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JUL 31 2018

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Mr. Jon Richards
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Superfund Division
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW
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Dear Ms. Fulmer and Mr. Richards:

SUBJECT: D-Area Groundwater Operable Unit Letter Report for Calendar Year 2017 Data, SEMS
Number 63

In accordance with the terms of the Federal Facility Agreement and the *Monitoring Work Plan for the D-Area Groundwater Operable Unit* (WSRC-RP-2003-4150, Revision 1, June 2004), the U. S. Department of Energy (DOE) is submitting this biennial letter report for your review. Per the monitoring work plan, groundwater reports are submitted in odd number years and groundwater letter reports are submitted in even number years. All reports are due by July 31 of each year. Therefore, the 2017 D-Area Groundwater Operable Unit data and analyses are presented in this letter report.

Please review this letter report and provide your comments or approval within one hundred twenty (120) days of receipt. The effort and time that the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency have given on the subject operable unit are greatly appreciated.

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D-Area Groundwater Operable Unit Letter Report for Calendar Year 2017 Data

Introduction

Groundwater and surface water in D-Area was sampled annually or semi-annually during calendar year 2017 during the second quarter (2Q) or fourth quarter (4Q) following the *Monitoring Work Plan for the D-Area Groundwater Operable Unit* (WSRC-RP-2003-4150, Revision 1, June 2004). Wells DWP 1 and DWP 6 were dry during 2Q2017 and 4Q2017; therefore, no samples were collected for these wells during 2017. Wells DWP 2 and DWP 8 were dry during 4Q2017 so no samples were collected at these wells during this quarter.

Tritium, volatile organic compounds (VOCs), and metals are present in the D-Area groundwater at levels above the maximum contaminant levels (MCLs). The contamination is located within the Upper Three Runs Aquifer. Tritium contamination is related to spills of reactor moderator in the vicinity of the moderator recovery facility and various storage facilities that were present in the area. VOC contamination, primarily trichloroethylene (TCE), in the groundwater is related to spills of solvent and past disposal practices for solvents near the maintenance facilities. Metals contamination in the groundwater is related to low pH conditions from former power plant coal storage and runoff.

Monitoring Results

Locations monitored during 2017 are shown in Figure 1. Groundwater samples were collected from 66 monitoring wells. Monitoring results for 2017 revealed that the MCLs (Primary and Secondary Drinking Water Standards) or U.S. Environmental Protection Agency (USEPA) regional screening levels (RSLs) were exceeded for tritium, VOCs, and metals (See enclosure 1: Table 1 and Table 2). Tritium, tetrachloroethylene (PCE), TCE, aluminum, arsenic, beryllium, cadmium, chromium, ferric iron, ferrous iron, lead, manganese, mercury, selenium, sulfate, and uranium exceeded their respective MCLs. Hexavalent chromium, cobalt, nickel, and vanadium exceeded their respective RSLs.

Seven surface water locations (DSWM-1 through DSWM-7) are included as part of the groundwater monitoring sampling regimen and are sampled annually during 2Q. In 2017, aluminum, beryllium, and manganese concentrations exceeded their respective MCLs and cobalt exceeded its respective RSL. The 2017 results also indicate that no surface water samples exceeded their respective MCLs for VOCs or tritium.

Monitoring results are also compared to previously calculated well specific threshold limits for select source, intermediate, and downgradient monitoring wells as presented in the Monitoring Work Plan. These wells are color coded on Figure 1 and the threshold limits for each constituent/well are included in Table 1 and Table 2 (Enclosure 1). In the data tables, threshold limit exceedances and the well name are highlighted in orange and the exceeding result text is bold and underlined. There were no new occurrences of exceedances in the wells that had threshold limit exceedances in 2017.

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Tritium Results

The tritium plume is defined as the groundwater area with tritium activities greater than the MCL (20 pCi/mL) (Figures 2 and 3). Concentrations during 2017 are similar to those measured in 2016. Overall tritium concentrations have decreased with time when compared to the 2004 tritium data reported in the first D-Area Groundwater (DAG) Operable Unit (OU) biennial report (WSRC-RP-2005-4059, July 2005). Tritium levels in the source area of the plume range from approximately 59 to 329 pCi/mL as compared to 118 to 1,030 pCi/mL in 2004. Tritium activities in the intermediate portion of the plume area have also decreased since 2004. Tritium levels in the intermediate area ranged from 5.48 to 9.9 pCi/mL, below the MCL, compared to approximately 27 to 30 pCi/mL in 2004. Although tritium concentrations are lower in some intermediate plume wells as indicated by the data, the plume area has shifted to the south since 2004 causing an increase in tritium concentrations in the intermediate plume as the plume moves through the aquifer. In 2017, newer wells at the 488-4D Ash Landfill, DCB079 and DCB080 display tritium levels above the MCL with concentrations of 93.5 pCi/mL and 55 pCi/mL, respectively. Tritium levels in 2017 in the downgradient portion of the plume ranged from 2.23 to 37.7 pCi/mL. Tritium was not detected in any of the Gordon Aquifer wells.

The long-term decreasing trend of tritium concentrations in the groundwater and source area is indicative of radioactive decay (tritium half-life = 12.7 years). Furthermore, a reduction to the tritium source in the vadose zone was completed in 2011 by a Comprehensive Environmental Response, Compensation, and Liability Act removal action for the Moderator Processing Subunit of the D-Area OU (detritionation of concrete and soil). Therefore, reduced tritium concentrations in groundwater near the source are expected to continue. All tritium concentrations are far below their respective threshold limits.

VOC Results

The TCE plume is defined as the groundwater area with TCE concentrations greater than the MCL (5 µg/L) (Figures 4 and 5). During 2017 the maximum concentration in the source area of the plume was measured at 140 µg/L; the maximum concentration in the middle portion of the plume is 32.6 µg/L; and the maximum TCE concentration in the downgradient portion of the plume is 27.9 µg/L. Concentrations reported for 2017 were similar to 2016 data. When compared to the 2004 data, the 2017 data did not indicate any significant changes in the size or shape of the TCE plume; however, most of the concentrations have decreased. In the Gordon Aquifer there was one detection of TCE at a concentration of 2.65 µg/L at well DCB 33D, which is below the MCL of 5.0 µg/L. All other Gordon Aquifer TCE results were non-detect. None of the TCE results exceeded the threshold limits outlined in the *Monitoring Work Plan for the D-Area Groundwater Operable Unit* (WSRC-RP-2003-4150, Revision 1, June 2004). Additionally, no VOC constituents were detected in surface water during 2017.

Decreasing concentrations of TCE are mainly the result of dilution and dispersion rather than degradation. Vinyl chloride is rarely detected in any of the wells used to monitor TCE and was not detected in the 2017 sampling events. Cis-1,2-dichloroethylene was detected in approximately a third of the VOC samples collected, all below the MCL of 70 µg/L. The maximum concentration of cis-1,2-dichloroethylene was 20.2 µg/L at well DCB 62. Furthermore, the TCE concentration is decreasing in wells DCB 62 and DCB 55, source and distal edge wells, respectively. The TCE concentration is increasing slightly in well DCB

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26R, which can be considered a mid-plume well and is located near the western edge of the plume. Concentrations in the downgradient wells display slightly decreasing trends.

pH and Metals Results

The pH of groundwater ranged from 2.1 to 6.2 (Figures 6 and 7). These values were consistent with previous values with the low pH near the D-Area Coal Pile Runoff Basin (489-D) and Coal Storage Area (484-17D). The low values of pH, which are attributed to the D-Area Coal Pile Runoff Basin (489-D), correlate to the exceedances of metal concentrations that are seen downgradient of the D-Area Coal Pile Runoff Basin (489-D). As an example of the effects of low pH on metal concentration in the DAG OU, Figure 6 shows the correlation of pH with beryllium.

Concentrations of metals were consistent with previous results with the highest concentrations reported being near the D-Area Coal Pile Runoff Basin (489-D). The maximum concentrations of aluminum (328,000 µg/L), arsenic (14.9 µg/L), beryllium (189 µg/L), cadmium (15.1 µg/L), chromium (209 µg/L), ferric iron (9,900 µg/L), ferrous iron (55,000 µg/L), lead (112 µg/L), manganese (13,000 µg/L), mercury (3.04 µg/L), selenium (58.9 µg/L), sulfate (2,850 µg/L), and uranium (60.4 µg/L) exceeded their respective MCLs (USEPA Primary and Secondary Drinking Water Standards shown in Tables 1 and 2 of Enclosure 1) in at least one well.

Chromium was detected above the MCL (100 µg/L) in one well, DCB 21B during 2Q2017 with a concentration of 209 µg/L (maximum result). All other samples were below the 100 µg/L or non-detect. During 2Q2017, all groundwater samples that included chromium analysis also included hexavalent chromium analysis (analyzed using method EPA7196A). Hexavalent chromium was detected in 11 samples, mostly from wells downgradient of the D-Area Coal Pile Runoff Basin (489-D), Coal Storage Area (484-17D), and around the D-Area Ash Basins Wetlands. All the hexavalent chromium results were estimated values and were above the RSL of 0.035 µg/L, but far below the 100 µg/L total chromium MCL which the regulation assumes to be 100% hexavalent chromium (USEPA Factsheet on *Chromium in Drinking Water*, <https://www.epa.gov/dwstandardsregulations/chromium-drinking-water>, accessed July 17, 2018). The maximum hexavalent chromium result was 20.9 µg/L at well DCB077. In future sampling events, if chromium exceeds the MCL (100 µg/L) then a sample will be collected and analyzed for hexavalent chromium during the next sampling event.

The maximum concentrations of cobalt (954 µg/L), hexavalent chromium (20.9 µg/L) and nickel (1,670 µg/L) exceeded their respective RSLs.

In surface water, the 2017 sampling showed aluminum (6,820 µg/L), beryllium (11.9 µg/L), and manganese (1,090 µg/L) concentrations exceeding their respective MCLs and cobalt (35.5 µg/L) exceeding its respective RSL. The highest concentrations in surface water are seen downgradient of the D-Area Coal Pile Runoff Basin (489-D) and Coal Storage Area (484-17D) due to the acidic groundwater conditions. Contaminant levels in surface water are lower than the maximum results seen in groundwater.

Three source wells (DCB 21B, DCB 21C, and DCB 34C) exceeded threshold limits for beryllium, chromium, copper, or selenium in 2017. However, exceedances are not new occurrences so confirmation samples were not collected. Due to the changes that have occurred with the actions on the ash basins and D-Area Coal Pile Runoff Basin (489-D), as discussed below, the hydrodynamics in the area downgradient

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of the source units are under change as water within the basins have been removed and river water is not being discharged in the D-Area Discharge Canal.

Remedial/Removal Actions at D Area

Tritium

The removal action for the tritium contaminated soils and concrete at the Moderator Processing Subunit was completed during August 2011. Since the tritium source in the concrete and the vadose zone has been removed, tritium activity levels in the groundwater at the source area have decreased. Reductions are expected in the future due to dispersion and radioactive decay.

VOCs

A MicroBlower™ soil vapor extraction system was installed and is operating at the Bubble Tower Subunit. The purpose of this action is to reduce the potential leaching of VOCs in vadose zone soils into groundwater. This system is operating according to design. Minimal VOC removal has occurred over the last few years which may indicate the source has been remediated. Future confirmation soil sampling will confirm remedial goals have been met.

Acidity/Inorganics

Acidic surface water was removed from the northern 25% of the D-Area Coal Pile Runoff Basin (489-D). Additional contaminated sediment was added to the northern 25% of the D-Area Coal Pile Runoff Basin (489-D) and a soil cover was installed. The surficial coal and coal reject materials from the Coal Storage Area (484-17D) and ash from the 488-2D Ash Basin were removed and placed in the 488-4D Ash Landfill prior to placement of a geosynthetic cover system. The acidic surface water has been removed and coal fines have been excavated from the remaining 75% of the D-Area Coal Pile Runoff Basin (489-D). The coal fines were consolidated in the 488-1D Ash Basin. The southern 75% of the D-Area Coal Pile Runoff Basin (489-D) is currently acting as a retention basin for storm water drainage in D Area. Ash in the western end of the 488-1D Ash Basin was consolidated in the eastern end of the 488-1D Ash Basin. Consolidation of all materials in the eastern end of the 488-1D Ash Basin is complete and the area is currently being covered by a geosynthetic cover system and is expected to be mechanically complete in 2018. These actions will reduce the acidic conditions and eventually reduce metal contamination in the groundwater. However, since aquifer materials are coated with hydrogen ions and groundwater at D Area is acidic, metals contamination will tend to persist.

The upcoming D-Area Groundwater OU Treatability Study will involve an injection scenario that will flush low-pH groundwater out of the upper water table aquifer. Additional groundwater discharge into the D-Area Discharge Canal is expected to occur where the low-pH surface water will go through a pH adjusting engineered structure prior to convergence with Beaver Dam Creek, the Savannah River Floodplain, and Savannah River. The Removal Site Evaluation Report/Engineering Evaluation/Cost Analysis on neutralization of acidic soils at the D-Area Coal Storage Area is anticipated to improve the acidic and metal plume conditions in the source soils and subsequently the groundwater. The start dates for both actions are currently scheduled in 2020.

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Changes in the Monitoring Program (Effective 2017)

The 488-4D monitoring wells (DCB077, DCB078, DCB079, and DCB080) were incorporated into the DAG OU monitoring network during 2017 based on proposals submitted with the 2016 groundwater monitoring report. These four wells were sampled during 2Q2017 and included field parameters, metals, sulfate, tritium, and volatile analyses. Only water elevations were measured during 4Q2017.

No changes to the monitoring network are proposed at this time. The 2Q2018 and 4Q2018 sampling will continue as scheduled.

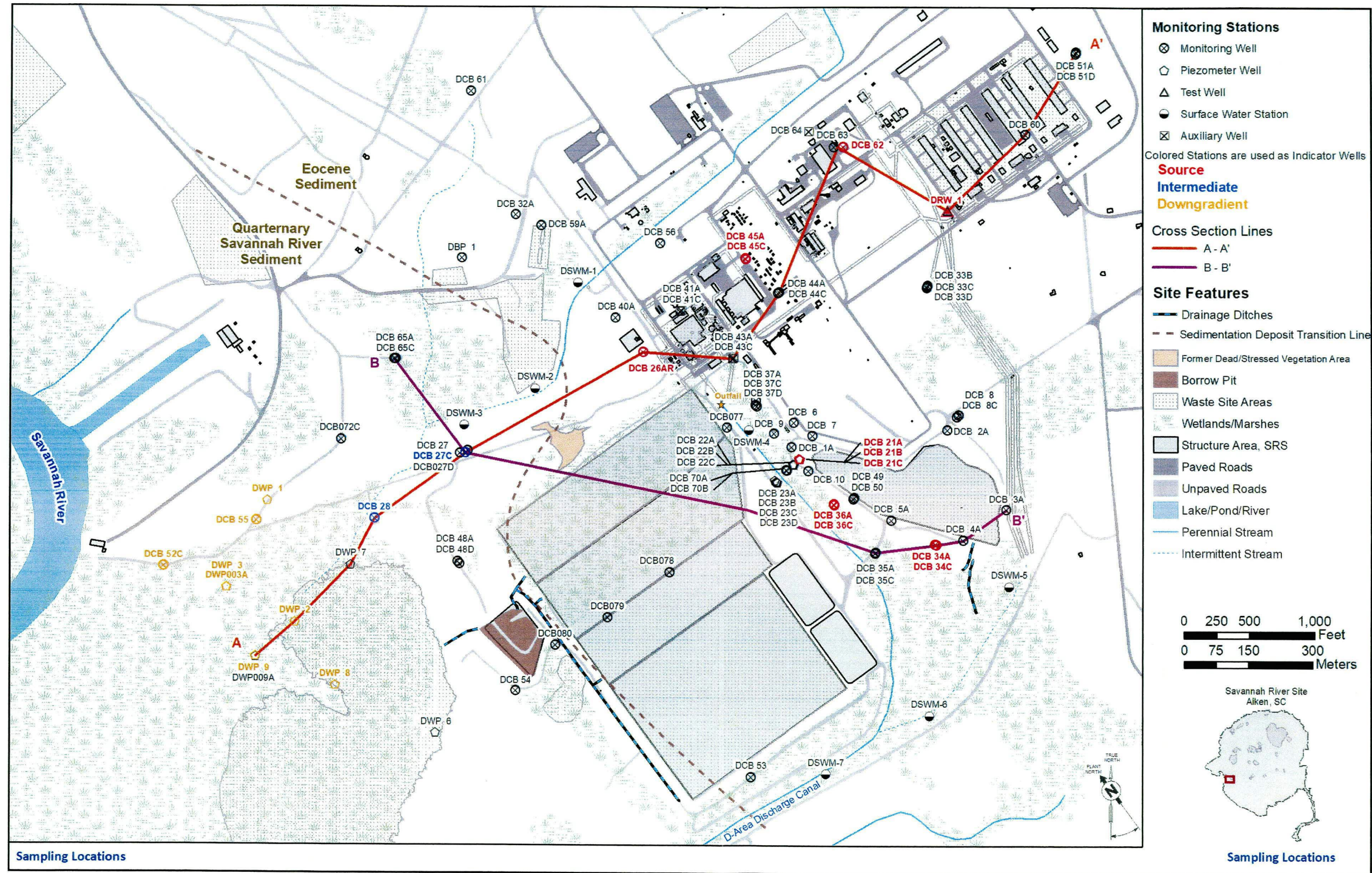


Figure 1. Sampling Locations for the DAG OU

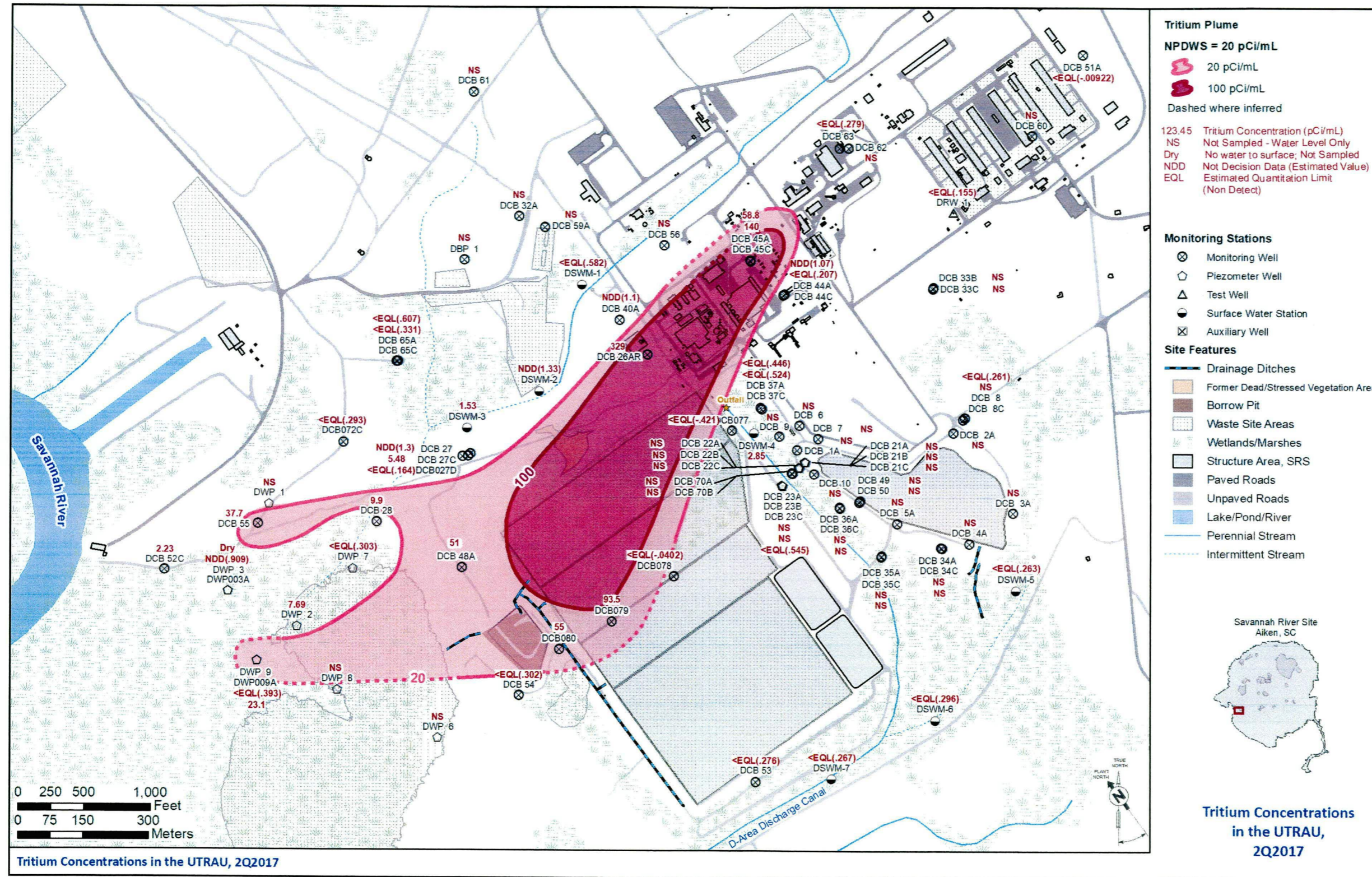
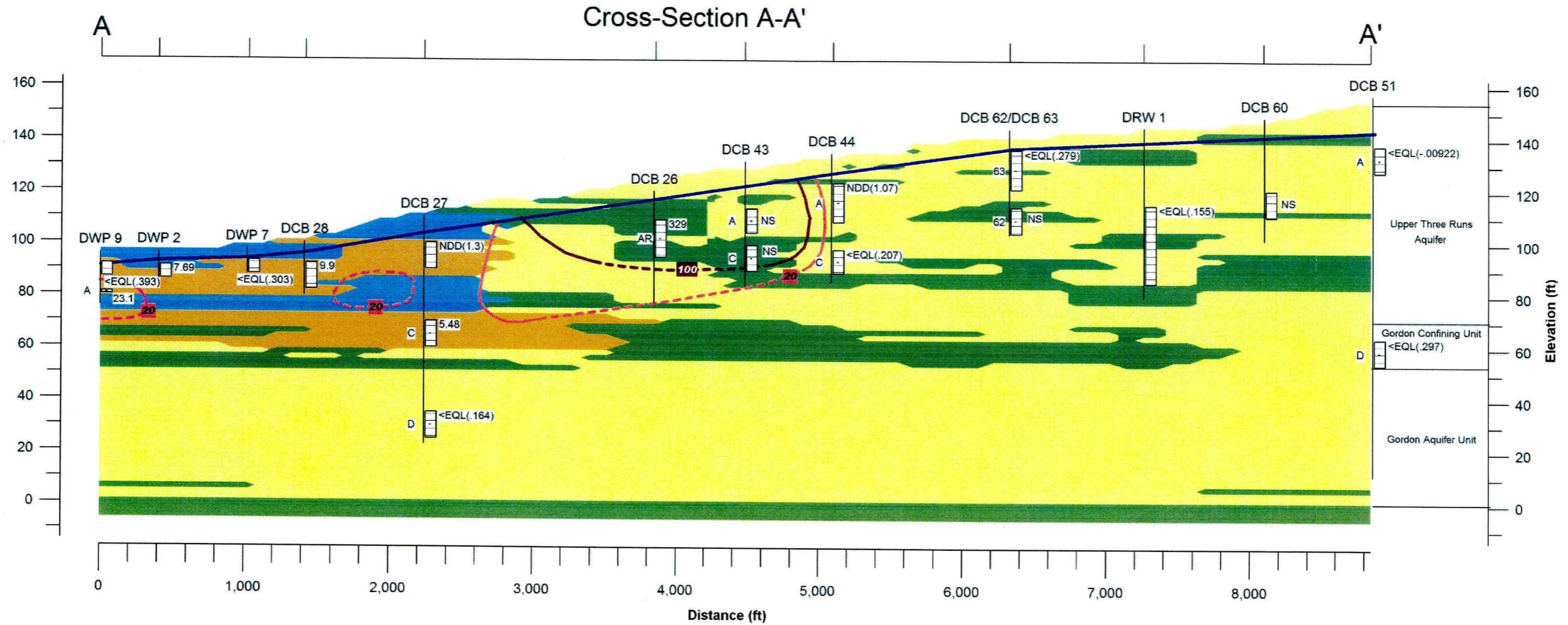


Figure 2. Tritium Concentrations (pCi/mL) in the Upper Three Runs Aquifer Unit (UTRAU), 2Q2017



Legend

- clay to silty clay
- fluvial clay to silty clay
- fluvial sand to silty sand
- sand to silty sand
- SCREEN

- 10.1 Tritium Concentration (pCi/mL)
- NS Not Sampled
- EQL Estimated Quantation Limit
- NDD Not Decision Data
- Well/Boring
- Potentiometric Surface 2Q17(ft msl)
- Tritium Isoconcentration Contour 2Q17 (>20 pCi/mL) dashed where inferred
- Tritium Isoconcentration Contour 2Q17 (>100 pCi/mL) dashed where inferred

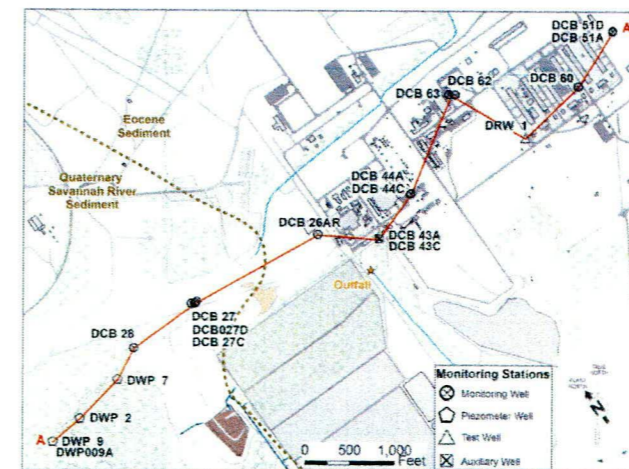


Figure 3. D-Area Groundwater Cross Section A-A' for Tritium, 2Q2017

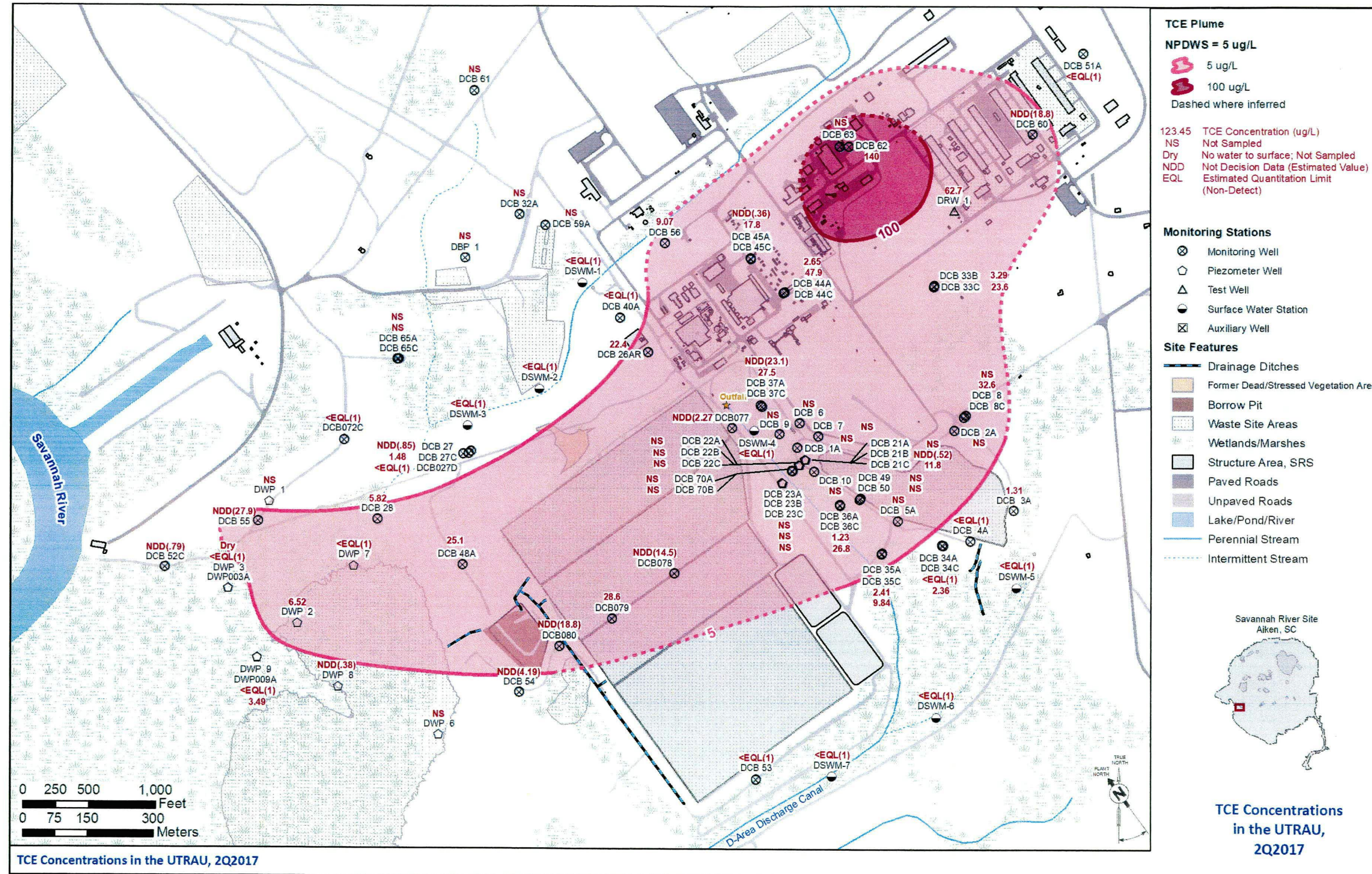
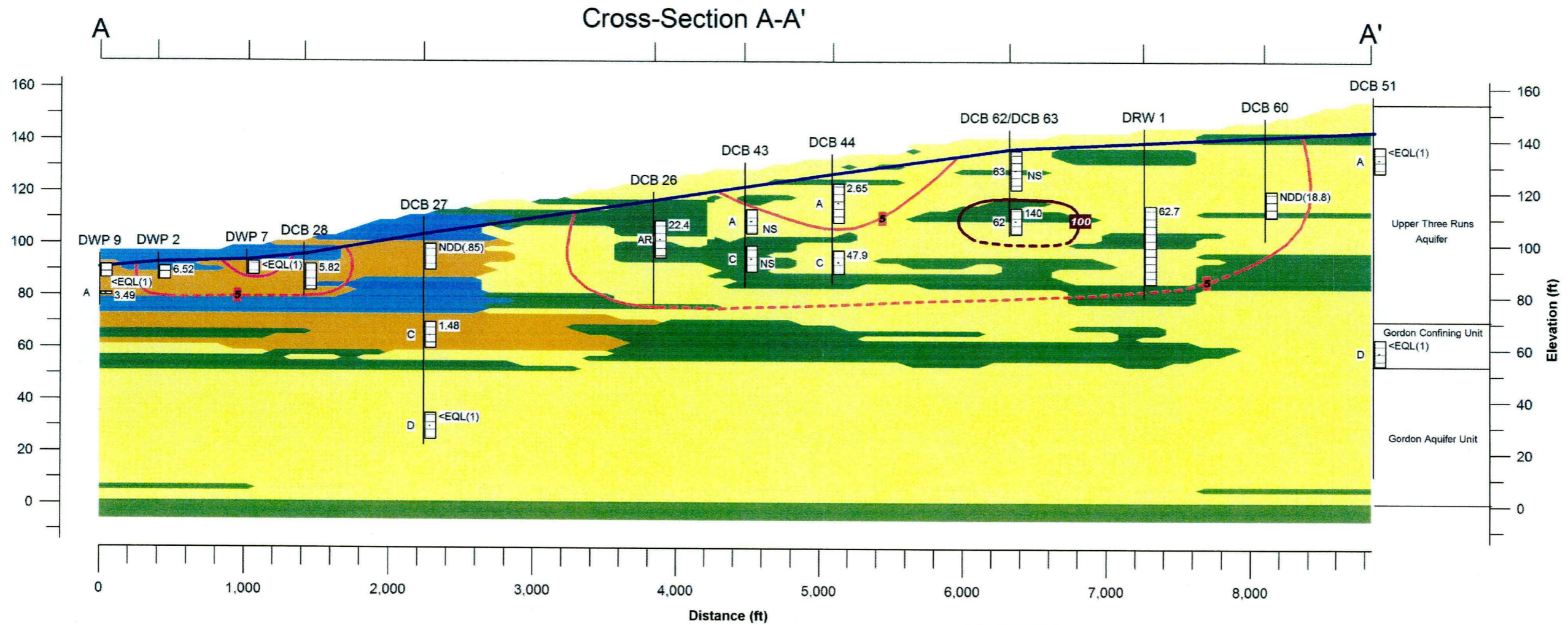


Figure 4. TCE Concentrations ($\mu\text{g/L}$) in the UTRAU, 2Q2017



Legend

- clay to silty clay
- fluvial clay to silty clay
- fluvial sand to silty sand
- sand to silty sand
- SCREEN
- 10.1 TCE Concentration (ug/L)
- NS Not Sampled
- EQL Estimated Quantation Limit
- NDD Not Decision Data
- Well/Boring
- Potentiometric Surface 2Q17 (ft msl)
- TCE Isoconcentration Contour 2Q17 (>5 ug/L)
dashed where inferred

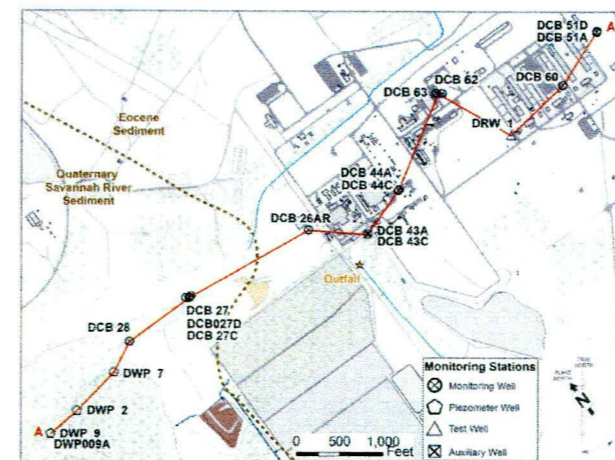


Figure 5. D-Area Groundwater Cross Section A-A' for TCE, 2Q2017

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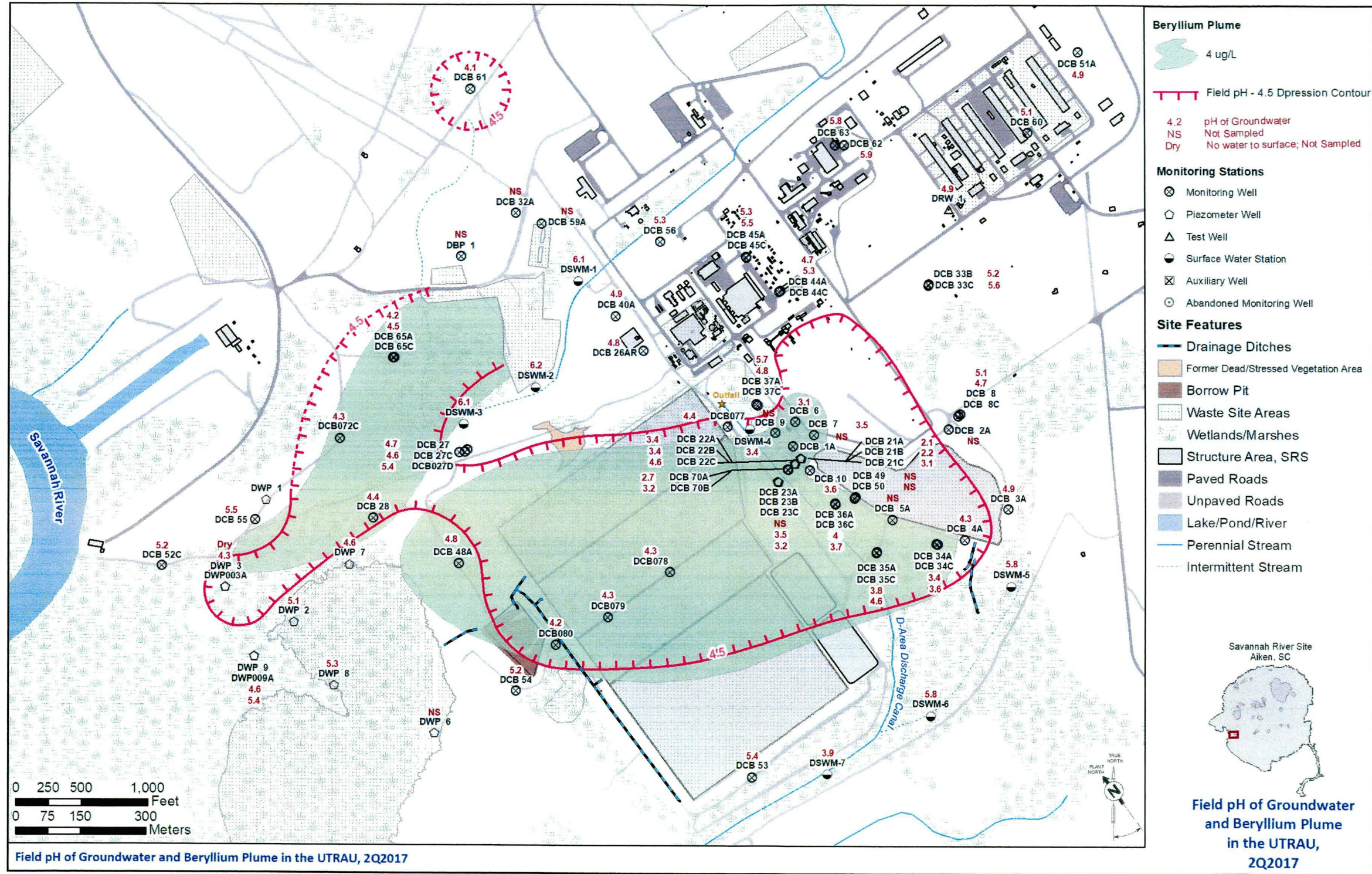


Figure 6. Field pH of Groundwater and Beryllium Plume in the UTRAU, 2Q2017

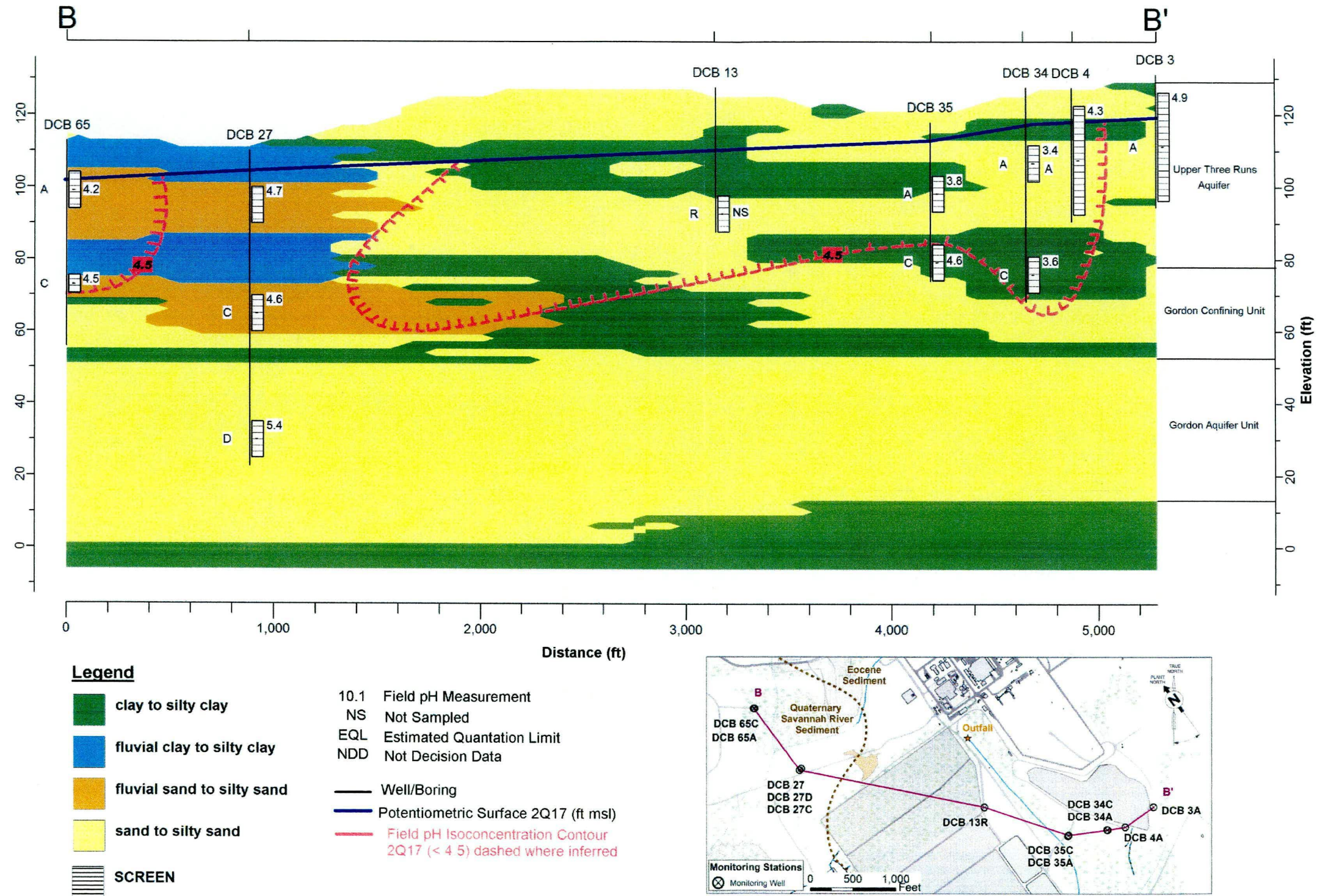


Figure 7. D-Area Groundwater Cross Section B-B' for pH, 2Q2017

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Questions from you or your staff may be directed to me at (803) 952-8365, or the DOE Federal Project Director, Karen Adams, at (803) 952-7871.

Sincerely,



Brian T. Hennessey
SRS Remedial Project Manager
Infrastructure and Area Completion Division

IACD-18-170

Enclosure:

ERD-EN-2018-0037, D-Area Groundwater 2017 Data Tables 1 and 2

cc:

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