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Savannah River Site

Treatability Study Data Report for Groundwater Injection and Discharge Canal Neutralization at the D-Area Groundwater Operable Unit (OU) (U)

2021 Data and Information

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DISCLAIMER

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Aiken, South Carolina

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LIST OF ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
$CaCO_3$	calcium carbonate
CPRB	Coal Pile Runoff Basin
DAG	D-Area Groundwater
DCSA	D-Area Coal Storage Area
ft	feet
gpm	gallons per minute
m	meters
MCL	maximum contaminant level
OU	operable unit
RSER/EE/CA	Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SRNS	Savannah River Nuclear Solutions LLC
SRS	Savannah River Site
USEPA	U.S. Environmental Protection Agency
UTRA	Upper Three Runs aquifer

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1.0 INTRODUCTION

SRS has continued implementation of a groundwater treatability study in D-Area to reduce the acidic conditions in groundwater (SRNS 2019a). The acidic conditions were caused by the storage of coal in the former 484-17D D-Area Coal Storage Area (DCSA), and the subsequent runoff into the 489-D Coal Pile Runoff Basin (CPRB). This data report summarizes all actions and data that have been taken during 2021 as presented and required in the *Treatability Study Work Plan for Groundwater Injection and Discharge Canal Treatment at the D-Area Groundwater (DAG) Operable Unit (OU)* (SRNS 2019a) and subsequent data reports (2020 DAG OU Data Report: SRNS, 2021).

The coal-fired 484-D Powerhouse provided electricity and steam for the D-Area facilities and other areas at SRS. The power plant was put into operation in 1952. The major ancillary facilities associated with the powerhouse are the former DCSA, the 489-D CPRB, and four ash basins (Figure 1). For over 60 years, the DCSA was a staging area for coal prior to its use in the powerhouse. Exposure of the coal to rainwater has allowed the degradation of iron sulfide (pyrite; a mineral commonly found in coal) to sulfuric acid. As a result, the soils underneath the DCSA, associated storm water runoff, and groundwater underlying the area have been acidified. The leaching of metals from both the coal and the natural minerals in the underlying soils in the vadose zone and aquifer are due to the acidic conditions and has resulted in a metals and sulfate groundwater plume in the Upper Three Runs Aquifer (UTRA) (Figures 2 and 3). Currently, acidic groundwater outcrops into the D-Area Effluent Discharge Canal at pH levels generally below 4.

Although, maintenance actions conducted in 2012 and 2013 removed virtually all of the coal present at the DCSA, the vadose zone soils beneath the DCSA remained acidified. To address the vadose zone soils, a Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis (RSER/EE/CA) was submitted in 2019 to describe a non-time critical removal action for neutralization of the soils to a 4 ft depth at the DCSA (SRNS 2018). This removal action was completed in 2020.

This treatability study is designed to address the continuing acidic conditions in the shallow groundwater beneath the DCSA and 489-D CPRB as well as the discharge to surface water in the D-Area Effluent Discharge Canal.

2.0 PROJECT DESCRIPTION

The vadose zone and groundwater within the upper water table aquifer beneath the DCSA and the 489-D CPRB are impacted by low pH conditions (< pH of 4) that are expected to last for decades under natural groundwater conditions. The low-pH groundwater is currently outcropping into the D-Area Effluent Discharge Canal which later converges with Beaver Dam Creek and flows through the Savannah River floodplain to the Savannah River. If the pH of the aquifer can be raised to more normal, less acidic conditions, the groundwater and surface water conditions in the D-Area Effluent Discharge Canal would improve.

This study is testing the viability of an approach to remediation that contains two relatively simple elements:

- Higher pH, potable groundwater sourced from production wells in D Area will be added into the water table aquifer upgradient of the low-pH, metals, and sulfate plumes using injection wells. The injected production well water is naturally buffered which will aid in the neutralization of acidic conditions currently present in the water table aquifer. The injected production well water will also create a hydraulic head that will displace the low-pH groundwater within in the aquifer.
- Treat the low-pH surface water that outcrops into the D-Area Effluent Discharge Canal by adjusting the pH with calcium carbonate ($CaCO_3$) reactive structure(s).

<u>Injection of Production Well Water</u>

Two potable water production wells (PW 3D and PW 136D) are in D-Area northwest of the 484-D Powerhouse. Both production wells were used for operations and are screened approximately 204 - 229 meters (m) (670 - 750 feet [ft]) below ground surface (bgs) within the McQueen Branch Aquifer. These production wells produce groundwater with a pH of approximately 6.0 to 6.5 containing low, but measurable, levels of carbonate alkalinity. This water will be injected into the upper water table aquifer upgradient of the low-pH, metals, and sulfate plumes to create a hydraulic head and increase groundwater flow velocity horizontally to displace the low-pH groundwater currently present in the aquifer. The alkalinity will buffer the system and partially neutralize acidity in the aquifer. Both production wells are artesian and produce over 60 gallons per minute (gpm) each without the assistance of pumps. The well head pressure of the wells is approximately 5 to 10 pounds per square inch and is expected to support enough flow and pressure to deliver large volumes of water to the proposed injection field as shown by artesian well flow testing conducted in 2019 on both production wells (SRNS 2021).

The production well water will be piped to the DCSA and 489-D CPRB and injected into the upper water table aquifer with a series of injection wells (Figure 7). A portion of the injection well field has been installed and is described in section 5.1. Creating a water mound approximately 1.5 m (5 ft) above current conditions is expected to increase the volume of groundwater outcropping into the D-Area Effluent Discharge Canal. It is expected that the production wells can supply enough water to fill the pore space volume (the space between the sediment grains in the vadose zone) to create the 1.5 m (5 ft) water mound in approximately 100 days. The pore space volume was calculated by multiplying the surface area of the DCSA and the 489-D CPRB by the proposed rise in water elevation (1.5 m [5 ft]) by the porosity (30%) and converting to gallons. A total of approximately 19 million gallons is estimated to be needed to raise the water table 1.5 m (5 ft). Based on aqueous chemical equilibrium modeling software, a total of 10 pore space volumes of injected potable groundwater could significantly displace and raise the pH levels in the upper water table within a three-year study period. The production wells are expected to support the groundwater injection study in addition to future remedial activities if needed (SRNS 2016a).

Although the water table is expected to rise approximately 1.5 m (5 ft) into the vadose zone, the groundwater injection is not intended to be the only treatment for the vadose zone and is not expected to remove all of the acidity from the vadose zone. However, the production well water to be injected within the upper water table aquifer is anticipated to provide an important buffering interaction to mitigate the low-pH groundwater. The DCSA RSER/EE/CA action that added neutralization amendments to the vadose zone soils (SRNS 2018) is intended to reduce acidity in the vadose zone source that has contributed to groundwater contamination. Although acidity is expected to be released from the lower vadose zone soils into the groundwater, the lower vadose zone is not expected to be neutralized or have much change in pH as a result of the groundwater injection treatability study. The lower vadose zone will eventually see the buffering effects of the upper vadose zone amendments through their dissolution and infiltration over time. The combined (or synergistic) effects of the two actions will be apparent from the measurement of the parameters described in the Treatability Study Work Plan and the DCSA RSER/EE/CA (SRNS 2018), and the regular DAG OU groundwater and surface water monitoring that occurs concurrently.

Reactive Structures in D-Area Effluent Discharge Canal

An increase in the amount of acidic water outcropping into the D-Area Effluent Discharge Canal is expected to occur as groundwater elevations rise and low-pH groundwater is displaced. Titration test results using surface water from the D-Area Effluent Discharge Canal indicate that contact of surface water with a high purity $CaCO_3$ reactive structure will raise the pH of the surface water to over 6.0 (SRNS 2016b). Figure 5 shows the carbonate consumption rates associated with the neutralization of the sulfuric acid and illustrates a titration curve of the test. Although the installation of one reactive structure should be sufficient in raising the pH of the surface water, installation of two reactive structures has been completed to further ensure pH adjustment is sufficient over time. $CaCO_3$ marble chips, placed within the stream in two sections downgradient of the acidic groundwater discharge point within the D-Area Effluent Discharge Canal, are expected to allow enough contact time with the surface water for pH adjustment to natural conditions (Figure 5 and Figure 6). The use of high purity $CaCO_3$ (typically greater than 90% $CaCO_3$) limits the introduction of undesirable materials into the surface water (silt, clay, reactive minerals, etc.). The description of installation and the data collected to date associated with the $CaCO_3$ reactive structures is summarized in section 5.2.

3.0 TEST OBJECTIVES

The objective of this treatability study is to determine the effectiveness of injecting higher-pH potable groundwater to:

- Displace the acidic groundwater out of the upper water table aquifer of the UTRA in the vicinity of and downgradient of the DCSA and 489-D CPRB to improve the aquifer conditions (increase the pH) and reduce or eliminate the dissolved metal groundwater plumes.
- Increase the pH level of the D-Area Discharge Canal surface water with $CaCO_3$ reactive structures prior to discharge into Beaver Dam Creek and the Savannah River floodplain and river.

The results of the treatability study will be used to support the development of the DAG OU Feasibility Study, currently scheduled to be submitted by March 10, 2026.

Monitoring of water table elevations and pH measurements in surrounding monitoring wells and streams, as well as metal analyses of groundwater and surface water, will be used to determine the impact of the production well water injections. Stream flow measurements will document the increase in flow in the D-Area Discharge Canal from the groundwater injections.

4.0 SAMPLING AND ANALYSIS

Measurements of water table elevations, stream flow, pH, and sample collection for metal analyses in surface water and/or groundwater are conducted following the SRS *3Q1 Manual: Environmental Requirements and Program Documents, Procedure 9015: Sampling Groundwater Monitoring Wells, Tanks/Vessels (Sample Ports or Spigots) and Surface Water* (SRNS 2019b).

Table 1 includes the stations that are to be monitored and identifies the sampling frequency and constituents that will be monitored. Figure 11 shows the locations of the monitored stations. A total of 32 wells and 10 surface water stations outside of the injection field will be monitored. Twenty monitoring wells and all 10 surface water stations will include metals, pH, and other routine field analyses.

A potentiometric surface map of the UTRA during 2Q2020 is provided in Figure 14. Water elevations will be measured on a monthly basis for the first eight months after groundwater injections begin, then quarterly afterwards. A map of the acidic groundwater with pH data is provided in Figure 2 and a map of the sulfate plume is provided in Figure 3.

Stream flow measurements will be collected at all surface water station locations within the D-Area Effluent Discharge Canal and the tributary to the east where safely accessible. Groundwater and surface water samples will be monitored for the metals included in DAG OU monitoring program. Monitoring will also include field pH measurements and other routine field measurements (i.e., oxidation/reduction potential, dissolved oxygen, specific conductance, total alkalinity [as $CaCO_3$], turbidity, water temperature, and water elevation [at wells]).

One round of sampling occurred in 2Q2020 as a baseline before production well water injections were to begin. This data was supplied in the 2020 DAG OU Treatability Study Data Report (SRNS 2021). Since groundwater injections have not yet begun and the $CaCO_3$ reactive structures have been installed, sampling during 2021 only included the surface water stations DSWM-8, DSWM-8A, and DSWM-9. All analytical and field data are provided in Appendix B and discussed in section 5.2.

Any adjustments needed to the monitoring based on field conditions or monitoring results will be discussed with the United States Department of Energy -Savannah River, United States Environmental Protection Agency (USEPA), and South Carolina Department of Health and Environmental Control (SCDHEC) and approved prior to implementation. The second quarter (2Q) and fourth quarter (4Q) DAG OU monitoring will not be impacted by the treatability study and will continue as normally scheduled.

As field conditions warrant, adjustments such as varying injection flows or other traditional methods such as re-development of the wells could also be employed. Any permanent discontinuation of an injection well will be communicated with EPA and SCDHEC.

5.0 TREATABILITY STUDY PROGRESS AND DATA

Due to the discovery of unfavorable injection sediments within the UTRA, potential interferences with deactivation & decommissioning (D&D) activities in D Area, and delays in field personnel availability due to Covid-19 management practices, a stepped approach has been taken with implementation of the DAG OU treatability study. Ten injection wells have been installed; five were installed during 2020 (DGI007, DGI010, DGI014, DGI016, and DGI019), and five were installed during 2021 (DGI011, DGI012, DGI013, DGI015, and DGI017) (Figure 7). Additionally, the two $CaCO_3$ reactive structures were previously installed within the D-Area Effluent Discharge Canal in 2020. Ongoing monthly monitoring of pH and metal analyses within the D-Area Effluent Discharge Canal is performed upgradient, between, and downgradient of the $CaCO_3$ reactive structures to determine the efficacy of both the $CaCO_3$ material and structure design. Details on each portion of the treatability study project are provided below.

5.1 Injection Well Installation

Ten injection wells (DGI007, DGI010, DGI011, DGI012, DGI013, DGI014, DGI015, DGI016, DGI017, and DGI019) spread across the northeastern line have been installed to date (Figure 7).

The injection wells were originally planned to be screened within the upper water table aquifer at approximately 12-32 ft bgs. However, similar to the first five injection wells that were installed in 2020, due to the abundance of clays, sandy clays, and silty sands, especially near the DCSA, the wells were installed deeper within the mid to lower zone of the UTRA (Table 2). Geologic core logs for the 2021 installed injection wells are provided in Appendix A. A cross-sectional view of the sediments including all 10 installed injection wells can be seen in Figures 8 and 9. Development of the injection wells was done vigorously (pumping, swabbing, and surging) to ensure future injection rates are maximized.

Due to Covid-19 related delays and material supply issues, the procurement and installation of the piping system did not start until December 2021. The final selection of the main piping system consists of 6-inch and 4-inch HPDE (high-density polyethylene) pipes (Figure 10). The installation is expected to be completed prior to April 2022.

SRS plans to start groundwater injections into the 10 installed injection wells (Figure 7) and existing well DCB 2A after initial testing of the piping system in the spring of 2022 with water from one of the production wells (PW 136D). Since approximately half of the injection wells will be utilized initially, simultaneous operation of both production wells is not expected to be needed but can be added if necessary. Based on the results of the initial groundwater injections, a phased approach to install additional injection wells will be used.

5.2 $CaCO_3$ Reactive Structures

Due to the ongoing and further expected acidic conditions within the D-Area Discharge Canal, two $CaCO_3$ reactive structures were installed during 2020. To perform initial testing of the design and function of the structures, one reactive structure was installed in February 2020. A surface water pH increase was observed with the first structure, and the second reactive structure was installed immediately downgradient of the first structure in October 2020.

Due to the final placement of the reactive structures, a change in the surface water stations initially proposed to monitor pH/metals was appropriate. Surface water station DSWM-8 now monitors upgradient of the first structure (originally DSWM-7), DSWM-8A monitors between the first and second structure (originally DSWM-8), and station DSWM-9 monitors downgradient of the structures (no change) (Figure 11). Figure 12 displays the field pH measurements collected monthly upgradient, between, and downgradient of the two $CaCO_3$ reactive structures at these three surface water stations. Surface water pH increases are occurring as water flows through the reactive structures with the pH increasing after each structure. However, during periods of prolonged or heavy rains, stream flow increases and tops over the reactive structures. This is part of the design to not restrict flooding events; however, this consequently reduces the contact time of the surface water with the reactive structures. Additionally, increased sediment and leaf drop litter over the last two years have created a layer of detritus that limits stream flow through the $CaCO_3$ reactive structures as the stream levels, even in low rainfall periods, have been overtopping the $CaCO_3$ reactive structures. Maintenance to address this debris is being evaluated and it will be removed as practical.

As part of the DAG OU Treatability Study, if the pH of the surface water downgradient of the two reactive structures at surface water station DSWM-9 is not raised to or above a pH of 5.0 (during times when surface water is not topping over the reactive structures), then remixing, replacement, and/or reconfiguration of the calcium carbonate material will be evaluated.

Additionally, metal sample results indicate some minor decreasing concentrations as surface water passes through the reactive structures as the pH is increased. Surface water data shows that the secondary drinking water standards for aluminum, iron, and manganese, as well as the groundwater MCL for beryllium are consistently exceeding their respective limits (Table B-1). Figure 13 shows the difference in beryllium concentrations at the three surface water stations at the $CaCO_3$ reactive structures. This is more noticeable during baseflow and low flow conditions as is with pH increases. Appendix B contains all the surface water data analytical and field results from the 2021 sampling. Further sampling will bolster trending data analyses.

6.0 DATA COLLECTION AND REPORTING

Once groundwater injections begin, data (field measurements, sample results, flow rates, etc.) will be collected and presented in a combination of tabular form, graphs, and time-series plots. Maps depicting the water table will also be created. All these items and an interpretation will be supplied in subsequent data reports. Future data reports will be no later than January 31st of the year, unless an alternative proposal is made to and accepted by USEPA and SCDHEC.

7.0 SUMMARY

The anticipated length of the treatability study is currently estimated at a minimum of three years of groundwater injection. Analysis of the production well flow rates, injection operation, aquifer acceptance, field data, sample data, and performance of the $CaCO_3$ reactive structures will indicate the actual length of the treatability study once all systems are operating. Construction of the $CaCO_3$ reactive structures in the D-Area Effluent Discharge Canal is complete, and they are generally raising the pH of the surface water to a pH above 5; however, some maintenance to address sediment/leaf detritus may need to be performed to ensure they remain effective under normal flow or slightly increased flow conditions. Maintenance to address this debris is being evaluated and it will be removed as practical. A portion (ten) of the proposed 20 injection wells have been installed. A stepped approach has been taken with the DAG OU treatability study and the installation of the remaining injection wells. Additional injection wells will be installed based on the overall performance review of the groundwater injections into the 10 installed injection wells and the one converted monitoring well.

Baseline sampling was conducted for the treatability study monitoring network in 2Q2020. Since no groundwater injections have begun, only monitoring of pH of surface water in the D-Area Effluent Discharge Canal is ongoing monthly upgradient, between, and downgradient of the $CaCO_3$ reactive structures, with quarterly sampling for metals analyses. That monitoring will continue until groundwater injections begin and subsequent monitoring will follow the stations and schedule shown in Table 1. The groundwater injection piping system is currently being installed and is expected to be completed prior to April 2022. Testing and groundwater injections will follow the piping installation. Depending on how the production well water injection flow rates proceed in the existing injection wells (minimum of 5 gpm or equivalent average for a particular area), a phased approach to installing any additional injection wells will be used, as applicable.

8.0 REFERENCES

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Table 1. D-Area Treatability Study Monitoring Network and Sampling Schedule

Monitoring Well Information				Sampling			
				Before Injection	After Injections start		
Station	Station Type	Total Depth (ft bgs)	Screened Interval (ft msl)		Monthly - First 8 months	Monthly	Quarterly
PW 3D	Production Well	736	-541.25 - -551.25, -651.25 - -601.25	M	WL		WL
PW 136D	Production Well	765	-507.5 - -537.5, -577.5 - -617.5	M	WL		WL
DCB 3A	Monitoring Well	36.8	126.2 - 96.2	WL	WL		WL
DCB 4A	Monitoring Well	37	122.5 - 92.5	M	WL		M
DCB 5A	Monitoring Well	37	115.9 - 85.9	WL	WL		WL
DCB 6	Monitoring Well	23.7	129.5 - 109.5	M	WL		M
DCB 7	Monitoring Well	23.9	128.9 - 108.9	WL	WL		WL
DCB 8	Monitoring Well	26.5	130.3 - 110.3	M	WL		M
DCB 9	Monitoring Well	25	117.3 - 97.3	WL	WL		WL
DCB 10	Monitoring Well	24.1	119.8 - 99.8	M	WL		M
DCB 21A	Monitoring Well	20	120.1 - 110.1	M	WL		M
DCB 21B	Monitoring Well	27	104.7 - 102.2	M	WL		M
DCB 21C	Monitoring Well	44	90.8 - 88.3	M	WL		M
DCB 22A	Monitoring Well	18.5	119.8 - 109.8	M	WL		M
DCB 23A	Monitoring Well	16	115.7 - 105.7	WL	WL		WL
DCB 23B	Monitoring Well	27.5	96.6 - 94.1	M	WL		M
DCB 23C	Monitoring Well	35	89.1 - 86.6	M	WL		M
DCB 26AR	Monitoring Well	26	111.7 - 97.4	WL	WL		WL
DCB 33B	Monitoring Well	37	114 - 104	WL	WL		WL
DCB 34A	Monitoring Well	26	112 - 102	M	WL		M
DCB 34C	Monitoring Well	59.3	80.8 - 70.8	M	WL		M
DCB 35A	Monitoring Well	25	103.4 - 93.4	M	WL		M
DCB 35C	Monitoring Well	44	84.2 - 74.2	M	WL		M
DCB 36A	Monitoring Well	20	114.1 - 104.1	M	WL		M
DCB 36C	Monitoring Well	37	97.3 - 87.3	M	WL		M
DCB 37A	Monitoring Well	25.9	110.8 - 100.8	M	WL		M
DCB 41A	Monitoring Well	33	108.28 - 98.28	WL	WL		WL
DCB 44A	Monitoring Well	26.5	123.3 - 108.3	WL	WL		WL
DCB 45A	Monitoring Well	25.2	125.2 - 110.2	WL	WL		WL
DCB 49	Monitoring Well	16.5	118.65 - 106.15	WL	WL		WL
DCB 53	Monitoring Well	41	87.58 - 77.48	WL	WL		WL
DCB 70A	Monitoring Well	12.5	114.69 - 104.69	M	WL		M
DCB077	Monitoring Well	31.7	118 - 98	M	WL		M
DCB078	Monitoring Well	41.7	107 - 87	M	WL		M
DSWM-4	Surface Water Station	--	--	M			M
DSWM-4A	Surface Water Station	--	--	M			M
DSWM-4B	Surface Water Station	--	--	M			M
DSWM-4C	Surface Water Station	--	--	M			M
DSWM-5	Surface Water Station	--	--	M			M
DSWM-6	Surface Water Station	--	--	M			M
DSWM-7	Surface Water Station	--	--	M			M
DSWM-8	Surface Water Station	--	--	M	M	pH	M
DSWM-8A	Surface Water Station	--	--	M	M	pH	M
DSWM-9	Surface Water Station	--	--	M	M	pH	M

M = Metals and field parameters including pH
WL = Water elevation measurement only
pH = pH reading of surface water only for performance monitoring of the reactive structures

Table 2. D-Area Injection Well Screen Zone Depths

Injection Well	Screen Zone (ft bgs)	Month/Year Installed
DGI007	21.49 - 42.41	December/2019
DGI010	30.51 - 51.43	December/2019
DGI011	24.2 - 45.1	February/2021
DGI012	26.6 - 47.5	February/2021
DGI013	34.1 - 55.0	February/2021
DGI014	34.58 - 55.5	February/2020
DGI015	35.1 - 56.0	February/2021
DGI016	34.26 - 55.18	January/2020
DGI017	34.1 - 55.0	March/2021
DGI019	23.72 - 44.64	January/2020

Installed during 2021

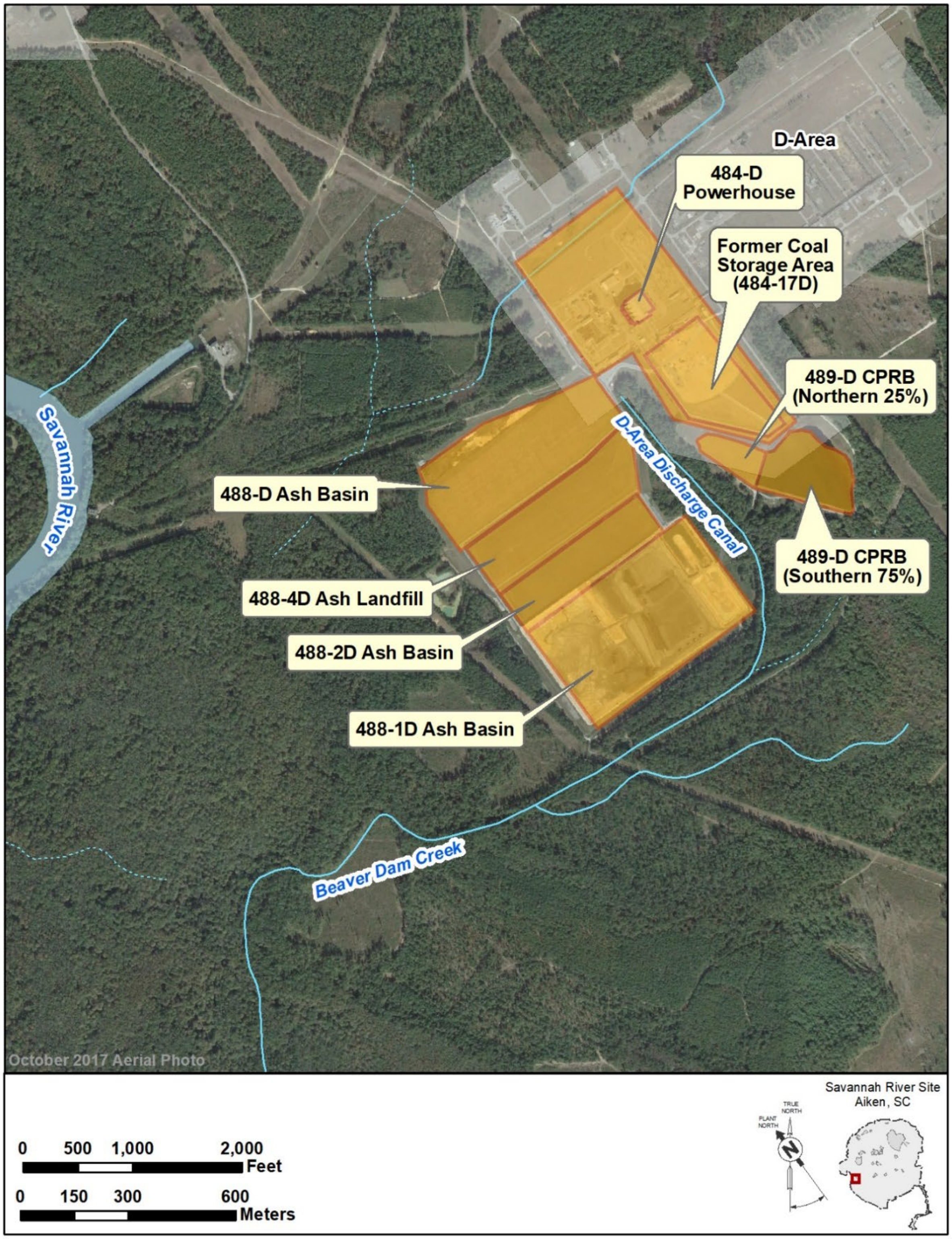

Figure 1. D-Area Powerhouse Associated Facilities

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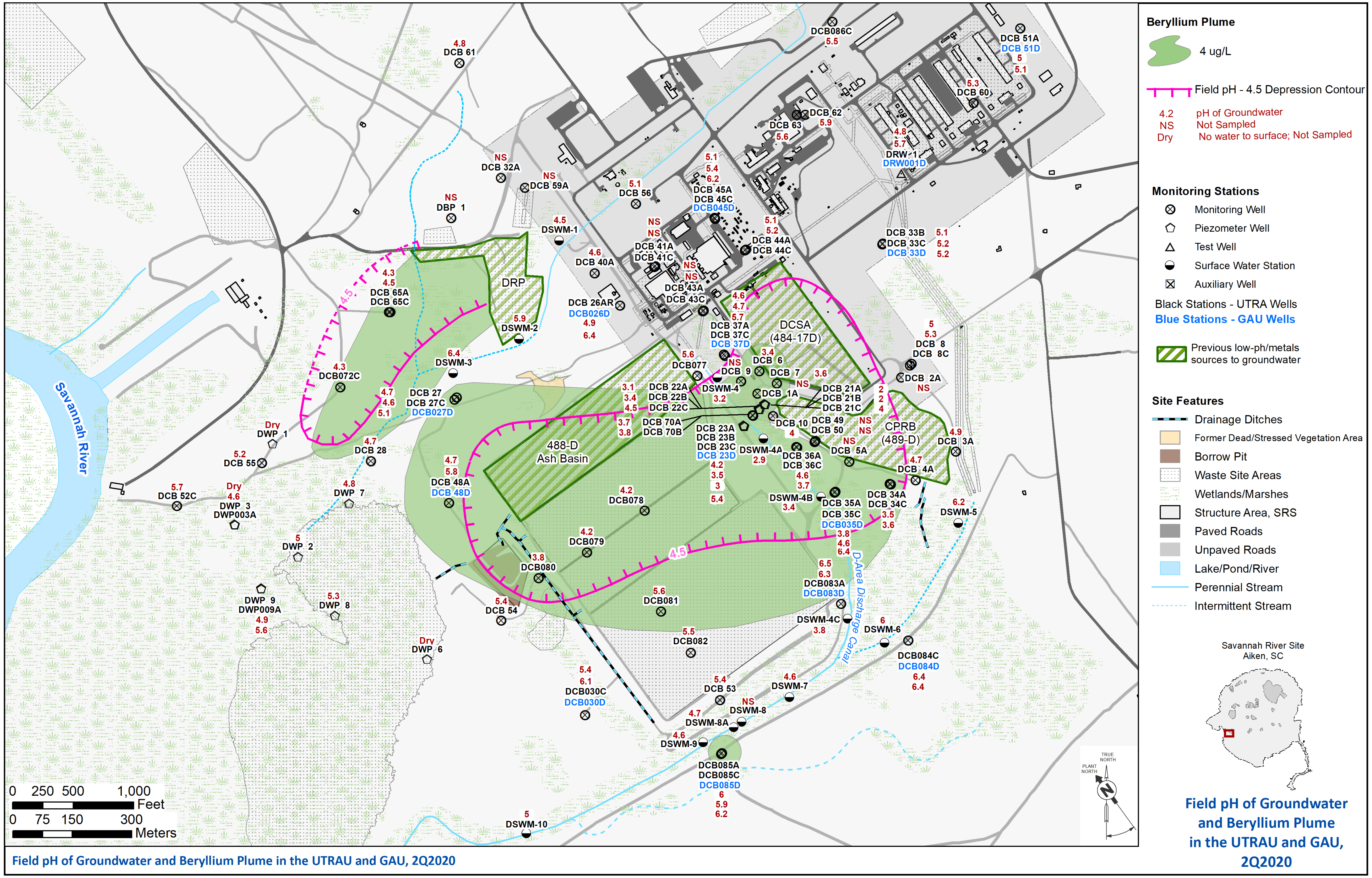

Figure 2. D-Area Groundwater 2Q2020 pH and Beryllium Plume

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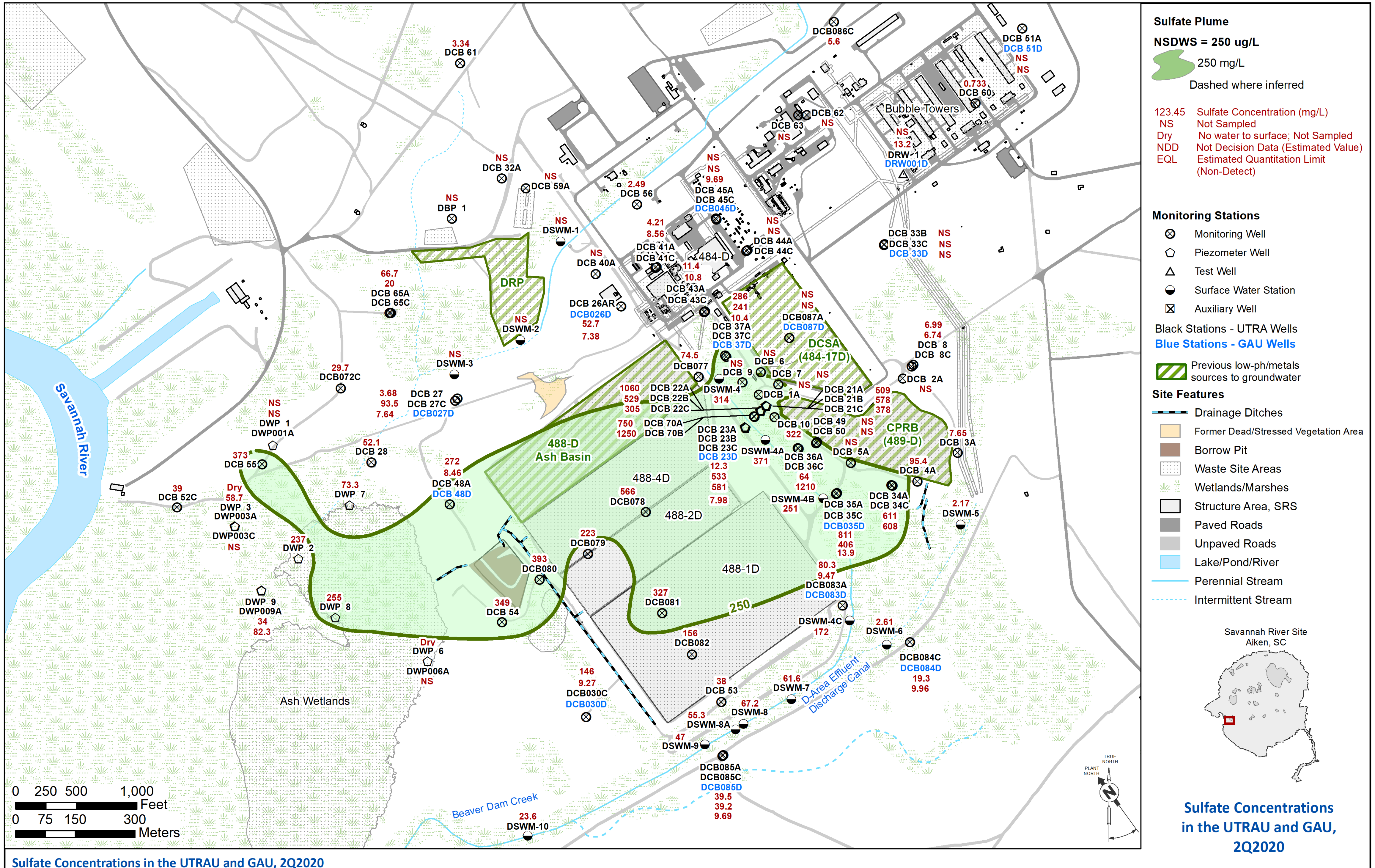

Figure 3. D-Area Groundwater 2Q2020 Sulfate Plume

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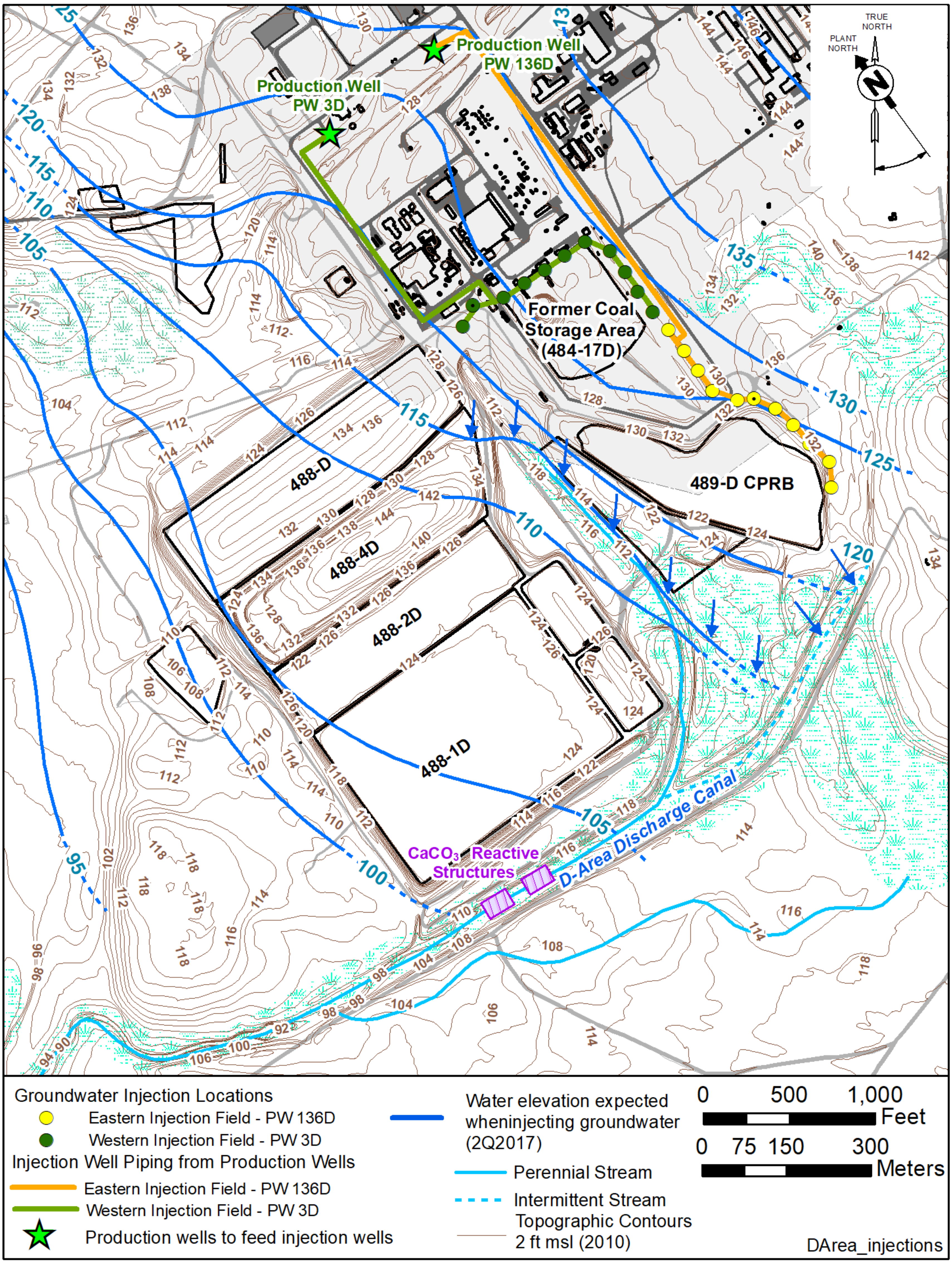

Figure 4. D-Area Treatability Study Injection Wells, Reactive Structure, and Projected Water Table Elevation

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Water Volume, ml	$CaCO_3$ Mass, g	Initial pH	Final pH	Mass $CaCO_3$ per Water Volume, mg/l
Initial		3		0
200	0.018	3.08	3.99	90
200	0.05	3.05	5.75	250
200	0.1	3.02	6.15	500
50	0.1	2.98	6.64	2,000
50	0.25	2.93	6.50	5,000
50	0.5	2.90	6.60	10,000

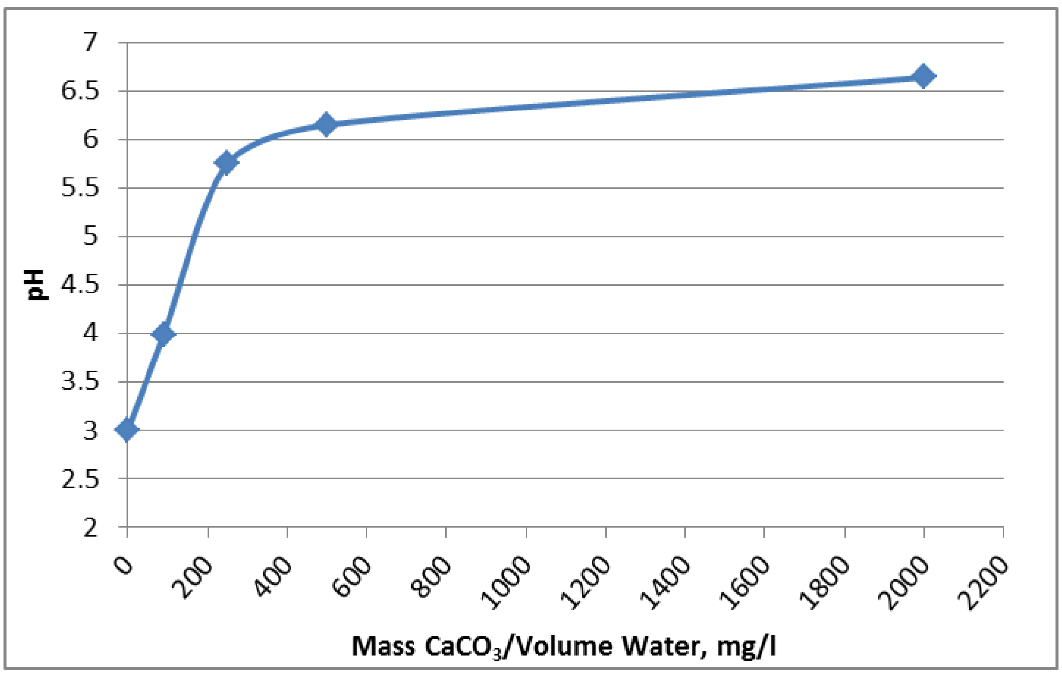

Figure 5. Titration Test Chart and Graph of D-Area Discharge Canal Acidic Surface Water with Calcium Carbonate Additions

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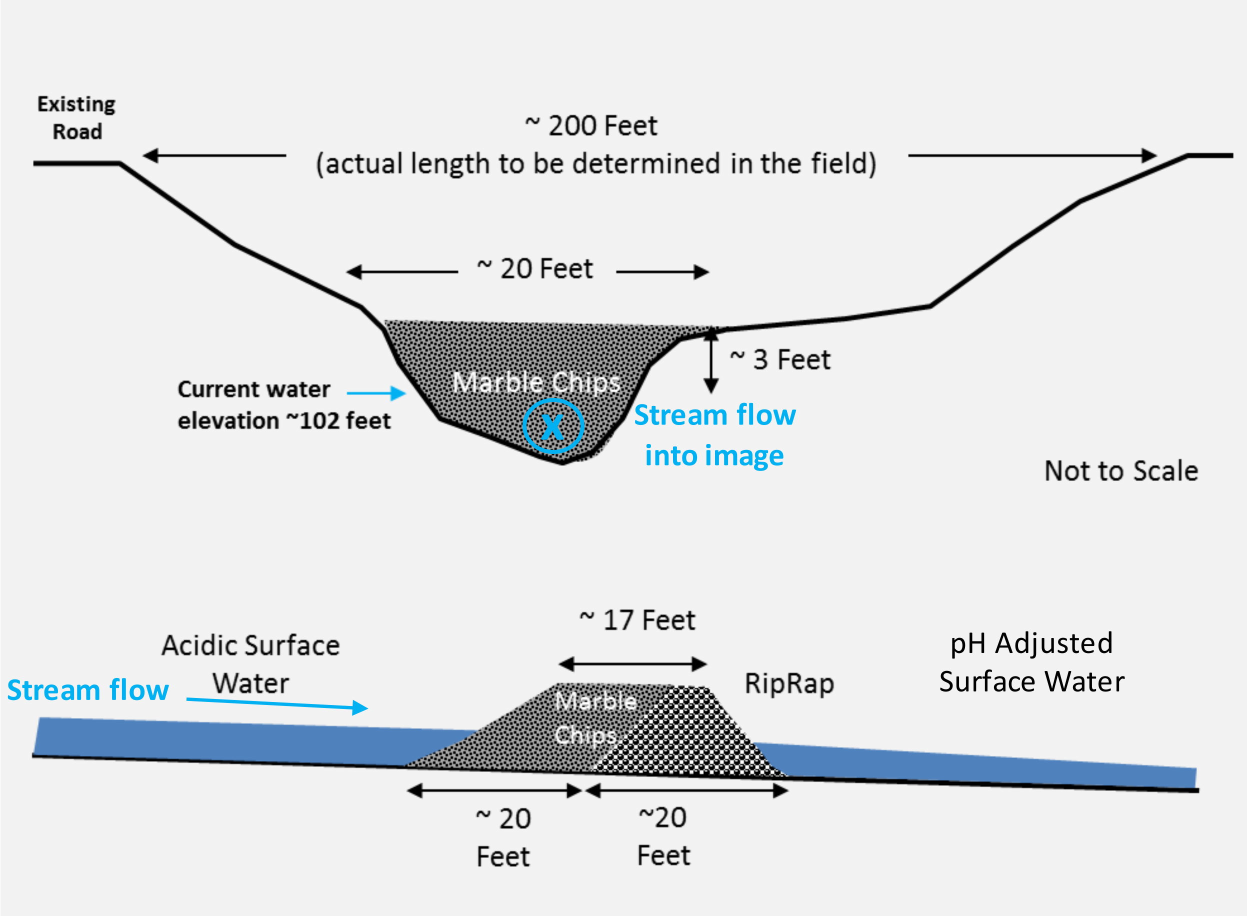

Figure 6. Diagram of $CaCO_3$ Reactive Structures in the D-Area Discharge Canal

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Figure 7. D-Area Injection Wells Installed and Production Well Piping

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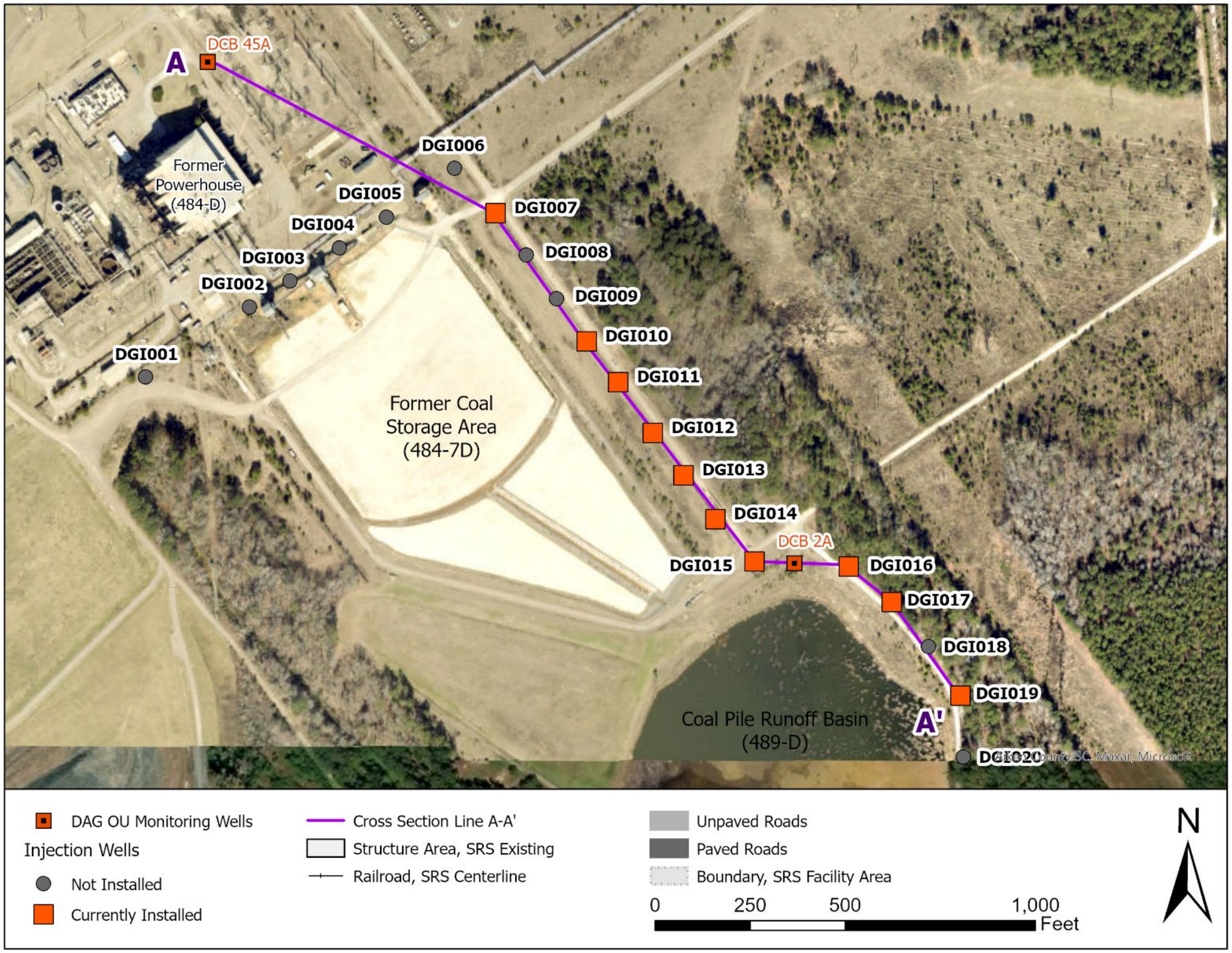

Figure 8. Installed Injection Wells and Cross Section Line A–A'

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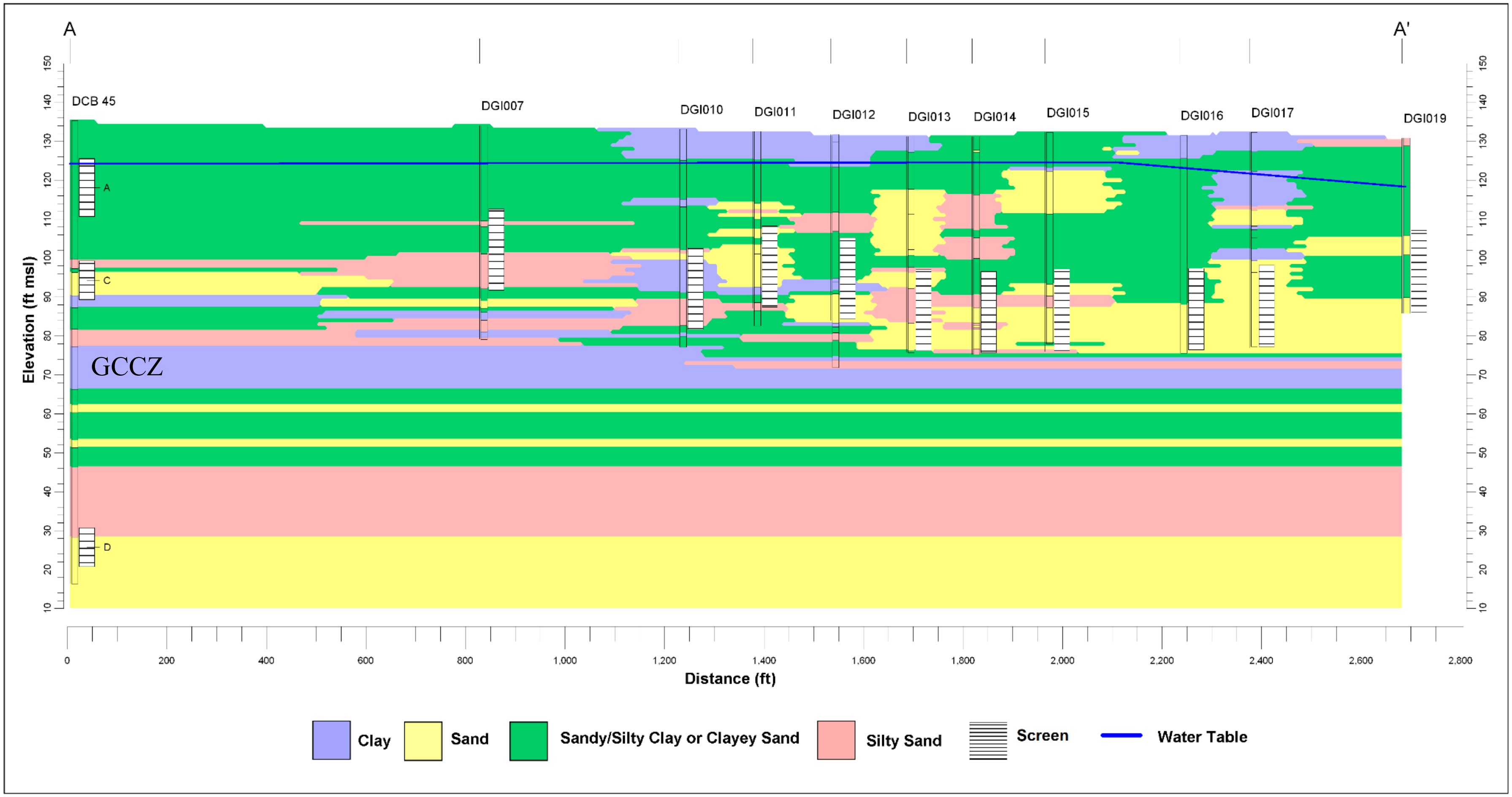

Figure 9. D-Area Injection Well Lithological Cross-Section A-A'

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Figure 10. D-Area Treatability Study Pipeline Installation

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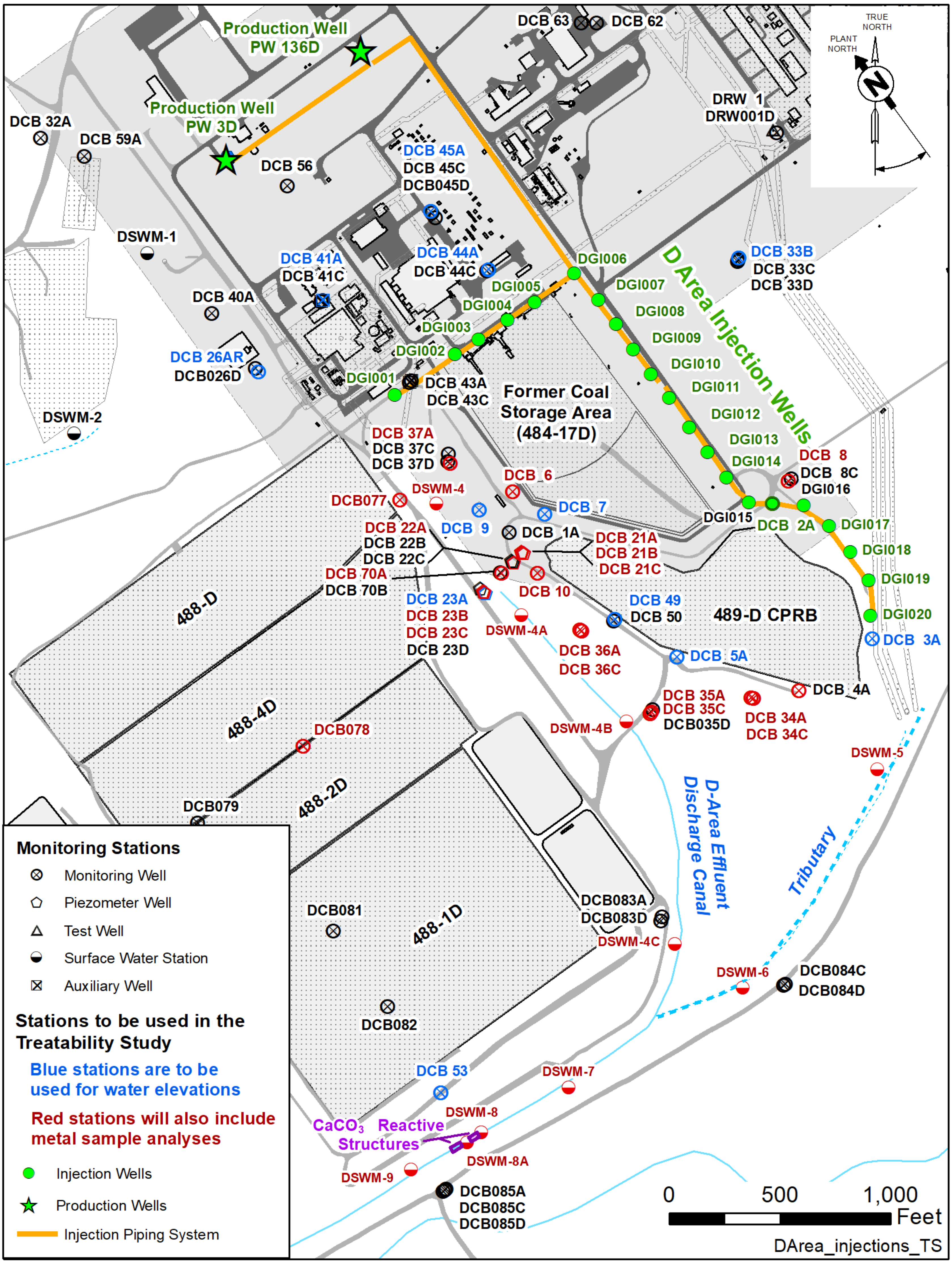

Figure 11. D-Area Treatability Study Monitoring Locations

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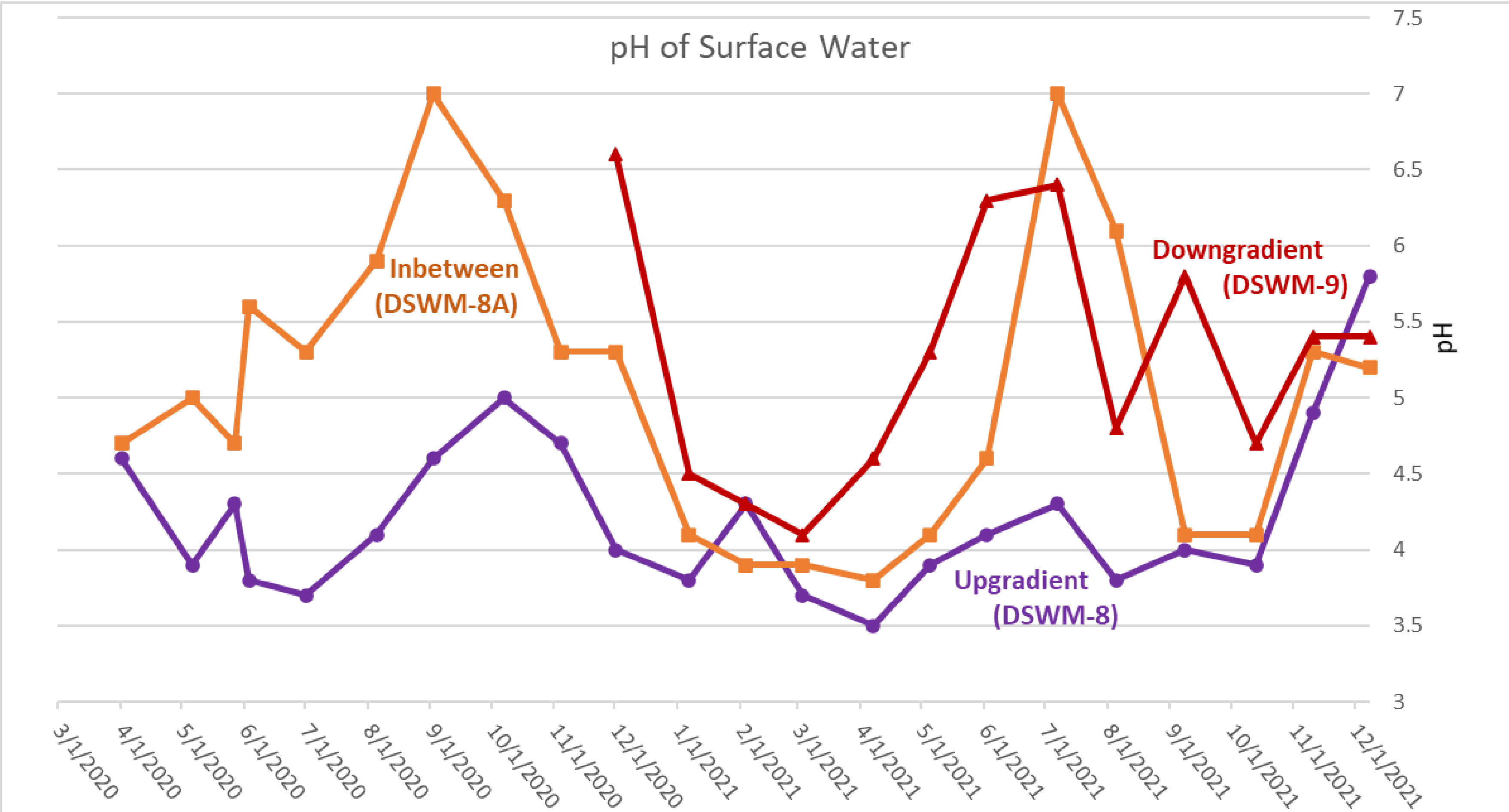

Figure 12. **$CaCO_3$ Reactive Structure Surface Water pH Results**

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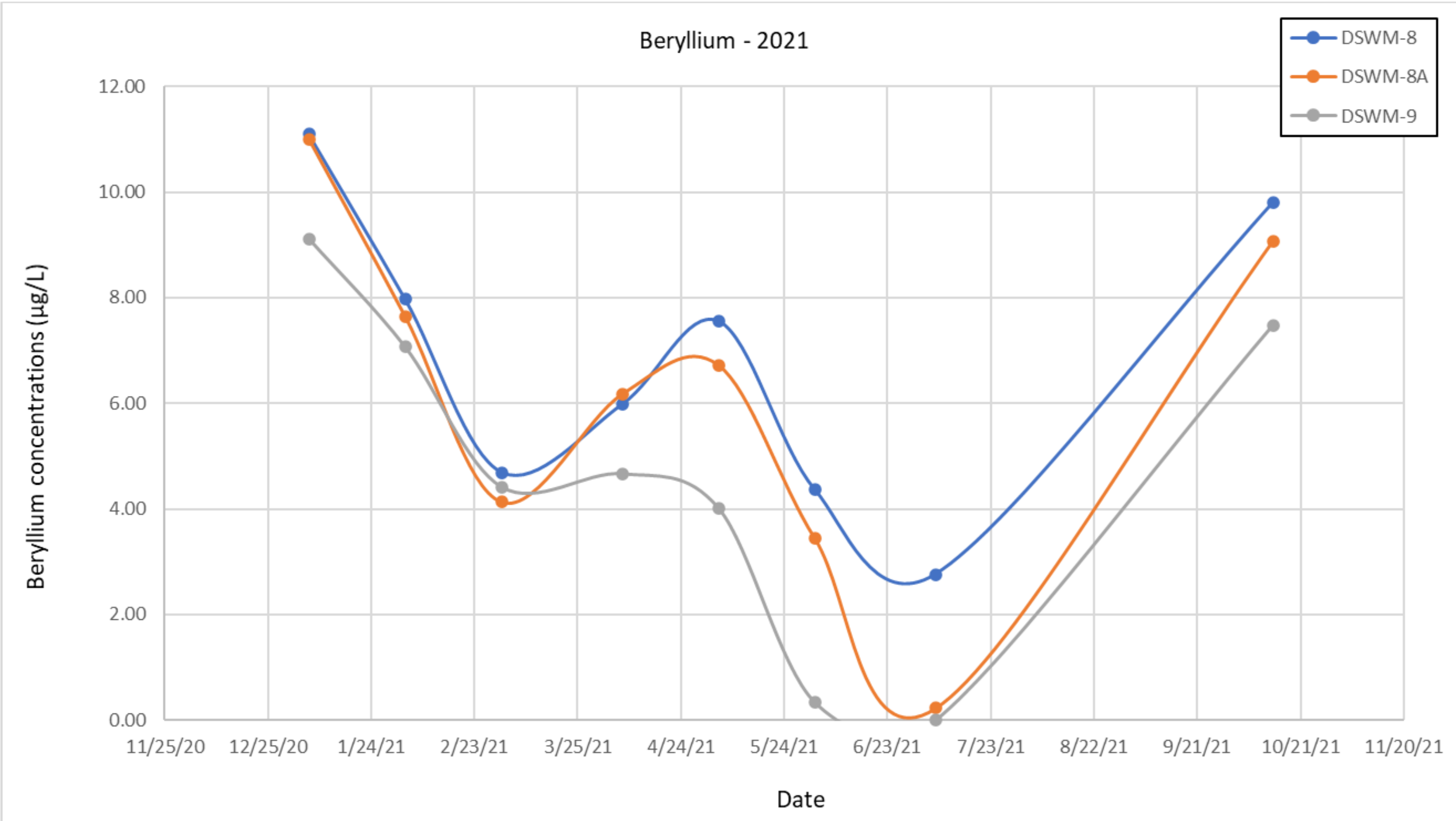

Figure 13. **Beryllium 2021 Results at Surface Water Stations DSWM-8, DSWM-8A, and DSWM-9**

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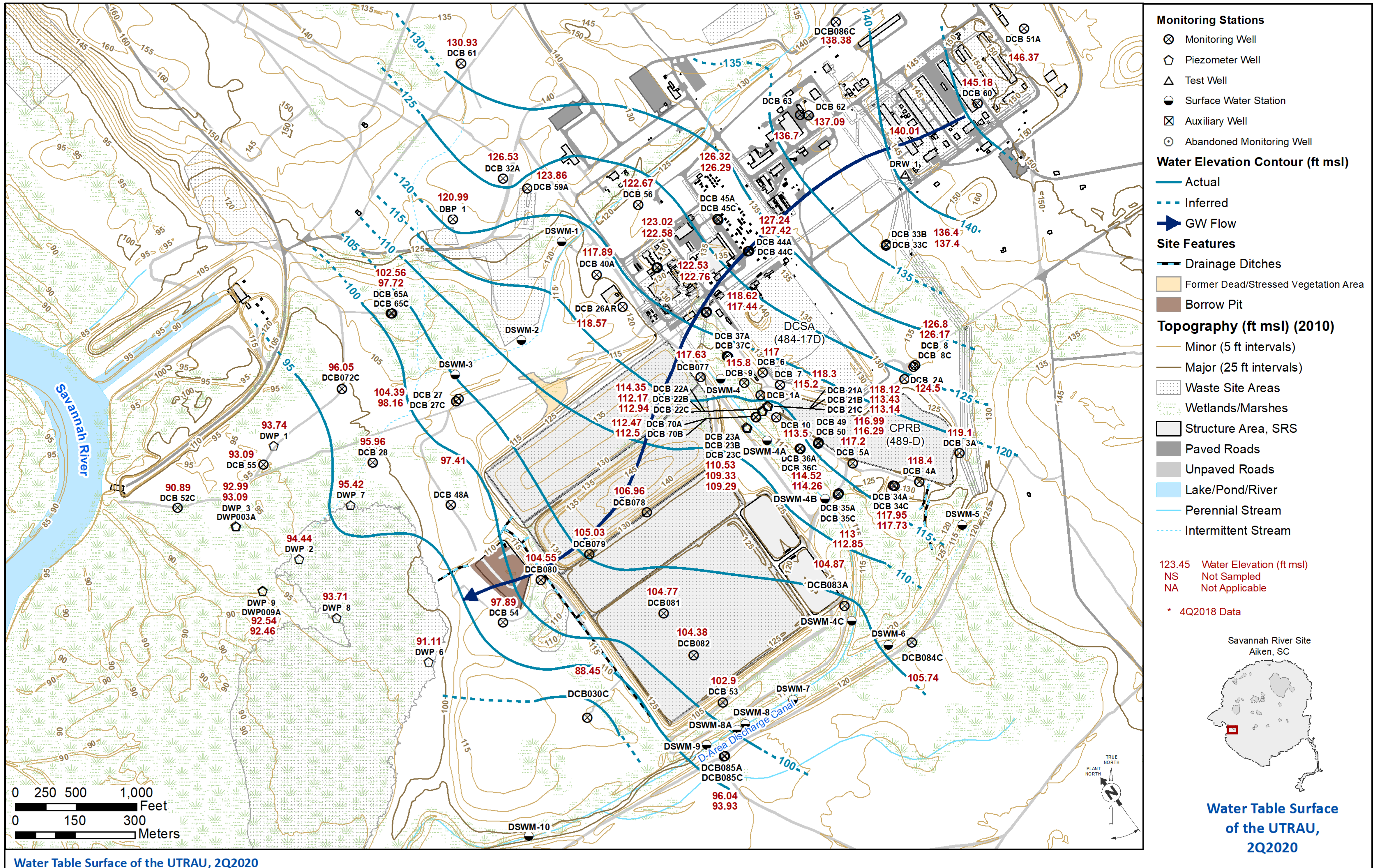

Figure 14. D-Area Groundwater OU UTRA Potentiometric Surface (2Q2020)

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APPENDIX A

GEOLOGIC LOGS OF INJECTION WELLS

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Field Geologic Log

Proc. Ref. 3Q1-9004, 9006

Project			Date
D-Area Well Installation			2/23/21
Well Number	**Location**	**Drilling Subcontractor**	
OGI 011	D-Area	Cascade	
Logs Prepared By		**Driller**	
Justin Steadman		Chris Ruffer	
Company		**Drilling Method**	
SRNS		Rotosonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0		100%	Hand augered 0.0'- 6.0'	
	1–5			Clay (sand trace - 5%), pale brown (5 YR 5/2) - light brown (5 YR 6/4), v. firm - firm, dry, friable, interval 0.0' - 7.2'	
	6–9			Sandy Clay (sand 5 - 15%), light brown (5 YR 6/4) - grayish orange (10 YR 7/4), large cobbles of sand, v. firm, dry, friable, interval 0.0'- 10.0'	
2	10–11		100%	Sandy Clay (sand 10 - 20%) grayish orange (10 YR 7/4) - dark yellowish orange (10 YR 6/6) large cobbles of sand, firm, moist, malleable, interval 10.0'- 11.5'	
	13–14			Sandy Clay (sand 20 - 25%) grayish orange (10 YR 7/4) large cobbles of sand, md. firm, moist, malleable, interval 11.5'- 14.0'	
	15–17			Clayey Sand (clay 20 - 25%) md - cs grn, grayish orange (10 YR 7/4), poorly sorted, subang - subrnd, moist, interval 14.0' - 16.0'	
	18–20			Clayey Sand (clay 20 - 25%) fn - md grn, pale yellowish brown (10 YR 6/2), mod sorted, subang - subrnd, interval 16.0'- 18.5'	

Sand (silt 5 - 10%) pockets of clay, md - cs grn, md light gray (N6), mod sorted, wet, [illegible] interval 19.5' - 20.0'

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	20		100%	Silty Sand (silt 10-15%) fn grn (pale yellowish brown (10 YR 6/2), well sorted, subrnd, wet, interval 20.0'-21.0'	
	21–22.5			Sand (clay 5-10%) md-cs grn, md light gray (N6)-pale yellowish orange (10 YR 8/6) poorly sorted, subang-subrnd, wet, interval 21.0'-22.5'	
	22.5–25			Sandy Clay (sand 15-20%) md light gray (N6), soft, moist malleable, interval 22.5'-25.0'	
	25–27.5			Sand (silt 5-10%) md light gray (N6) - yellowish gray (5Y 7/2) fn grn, well sorted subrnd, wet, interval 25.0' - 27.5'	
	27.5–29			Sandy Clay (sand 10-15%) dusky yellow (5Y 6/4) - pale olive (10 Y 6/2), soft, moist, malleable, interval 27.5' - 29.0'	
	29–30			Sand (silt 5-10%) md-cs grn, md gray (N5), poorly sorted, subang-subrnd, wet, interval 29.0'-30.0'	
4	30–31.5		15%	Sand A/A grayish orange (10 YR 7/4) - light brown (5YR 5/6) interval 30.0' - 31.5'	
	31.5–40				

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9005

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
5	40–42		100%	Clay (Sand 5 - 10%) medium gray (N5) with dark yellowish orange (10 YR 6/6) pockets of sand, soft, wet, malleable, interval 40.0' - 42.0'	
	42–44			Sandy Clay (sand 10-15%) dark yellowish orange (10YR 6/6) Soft, wet, malleable, interval 42.0' - 44.0'	
	44–46			Silty Sand (silt 20 - 25%) md - cs grn, dark yellowish orange (10 YR 6/6), poorly sorted, subang - sub rnd, wet, interval 44.0' - 46.0'	
	46–47.5			Clay (Sand 5 - 10%) white (N9) with light brown (5YR 5/6) pockets of sand, fades to light brown (5YR 5/6) clay firm, dry, friable, interval 46.0' - 47.5'	
	47.5–50			Sandy Clay Sand (10 - 15%) dark yellowish orange (10YR 6/6) - light brown (5YR 5/6), firm dry, friable, interval 47.5' - 50.0'	
				Total depth - 50.0'	
	51–60				

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Field Geologic Log

Proc. Ref. 3Q1-9004, 9006

Project: D-Area Well Installation			Date: 2/24/21
Well Number: DGI012	Location: D-Area	Drilling Subcontractor: Cascade	
Logs Prepared By: JUSTIN STEADMAN		Driller: Chris Ruffer	
Company: SRNS		Drilling Method: Rotosonic	

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0–2	X	80%	Hand augered 0.0'-6.0'	
	2–8.5			Clay, (sand trace - 5%), pale brown (5YR 5/2) - light brown (5YR 6/4), firm, dry, friable, interval 2.0'-8.5'	
	8.5–10			Sandy Clay (sand 10-20%) grayish orange (10YR 7/4), large rounded cobbles, firm, dry, friable, Interval 8.5'-10.0'	
2	10–16		100%	Sandy Clay, A/A, grayish orange (10YR 7/4) - grayish orange pink (5YR 7/2), interval 10.0'-16.0'	
	16–20			Sandy Clay (sand 5-15%) grayish orange (10YR 7/4) and firm, moist, malleable, Interval 16.0'-20.0'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	20–30		100%	Silty Sand (silt 15-20%) fn-md grn, yellowish gray (5Y 7/2), mod sorted, subrnd-subang, wet, interval 20.0'-22.0'	
				Silty Sand (silt 10-15%) md-cs grn, yellowish gray (5Y 7/2), poorly sorted, subrnd-subang, wet, interval 22.0'-25.0'	
				Clayey Sand (clay 10-15%) md-cs grn, dusky yellow (5Y 6/4) - light olive gray (5Y 6/2) - medium light gray (N6), poorly sorted, subang-subrnd, wet, interval 25.0'-30.0'	
4	30–40		80%	Sandy Clay (sand 5-15%) yellowish gray (5Y 7/2), md firm, wet, malleable, interval 30.0'-31.5'	
				Sandy Clay (sand 5-10%) yellowish gray (5Y 7/2), firm, moist, friable, interval 31.5'-33.0'	
				Clay, (trace - 5% sand) light gray (N7), firm, dry, friable, interval 37.0'-38.0'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
5	40–41		100%	Sandy Clay (sand 10-20%) dark yellowish orange (10YR 6/6) soft, moist, malleable, interval 40.0'-41.0'	
	41–48.5			Sand (silt 5-10%), md-cs grn, medium light gray (N6) mod-poorly sorted, wet, interval 41.0' - 48.5'	
	48.5–49.5			Clay, sand trace, light gray (N7), md firm, moist, malleable, interval 48.5'-49.5'	
	49.5–50			Sand (silt trace - 5%) cs grn, pale yellowish orange (10YR 8/6), well sorted, subang-subrnd, wet, interval 49.5'- 50.0'	
6	50–51		100%	Silty Clayey Sand (silt 10-15%) (clay 20-25%) fn-md-cs grn, light brown (5YR 5/6), poorly sorted, subang-subrnd, moist, interval 50.0' - 51.0'	
	51–53			Silty Sand (silt 20-25%) md-cs grn, light brown (5YR 5/6) iron staining at 52.5', poorly sorted, subang-subrnd, dry, interval 51.0'- 53.0'	
	53–57			Sandy Clay (sand 15-20%), medium gray (N5), soft, moist, malleable, interval 53.0' - 57.0'	
	57–58			Clay (sand trace - 5%), medium gray (N5), firm, moist, malleable interval 57.0' - 58.0'	
	58–60			Silty Sand (silt 15-20%) md-cs grn, medium gray (N5), poorly sorted, subang-subrnd, wet, interval 58.0' - 60.0'	

Total depth - 60.0'

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Field Geologic Log

Proc. Ref. 3Q1-9004, 9006

Project: D-AREA Well Installation		Date: 2/22/21
Well Number: DGIB13	Location: D-Area	Drilling Subcontractor: Cascade
Logs Prepared By: JUSTIN STEADMAN		Driller: Chris Ruffer
Company: SRNS		Drilling Method: Rotosonic

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0–9		100%	Hand augered 0.0' - 6.0'	
				Clay (Sand trace - 10%) pale brown (5 YR 5/2) - grayish orange (10 YR 7/4), md firm - firm, moist - dry, friable, interval 0.0' - 7.6'	
				Sandy Clay (Sand 20 - 25%) light brown (5 YR 5/6) - dark yellowish orange (10 YR 6/6), md firm, moist, friable interval 7.6' - 8.3'	
				Clayey Sand (Clay 10 - 15%) md - cs grn w/ large cobbles, dark yellowish orange (10 YR 6/6) poorly sorted, subang - subrnd, moist interval 8.3' - 9.0'	
2	9–19		100%	Clayey Sand A/A interval 9.0' - 10.5'	
				Clayey Sand, (Clay 5 - 10%) fn - md grn, light gray (N7) poorly sorted, subang - subrnd moist, interval 10.5' - 12.5'	
				Sandy Clay (sand 10 - 15%) light gray (N7), soft, moist malleable, interval 12.5' - 13.5'	
				Sand (silt trace - 10%), fn - md - cs grn, light gray (N7) - light olive gray (5 Y 6/1), poorly sorted, subang - subrnd, moist - wet, interval 13.5' - 19.0'	
3	19–20		10%	Sand A/A interval 19.0' - 20.0'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	20–29 (20, 1, 2, 3, 4, 25, 6, 7, 8)	X	10%		
4	29–30.5 (9, 30)		100%	Sand (silt 5-10%) fn-md grn, light gray (N7), poorly sorted, subrnd, wet, interval 29.0'-30.5'	
	30.5–32.7 (1, 2)			Sandy Clay (sand 10-15%), (silt 5-10%) soft, wet, malleable, interval 30.5'-32.7'-3	
	32.7–33.5 (3)			Clayey Sand (clay 10-15%) fn-md-cs grn, light brownish gray (5 YR 6/1), poorly sorted, sub ang - subrnd, wet, interval 32.7'-33.5'	
	33.5–35.0 (4, 35)			Silty Sand (silt 10-15%), fn-md grn, dark yellowish orange (10 YR 6/6) poorly sorted, subang - subrnd, wet interval 33.5'-35.0'	
	35.0–39.0 (6, 7, 8)			Sand (silt 5-10%) grades to trace, dark yellowish orange (10YR 6/6) poorly sorted, subang - subrnd, wet - moist interval 35.0'-39.0'	
5	39–40 (9, 40)		100%		

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
5	40–49		100%	Silty Sand (silt 15-20%) fn-md-cs grn, dark yellowish orange (10 YR 6/6)-light gray (N7), iron staining at 40', poorly sorted, subang-subrnd, wet, interval 39.0' - 48.0'	
				Sand (silt trace - 5%) md-cs grn, light gray (N7) poorly sorted, subang-subrnd wet, interval 48.0' — 49.0'	
6	49–56.5		100%	Sand (silt trace - 10%) v.cs-cs grn, grayish orange (10YR 7/4) - light gray (N7), poorly sorted, subang - subrnd, wet, interval 49.0' - 55.0'	
				Clayey Sand (clay 10-15%) (silt 5-10%) v.cs-cs grn dark yellowish orange (10YR 6/6) poorly sorted, subang-subrnd moist, interval 55.0' - 56.5'	
	57–60			Total depth - 56.5'	

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Field Geologic Log

Proc. Ref. 3Q1-9004, 9006

Project: D-Area Well Installation	Date: 02/17/21
Well Number: DGJ015	Location: D-Area
Drilling Subcontractor: Cascade	
Logs Prepared By: Justin Steadman	Driller: Jimmy Hall
Company: SRNS	Drilling Method: Rotosonic

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
1	0–9		90%	0.0' - 6.0' Hand augered Sandy Clay (Sand 5-10%), pale brown (5YR 5/2), firm, dry, friable, interval 1.0'-7.7' Sandy Clay, (Sand 10-15%) pale brown (5YR 5/2), large pebbles and boulders throughout firm, dry, friable, interval 7.7' - 9.0'	
2	9–19		100%	Clay, trace sand, light gray (N7), firm, moist, malleable, interval 9.0'-10.0' Sand (silt trace - 5%) md-cs grn, grayish orange (10YR 7/4) fades to pale yellowish orange (10YR 8/6) fades to light gray (N7), poorly sorted, subang - subrnd, moist - wet, interval 10.0' - 19.0'	
3	19–20		100%	Sand, A/A, dark yellowish orange (10YR 6/6), interval 19.0' - 20.5'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	20–21.5		100%	Silty Sand (silt 10-15%) fn-md grn, light gray (N7), poorly sorted, subang - subrnd, wet, interval 20.5' - 21.5'	
3	21.5–22.9			Sandy Clay (sand 10-15%) dark yellowish orange (10 YR 6/6), soft, wet, malleable, interval 21.5' - 22.9'	
3	22.9–28.3			Silty Sand (silt 10-15%) fn-md grn, moderate yellowish orange (10 YR 6/6), poorly sorted, subang - subrnd, wet, interval 22.9' - 28.3'	
3 / 4	28.3–29.0			Sandy Clay (sand 5-10%) dark yellowish orange (10YR 6/6) soft, moist, malleable, interval 28.3' - 29.0'	
4	29.0–34.8		100%	Sandy Clay A/A, interval 29.0' - 34.8'	
4	34.8–36.0			Clayey Sand (Clay 20-25%) fn-md-cs grn, dark yellowish orange (10 YR 6/6), poorly sorted, subang-subrnd, wet, interval 34.8' - 36.0'	
4	36.0–39.0			Sand (silt trace - 5%) cs grn, dark yellowish orange (10 YR 6/6) subrnd, well sorted, wet, interval 36.0' - 39.0'	
5	39.0–40		100%	Sand A/A interval 39.0' - 41.7'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
5	40				
	1			Silty Sand (silt 20-25%) fn grn, dark yellowish orange (10YR 6/6), well sorted, wet, interval 41.7'-46.5'	
	2				
	3				
	4		100%		
	45			Sand (silt 5-10%) md-cs grn, dark yellowish orange (10 YR 6/6), iron oxidation at 47', poorly sorted, subang-subrnd, wet-moist, interval 46.5'-49.0'	
	6				
	7				
	8				
6	9			Sand A/A, iron oxidation at 53', interval 49.0'-54.0'	
	50				
	1				
	2		71.4%		
	3			Sandy Clay (Sand 10-15%) dark yellowish orange (10 YR 6/6) md stiff, dry, friable, interval 54.0'-54.3'	
	4				
	5				
	6			Total Depth - 56.3'	
	7				
	8				
	9				
	0				

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Field Geologic Log

Proc. Ref. 3Q1-9004, 9006

Project: D-Area Well Installation		Date: 3/1/21
Well Number: DGI017	Location: D-Area	Drilling Subcontractor: Cascade
Logs Prepared By: JUSTIN STEADMAN		Driller: Chris Ruffer
Company: SRNS		Drilling Method: Roto sonic

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
	0–5			Hand augered 0.0'-6.0'	
1	5–10		50%	Sandy Clay (sand 10-15%) pebbles throughout, pale brown (5YR 5/2), md firm, dry, friable, large cobbles of Mica at 9.5', interval 5.0'-10.0'	
2	10–16		100%	Clay (sand trace - 5%) very pale orange (10YR 8/2)-dark yellowish orange (10YR 6/6) firm - md. firm, moist, friable, interval 10.0'-16.0'	
	16–19			Clay (sand trace - 5%) dark yellowish orange (10YR 6/6) md firm - soft, wet, malleable, 16.0' - 19.0'	
	19–20			Silty Sand (silt 15-20%) fn-md-cs grn, dark yellowish orange (10YR 6/6) poorly sorted, subang - subrnd, wet, interval 19.0' - 20.0'	

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
3	20		70%	Sand, A/A, interval 20.0' - 24.0'	
	24			Clay (sand trace - 5%) dark yellowish orange (10YR 6/6), soft moist, malleable, interval 24.0'-25.0'	
	25			Clayey Sand (clay 15-20%) md - cs grn, dark yellowish orange (10 YR 6/6), poorly sorted, subang - subrnd, wet, interval 25.0' - 26.5'	
	26.5			Sandy Clay (sand 10-15%) dark yellowish orange (10 YR 6/6) soft, moist, malleable, interval 26.5' - 27.0'	
4	30		60%	Sandy Clay, A/A, interval 30.0 - 30.5'	
	30.5			Clay, sand trace, dark yellowish orange (10YR 6/6) - very pale orange (10 YR 8/2) firm, dry, friable, interval 30.5' - 33.0'	
	33			Sand (silt trace - 5%) md - cs grn, dark yellowish orange (10 YR 6/6) mod sorted, subang - subrnd, wet, interval 33.0' - 36.0'	
	40				

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Field Geologic Log (Continued)

Proc. Ref. 3Q1-9004, 9006

Run Number	Depth Below Ground Surface (Feet)	Lithology	Percent Recovery	Sample Description	Drilling Comments/Remarks
5	40–50		100%	Sand, silt (trace - 5%), md-cs grn, dark yellowish orange (10 YR 6/6), iron oxidation at 49.5'-50.0', poorly - med sorted, subang-subrnd, wet, interval 40.0' - 50.0'	
6	50–55		100%	Sand, A/A, iron oxidation from 54.0' - 55.0' Total depth - 55.0'	
	55–60				

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Appendix B

D-Area Groundwater Treatability Study Data Table (2021)

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Table B-1. D-Area Treatability Study 2021 Sample Results

		Field Data									Inorganics																								
Station	Well Use	SAMPLE COLLECTION DATE	TURBIDITY	PH	WATER TEMPERATURE	SPECIFIC CONDUCTANCE	OXIDATION/REDUCTION POTENTIAL	OXYGEN	Constituent	FIELD CONDITIONS	ALUMINUM	ANTIMONY	ARSENIC	BARIUM	BERYLLIUM	CADMIUM	CALCIUM	CHROMIUM	COBALT	COPPER	IRON	LEAD	MAGNESIUM	MANGANESE	MERCURY	NICKEL	POTASSIUM	SELENIUM	SILVER	SODIUM	SULFATE	THALLIUM	URANIUM	VANADIUM	ZINC
		day-month-year	NTU	pH	degC	uS/cm	mV	mg/L	Unit		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	ug/L	mg/L	ug/L
									NPDWS			6	10	2000	4	5		100		1300		15			2			50				2	30		
									NSDWS		200										300			50					100		250				5000
									RSL																	390									
DSWM-8	Surface Water	06-Jan-2021	1.1	3.8	10.1	272	335	0.45			6060	<EQL (3)	[2.18]	46.6	[11.1]	[0.43]	15500	<EQL (10)	23.1	2.67	666	<EQL (2)	4640	584	<EQL (0.2)	35.9	2020	<EQL (5)	<EQL (1)	2.58	99.4	<EQL (2)	[0.107]	<EQL (20)	86.2
DSWM-8	Surface Water	03-Feb-2021	1.3	4.3	8.1	230	42.3	10.72			4520	<EQL (3)	<EQL (5)	44.1	7.97	[0.409]	13500	<EQL (10)	18.2	2.61	715	<EQL (2)	4290	471	<EQL (0.2)	25.9	1770	<EQL (5)	<EQL (1)	3.11	82.4	<EQL (2)	[0.076]	<EQL (20)	61.9
DSWM-8	Surface Water	03-Mar-2021	6.6	3.7	10.2	197	401	8.23			3280	<EQL (3)	[2.53]	42.5	4.69	[0.438]	13700	<EQL (10)	13	5.1	1390	<EQL (2)	[3290]	478	<EQL (0.2)	19	1660	<EQL (5)	<EQL (1)	3.15	69.4	<EQL (2)	[0.106]	<EQL (20)	51
DSWM-8	Surface Water	07-Apr-2021	3.2	3.5	14.7	222	394	10.5			3410	<EQL (3)	<EQL (5)	40.8	5.98	[0.316]	14900	<EQL (10)	16.5	2.98	1540	<EQL (2)	3880	588	<EQL (0.2)	22.3	1530	<EQL (5)	<EQL (1)	2.97	99	<EQL (2)	[0.072]	<EQL (20)	59.2
DSWM-8	Surface Water	05-May-2021	4.6	3.9	20.6	226	463	3.73			2730	<EQL (3)	<EQL (5)	38.2	7.56	<EQL (1)	15400	<EQL (10)	17.6	2.02	1390	<EQL (2)	3900	648	<EQL (0.2)	21.8	1600	<EQL (5)	<EQL (1)	2.65	102	<EQL (2)	[0.122]	<EQL (20)	55.9
DSWM-8	Surface Water	02-Jun-2021	7.1	4.1	20.2	154	385	2.84			1130	<EQL (3)	<EQL (5)	34.2	4.36	<EQL (1)	10900	<EQL (10)	10.8	[0.977]	724	<EQL (2)	2680	508	<EQL (0.2)	13.4	1360	<EQL (5)	<EQL (1)	2.37	52.9	<EQL (2)	<EQL (0.2)	<EQL (20)	30.1
DSWM-8	Surface Water	07-Jul-2021	3.6	4.3	24.9	138	331	5.86			498	<EQL (3)	<EQL (5)	29.7	2.76	<EQL (1)	9970	<EQL (10)	7.76	[0.625]	479	<EQL (2)	2340	505	<EQL (0.2)	9.52	1350	<EQL (5)	<EQL (1)	2.27	36.2	<EQL (2)	<EQL (0.2)	<EQL (20)	[18.2]
DSWM-8	Surface Water	05-Aug-2021	6.9	3.8	26.1	262	424	3.89			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8	Surface Water	08-Sep-2021	1	4	23.5	175	189	3.25			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8	Surface Water	13-Oct-2021	2.3	3.9	19.8	220	435	5.86			3860	<EQL (3)	[2.13]	51.5	9.81	[0.315]	14600	<EQL (10)	19.2	2.07	1040	<EQL (2)	3720	432	<EQL (0.2)	30.6	2200	<EQL (5)	<EQL (1)	2.47	82.8	<EQL (2)	<EQL (0.2)	<EQL (20)	[65.7]
DSWM-8	Surface Water	10-Nov-2021	0.7	4.9	11.1	161	261	5.16			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8	Surface Water	08-Dec-2021	2.9	5.8	12.2	131	203	5.12			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8A	Surface Water	06-Jan-2021	1.2	4.1	NS	256	NS	0.61			5780	<EQL (3)	[2.56]	47.5	[11]	[0.49]	16000	<EQL (10)	21.8	2.64	600	<EQL (2)	4610	558	<EQL (0.2)	34.3	2030	<EQL (5)	<EQL (1)	2.55	97.8	<EQL (2)	[0.098]	<EQL (20)	86.8
DSWM-8A	Surface Water	06-Jan-2021								Lab Duplicate																					97.4				
DSWM-8A	Surface Water	03-Feb-2021	1.7	3.9	7.8	228	426	10.98			4340	<EQL (3)	<EQL (5)	35.7	7.64	[0.435]	13400	<EQL (10)	17.1	2.43	639	<EQL (2)	4180	450	<EQL (0.2)	25.1	1690	<EQL (5)	<EQL (1)	2.99	83.3	<EQL (2)	[0.075]	<EQL (20)	58.1
DSWM-8A	Surface Water	03-Mar-2021	8.7	3.9	10.1	183	425	9.71			2920	<EQL (3)	[2.42]	39.3	4.13	[0.395]	12500	<EQL (10)	11.6	4.5	1430	<EQL (2)	[3180]	432	<EQL (0.2)	17.6	1770	<EQL (5)	<EQL (1)	2.96	63.1	<EQL (2)	[0.111]	<EQL (20)	48.1
DSWM-8A	Surface Water	07-Apr-2021	2.1	3.8	14.2	216	439	9			3340	<EQL (3)	<EQL (5)	41.9	6.17	[0.343]	16300	<EQL (10)	16.4	2.96	1340	<EQL (2)	3870	620	<EQL (0.2)	22.7	1580	<EQL (5)	<EQL (1)	3.03	96.8	<EQL (2)	[0.079]	<EQL (20)	55.5
DSWM-8A	Surface Water	05-May-2021	4.4	4.1	20.6	205	432	3.54			2490	<EQL (3)	<EQL (5)	38.7	6.72	<EQL (1)	16900	<EQL (10)	16.6	[1.72]	1150	<EQL (2)	3810	682	<EQL (0.2)	20.5	1580	<EQL (5)	<EQL (1)	2.67	91.8	<EQL (2)	[0.105]	<EQL (20)	53.4
DSWM-8A	Surface Water	02-Jun-2021	10.9	4.6	20.4	150	346	2.11			701	<EQL (3)	<EQL (5)	37.9	3.44	<EQL (1)	14400	<EQL (10)	11.4	[0.63]	752	<EQL (2)	2820	752	<EQL (0.2)	12.2	1380	<EQL (5)	<EQL (1)	2.35	53.1	<EQL (2)	<EQL (0.2)	<EQL (20)	25.2
DSWM-8A	Surface Water	07-Jul-2021	10.2	7	24.1	217	21	2.11			52.1	<EQL (3)	<EQL (5)	39.8	[0.225]	<EQL (1)	36000	<EQL (10)	8.39	<EQL (2)	1670	<EQL (2)	3010	1390	<EQL (0.2)	3.95	1530	<EQL (5)	<EQL (1)	2.32	34	<EQL (2)	[0.077]	<EQL (20)	<EQL (20)
DSWM-8A	Surface Water	07-Jul-2021								Lab Duplicate																					34				
DSWM-8A	Surface Water	05-Aug-2021	10	6.1	25.5	261	90	4.18			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8A	Surface Water	08-Sep-2021	2.8	4.1	23.7	166	334	2.66			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8A	Surface Water	13-Oct-2021	3.8	4.1	19.7	204	461	3.6			3450	<EQL (3)	[2.11]	50.4	9.06	[0.307]	15900	<EQL (10)	17.9	[1.91]	983	<EQL (2)	3640	448	<EQL (0.2)	28.6	2260	<EQL (5)	<EQL (1)	2.43	81.9	<EQL (2)	<EQL (0.2)	<EQL (20)	[60]
DSWM-8A	Surface Water	10-Nov-2021	1.6	5.3	11.4	212	229	6.13			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-8A	Surface Water	08-Dec-2021	7.2	5.2	11.2	130	231	6.5			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-9	Surface Water	06-Jan-2021	3.5	4.5	9.7	235	327	0.63			4770	<EQL (3)	<EQL (5)	50.5	[9.12]	[0.432]	21200	<EQL (10)	20.5	2.41	695	<EQL (2)	4650	552	<EQL (0.2)	33.9	2010	<EQL (5)	<EQL (1)	2.72	97.8	<EQL (2)	[0.081]	<EQL (20)	77
DSWM-9	Surface Water	03-Feb-2021	2.1	4.3	7.1	206	382	12.01			4080	<EQL (3)	<EQL (5)	41.4	7.07	[0.384]	15500	<EQL (10)	16.3	2.31	799	<EQL (2)	4280	444	<EQL (0.2)	29.2	1740	<EQL (5)	<EQL (1)	3.41	82.2	<EQL (2)	[0.08]	<EQL (20)	55.4
DSWM-9	Surface Water	03-Mar-2021	8.3	4.1	10.1	186	419	9.69			3010	<EQL (3)	[2.32]	41.6	4.42	[0.419]	14100	<EQL (10)	12.5	4.54	1330	<EQL (2)	[3180]	450	<EQL (0.2)	17.9	1690	<EQL (5)	<EQL (1)	2.99	66.4	<EQL (2)	[0.123]	<EQL (20)	49.2
DSWM-9	Surface Water	03-Mar-2021								Lab Duplicate																					65.5				
DSWM-9	Surface Water	07-Apr-2021	5.2	4.6	13.8	200	309	11.25			2480	<EQL (3)	<EQL (5)	45	4.67	<EQL (1)	21100	<EQL (10)	14.3	2.22	1740	<EQL (2)	3990	569	<EQL (0.2)	19.3	1580	<EQL (5)	<EQL (1)	3.81	85.5	<EQL (2)	[0.08]	<EQL (20)	47.7
DSWM-9	Surface Water	05-May-2021	8.3	5.3	20.3	190	205	5.1			1370	<EQL (3)	<EQL (5)	47.8	4.02	<EQL (1)	22900	<EQL (10)	13.1	[1.45]	1990	<EQL (2)	3860	703	<EQL (0.2)	17.1	1640	<EQL (5)	<EQL (1)	3.58	74.4	<EQL (2)	[0.071]	<EQL (20)	38.2
DSWM-9	Surface Water	02-Jun-2021	31.3	6.3	19.3	246	350	3.52			111	<EQL (3)	<EQL (5)	57.2	[0.343]	<EQL (1)	35000	<EQL (10)	4.2	[0.38]	2560	<EQL (2)	3240	842	<EQL (0.2)	4.09	1480	<EQL (5)	<EQL (1)	5.23	56.3	<EQL (2)	<EQL (0.2)	<EQL (20)	[3.48]
DSWM-9	Surface Water	02-Jun-2021								Lab Duplicate																					56				
DSWM-9	Surface Water	07-Jul-2021	27.2	6.4	25.1	227	103	2.52			[48.8]	<EQL (3)	<EQL (5)	66.2	<EQL (0.5)	<EQL (1)	33500	<EQL (10)	3.17	[0.363]	2750	<EQL (2)	3150	567	<EQL (0.2)	3.15	1590	<EQL (5)	<EQL (1)	[7.8]	42.3	<EQL (2)	<EQL (0.2)	<EQL (20)	[3.49]
DSWM-9	Surface Water	05-Aug-2021	8	4.8	25.9	234	287	5.7			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-9	Surface Water	08-Sep-2021	38.2	5.8	23.7	231	119	3.11			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-9	Surface Water	13-Oct-2021	7.5	4.7	19.1	192	337	5.36			2300	<EQL (3)	[2.58]	60.8	7.48	<EQL (1)	20100	<EQL (10)	16.3	[1.48]	1290	<EQL (2)	3860	505	0.446	26	2390	<EQL (5)	<EQL (1)	3.58	77.3	<EQL (2)	<EQL (0.2)	<EQL (20)	[54.3]
DSWM-9	Surface Water	10-Nov-2021	70.3	5.4	11.2	233	176	6.04			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
DSWM-9	Surface Water	08-Dec-2021	16.8	5.4	11.9	170	182	6.45			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Explanation

[##]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quanity.
<EQL(##)	Constituent was below detection. The sample-specific Estimated Quantitation Limit is in parentheses.
	Result exceeds applicable limit.
REJ	Result Rejected.
	Result is less than the applicable limit and without EPA Functional Guidline qualifiers.
NS	Requested to be sampled but was not. See comments as to why not.
Blue Text	Not a required sample analysis.