeter stations to monitor the release of tritium from the disposal trenches. At 93 of the 102 stations, the deepest or second deepest lysimeter is designated as the Action-Level (AL) lysimeter. Samples are collected from the lysimeter network biannually and analyzed for tritium. Tritium data from these lysimeters are compared to administrative limits as a guideline for whether further action is needed to assess performance at the 100-m compliance point of assessment. The administrative limit for a given trench is 25% of the tritium concentration in the vadose zone which, if it occurred beneath the entire areal footprint of the trench, would cause groundwater concentrations at the 100-meter boundary to reach the Environmental Protection Agency (EPA) Maximum Contaminant Level (MCL) for tritium of 20 pCi/ml.

The performance of the ELLWF is assessed based on the tritium concentrations measured in the VZMS. This approach to monitoring was taken because ELLWF lies down-gradient of the Mixed Waste Management Facility (MWMF) and contaminants (tritium, volatile organic compounds, refrigerant compounds, etc.) from MWMF have migrated beneath ELLWF in the water table aquifer. Contamination from MWMF was measured in down-gradient water table wells prior to construction of ELLWF (Kubilius, 2019). Therefore, it was assumed any contamination migrating from ELLWF would overlap and comeingle with MWMF contamination making it difficult to determine the source.

Since 1999, the VZMS has been used to successfully demonstrate that the ELLWF performance meets the requirements and predictions of the approved PA (WSRC, 2007). However, over time, several AL lysimeters have exceeded their established administrative limits. In FY2020, ten AL lysimeters exceeded the assigned administrative limit (LaBone et al., 2020). Additionally, as various waste trenches have been closed and capped with low permeability covers, vadose zone moisture has been reduced to the point that some of the shallower lysimeters routinely fail to produce a water sample. Although AL lysimeters are not expected to be significantly affected by reduced vadose zone moisture content due to closure capping, the shallower lysimeters may be

impacted. These factors have provided the motivation to revisit saturated zone monitoring for the ELLWF as a complement to the successful vadose zone monitoring program.

Kubilius (2019) provided an updated approach to performance monitoring at ELLWF that optimizes the VZMS and adds a saturated zone component to the existing vadose zone monitoring program. This approach specified a reduction in the frequency of sampling for a majority of lysimeters in the VZMS, eliminated several historically dry lysimeters from the sampling schedule, and added three new lysimeter stations on the north rim of ET3. The revised strategy results in a substantial reduction in the level of effort required for sampling while maintaining the effectiveness of the monitoring system by preserving all AL lysimeters and at least one shallower lysimeter at each station.

The revised monitoring approach also specified that eight new water table monitoring wells be installed at various locations around ELLWF. Four wells were specified for areas where there is known MWMF contamination, and four wells were specified for areas free of MWMF contamination in the shallow water table (Dixon, 2020b). These new wells will complement the existing monitoring well network and will be used in combination with the VZMS to assess the performance of the facility.

This project summary report is intended to provide the final construction details and layout for the new vadose zone lysimeters at ET3 and the water table monitoring wells installed as part of the updated approach to the performance monitoring program for ELLWF.

2.0 Vadose Zone Monitoring – Lysimeter Installation

The details of the lysimeter installation at ET3 are given by Dixon (2020a) and are summarized here. Drilling and lysimeter installation occurred during October 2020. Drilling services were provided by Cascade Environmental, LLC. Technical oversight of the drilling activities was provided by SRNS Geotechnical Engineering personnel. Three new lysimeter stations were installed along the north perimeter of ET3. These lysimeter stations were installed in a line with the two existing lysimeter stations (ET3-VL-1 and ET3-VL-2) and were spaced approximately 100 ft apart. The new lysimeter stations were identified as ET3-VL-3, ET3-VL-4, and ET3-VL-5. Figure 2 and Appendix A provides the layout of the lysimeter stations at ET3. The new lysimeter stations, together with the existing stations, span the length of ET3 on the north side of the disposal trench.

2.1 Lysimeter Placement

The conceptual model for placement of the new lysimeters at ET3 was to maintain consistency with the existing lysimeter stations (ET3-VL-1 and ET3-VL-2) while honoring the local lithology observed in each new borehole. The existing lysimeter stations ET3-VL-1 and ET3-VL-2 each have two lysimeters with the deeper of the two lysimeters being designated the action level lysimeter. The strategy for the placement was to locate the new lysimeters in sandy zones above silt/clay layers while maintaining consistency with the elevations of the existing lysimeters. This may improve the odds of collecting samples due to perched water at this interface. Lysimeters were not placed near the water table and capillary fringe due to the possibility they could be

influenced by contaminants in the water table aquifer. The water table near ET3 was at 71 ft bgs surface at the time of installation.

The placement of each lysimeter was based on core description, gamma logs, and CPT logs (when available). More weight was given to the core description for lysimeter placement in cases where the logging results and the core description differed. Construction details for the lysimeters are presented in Table 1. The initial tritium concentrations measured in the lysimeters are presented in Table 2.

3.0 Saturated Zone Monitoring – Well Installation

In addition to the new lysimeters installed at ET3, the updated monitoring approach called for the installation of new water table monitoring wells to complement the existing well network surrounding the ELLWF. The location and target screen zones for the new wells were identified by Kubilius (2019) and Dixon (2020b).

Drilling and well installation occurred during May/June 2021. Drilling services were provided by Cascade Environmental, LLC. Technical oversight of the drilling activities was provided by SRNS Geotechnical Engineering personnel.

3.1 Well Installation

Eight new water table monitoring wells were installed at the ELLWF as shown in Figure 3. The new wells were assigned the prefix “ELF”. Wells were installed using sonic drilling technology. At each location, six-inch diameter steel casing was advanced to a depth of about ten feet above the screen zone. Then, four-inch diameter core barrel was used to collect core to total depth through six-inch diameter steel override casing. Finally, each borehole was over-reamed with eight-inch diameter steel casing. Sediment core was visually described, and detailed logs were documented for each borehole (Appendix B). In general, sediments encountered can be described as silty sands with occasional interbedded clayey layers.

Soil plug samples were collected from the sediment cores on two-foot intervals. These samples were analyzed for trichloroethylene (TCE) and perchloroethylene (PCE). All results were below analytical detection limits except for samples collected from ELF007D. For well ELF007D, TCE was detected in the interval from 93 to 97 ft below ground surface (bgs) (Table 3).

Each well was constructed of four-inch diameter schedule 40 polyvinyl chloride (PVC) casing. The wells were screened with 0.010 slot PVC screen as indicated in Table 4. All wells were completed to the ground surface with schedule 40 PVC riser. Well construction diagrams are provided in Appendix C and the final layout of the wells is provided in Appendix D.

3.2 Well Development

Well development was conducted according to the guidelines specified in SRS environmental compliance manual 3Q1 Procedure 9007 (SRNS, 2020). Proper development reduces the turbidity

of the water in the well and improves the quality of samples collected from the well. Water quality parameters monitored during the development process included turbidity, pH, temperature, and specific conductance. For each well, these parameters were measured and used to determine when development was complete. Development was considered complete when the change in water quality parameters was less than $\pm 10\%$ for three consecutive readings and turbidity less than 15 Nephelometer Turbidity Units (NTU).

Development was completed in two stages. During the first stage each well was pumped (air lifted) to remove particulates remaining from well drilling and construction. Subsequently, a low flow submersible pump was used to continue the development process. For wells ELF005D, ELF006D, ELF007D, and ELF008D, pumping continued until development criteria were met.

Wells ELF001D, ELF002D, ELF003D, and ELF004D all pumped dry during the development process. The effluent from each well was very turbid. To aid with the development process, two gallons of potable water were added to each well. The wells were then swabbed with a surge block and pumped dry. This process was repeated three times after which the wells were allowed to fully recover. Wells ELF001D, ELF002D, and ELF003D were hand bailed until development criteria were met. For ELF004D, a low flow pump was used for development rather than a hand bailer. Water was pumped from the well at a flow rate of about 0.25 gpm until development criteria were met.

At the conclusion of development, samples were collected from all wells according to the guidelines specified in SRS environmental compliance manual 3Q1 Procedure 9015 (SRNS, 2019). Samples were collected for tritium, VOCs, technetium-99 (Tc-99), and iodine-129 (I-129). Water quality parameters monitored during sampling included turbidity, pH, temperature, and specific conductance. The same criteria were used for sampling as was used for development (≤ 15 NTU for turbidity and $\pm 10\%$ for three consecutive readings on other parameters). All wells met the criteria except ELF003D. For ELF003D, the criteria were met for tritium, VOCs, and Tc-99. However, for the I-129 sample at ELF003D, the turbidity was slightly higher (< 35 NTU).

At the time of this report, analytical data from the samples were not available.

4.0 Summary

Savannah River Site (SRS) has developed a revised approach to performance monitoring of the E-Area Low Level Waste Facility (ELLWF) that adds a saturated zone component to the existing vadose zone monitoring program (Kubilius, 2019). The revised approach specifies modifications to the vadose zone monitoring program, the addition of new lysimeters at Engineered Trench 3 (ET3), and the installation of water table monitoring wells to complement the existing well network surrounding the ELLWF. This project summary report provides the final construction details and layout for the new vadose zone lysimeters at ET3 and the water table monitoring wells installed as part of the new saturated zone component of the revised performance monitoring program.

Three new lysimeter stations were installed on the north rim of ET3 and were designated as ET3-VL-3, ET3-VL-4, and ET3-VL-5. The stations were installed in a line with the two existing stations (ET3-VL-1 and ET3-VL-2) and spaced approximately 100 ft apart. Two lysimeters were installed at each station. The deepest lysimeter at each of the three new lysimeter stations was designated as the action-level lysimeter.

With the addition of the new lysimeters at ET3, the E-Area Vadose Zone Monitoring System (VZMS) is now comprised of 307 suction lysimeters at 102 stations surrounding 14 waste trenches. At 93 of 102 lysimeter stations, a deep lysimeter is designated as an Action-Level (AL) lysimeter. The revised monitoring approach proposes reducing the number of lysimeters sampled and reducing the sampling frequency for some lysimeters from twice per year to once per year (Kubilius, 2019). However, all AL lysimeters will continue to be sampled twice per year.

Eight water table monitoring wells were installed in May/June 2021: four north of Engineered Trench 2 (ET2), two north of Slit Trench 1 (ST1), and two south of ST1 near well cluster BGX-2. Each well was constructed of 4-inch diameter PVC casing. Wells ELF001D, ELF002D, ELF003D, and ELF004D will be sampled using passive methods. Wells ELF005D, ELF006D, ELF007D, and ELF008D will be equipped with bladder pumps.

Installation of the three lysimeters along the north rim of ET3 and installation of the eight new water table monitoring wells completes the field work required for the revised approach to performance monitoring (Kubilius, 2019). As such, the performance assessment monitoring plan (Millings, 2012) will be updated to reflect the revised monitoring approach.

5.0 References

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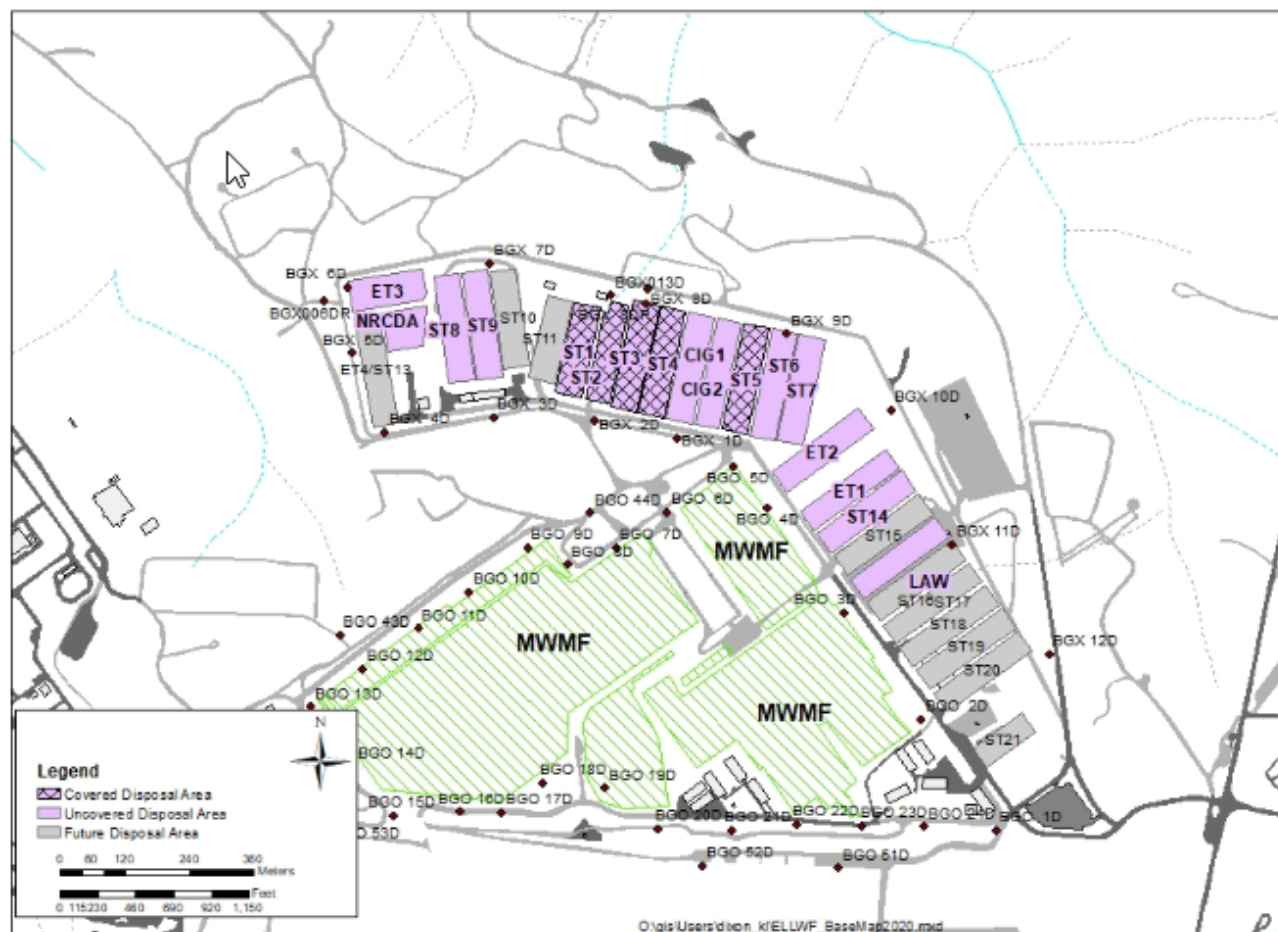


Figure 1. E-Area Low-Level Waste Facility.

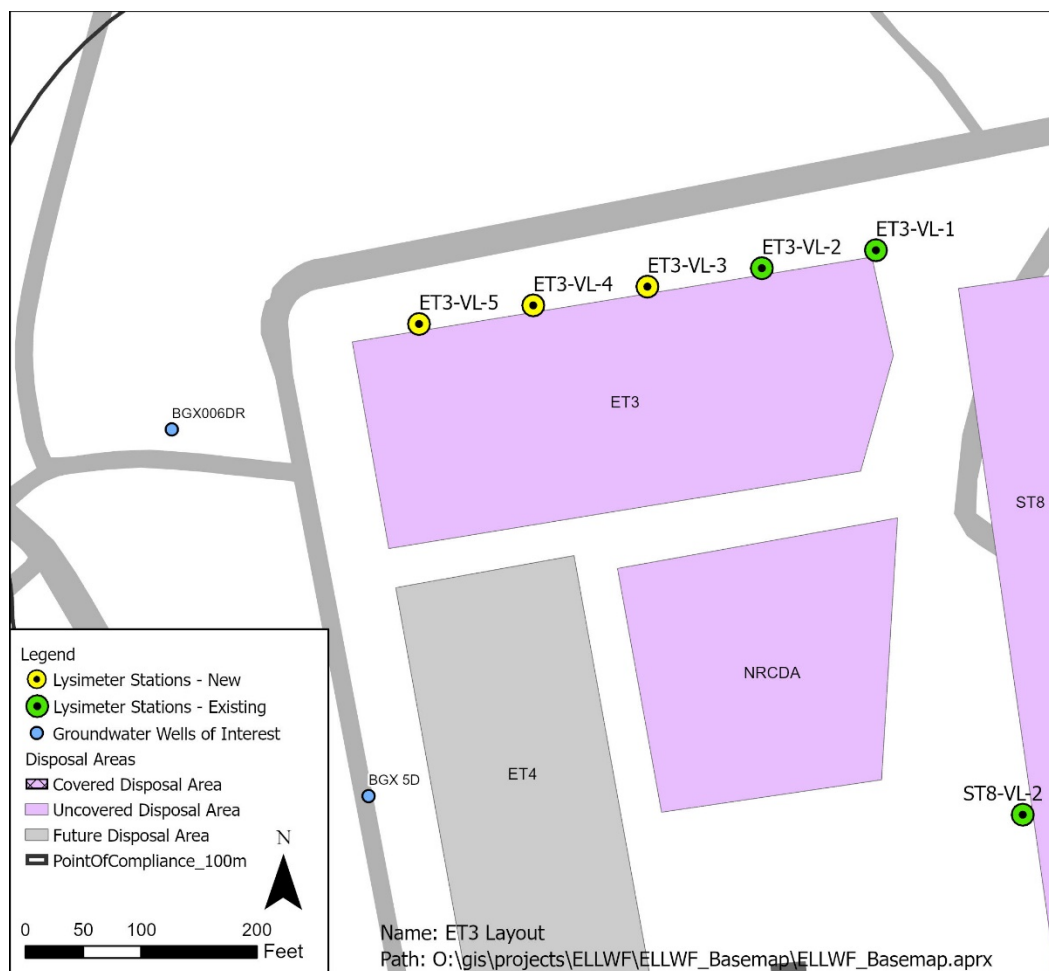


Figure 2. Layout of New Lysimeters at ET3.

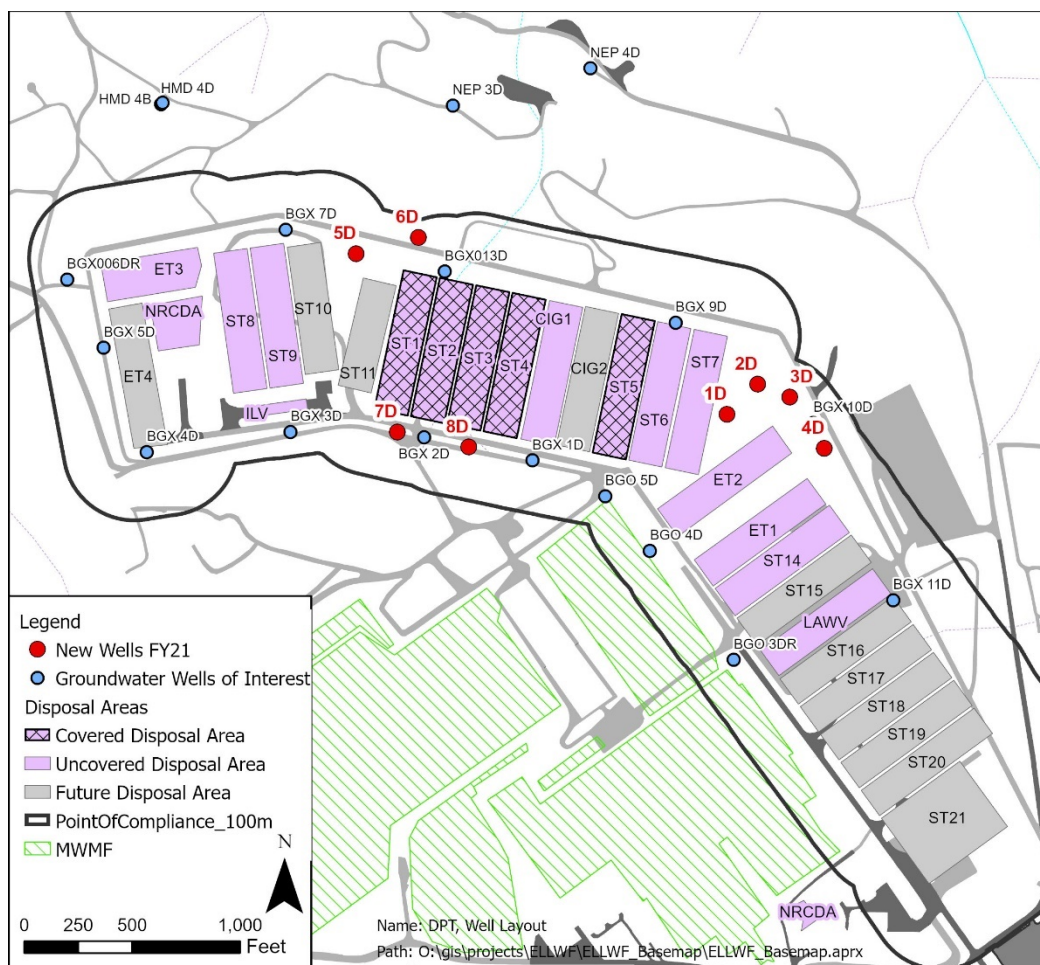


Figure 3. Layout of New Water Table Monitoring Wells.

Table 1 Construction Details for ET3 Lysimeter Locations.

Station Name	Date Installed	SRS North (ft)	SRS East (ft)	Ground Elevation (ft msl)	Lysimeter Elevation (ft msl)	Lysimeter Depth (ft bgs)	Action Level Lysimeter	Action Level (pCi/ml)
ET3-VL-1 (234)	2016	78525.21	57940.98	275.6	234	42	NO	-
ET3-VL-1 (221)	2016	78525.21	57940.98	275.6	221	55	YES	43.7
ET3-VL-2 (243)	2016	78570.92	57851.84	280.1	243	37.5	NO	-
ET3-VL-2 (226)	2016	78570.92	57851.84	280.1	226	54	YES	43.7
ET3-VL-3 (236)	2020	78614.41	57764.17	275.9	236	40	NO	-
ET3-VL-3 (222)	2020	78614.41	57764.17	275.9	222	54	YES	43.7
ET3-VL-4 (233)	2020	78659.91	57674.15	275.2	233	42	NO	-
ET3-VL-4 (224)	2020	78659.91	57674.15	275.2	224	51	YES	43.7
ET3-VL-5 (236)	2020	78705.96	57584.55	274.9	236	39	NO	-
ET3-VL-5 (222)	2020	78705.96	57584.55	274.9	222	53	YES	43.7

Table 2 Initial Tritium Concentrations Measured in New ET3 Lysimeters.

Lysimeter	Action Level (pCi/mL tritium)	Sample Volume (ml)	December 2020 Concentration (pCi/ml)
ET3-VL-3 (236)	43.7	1000	2.26
ET3-VL-3 (222)	43.7	1000	1.68
ET3-VL-4 (233)	43.7	1000	0.95
ET3-VL-4 (224)	43.7	1000	1.67
ET3-VL-5 (236)	43.7	1000	0.83
ET3-VL-5 (222)	43.7	1000	27.5

Table 3 TCE and PCE Results from Soil Plug Sampling (mg/kg)^{1,2}.

Depth (ft bgs)	ELF001D		ELF002D		ELF003D		ELF004D		ELF005D		ELF006D		ELF007D		ELF008D	
	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE	TCE	PCE
37			U	U	U	U	U	U								
39			U	U	U	U	U	U								
41			U	U	U	U	U	U								
43			U	U	U	U	U	U								
45			U	U	U	U	U	U								
47	U	U	U	U	U	U	U	U								
49	U	U	U	U	U	U	U	U								
51	U	U	U	U	U	U	U	U								
53	U	U	U	U	U	U	U	U								
55	U	U	U	U	U	U	U	U								
57	U	U	U	U			U	U	U	U	U	U				
59	U	U	U	U			U	U	U	U	U	U				
61	U	U	U	U					U	U	U	U				
63	U	U							U	U	U	U				
65	U	U							U	U	U	U				
67	U	U							U	U	U	U	U	U		
69	U	U							U	U	U	U	U	U		
71	U	U							U	U	U	U	U	U		
73	U	U							U	U	U	U	U	U		
75									U	U	U	U	U	U		
77									U	U	U	U	U	U	U	U
79									U	U	U	U	U	U	U	U
81									U	U	U	U	U	U	U	U
83													U	U	U	U
85													U	U	U	U
87													U	U	U	U

89														U	U	U	U
91														U	U	U	U
93														0.006	U	U	U
95														0.008	U	U	U
97														0.004	U	U	U
99																U	U
101																U	U
103																U	U
105																U	U
107																U	U
109																U	U

¹Shaded regions indicate samples from screen zone.

²U=Undetected

Table 4: New E-Area Well Construction Details.

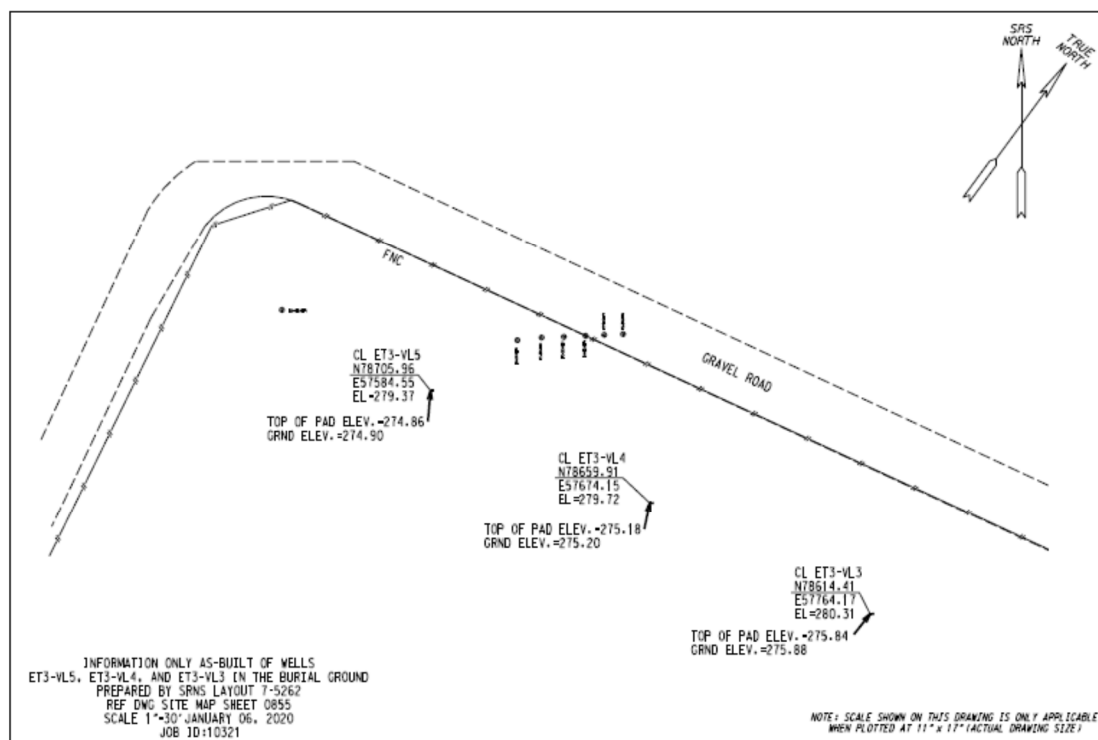
Well Name¹	SRS North (ft)	SRS East (ft)	Ground Elevation (ft msl)	Pad Elevation (ft msl)	Top of Casing Elevation (ft msl)	Water Table (ft msl)	Water Table Depth (ft bgs)	Top of Screen (ft msl)	Bottom of Screen (ft msl)	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Screen Length (ft)
ELF001D ²	76452.42	59464.49	286.38	286.78	76452.42	226	60	230	215	56	71	15
ELF002D ²	76480.48	59661.53	277.59	277.80	76480.48	225	53	231	216	47	62	15
ELF003D ²	76344.35	59747.24	274.95	275.14	76344.35	224	51	230	220	45	55	10
ELF004D ²	76058.15	59737.53	275.19	275.43	76058.15	226	50	230	215	45	60	15
ELF005D ³	78066.88	58512.30	276.17	276.49	78066.88	204	72	215	195	61	81	20
ELF006D ³	77957.22	58790.48	268.19	268.45	77957.22	204	64	209	189	59	79	20
ELF007D ³	77285.60	58180.25	288.15	288.70	77285.60	212	76	211	191	77	97	20
ELF008D ³	77034.00	58406.55	288.07	288.57	77034.00	213	75	188	178	100	110	10

¹All wells 4-inch diameter PVC

²No pump, HYDRASleeve™

³Bladder pump

Appendix A. Final Layout for New ET3 Lysimeters



Appendix B. Core Descriptions for ELF Monitoring Wells

GSR 30-37a (2-12-07)

Field Geologic Log

Project		E Area Groundwater Wells		Date	5-18-21	Sheet	1 of 2
Well Number		ELF001D		Location	E Area	Drilling Subcontractor	
Logs Prepared By		Bill Joyce		Driller		David Wilcox	
Company		SRNS		Drilling Method		Rotasonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	4 0				
	1				
	2				
	3				
	4				
	4 5				
	6				
	7			Silty SAND (silt 20-25%) fa =	
	8			fin grn, mod reddish orange (10R 6/4) -	
	9			pale reddish brown (10R 5/4) grading	
1	5 0			to some dark yellowish orange (10YR 6/6)	
	1			with kaolin, sand-sbng, well sorted,	
	2			slightly moist-dry	
	3				
	4				
	5			Grading color change	
	6				
	7			SAND (silt 5-10%) fa grn, pale	
	8			reddish brown (10R 5/4) - light brown	
	9			(5YR 5/6) sbng-sbng, well sorted,	
2	6 0			moist-cwet	

OSR 30-37rev3 12-97

Field Geologic Log

Project		E Area Groundwater Wells		Date	5-18-21	Sheet	2 of 2
Well Number		ELF001D		Location		E Area	
Logs Prepared By		Bill Joyce		Drilling Subcontractor		Cascade	
Company		SRNS		Driller		David Wilcox	
				Drilling Method		Rotasonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
2	0		75	Silty SAND (silt 15-20%) to gr, pale reddish brown (10R 5/4) - light brown (5YR 5/6), sand - clay, well sorted, moist	
	1				
	2				
	3				
	4				
	5				
3	6		100	SAND (silt 10%) to med gr, light brown (5YR 5/6) - mod yellowish brown (10YR 5/4), sand - clay, mod sorted, moist - wet	
	7				
	8				
	9				
	10				
	11				
7	12			Total Depth: 71.3'	
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				

OSR 30-27a (12-13-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>			Date <i>5-13-21</i>	Sheet <i>1</i> of <i>2</i>
Well Number <i>ELF002D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>			Driller <i>David Wilcox</i>	
Company <i>SRNS</i>			Drilling Method <i>Rotasonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
<i>1</i>	<i>3</i> 0				
	1				
	2				
	3				
	4				
	<i>3</i> 5				
	6				
	7				
	8				
	9				
	<i>4</i> 0				
	1				
	2				
	3				
	4				
	<i>4</i> 5				
6					
7					
8					
9					
<i>2</i> 0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
<i>5</i> 0					

Silty SAND (silt 30-35% kaolin 10-15%) vln grn, light brown (5YR 5/6) - dark yellowish orange (10YR 6/8) with white (N9) sand-slags, well sorted, dry

Color change to mod red (5R 5/4) SAND (silt to 5%) to-medi grn, light brown (5YR 5/6) - dark yellowish orange (10YR 6/6), sand-slags, mod sorted, dry

Moist at 49.0'

Wet at 50.0'

OSR 50-27a (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>			Date <i>5-13-21</i>	Sheet <i>2 of 2</i>
Well Number <i>ELF 002 D</i>		Location <i>E Area</i>		
Logs Prepared By <i>Bill Joyce</i>			Drilling Subcontractor <i>Cascade</i>	
Company <i>SRNS</i>			Driller <i>David Wilcox</i>	
			Drilling Method <i>Rotosonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
<i>2</i>	<i>5</i> 0				
	1				
	2				
	3				
	4				
<i>5</i>	5				
	6				
	7				
	8				
	9				
<i>3</i>	10				
	11				
	12				
	13				
	14				
<i>6</i>	15				
	16				
	17				
	18				
	19				
<i>6</i>	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
				<i>Total Depth: 62.3'</i>	

OSR 30-374 (2-11-97)

Field Geologic Log


Project		E Area Groundwater Wells		Date	5-19-21	Sheet	1 of 2
Well Number		ELF003D		Location	E Area		
Logs Prepared By		Bill Joyce		Drilling Subcontractor	Cascade		
Company		SRNS		Driller	David Wilcox		
				Drilling Method	Rotasonic		

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
1	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
4	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
2	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
5	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				

OSR 30-278 (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>5-19-21</i>	Sheet <i>2</i> of <i>2</i>	
Well Number <i>ELF 003D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>		Driller <i>David Wilcox</i>		
Company <i>SRNS</i>		Drilling Method <i>Rotasonic</i>		

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
<i>2</i>	<i>5</i> 0		<i>100%</i>	<i>SAND (5:14 10-15%) vfn-fn grn, light brown (5 YR 5/6), sand, well sorted, moist-wet, trace mang. oxide</i>	
	1				
	2				
	3				
	4				
	<i>5</i> 5				
	6			<i>Total Depth: 55.3'</i>	
	7				
	8				
	9				
<i>6</i>	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	0				

OSR 30-374 (2-13-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>				Date <i>5-20-21</i>	Sheet <i>1</i> of <i>2</i>
Well Number <i>ELF 004D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>	
Logs Prepared By <i>Bill Joyce</i>				Driller <i>David Wilcox</i>	
Company <i>SRNS</i>				Drilling Method <i>Roto sonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
	3 0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
1	4 0		100	<i>Silty SAND (silt 30-35%, kaolin 10-15%) vfn-fn grn, mod reddish orange (10R 6/4) - very pale orange (10YR 8/2) - white (N9) sand, well sorted</i>	
	1				
	2			<i>Silty SAND (silt 20-25%) vfn-fn grn, pale reddish brown (10R 5/4) - light brown (5YR 5/6), sand - sbang, well sorted, dry</i>	
	3				
	4				
	5				
	6				
	7				
	8				
	9				
2	5 0		100	<i>Silty/clayey SAND with kaolin vfn-fn grn, light brown (5YR 5/6) - dark yellowish orange (10YR 6/4) - white (N9) sand - sbang, well sorted</i>	
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				

OSR 30-27a (3-13-99)

Field Geologic Log

Project		E Area Groundwater Wells		Date	5-24-21	Sheet	2 of 2
Well Number		ELF 004D		Location		E Area	
Logs Prepared By		Bill Joyce		Drilling Subcontractor		Cascade	
Company		SRNS		Driller		David Wilcox	
				Drilling Method		Rotasonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
2	0		100%	Silt, SAND (silt 20-25%) to grn, light brown (5YR 5/6) - mod yellowish brown (10YR 5/4), sbrnd - sbrng, well sorted, moist-wet	
	1				
	2				
	3				
	4				
3	5		100%	SAND (silt 10-15%) to grn with some med grn, light brown (5YR 5/6) - mod yellowish brown (10YR 5/4), sbrnd - sbrng, well sorted, moist-wet, thin clay at 54.3'	
	6				
	7				
	8				
	9				
6	0		100%	CLAY - Silt, SAND, dark yellowish orange (10YR 6/6) - white (N9) kaolin, solid	
	1				
	2				
	3				
	4				
6	5		100%	SAND (silt 5-10%) med- to grn, dark yellowish orange (10YR 6/6) - grayish orange (10YR 7/4), sbrnd - sbrng, mod sorted, wet	
	6				
	7				
	8				
	9				
	0			Total Depth: 64.3'	
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	0				
	1				
	2				
	3				
	4				

OSR 30-27a (2-13-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>5-25-21</i>	Sheet <i>1</i> of <i>2</i>	
Well Number <i>ELF005D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>		Driller <i>David Wilcox</i>		
Company <i>SRNS</i>		Drilling Method <i>Rotasonic</i>		

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
<i>1</i>	<i>5</i> 0				
	1				
	2				
	3				
	4				
	<i>5</i> 5				
	6				
	7				
	8				
	9				
	6 0				
	1				
<i>2</i>	2				
	3				
	4				
	6 5				
	6				
	7				
	8				
	9				
	7 0				

CLAY dark yellowish orange (10YR 6/6), clean, solid, slightly moist, malleable

Interbedded sandier clay and clayey sand, vfn-fn grn, mod yellowish brown (10YR 5/4)-light brown (5YR 5/6), sand, well sorted, dry, trace mang. oxide

SAND (silt tr-5%) fn grn, white (N9)-pale red (10R 6/2)-grayish orange (10YR 7/4), sand-sand, well sorted, dry, trace mang oxide

SAND (silt tr-5%) fn-vfn grn with some med grn, dark yellowish orange (10YR 6/6)-light brown (5YR 5/6), sand, well sorted

Moist at 69.0'

QSR 30-27a (2-13-97)

Field Geologic Log

Project		E Area Groundwater Wells		Date	5-25-21	Sheet	2 of 2
Well Number		ELF 005D		Location	E Area	Drilling Subcontractor	
Logs Prepared By		Bill Joyce		Driller		David Wilcox	
Company		SRNS		Drilling Method		Rotasonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
2	7 0	9φ		SAND (silt fr - 5%) fr-med grn. dark yellowish orange (10 YR 6/5) - light brown (5 YR 5/5), sbrd, med sorted, wet at 71.0'	
	1				
	2				
	3				
	4				
3	7 5	10φ		SAND (silt trace - mostly clean) fr-med grn, pale yellowish orange (10 YR 8/5) - light brown (5 YR 5/5), sbrd, med sorted, wet	
	6				
	7				
	8				
	9				
8	8 0			Total Depth: 81.3'	
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
8	8 0				
	1				
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	9				
8	8 0				

OSR 30-27a (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>6-03-21</i>	Sheet <i>1</i> of <i>2</i>
Well Number <i>ELF 006D</i>	Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>B:11 Joyce</i>		Driller <i>David Wilcox</i>	
Company <i>SRNS</i>		Drilling Method <i>Rotosonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
	5 0				
	1				
	2				
	3				
	4				
	5 5				
	6				
	7			<i>CLAY light brown (5YR 5/6) with light greenish gray (5G 7.5/1) and black mang. oxide, clean, soft, moist, malleable</i>	
	8				
	9			<i>Sandy CLAY fn gen, light brown (5YR 5/6) - med brown (5YR 4/4)</i>	
	6 0			<i>Clean CLAY</i>	
1	1		100	<i>Sandy CLAY fn gen, light brown (5YR 5/6) - med brown (5YR 4/4), ssand, well sorted, moist</i>	
	2				
	3				
	4				
	5			<i>Clayey / silty SAND fn gen, light brown (5YR 5/6), ssand - ssang, well sorted, moist with mang. oxide</i>	
	6				
	7				
2	8		100	<i>As Above grading less silty (5-10%)</i>	
	9				
	7 0				

OSR 30-27# (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>6-03-21</i>	Sheet <i>2 of 2</i>
Well Number <i>ELF 006D</i>		Location <i>E Area</i>	
Logs Prepared By <i>Bill Joyce</i>		Drilling Subcontractor <i>Cascade</i>	
Company <i>SRNS</i>		Driller <i>David Wilcox</i>	
		Drilling Method <i>Rotosonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
2	0			<i>Interbedded CLAY and Clayey SAND</i>	
	1				
	2				
	3			<i>SAND (silt 5-10%) fr-med grn, light brown (5YR 6/6) sbnd-ssang, med sorted, moist-wet, with mang. oxide</i>	
	4				
3	5				
	6			<i>SAND (silt fr-5%) fr-med grn dark yellowish orange (10YR 6/6) - light brown (5YR 5/6) with grayish orange (10YR 7/4) sbnd-ssang, med sorted, moist-wet</i>	
	7				
	8				
	9				
8	0				
	1				
	2			<i>Total Depth: 81.0'</i>	
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	0				

OSR 30.278 (2-11-97)

Field Geologic Log

Project		E Area Groundwater Wells		Date	6-01-21	Sheet	1 of 2
Well Number		ELF 007D		Location	E Area	Drilling Subcontractor	
Logs Prepared By		Bill Joyce		Driller		David Wilcox	
Company		SANS		Drilling Method		Rotasonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7			CLAY light gray - light brown (5YR 5/6), firm, moist, slightly malleable, sand pocket at 69.0'	
	8				
	9				
2	0				
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
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2	0				
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NSR 30.72a (7-11-90)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>6-01-21</i>	Sheet <i>2 of 2</i>
Well Number <i>ELF 007D</i>	Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>		Driller <i>David Wilcox</i>	
Company <i>SRNS</i>		Drilling Method <i>Rotasonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
<i>2</i>	<i>8</i> 0		<i>100%</i>	<i>CLAY with occ. sandy pockets (82.6' - 83.2') greenish gray, soft, moist, malleable, with black (mang. oxide)</i>	
	1				
	2				
	3				
	4				
<i>3</i>	<i>8</i> 5		<i>100%</i>	<i>CLAY As Above</i>	
	6				
	7				
	8				
	9				
	9 0				
	1				
	2				
	3				
	4				
	9 5				
	6				
	7				
	8				
	9				
10 0					
				<i>SAND (silt trace) medium-fn grs, light brown (5% silt), sorted-sb ang, mod sorted, wet-moist</i>	
				<i>SAND As Above but grades slightly siltier (5%)</i>	
				<i>Total Depth: 97.3'</i>	

IOSR 30-27# (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>		Date <i>5-26-21</i>	Sheet <i>1</i> of <i>2</i>	
Well Number <i>ELF008D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>		Driller <i>David Wilcox</i>		
Company <i>SRNS</i>		Drilling Method <i>Rotosonic</i>		

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0				
	1				
	2				
	3				
	4				
	5				
	6				
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1	0				
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OSR 30-27# (2-12-97)

Field Geologic Log

Project <i>E Area Groundwater Wells</i>			Date <i>5-26-21</i>	Sheet <i>2</i> of <i>2</i>
Well Number <i>ELF008D</i>		Location <i>E Area</i>		Drilling Subcontractor <i>Cascade</i>
Logs Prepared By <i>Bill Joyce</i>			Driller <i>David Wilcox</i>	
Company <i>SRNS</i>			Drilling Method <i>Rotasonic</i>	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
2	9 0		100%	Clayey/Silty SAND As Above	
	1			CLAY with some sand, yellowish gray (TYR 1/4) - pale olive, solid, firm	
	2				
	3				
	4				
3	9 5		100%	Clayey SAND	
	6			SAND (silt 5%) fn-med grn, light brown (TYR 5/6), sband-sbng, med sorted, wet	
	7				
	8				
	9			SAND (silt trace) fn-med grn, light brown (TYR 5/6), sband-sbng, med sorted, wet	
	10 0				
	1			Silty/Clayey SAND (silt 10-15%, clay 5%) med-fn grn with some coarse grn, light brown (TYR 5/6), sbang-sband, med sorted, moist-wet, with mang. oxide	
	2				
	3				
	4				
4	10 5		100%	SAND As Above	
	6			SAND (silt 7-5%) fn-med grn with some coarse grn, light brown (TYR 5/6), sbang-sband, med sorted, wet	
	7				
	8				
	9			Thin CLAY layer	
	11 0			SAND (silt 7-5%) fn-med grn, light brown (TYR 5/6), sband, med sorted, moist	

Total Depth: 110.3'

Appendix C. Well Construction Diagrams for ELF Series Monitoring Wells

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF001D	
Well Installation Date 5-18-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-76452,42		SRS East Grid Coordinate (as built) E-59464,49		Latitude (deg/min/sec - as built) (NAD 27) 33/17/30,79		Longitude (deg/min/sec - as built) (NAD 27) -81/39/31,41	
Top of Pad Elevation (as built) 286,78' msl		Water Level Reference Point Elevation (as built) 288,98' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					
Total Depth of Installed Casing <u>NA</u>							
Casing Material/Diameter <u>NA</u>							
Grout Quantity <u>NA</u>							

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

47.9' Grout (if 1)

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Water Table

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

Bottom of Filter Pack

Top of Back Plug (if applicable)

Total Depth of Well

71.3'

71.3'

71.3'

56.0'

71.0'

71.3'

52.4'

47.9'

8" Borehole Diameter

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Page 3 of 4

Monitoring Well Installation Report (Continued)

					Well Number ELF001D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.6'	56.0	PVC / Schedule 40	4"		
Screen	56.0'	71.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	71.0'	71.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	52.4'	71.3'	7.5 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	47.9'	52.4'	2 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	47.9'	16 bags / 46,2lbs/bag	5-19-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments Hydrosleeve to be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date		Installer/Company		Model/Manufacturer		Diameter
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump				
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

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Page 4 of 4

Well Development Data Field Parameters

Well Developed By Cascade Drilling						Well Number ELF001D
Development Oversight Bill Joyce			Development Method Air Lift / Pump / Bail			Final Yield (gpm) NA
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-09-2021	12:16 PM		uS	NTUs	Celsius	Water Level - 60.13' bgs (below ground surface)
	12:29 PM					Air Lift for 79 minutes
6-10-2021	8:25 AM					Water Level - 60.8' bgs
	8:48 AM					Pump with low flow mega-monsoon pump. Very Turbid. Pumps dry. Let recover
						Pumps dry in 1-2 minutes. Pump dry every 20 minutes. Very turbid
	3:35 PM	7.13	126.8	Over-Range	25.6	Pump slow. Still pumps dry. Recharge is 0.6' per 30 minutes
6-24-2021	9:20 AM					Water Level - 60.25' bgs
	9:43 AM					Tried Watera Pump - unsuccessful. Lost stainless steel check valve in the well
	11:00 AM					Pump with mega-monsoon pump. Pumped dry after 6.5 gallons
	11:05 AM					3 times: Add 2 gallons potable water, swab/surge, pump dry
6-28-2021	11:35 AM					Water Level - 60.85' bgs
7-08-2021	1:38 PM					Water Level - 60.40' bgs
7-13-2021	12:25 PM					Water Level - 60.28' bgs
	12:35 PM	6.83	106.8	1.55	24.9	Bail #1 - total is less than 1/2 gallon
	12:48 PM	6.93	107.3	4.15	24.6	Bail #2 - total is greater than a 1/2 gallon
	12:56 PM	6.89	106.6	6.95	24.3	Bail #3 - total is less than 1 gallon
	1:04 PM	6.97	107.7	9.37	24.4	Bail #4 - total is 1 1/4 gallons. Water Level - 61.47' bgs
	1:16 PM	6.96	107.2	52.5	24.2	Bail #5 - total is 1 1/2 gallons
	1:24 PM	6.96	107.1	79.3	24.2	Bail #6 - total is 1 3/4 gallons. Water Level - 61.92' bgs
7-14-2021	12:43 PM					Water Level - 60.25' bgs. Collected Rad sample to clear for shipping
7-15-2021	9:10 AM					Water Level - 60.20' bgs
	9:20 AM	6.82	106.2	4.57	24.3	Collect Sample ELLWF-NEW0004 at 0920. Samples had a turbidity below 15 NTUs
	12:50 PM			11.8		Completed sampling

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B	Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF002D
Well Installation Date 5-17-2021	SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling		
SRS North Grid Coordinate (as built) N-76480.48	SRS East Grid Coordinate (as built) E-59661.53	Latitude (deg/min/sec - as built) (NAD 27) 33/17/32.17	Longitude (deg/min/sec - as built) (NAD 27) -81/39/29.74		
Top of Pad Elevation (as built) 277.80' msl	Water Level Reference Point Elevation (as built) 280.45' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface		
Surface Casing (if installed) _____ Depths measured from ground surface to nearest 0.1 ft					
Total Depth of Installed Casing NA _____					
Casing Material/Diameter NA _____					
Grout Quantity NA _____					

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

Grout (if 1 screen)

39.4'

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

39.4'

43.3'

Top of Bentonite

Top of Filter Pack

47.0'

62.0'

62.3'

62.3'

Bottom of Filter Pack

NA Top of Back Plug (if applicable)

62.3' Total Depth of Borehole

8" Borehole Diameter

Monitoring Well Installation Report (Continued)

Program Plan Name ELLWF Water Table Monitoring Wells			Location Description E Area		Site ID N3 / W2		Well Number ELF002D		
Station Type (Monitoring Well, Piezometer, etc.) Monitoring Well							Project Manager Virginia Rigsby		
Drilling and Sampling									
Drilling Start Date 5-13-2021			Drilling Completion Date 5-17-2021			Total Drilled Depth 62.3'			
Drilling Sampling Method			Top Depth		Bottom Depth		Diameter		
Rotosonic Drill			0.0'		36.0'		6"		
Core / Rotosonic Drill			36.0'		62.3'		6"		
Over-Ream			0.0'		62.3'		8"		
Drilling and Sampling Comments (lost circulation zones, drilling problems, etc.)									
Hand-augered from 0.0' - 6.0' to ensure there were no underground obstructions. No problems were encountered.									
Soil plug samples were collected every 2 ft beginning at 37' (37' - 61').									
The screen interval was predetermined based on CPT/DPT results.									
Ground Surface Elevation: 277.59' msl									
Geophysical Logging									
Date Logged NA		Logging Top Depth NA		Logging Bottom Depth NA		Logging Contractor NA		Logging Truck Operator NA	
Geophysical Logs									
<input type="checkbox"/> Caliper <input type="checkbox"/> Natural Gamma <input type="checkbox"/> Neutron Density <input type="checkbox"/> Resistivity <input type="checkbox"/> Single Pt. Resistivity <input type="checkbox"/> L & S Normal Resistivity <input type="checkbox"/> Spontaneous Potential									
<input type="checkbox"/> Other (List)									
Backfill Top Depth NA		Backfill Bottom Depth NA		Backfill Material (Include Type, Quantity) NA					
Depths measured from ground surface to nearest 0.1 ft.									

Monitoring Well Installation Report (Continued)

					Well Number ELF002D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.8'	47.0'	PVC / Schedule 40	4"		
Screen	47.0'	62.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	62.0'	62.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	43.3'	62.3'	8.5 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	39.4'	43.3'	1.5 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout <input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	39.4'	12 bags / 46.2lbs/bag	5-17-2021	14.0 - 15.0 lbs/gal	
Well Installation Comments Hydrosleeve to be installed at a later date.						
Pump Installation Information			<input checked="" type="checkbox"/> Pump Not Installed			
Installation Date	Installer/Company	Model/Manufacturer		Diameter		
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump				
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

Well Development Data Field Parameters

Well Developed By		Development Oversight		Development Method		Well Number
Cascade Drilling		Bill Joyce		Air Lift / Pump / Bail		ELF002D
						Final Yield (gpm)
						NA
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-09-2021	11:15 AM					Water Level - 52.45' bgs (below ground surface)
	11:34 AM					Air Lift for 22 minutes
6-24-2021	12:08 PM					Water Level - 52.53' bgs
	12:50 PM					Pump with mega-monsoon pump. Pumped dry after 7 gallons
						3 times: Add 2 gallons potable water, swab/surge, pump dry
6-29-2021	12:10 PM					Water Level - 52.80' bgs
7-08-2021	1:44 PM					Water Level - 52.59' bgs
7-13-2021	2:20 PM					Water Level - 52.64' bgs
	2:25 PM	7.00	142.7	1.34	24.7	Bail #1 - total is greater than 1/4 gallon
	2:32 PM	7.00	139.9	24.7	23.5	Bail #2 - total is greater than 1/2 gallon
	2:40 PM	6.93	139.6	40.3	23.6	Bail #3 - total is greater than 3/4 gallon
	2:48 PM	6.93	137.5	95.1	23.8	Bail #4 - total is greater than 1 gallon, Water Level - 53.72' bgs
7-14-2021	1:00 PM					Water Level - 52.64' bgs. Collected Rad sample to clear for shipping
7-15-2021	10:20 AM					Water Level - 52.64' bgs
	10:40 AM	6.96	141.3	7.99	25.6	Collect Sample ELLWF-NEW0006 at 1040. Only collected Volatiles/Tritium
						1/2 liter placed in storage - insufficient volume to send other samples
				34.3		Bail #2 exceeded 15 NTUs - no sample
		6.92	140.9	39.7	25.6	Bail #3 - no sample
		6.95	138.9	104	24.9	Bail #4 - no sample
7-19-2021	10:30 AM			5.93		Water Level - 52.62' bgs. Sample collected and added to volume for Tech-99/Iodine
	10:40 AM			27.5		Bail #2 - no sample
7-20-2021	8:55 AM			10.1		Water Level - 52.65' bgs. Sample collected and added to volume for Tech-99/Iodine
	9:05 AM			8.95		Sample collected and added to volume for Tech-99/Iodine
	9:13 AM			30.4		Bail #3 - no sample
7-21-2021	9:40 AM					Water Level - 52.69' bgs
	10:10 AM			10.7		Finished sample ELLWF-NEW0006A (for Tech-99 and Iodine-129)

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF003D	
Well Installation Date 5-20-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-76344.35		SRS East Grid Coordinate (as built) E-59747.24		Latitude (deg/min/sec - as built) (NAD 27) 33/17/31.59		Longitude (deg/min/sec - as built) (NAD 27) -81/39/27.97	
Top of Pad Elevation (as built) 275.14' msl		Water Level Reference Point Elevation (as built) 277.91' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

37.0' Grout (if 1)

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

37.0' Top of Bentonite

41.1' Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

45.0'

Water Table

Bottom of Screen

55.0'

Total Depth of Well

55.3'

55.3' Bottom of Filter Pack

NA Top of Back Plug (if applicable)

55.3' Total Depth of Borehole

8" Borehole Diameter

Monitoring Well Installation Report (Continued)

Monitoring Well Installation Report (Continued)			Well Number ELF003D	
Program Plan Name ELLWF Water Table Monitoring Wells		Location Description E Area	Site ID N3 / W2	
Station Type (Monitoring Well, Piezometer, etc.) Monitoring Well			Project Manager Virginia Rigsby	
Drilling and Sampling				
Drilling Start Date 5-19-2021		Drilling Completion Date 5-19-2021		Total Drilled Depth 55.3'
Drilling Sampling Method		Top Depth	Bottom Depth	Diameter
Rotosonic Drill		0.0'	35.5'	6"
Core / Rotosonic Drill		35.5'	55.3'	6"
Over-Beam		0.0'	55.3'	8"
Drilling and Sampling Comments (lost circulation zones, drilling problems, etc.) Hand-augered from 0.0' - 6.0' to ensure there were no underground obstructions. No problems were encountered. Soil plug samples were collected every 2 ft beginning at 37' (37' - 55'), The screen interval was predetermined based on CPT/DPT results. Ground Surface Elevation: 274.95' msl				
Geophysical Logging				
Date Logged NA	Logging Top Depth NA	Logging Bottom Depth NA	Logging Contractor NA	Logging Truck Operator NA
Geophysical Logs <input type="checkbox"/> Caliper <input type="checkbox"/> Natural Gamma <input type="checkbox"/> Neutron Density <input type="checkbox"/> Resistivity <input type="checkbox"/> Single Pt. Resistivity <input type="checkbox"/> L & S Normal Resistivity <input type="checkbox"/> Spontaneous Potential <input type="checkbox"/> Other (List)				
Backfill Top Depth NA	Backfill Bottom Depth NA	Backfill Material (Include Type, Quantity) NA		
Depths measured from ground surface to nearest 0.1 ft.				

Monitoring Well Installation Report (Continued)

					Well Number ELF003D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.9'	45.0'	PVC / Schedule 40	4"		
Screen	45.0'	55.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	55.0'	55.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	41.1'	55.3'	7.5 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	37.0'	41.1'	1.5 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	37.0'	16 bags / 47 lbs/bag	5-20-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments Hydrosleeve to be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date		Installer/Company		Model/Manufacturer		Diameter
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump				
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

Well Development Data Field Parameters

Well Development Data Field Parameters						Well Number ELF003D
Well Developed By Cascade Drilling		Development Oversight Bill Joyce		Development Method Air Lift / Pump / Bail		Final Yield (gpm) NA
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-09-2021	10:12 AM					Water Level - 50.35' bgs (below ground surface)
	10:30 AM					Air Lift for 31 minutes
6-24-2021	1:50 PM					Water Level - 50.65' bgs. Pump with mega-monsoon pump - dry after 4.75 gals
	2:05 PM					3 times: Add 2 gallons potable water, swab/surge, pump dry
6-28-2021	10:00 AM					Water Level - 50.65' bgs
7-08-2021	1:52 PM					Water Level - 50.51' bgs
7-14-2021	1:30 PM	6.81	126.5	7.54	26.6	Water Level - 50.59' bgs. Bail #1 - total is greater than 1/4 gallon
	1:40 PM	6.95	125.3	22.6	25.7	Bail #2 - total is greater than 1/2 gallon
	1:45 PM	7.00	123.8	33.8	25.3	Bail #3 - total is less than 1 gallon
	1:50 PM	6.99	126.7	41.7	24.2	Bail #4 - total is 1 1/4 gallons.
	1:54 PM	6.97	124.8		24.0	Bail #5 - total is greater than 1 1/4 gallons, Sample discharged before turbidity
	1:56 PM					Water Level - 51.89' bgs
7-15-2021	11:40 AM					Water Level - 50.60' bgs
	11:50 AM	6.83	115.0	12.8	25.5	Collect Sample ELLWF-NEW0007 at 1150, Only collected Volatiles/Tritium
						About 3/4 of a liter placed in storage - insufficient volume to send other samples
		6.82	116.2	25.9	25.2	Bail #2 exceeded 15 NTUs - no sample
				30.3		Bail #3 -no sample
		6.82	119.4	53.0	25.3	Bail #4 - no sample
7-19-2021	11:10 AM			51.1		Water Level - 50.59' bgs. Bail #1 exceeded 15 NTUs - no sample
	11:15 AM			52.6		Bail #2 exceeded 15 NTUs - no sample
7-20-2021	9:35 AM			34.7		Water Level - 50.56' bgs. Bail #1 exceeded 15 NTUs - no sample
	9:45 AM			40.7		Bail #2 exceeded 15 NTUs - no sample
7-21-2021	11:00 AM			28.5	Bail #1	Finished sample ELLWF-NEW0007A, Collected Iodine-129 sample with turbidity above 15 NTUs. Previously collected sample (12.8 NTUs) used for Tech-99
				26.0	Bail #2	
				35.0	Bail #3	
				32.3	Bail #4	Sampling completed

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF004D	
Well Installation Date 5-24-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-76058,15		SRS East Grid Coordinate (as built) E-59737,53		Latitude (deg/min/sec - as built) (NAD 27) 33/17/29,26		Longitude (deg/min/sec - as built) (NAD 27) -81/39/26,06	
Top of Pad Elevation (as built) 275.43' msl		Water Level Reference Point Elevation (as built) 277.58' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

35.7' Grout (if 1)

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

35.7' Top of Bentonite

40.2' Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

45.0'

60.0'

Water Table

60.3'

60.3' Bottom of Filter Pack

NA Top of Back Plug (if applicable)

60.3' Total Depth of Borehole

8" Borehole Diameter

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Monitoring Well Installation Report (Continued)

Well Number ELF004D						
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.4'	45.0'	PVC / Schedule 40	4"		
Screen	45.0'	60.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	60.0'	60.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	40.2'	60.3'	10.5 bags (50 lb/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	35.7'	40.2'	2 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	35.7'	16 bags / 46.2lbs/bag	5-24-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments Hydrosleeve to be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date	Installer/Company		Model/Manufacturer		Diameter	
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed			Depth from Top of Casing to Top of Pump			
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

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Well Development Data Field Parameters

Well Developed By Cascade Drilling						Well Number ELF004D
Development Oversight Bill Joyce			Development Method air Lift / Pump			Final Yield (gpm) 1/4 gpm
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-08-2021	3:55 PM		uS	NTUs	Celsius	Water Level - 49.52' bgs (below ground surface)
	4:14 PM					Air Lift for 21 minutes
6-09-2021	9:39 AM					Air Lift for 13 minutes
6-24-2021	2:50 PM					Water Level - 49.70' bgs. Pump with mega-monsoon pump - dry after 10.75 gals
	3:02 PM					3 times: Add 2 gallons potable water, swab/surge, pump dry
6-29-2021	2:15 PM					Water Level - 49.70' bgs
7-08-2021	2:02 PM					Water Level - 49.69' bgs
	3:30 PM					Begin to pump. Started at 1/2 gpm but worked down to 1/4 gpm
	3:40 PM					Water Level - 52.86' bgs
	3:47 PM	6.93	139.1	6.16	24.4	
	3:52 PM					Water Level - 53.51' bgs
	4:00 PM	6.89	134.8	6.58	24.0	
	4:05 PM					Water Level - 54.06' bgs
	4:20 PM	6.80	126.2	5.25	24.2	
	4:25 PM					Water Level - 54.51' bgs
	4:30 PM	6.82	123.2	4.68	24.6	Pumping at 1/4 gpm. Stop pumping at 1633
7-12-2021	10:15 AM					Water Level - 49.81' bgs
	10:50 AM					Begin to pump. Flow rate set at 1/4 gpm
	11:00 AM	6.54	100.5	16.4	24.2	
	11:15 AM	6.60	97.65	10.3	24.6	
	11:30 AM	6.60	94.05	7.77	26.3	Water Level - 53.39' bgs
	11:45 AM	6.60	92.70	9.33	26.8	Pumping at 1/4 gpm
	11:50 AM	6.56	94.21	7.99	26.7	Water Level - 53.68' bgs
	12:00 PM	6.52	91.33	6.25	26.1	Flow rate had fallen below 1/4 gpm. Raised the flow rate to 1/4 gpm
	12:10 PM	6.42	85.14	6.76	25.3	Collect Sample ELLWF-NEW0003 at 1210
	12:33 PM					Sampling completed. Water Level - 55.28' bgs. Turn off the pump.

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF005D	
Well Installation Date 5-25-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-78066,88		SRS East Grid Coordinate (as built) E-58512,30		Latitude (deg/min/sec - as built) (NAD 27) 33/17/38,06		Longitude (deg/min/sec - as built) (NAD 27) -81/39/51,73	
Top of Pad Elevation (as built) 276.49' msl		Water Level Reference Point Elevation (as built) 278.83' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

53.2' Grout (if 1)

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

53.2' Top of Bentonite

57.5' Top of Filter Pack

61.0' Top of Screen

81.0' Bottom of Screen

81.3' Bottom of Filter Pack

81.3' Total Depth of Well

NA Top of Back Plug (if applicable)

81.3' Total Depth of Borehole

8" Borehole Diameter

Monitoring Well Installation Report (Continued)

Program Plan Name ELLWF Water Table Monitoring Wells			Location Description E Area		Site ID N3 / W2		Well Number ELF005D		
Station Type (Monitoring Well, Piezometer, etc.) Monitoring Well							Project Manager Virginia Rigsby		
Drilling and Sampling									
Drilling Start Date 5-24-2021			Drilling Completion Date 5-25-2021			Total Drilled Depth 81.3'			
Drilling Sampling Method			Top Depth		Bottom Depth		Diameter		
Rotosonic Drill			0.0'		56.0'		6"		
Core / Rotosonic Drill			56.0'		81.3'		6"		
Over-Ream			0.0'		81.3'		8"		
Drilling and Sampling Comments (lost circulation zones, drilling problems, etc.)									
Hand-augered from 0.0' - 6.0' to ensure there were no underground obstructions. No problems were encountered.									
Soil plug samples were collected every 2 ft beginning at 57' (57' - 81').									
The screen interval was predetermined based on CPT/DPT results.									
Ground Surface Elevation: 276.17' msl									
Geophysical Logging									
Date Logged NA		Logging Top Depth NA		Logging Bottom Depth NA		Logging Contractor NA		Logging Truck Operator NA	
Geophysical Logs									
<input type="checkbox"/> Caliper <input type="checkbox"/> Natural Gamma <input type="checkbox"/> Neutron Density <input type="checkbox"/> Resistivity <input type="checkbox"/> Single Pt. Resistivity <input type="checkbox"/> L & S Normal Resistivity <input type="checkbox"/> Spontaneous Potential									
<input type="checkbox"/> Other (List)									
Backfill Top Depth NA		Backfill Bottom Depth NA		Backfill Material (Include Type, Quantity) NA					

Depths measured from ground surface to nearest 0.1 ft.

Monitoring Well Installation Report (Continued)

Well Number					ELF005D	
Casing	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
	-2.6	61.0'	PVC / Schedule 40	4"		
Screen	61.0'	81.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	81.0'	81.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	57.5'	81.3'	12 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	53.2'	57.5'	1.5 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	53.2'	16 bags / 46.2lbs/bag	5-25-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments A bladder pump will be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date	Installer/Company	Model/Manufacturer	Diameter			
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump				
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

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Well Development Data Field Parameters

Well Development Data Field Parameters						Well Number ELF005D
Well Developed By Cascade Drilling		Development Oversight Bill Joyce		Development Method Air Lift / Pump		Final Yield (gpm)
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-09-2021	2:06 PM		uS	NTUs	Celsius	Water Level - 72.00' bgs (below ground surface)
	2:28 PM					Air Lift for 31 minutes
6-28-2021	3:05 PM					Water Level - 72.15' bgs
7-01-2021	2:42 PM					Water Level - 72.15' bgs
	3:25 PM					Pumped wide open with mega-monsoon pump - pumped dry after 10.25 gallons
7-07-2021	4:30 PM					Water Level - 72.14' bgs
7-08-2021	8:55 AM					Water Level - 72.14' bgs
	9:10 AM					Swab /Surge (S/S) with swab
	9:30 AM					Begin to pump. Very turbid but clears. Set at 1/4 gpm
	9:40 AM					Water Level - 73.24' bgs. Set flow rate at 1/2 gpm
	9:45 AM	6.65	149.4	689	22.3	
	9:50 AM					Water Level - 74.44' bgs
	9:53 AM					S/S with the pump
	10:10 AM					S/S with the pump, Pumping 1/2 gpm
	10:20 AM	6.48	114.0	82.6	22.2	
	10:30 AM	6.49	111.0	18.2	22.1	
	10:40 AM	6.34	92.54	6.78	22.1	
	10:45 AM					Water Level - 76.94' bgs
	10:50 AM	6.32	92.75	3.73	22.4	
	11:00 AM	6.21	81.67	2.19	22.3	
	11:10 AM	6.21	82.06	1.83	22.2	Collect Sample ELLWF-NEW0008 at 1110.
	11:24 AM					Sampling completed. Turn off the pump.

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF006D	
Well Installation Date 6-03-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-77957,22		SRS East Grid Coordinate (as built) E-58790,48		Latitude (deg/min/sec - as built) (NAD 27) 33/17/38,82		Longitude (deg/min/sec - as built) (NAD 27) -81/39/48,32	
Top of Pad Elevation (as built) 268.45 msl		Water Level Reference Point Elevation (as built) 270.89 msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

Grout (if 1 screen)

50.2'

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

50.2'

55.0'

Top of Bentonite

Top of Filter Pack

59.0'

79.0'

79.3'

81.0'

NA

81.0'

8" Borehole Diameter

Top of Back Plug (if applicable)

Total Depth of Borehole

Water Table

Total Depth of Well

Monitoring Well Installation Report (Continued)

Well Number					ELF006D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.7	59.0'	PVC / Schedule 40	4"		
Screen	59.0'	79.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	79.0'	79.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	55.0'	81.0'	13 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	50.2'	55.0'	2 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	50.2'	16 bags / 46.2lbs/bag	6-03-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments A bladder pump will be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date		Installer/Company		Model/Manufacturer		Diameter
<input type="checkbox"/> Single Speed <input type="checkbox"/> Variable Speed				Depth from Top of Casing to Top of Pump		
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

Well Development Data Field Parameters

Well Developed By		Development Oversight		Development Method		Well Number
Cascade Drilling		Bill Joyce		Air Lift / Pump		ELF006D
						Final Yield (gpm)
						1/2 gpm
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-08-2021	8:55 AM		uS	NTUs	Celsius	Water Level - 63.15' bgs (below ground surface)
	9:10 AM					Air Lift for 45 minutes
7-01-2021	4:03 PM					Water Level - 64.40' bgs
	4:09 PM					Pumped wide open with mega-monsoon pump - stopped pumping after 16 gallons
7-06-2021	9:15 AM					Water Level - 64.50' bgs
	10:10 AM					Swab/Surge (S/S)
	10:34 AM					Pumping wide open. Turbid turns to slightly turbid
	10:45 AM	6.14	90.45	Over-Range	22.2	
	10:50 AM					S/S with the pump
	10:54 AM					Pumped wide open. Pumped dry. Let recover
	11:00 AM					Begin to pump at 1/4 gpm (gallons per minute). Raise to 1/2 gpm
	11:05 AM	6.31	96.94	20.1	22.3	
	11:09 AM					S/S with the pump
	11:18 AM					Pumping at 1/2 gpm
	11:20 AM					Water Level - 73.70' bgs
	11:25 AM	6.29	96.83	14.3	23.2	
	11:40 AM					Water Level- 74.00' bgs
	11:45 AM	6.20	93.88	2.66	23.0	
	12:00 PM	6.15	90.15	2.18	23.2	
	12:35 PM	6.05	84.20	0.76	24.5	
	12:40 PM					Water Level - 74.25' bgs. Screen Zone is 59.0' - 79.0'
	12:45 PM	6.03	85.91	1.95	24.5	Pumping at 1/2 gpm
	1:00 PM	6.06	84.53	1.21	24.2	Collect Sample ELLWF-NEW0001 at 1300
	1:11 PM					Sampling completed. Turn off the pump.
7-08-2021	1:15 PM					Water Level - 64.30' bgs

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert, No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF007D	
Well Installation Date 6-01-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-77285.60		SRS East Grid Coordinate (as built) E-58180.25		Latitude (deg/min/sec - as built) (NAD 27) 33/17/29.88		Longitude (deg/min/sec - as built) (NAD 27) -81/39/49.41	
Top of Pad Elevation (as built) 288.70' msl		Water Level Reference Point Elevation (as built) 291.36' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

Grout (if 1)

68.8'

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

68.8'

73.1'

77.0'

97.0'

97.3'

97.3'

NA

97.3'

8" Borehole Diameter

Bottom of Filter Pack

Top of Back Plug (if applicable)

Total Depth of Borehole

Total Depth of Well

Water Table

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Monitoring Well Installation Report (Continued)

Program Plan Name ELLWF Water Table Monitoring Wells			Location Description E Area		Site ID N3 / W2		Well Number ELF007D		
Station Type (Monitoring Well, Piezometer, etc.) Monitoring Well							Project Manager Virginia Rigsby		
Drilling and Sampling									
Drilling Start Date 6-01-2021			Drilling Completion Date 6-01-2021			Total Drilled Depth 97.3'			
Drilling Sampling Method			Top Depth		Bottom Depth		Diameter		
Rotosonic Drill			0.0'		66.0'		6"		
Core / Rotosonic Drill			66.0'		97.3'		6"		
Over-Ream			0.0'		97.3'		8"		
Drilling and Sampling Comments (lost circulation zones, drilling problems, etc.)									
Hand-augered from 0.0' - 6.0' to ensure there were no underground obstructions. No problems were encountered.									
Soil plug samples were collected every 2 ft beginning at 67' (67" - 97").									
The screen interval was predetermined based on CPT/DPT results.									
Ground Surface Elevation: 288.15' msl									
Geophysical Logging									
Date Logged NA		Logging Top Depth NA		Logging Bottom Depth NA		Logging Contractor NA		Logging Truck Operator NA	
Geophysical Logs									
<input type="checkbox"/> Caliper <input type="checkbox"/> Natural Gamma <input type="checkbox"/> Neutron Density <input type="checkbox"/> Resistivity <input type="checkbox"/> Single Pt. Resistivity <input type="checkbox"/> L & S Normal Resistivity <input type="checkbox"/> Spontaneous Potential									
<input type="checkbox"/> Other (List)									
Backfill Top Depth NA		Backfill Bottom Depth NA		Backfill Material (Include Type, Quantity) NA					

Depths measured from ground surface to nearest 0.1 ft.

Monitoring Well Installation Report (Continued)

					Well Number ELF007D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-3.2	77.0'	PVC / Schedule 40	4"		
Screen	77.0'	97.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	97.0'	97.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	73.1'	97.3'	12 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	68.8'	73.1'	2 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	68.8'	24 bags / 46.2lbs/bag	6-02-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments A bladder pump will be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date		Installer/Company		Model/Manufacturer		Diameter
<input type="checkbox"/> Single Speed		<input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump		
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

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Well Development Data Field Parameters

Well Developed By Cascade Drilling						Well Number ELF007D
Development Oversight Bill Joyce			Development Method Air Lift / Pump			Final Yield (gpm) 1/2 gpm
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)
6-08-2021	10:22 AM		uS	NTUs	Celsius	Water Level - 75.46' bgs (below ground surface)
	10:48 AM					Air Lift for 49 minutes
7-06-2021	2:07 PM					Water Level - 76.50' bgs
	2:28 PM					Pump wide open
	2:36 PM					Pumped 10 gallons - not going dry, Turbid turning clear
	2:55 PM					Swab / Surge (S/S)
	3:05 PM					Pumping at 1 1/4 gpm. Knock it down to 3/4 gpm. S/S with pump every 15 minutes
	4:03 PM					Pumping at 1/2 gpm, Water Level - 88.1' bgs
	4:15 PM	6.14	97.34	30.0	24.6	
	4:25 PM	6.12	98.44	14.5	22.9	
	4:35 PM	6.11	95.14	7.03	22.9	
	4:36 PM					Stop pumping
7-07-2021	8:35 AM					Water Level - 76.45' bgs. Trip in and S/S with pump
	8:48 AM					Start pumping, Adjust flow to 1/2 gpm
	9:00 AM	6.00	90.75	25.4	22.2	
	9:15 AM	6.01	79.25	10.3	22.4	
	9:30 AM	5.97	73.08	6.91	22.6	
	9:40 AM	5.92	66.94	4.32	22.8	
	9:50 AM	5.93	69.16	1.90	22.7	
	9:55 AM					Water Level - 78.30' bgs
	10:00 AM	5.95	64.01	2.84	22.7	Collect Sample ELLWF-NEW0002 at 1000.
	10:18 AM					Sampling completed. Turn off the pump.
7-08-2021	1:05 PM					Water Level - 76.46' bgs

Monitoring Well Installation Report

Driller Name/Company David Wilcox / Cascade Drilling L.P.		Driller Cert. No. SC 1437B		Tech Oversight Name/Company Bill Joyce / SRNS		Well Number ELF008D	
Well Installation Date 5-27-2021		SC DHEC Well Approval Number MW-12705		Drilling Method (Auger Mud Rotary, Rotosonic, etc) Rotosonic Drilling			
SRS North Grid Coordinate (as built) N-77034.00		SRS East Grid Coordinate (as built) E-58406.55		Latitude (deg/min/sec - as built) (NAD 27) 33/17/29.21		Longitude (deg/min/sec - as built) (NAD 27) -81/39/45.51	
Top of Pad Elevation (as built) 288.57' msl		Water Level Reference Point Elevation (as built) 290.99' msl		Survey Point <input type="checkbox"/> Top of Casing <input checked="" type="checkbox"/> Top of Stand Pipe <input type="checkbox"/> Ground Surface			
Surface Casing (if installed)		Depths measured from ground surface to nearest 0.1 ft					

Total Depth of Installed Casing NA

Casing Material/Diameter NA

Grout Quantity NA

4" Well Diameter

Grout (if 3 screens)

Grout (if 2 screens)

Grout (if 1)

92.3'

Top of Bentonite

Top of Filter Pack

Screen Zone

Top of Screen

Bottom of Screen

Top of Bentonite

Top of Filter Pack

92.3'

96.1'

Top of Bentonite

Top of Filter Pack

100.0'

110.0'

110.3'

Bottom of Filter Pack

Top of Back Plug (if applicable)

110.3'

8" Borehole Diameter

Total Depth of Borehole

Monitoring Well Installation Report (Continued)

Program Plan Name ELLWF Water Table Monitoring Wells			Location Description E Area		Site ID N3 / W2		Well Number ELF008D		
Station Type (Monitoring Well, Piezometer, etc.) Monitoring Well							Project Manager Virginia Rigsby		
Drilling and Sampling									
Drilling Start Date 5-26-2021			Drilling Completion Date 5-26-2021			Total Drilled Depth 110.3'			
Drilling Sampling Method			Top Depth		Bottom Depth		Diameter		
Rotasonic Drill			0.0'		76.0'		6"		
Core / Rotasonic Drill			76.0'		110.3'		6"		
Over-Ream			0.0'		110.3'		8"		
Drilling and Sampling Comments (lost circulation zones, drilling problems, etc.)									
<p>Hand-augered from 0.0' - 6.0' to ensure there were no underground obstructions. No problems were encountered.</p> <p>Soil plug samples were collected every 2 ft beginning at 77' (77' - 109'),</p> <p>The screen interval was predetermined based on CPT/DPT results.</p> <p>Ground Surface Elevation: 288.07' msl</p>									
Geophysical Logging									
Date Logged NA		Logging Top Depth NA		Logging Bottom Depth NA		Logging Contractor NA		Logging Truck Operator NA	
Geophysical Logs									
<input type="checkbox"/> Caliper <input type="checkbox"/> Natural Gamma <input type="checkbox"/> Neutron Density <input type="checkbox"/> Resistivity <input type="checkbox"/> Single Pt. Resistivity <input type="checkbox"/> L & S Normal Resistivity <input type="checkbox"/> Spontaneous Potential									
<input type="checkbox"/> Other (List)									
Backfill Top Depth NA		Backfill Bottom Depth NA		Backfill Material (Include Type, Quantity) NA					
Depths measured from ground surface to nearest 0.1 ft.									

Monitoring Well Installation Report (Continued)

Well Number					ELF008D	
	Top Depth	Bottom Depth	Material/Schedule	Diameter	Slot Size	Slot Type
Casing	-2.9'	100.0'	PVC / Schedule 40	4"		
Screen	100.0'	110.0'	PVC / Schedule 40	4"	10 slot	Slotted
Sump	NA	NA	NA	NA		
Sump Cap	110.0'	110.3'	PVC / Schedule 40	4"		
Filter Pack	Top Depth	Bottom Depth	Amount (sacks and size)	Trade Name		
	96.1'	110.3'	7.5 bags (50 lbs/bag)	Southern Products GP-1A		
Bentonite Seal	Top Depth	Bottom Depth	Amount/Size (sack, bucket, etc.)			
	92.3'	96.1'	1.5 buckets / Bentonite Pellets (3/8"), 5 gallon bucket			
Grout	Top Depth	Bottom Depth	Amount (sacks and size)	Grout Date	Grout Weight	
	0.0'	92.3'	32 bags / 46.2lbs/bag	5-27-2021	14.0 - 15.0 lbs/gal	
<input type="checkbox"/> Neat Cement <input checked="" type="checkbox"/> Bentonite Cement <input type="checkbox"/> High Solids Bentonite						
Well Installation Comments A bladder pump will be installed at a later date.						
Pump Installation Information <input checked="" type="checkbox"/> Pump Not Installed						
Installation Date		Installer/Company		Model/Manufacturer		Diameter
<input type="checkbox"/> Single Speed		<input type="checkbox"/> Variable Speed		Depth from Top of Casing to Top of Pump		
Report Prepared By Bill Joyce					Date 7-16-2021	

Depths measured from ground surface to nearest 0.1 ft.

Well Development Data Field Parameters

Well Developed By Cascade Drilling		Development Oversight Bill Joyce		Development Method Air Lift / Pump		Well Number ELF008D	Final Yield (gpm) 1/2 gpm
Date	Time	pH	Conductivity	Turbidity	Temperature	Comments (additives, problems, etc.)	
6-08-2021	12:43 PM		uS	NTUs	Celsius	Water Level - 74.95' bgs (below ground surface)	
	1:07 PM					Air Lift for 39 minutes	
7-07-2021	11:20 AM					Water Level - 75.30' bgs	
	12:06 PM					Begin to pump wide open. Very turbid but clears some.	
	12:13 PM					Pumped 10 gallons, Clear	
	12:17 PM					Swab / Surge (S/S) with swab	
	12:42 PM					Begin to pump - set at 3/4 gpm	
	12:45 PM	6.24	118.8	77.9	22.2		
	1:00 PM					S/S with pump. Very turbid. Pump wide open to clear. Set at 3/4 gpm	
	1:10 PM					S/S with pump. Turbid but clears faster	
	1:20 PM					S/S with pump, Pump wide open, Clears, Set at 3/4 gpm	
	1:30 PM	6.24	100.9	46.7	22.0		
	1:45 PM	6.13	97.05	22.0	22.0		
	1:50 PM					Water Level - 102.1' bgs, Lower pump rate to 1/2 gpm	
	2:00 PM	6.20	106.5	14.6	22.4		
	2:10 PM	6.18	98.42	5.71	22.3		
	2:20 PM	6.16	92.15	3.14	22.2		
	2:30 PM	6.12	91.03	3.56	22.3	Collect Sample ELLWF-NEW0005 at 1430.	
	2:46 PM					Sampling completed. Turn off the pump.	
7-08-2021	1:30 PM					Water Level - 75.08' bgs	

Appendix D. Final Layout of ELF Monitoring Wells

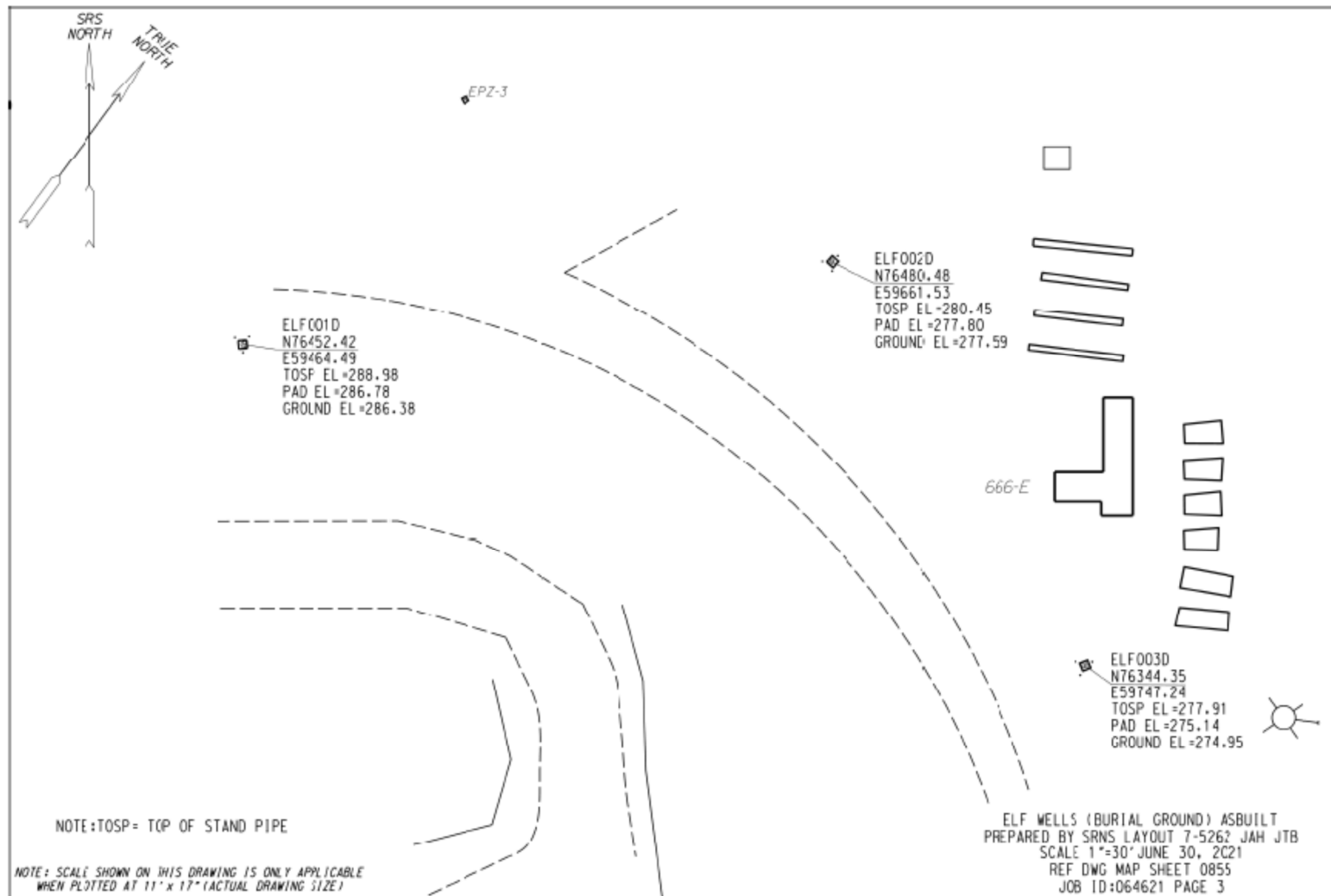


Figure D-1. Final Layout of ELF001D, ELF002D, and ELF003D.

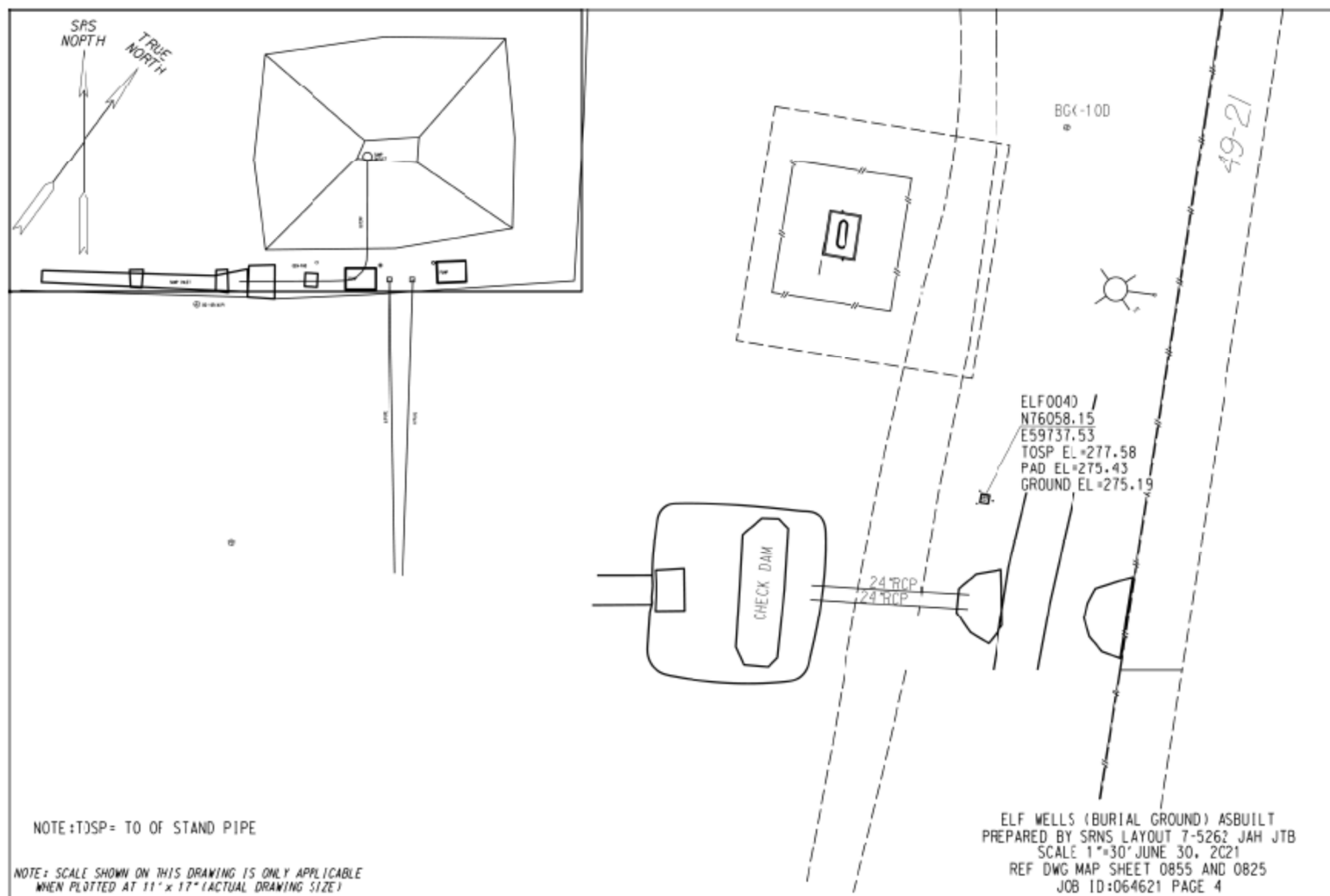


Figure D-2. Final Layout of ELF004D.

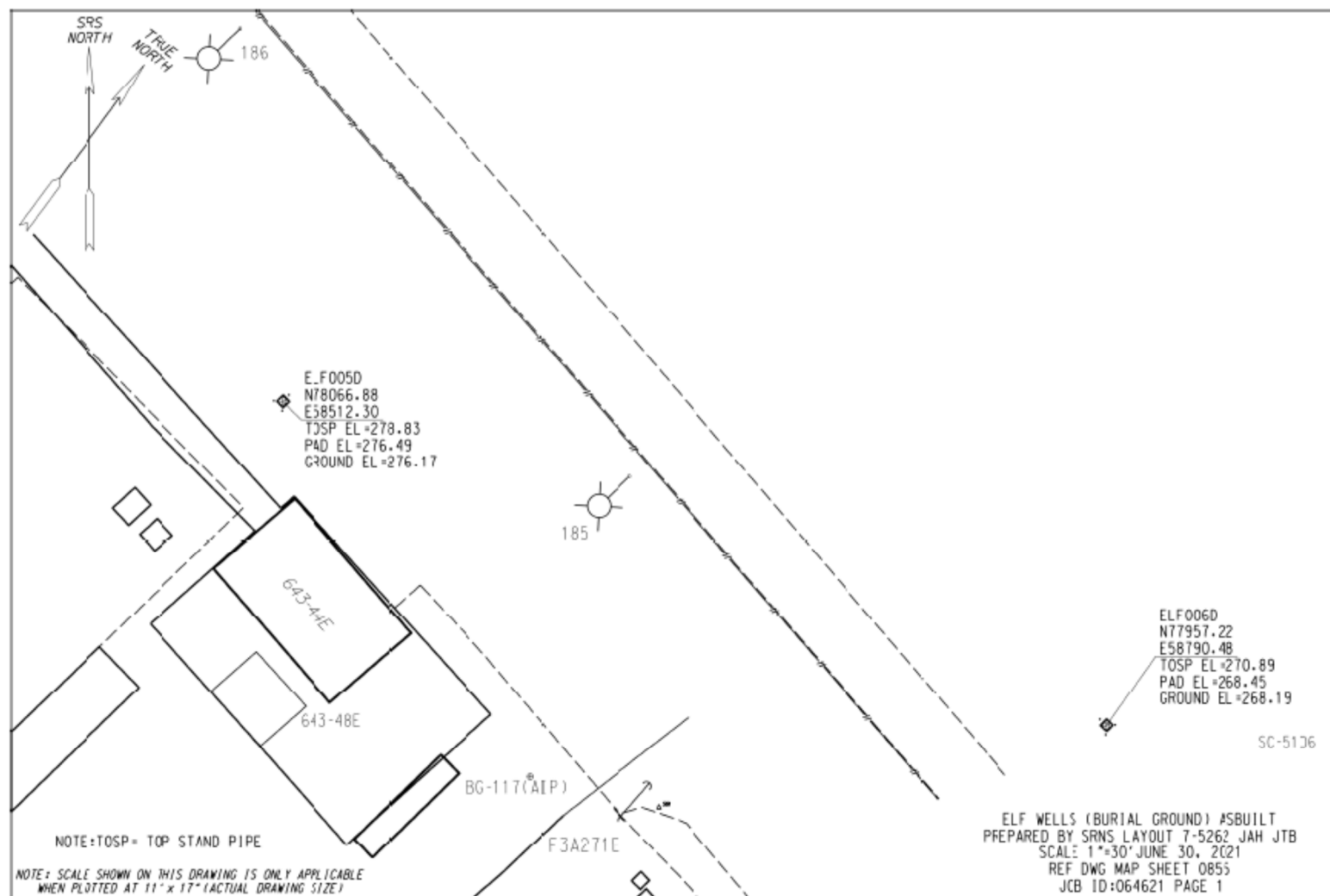


Figure D-3. Final Layout of ELF005D and ELF006D.

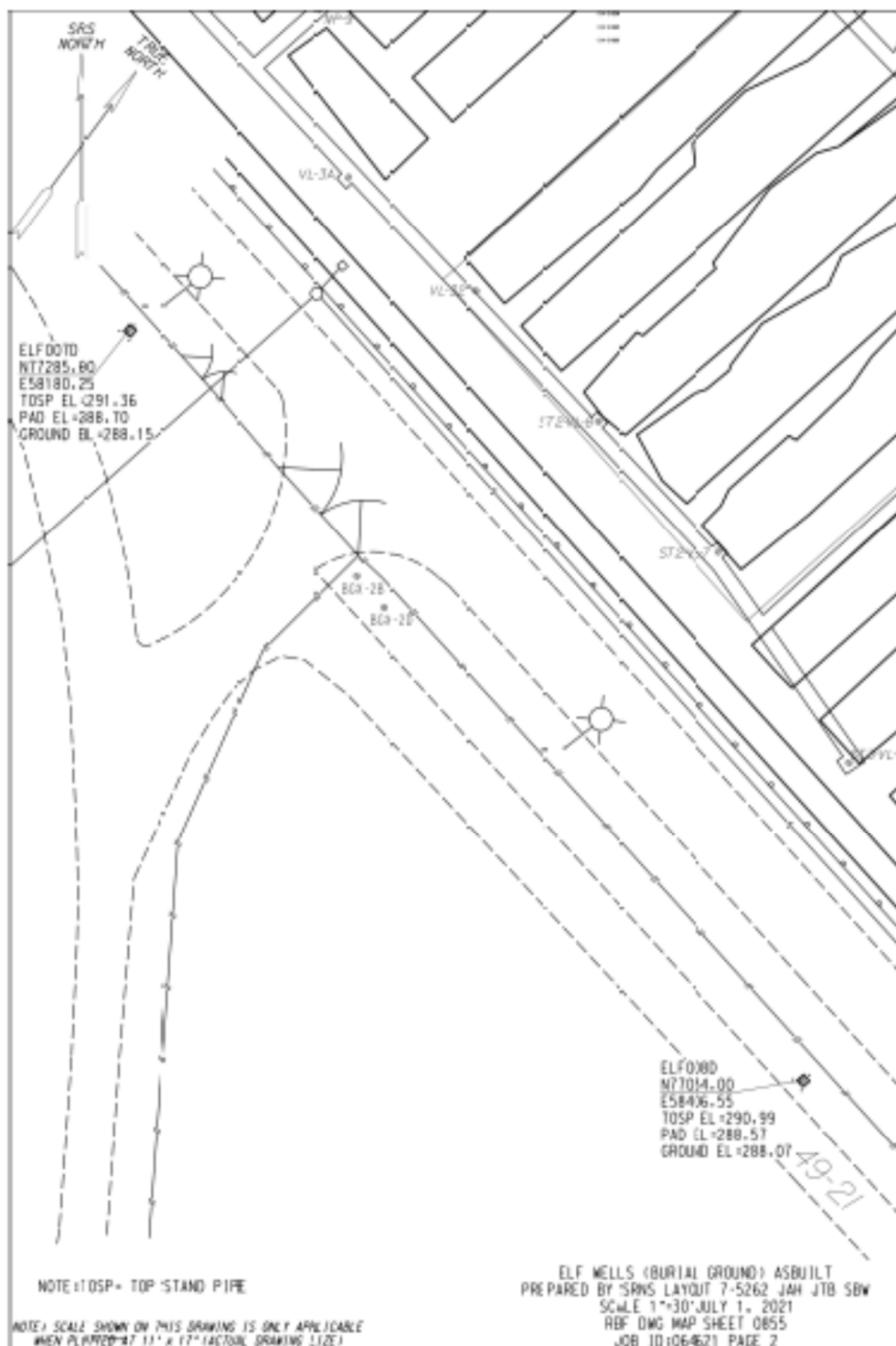


Figure D-4. Final Layout of ELF007D and ELF008D

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