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Sampling and Analysis Plan Addendum for the C-Area Groundwater (CAGW) Operable Unit (OU) (U)

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LIST OF ACRONYMS

CAGW	C-Area Groundwater
CBRP	C-Area Burning Rubble Pit
Ci/yr	Curies/year
COC	Chain of Custody
CMS/FS	Corrective Measures Study/Feasibility Study
CRGW	C-Area Reactor Groundwater (former name of CAGW)
DOECAP	USDOE Consolidated Audit Program
DPT	Direct Push Technology
DQO	Data Quality Objective
DUR	Data Usability Report
EC&ACP	Environmental Compliance & Area Completion Projects
ERDMS	Environmental Restoration Data Management System
ERH	Electrical resistance heating
FFA	Federal Facility Agreement
FMB	Fourmile Branch
ft	feet
H-3	tritium
IDW	Investigation Derived Waste
L	liter
m	meters
MCL	Maximum Contaminant Level(s)
MDL	Method detection limit
µg/L	microgram per liter
mg/kg	milligram per kilogram
mg/L	milligram per liter
MNA	Monitored Natural Attenuation
OU	Operable Unit
PARCC	precision, accuracy, representativeness, completeness, and comparability
pCi/mL	picocuries per milliliter
PHSS	Packaging, handling, shipping, and storage
ppm	parts per million
QA	Quality Assurance
QC	Quality Control

LIST OF ACRONYMS (*Continued*)

RCRA	Resource Conservation and Recovery Act
R&D	Research and Development
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional Screening Level(s)
SAP	Sampling and Analysis Plan
SB/PP	Statement of Basis / Proposed Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TCE	Trichloroethylene
TCL	Target Compound List
TO	Technical Oversight
TPH-DRO	Total Petroleum Hydrocarbons Diesel Range Organics
µg	micrograms
USEPA	United States Environmental Protection Agency
USDOE	United States Department of Energy
UTRA	Upper Three Runs Aquifer
U&U	Unverified and Unvalidated
VOA	Volatile Organic Analyses
VOC	Volatile Organic Compound
V&V	Verified and Validated
WSRC	Washington Savannah River Company (2005 - 2008)
WSRC	Westinghouse Savannah River Company (1989 – 2005)

1.0 INTRODUCTION

1.1 C-Area Groundwater Operable Unit Monitoring

The C-Area Groundwater (CAGW) Operable Unit (OU) Core Team (United States Department of Energy [USDOE], the United States Environmental Protection Agency [USEPA], and the South Carolina Department of Health and Environmental Control [SCDHEC]) agreed to monitor groundwater and associated surface water streams at a 2011 scoping meeting. SRNS prepared a Sampling and Analysis Plan (SAP) in response (SRNS 2012a), and the sampling results are provided in -annual reports. The Core Team met again in January 2017 to discuss the status of groundwater and surface water contamination in preparation for a scheduled Focused Corrective Measures Study/Feasibility Study (CMS/FS**)**.

The ~~goals~~objectives of this SAP Addendum ~~is prepared~~are to ~~capture~~ collect additional ~~characterization~~ data to support~~ing~~ the CMS/FS, ~~update the established monitoring of~~ determine changes in the CAGW OU TCE and tritium plumes discharging to Castor Creek and an unnamed tributary,~~ and to~~ provide ~~plans~~ data for ~~additional groundwater characterization focused on~~ a removal action on the TCE plume discharging to an unnamed tributary of Castor Creek, determine changes in the TCE groundwater plume near the C-Reactor Building (105-C), and~~ to~~ establish a groundwater monitoring station downgradient of the Fuel Unloading Facilities Power (108-3C). The expanded monitoring of the CAGW OU will be implemented in two phases: 1) Phase 1 will consist of three new seepline stations along Castor Creek and one monitoring well based on direct push technology (DPT) groundwater samples for the Fuel Unloading Facilities Power (108-3C); and 2) Phase 2 includes two monitoring wells based on ten DPT groundwater samples upgradient of an unnamed tributary of Castor Creek, and five DPT soil borings in the saturated zone to delineate the center of the VOC groundwater plume immediately downgradient of C-Reactor.

1.2 CAGW OU Location

The CAGW OU is located in the west-central portion of SRS in Aiken, SC within the Fourmile Branch watershed (Figure 1). The CAGW OU consists of a Vadose Zone Subunit, a Groundwater Subunit, and a Surface Water Subunit. The Vadose Zone Subunit includes a trichloroethylene (TCE) source area near the southern corner of the Assembly Area of the C-

Reactor Building (105-C), a tritium source area adjacent to and under the Purification Area of the C-Reactor Building (105-C), and the Fuel Unloading Facilities Power (108-3C) within C-Area. The Groundwater Subunit consists of a 440 acre tritium plume and a 240 acre TCE plume in the Upper Three Runs Aquifer (UTRA). The Surface Water Subunit includes the following three bodies of surface water: (1) Fourmile Branch (FMB), which flows into the Savannah River, (2) Twin Lakes, which flows into FMB, and (3) Castor Creek, which also flows into FMB.

1.3 Monitoring Objectives

The primary ~~goal~~ monitoring objective of the CAGW OU SAP addendum is to evaluate the changes to the TCE and tritium groundwater plumes near Castor Creek. Changes both in groundwater plume concentrations and flow path will be evaluated to provide data relative to the increasing TCE and tritium concentrations observed in Castor Creek and its tributary from 2011 to 2016. The second objective of the CAGW OU SAP addendum is to evaluate changes in the TCE groundwater plume near the C-Reactor Building (105-C) via the collection of soil sample plugs in the UAZ for VOC headspace analyses. The ~~other main~~third and final monitoring objective of the CAGW OU SAP addendum~~monitoring plan~~ is to assess any current impacts to the groundwater from the Fuel Unloading Facilities Power (108-3C). These objectives will be accomplished during two phases of field work.

The primary ~~goals of the~~ CAGW OU SAP Addendum Phase 1 field activities are the following:

1) Install three permanent seepline sampling stations along Castor Creek downstream of surface water station CC-05, in order to determine changes over time in the groundwater TCE and tritium plumes discharging to Castor Creek; and
2) Establish a permanent groundwater monitoring well downgradient of the Fuel Unloading Facilities Power (108-3C) based on DPT groundwater samples, in order to determine any impacts to groundwater.

The primary ~~goals of the~~ CAGW OU SAP Addendum Phase 2 field activities are the following:

1) Establish a permanent monitoring well between well CSB 15D and the unnamed tributary to Castor Creek based on DPT groundwater samples, in order to determine future changes in the tritium and TCE concentrations of the unnamed tributary;

2) Establish a permanent monitoring well east of well CSB020C based on DPT groundwater samples, in order to determine long-term changes in the tritium and TCE concentrations of the unnamed tributary; and
3) Better define the area of elevated TCE in the UAZ groundwater near the C-Reactor Building (105-C) with 5 DPT soil sampling locations.

Vadose zone soil samples for the Fuel Unloading Facilities Power (108-3C) subunit will not be collected as part of Phase 1 in this SAP addendum, as data collected in 2010 and 2011 were deemed sufficient to evaluate the vadose zone. The groundwater samples collected as part of Phase 1 of this SAP addendum will be used to directly evaluate impacts to the groundwater from the Fuel Unloading Facilities Power (108-3C) subunit.

2.0 CAGW OU BACKGROUND

Between 1998 and 2002, extensive groundwater characterization was performed as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RFI/RI) process for CAGW OU (WSRC 2004a). Additional data collected during 2002-2004 were reported in the CMS/FS (WSRC 2004b). All data collected from 2005 through 2011 for the C-Area monitoring stations was provided in the CAGW OU SAP in 2012 (SRNS 2012a). The data from 2012 through June 2016 are contained in the annual CAGW OU groundwater monitoring reports (SRNS 2012b, SRNS 2013, SRNS 2014, SRNS 2015a, and SRNS 2016). Table 1 contains the results that exceeded EPA PDWS MCLs for samples collected from July 2016 to December 2016. All the data collected from July 2016 through June 2017 will be reported in the next CAGW OU Data Report. Figure 2 compares the CAGW OU groundwater tritium plume in 2002 to the tritium plume in 2016, and Figure 3 compares the CAGW OU groundwater TCE plume in 2002 to the TCE plume in 2016. The most recent Scoping Summary for the CAGW OU (ERD-EN-2001-0146, December 2016) provides updated information for the three CAGW OU subunits, the Vadose Zone Subunit; the Groundwater Subunit; and the Surface Water Subunit.

2.1 Vadose Zone Subunit

The Vadose Zone Subunit includes three areas that provide a potential source of groundwater contamination: (1) a tritium source near the former moderator distillation tower on the east side of the C-Reactor Building (105-C); (2) the C-Reactor Area TCE Vadose Zone Source near the southern corner of the Assembly Area of the C-Reactor Building (105-C); and (3) a petroleum source at the former Fuel Unloading Facilities Power (108-3C). This addendum will focus on potential groundwater contamination associated with the petroleum source.

Emergency power required for the operation of SRS reactors was met by diesel generators, which were fueled by a system of above ground storage tanks in each reactor area. The Fuel Unloading Facilities Power (108-3C) was the location of the above ground storage tanks in C-Area. At the Fuel Unloading Facilities Power (108-3C), spills and/or leaks resulted in soils contaminated with petroleum. In 1994, removal of 383 m^3 (500 yd^3) of contaminated soil to a depth of 6.1 m (20 ft) was performed. At the bottom of the 6.1 m (20 ft) pit several hand auger samples were collected, which determined contamination continued another 3 m (10 ft), or a total of 9.1 m (30 ft) bgs. However, rather than continue excavating the soil, the initial 383m^3 (500 yd^3) was back-filled into the pit, and SRS implemented a Bioventing system to remediate the hydrocarbons. After eight months, the Total Petroleum Hydrocarbons Diesel Range Organics (TPH-DRO) had decreased from a mean value of 1122 ppm to a mean value of 116 ppm in the 0 to 20 ft zone, which was close to the RG of 100 ppm. However, the 6.1 to 9.1 m (20 to 30 ft) interval TPH-DRO had only decreased from a mean value of 3800 ppm to a mean value of 1700 ppm, and it was estimated to take another 1 to 3 years before remediation would be complete. Soil samples were collected in 1998 and a closure report was submitted indicating that all contaminants had been reduced to acceptable levels. SCDHEC approved the closure on January 26, 1999. Due to concerns of residual contaminants migrating to the groundwater the Fuel Unloading Facilities Power (108-3C) was added as a subunit to the C-Area OU (CAOU).

During the 2011 CAOU sampling effort, residual hydrocarbons were observed at 6.1 m (20 ft) bgs. Analysis indicated the presence of TPH-DRO and semi-volatile organics, including naphthalene and 2-methylnaphthalene. USEPA currently assesses toxicity of TPH considering the low, medium and high molecular weight categories of both aliphatic and aromatic TPH constituents._ Naphthalene and 2-methylnaphthalene are representative compounds of the medium aromatic TPH fraction. Concern exists that elevated soil concentrations of naphthalene and 2-methylnaphthalene could result in groundwater contamination exceeding the EPA Regional Screening Level [RSL] of 0.17 and 36 -µg/L, respectively. Figure 4 and Figure 5 show the distribution of naphthalene and 2-methylnaphthalene in the subsurface, respectively. Both naphthalene and 2-methylnaphthalene were below the detection limit for the two groundwater samples collected at the Fuel Unloading Facilities Power (108-3C) subunit. However, TPH-DRO was observed above 100 mg/kg in the soil at two depths (5.5 to 6.1 m [18 to 20 ft] and 8.5 to 9.1 m [28 to 30 ft]) at station 1083C-05, and TPH-DRO was observed in the groundwater sample (422 µg/L) at station 1083C-04 (Figure 6). This result is above the RG (100 µg/L) that SCDHEC approved on January 26, 1999. Therefore, in the May 2014 scoping meeting for the C-Area OU Early Action SB/PP, the Core Team decided to reassign the TPH groundwater contamination at the Fuel Unloading Facilities Power (108-3C) subunit to the CAGW OU.

Currently, there is no groundwater monitoring station at the Fuel Unloading Facilities Power (108-3C).

2.2 Groundwater Subunit

The Groundwater Subunit consists of two plumes: (a) a southern TCE and tritium plume originating near the Reactor Building (105-C), and extending west to FMB and south to Castor Creek, and (b) a northern tritium plume in the vicinity of the Twin Lakes drainage, originating near the Retention Basin for 100-C Containment (904-89G), and extending to FMB. This addendum will focus on the southern TCE and tritium plumes.

Groundwater was extensively characterized from 1998 to 2002 and documented in the RFI/RI report. Figures 2 and 3 show the extent and magnitude of tritium and TCE contamination.

The 2016 tritium plume has a small area above 1,000 pCi/mL near the C-Reactor Building (105-C) in the shallow Upper Aquifer Zone (UAZ) of the UTRA, another small area greater than 1,000 pCi/mL at the distal portion of the plume in the Middle Aquifer Zone (MAZ) of the UTRA, and a large area exceeding 100 pCi/mL in the middle of the plume (Figure 7 and Figure 8). Tritium trends from the mid plume wells consistently show decreasing tritium concentrations (Figure 9).

SRS conducted groundwater flow and contaminant transport modeling studies of CAGW OU in 2000, 2001, and 2003, which made predictions of future plume development at CAGW OU. The 2001 study (WSRC 2001), which conducted detailed contaminant transport modeling, predicted that tritium concentrations would remain relatively constant for about 10 years and then decrease over the next 15 to 20 years. However, the tritium measurements from 2002 to 2011 in Castor Creek indicate flux declined over that period (although predicted to be stable), and tritium measurements from 2011 to 2016 in Castor Creek indicate increasing tritium flux over that period (although predicted to decrease) (Figure 10). It is believed that transport of tritium is slower than predicted based on retention within low permeability zones of the aquifer.

The 2016 TCE plume has a small area above 100 µg/L near the C-Reactor Building (105-C) in the shallow UAZ of the UTRA, two wells exceeding 50 µg/L at the distal portion of the plume in the MAZ of the UTRA, and low levels of contamination in the middle of the plume (Figure 11 and Figure 12). Although concentrations in the two wells (CRW020D and CRW021DR) closest to the prior electrical resistance heating (ERH) remedial action in the vadose zone show decreasing concentrations, well CDB003D has recently shown an increase in concentrations (Figure 13).

The groundwater model for TCE concentrations near well CSB 15D predicted increasing concentrations from 2001 to 2012, with elevated TCE concentrations continuing until about 2017, and then rapidly decreasing concentrations. Actual TCE results for well CSB 15D have shown a slow decline since 2002, with a current concentration of 50.6 µg/L in 2016.

TCE has not been detected above its MCL in Castor Creek. In 2016, the maximum TCE was 18.6 µg/L in the small tributary (CCT-01) that discharges to Castor Creek. A study conducted by the South Carolina State University on Castor Creek in 2001 and 2003 identified partial TCE degradation (cis-1,2-dichloroethylene) along the seepline where TCE is entering Castor Creek. Seepline data collected from 2011 to 2016 verify some biodegradation for TCE is occurring in the wetlands adjacent to Castor Creek. This may indicate that model assumptions regarding plume mass were overly conservative, the TCE and tritium residence times in the aquifers are longer than modeled, and that the decline in tritium and TCE mass flux may not be as steep as the model simulation indicates on Figure 14 and Figure 15.

SRS plans to develop a new groundwater model that will include the past 15 years of data and the data collected as part of this SAP addendum, because the 2001 model predictions have not matched the observed data as well as expected. The new groundwater model will be used to simulate TCE and tritium transport under base case and various remedial alternatives in support of the final FS and ROD.

2.3 Surface Water Subunit

Contaminated groundwater in the CAGW OU discharges into three different bodies of surface water: (1) FMB, which flows into the Savannah River, (2) Twin Lakes, which flows into FMB, and (3) Castor Creek, which also flows into FMB. This addendum will focus on the impacts to Castor Creek.

TCE in Castor Creek has been below the MCL for the past 14 years of monitoring (Figure 16), and is expected to remain below the MCL based on recent decreasing TCE concentrations at nearby upgradient wells CSB 15D and CRW020C. However, the unnamed tributary discharging to Castor Creek has TCE concentrations above the MCL. The levels of TCE in the tributary have been decreasing since 2012, as indicated by monitoring station CCT 01 (Figure 16).

Castor Creek is currently contaminated with tritium above the MCL, and concentrations have been increasing over the last 5 years (Figure 10). Tritium levels in Castor Creek have increased from 30.6 pCi/mL to 51.9 pCi/L since 2011 at CC-05. This is contrary to the groundwater model results, which indicated that tritium concentrations in Castor Creek should have remained constant for about 10 years and then begin decreasing (base case discharge on Figure 14). This contradiction appears to be related to the increase in tritium in the small tributary to Castor Creek (CCT-01 in Figure 17), -as all other seepline wells and upgradient wells have shown a decrease in tritium concentration over this time period. Phase 1 of this SAP Addendum includes the addition of 3 seepline stations downstream of CC-05 to better identify changes in the tritium plume discharging to Castor Creek (Figure 18). Phase 2 of this SAP Addendum will include installation of two monitoring wells based on DPT groundwater samples to better predict TCE and tritium groundwater concentrations discharging into the unnamed tributary to Castor Creek.

3.0 PROJECT DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. It is both flexible and iterative, and applies to both decision-making (e.g., compliance/non-compliance with a standard) and estimation (e.g., ascertaining the mean concentration level of a contaminant). The DQO process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the ~~goals~~ objectives of the study. The DQO process leads to efficient and effective expenditure of resources; consensus on the type, and quantity of data needed to meet the project ~~goal~~objective; and the full documentation of actions taken during the development of the project. The DQO process is a series of seven planning steps based on the scientific method (Sections 3.1.1 to 3.1.7 below) and is detailed in USEPA guidance (USEPA 2006).

3.1 CAGW OU Problems Warra~~e~~nting Action

CAGW OU has TCE and tritium in the groundwater at levels exceeding MCLs:

- Tritium plume covers approximately 403 acres and discharges into both FMB and Castor Creek. This plume is located in the UTRA and is up to 27 m [90 ft] thick. The maximum tritium concentration in 2016 was 1,290 pCi/mL in well CSB020C, located in the distal-plume.
- TCE plume covers about 119 acres, but does not directly discharge into Castor Creek or FMB above MCLs. This plume is located in the UTRA, and is up to 7.5 m [25 ft] thick. The maximum TCE concentration in 2016 was 333 µg/L in well CRW020D, located near the TCE source area.

CAGW OU has tritium and TCE in the surface water at levels exceeding MCLs (20 pCi/mL):

- The tritium plume appears to be about 656 m (2,152 ft) wide as it discharges into Castor Creek. Mass flux of tritium into Castor Creek is estimated to be 50 curies/year (Ci/yr) in 2016. The maximum tritium concentration in Castor Creek was 51.9 pCi/mL at surface water station CC-05 in June 2016.
- The TCE concentration in the unnamed tributary to Castor Creek was 18.6 µg/L in June 2016.

3.2 CAGW OU Sampling Objectives

The objective of this sampling activity is to collect representative groundwater and surface water data of sufficient quality that will be used to support the selection of remediation alternatives and remedial/removal decisions. To help ensure data quality, the CAGW OU SAP addendum includes 1 split sample for every 20 regular samples, 1 duplicate sample for every 20 regular samples, and 1 trip blank with each shipment of VOC samples as part of the field QC program. Despite the CAGW OU having extensive historical data (WSRC 2004a, WSRC 2004b, WSRC 2004c, WSRC 2004d, WSRC 2007, SRNS 2012, SRNS 2013, SRNS 2014, SRNS 2015, and SRNS 2016), additional monitoring data are required to assist a focused decision-~~–~~making process.

The specific goal for this SAP is to provide sufficient data to address the following:

1) Collect additional data to support the CMS/FS;
2) Determine changes in ~~the current extent and magnitude of~~ the tritium and TCE groundwater plumes discharging into Castor Creek and its tributary;
3) ~~Determine the current extent and magnitude of the tritium and TCE groundwater plumes east of well CRW020C along Road 3 to provide empirical data to help predict the future trend of these contaminants as they near Castor Creek and establish a permanent well(s) to monitor groundwater upgradient of the unnamed tributary~~Provide data to implement a removal action on the CAGW OU TCE plume discharging to an unnamed tributary of Castor Creek;
4) Determine the current extent and magnitude of– the elevated portion of the TCE groundwater plume near the C Reactor from soil samples to provide empirical data to help estimate the scope of an alternative to treat that portion of the plume; and
5) Establish a groundwater monitoring station downgradient of the Fuel Unloading Facilities Power (108-3C) to determine any impacts to groundwater by TPH related contaminants.

3.3 Identify Information Inputs

All historical data collected for the CAGW OU has been reviewed and summarized previously in RFI/RI and the CM/FS documents (WSRC 2004a and WSRC 2004b). The data is of sufficient quality to make interim remedial decisions, however additional trend and extent data is required to support interim and final remedial/removal decisions. MCLs will be used as the basis for acceptance/performance criteria to determine whether groundwater or surface water is contaminated, and to drive the need for taking action. Higher concentration target levels will likely be used to establish remediation zones.

3.4 Define the Boundaries of the Study

Figure 1 delineates the overall boundary for the CAGW OU. Figures 2 and 3 depict tritium and TCE 2016 plumes, respectively, within the CAGW OU.

3.5 Develop the Analytical Approach

Samples will be analyzed by laboratories that have passed the USDOE Consolidated Audit Program (DOECAP) qualification audit and using USEPA SW846 methods, or approved equivalents, which have been certified by SCDHEC. The EPA methods for TPH (EPA8015), VOCs (EPA8260) and SVOCs (EPA8270) specify the required laboratory QC samples that must be included in every analytical batch. At a minimum, laboratory QC samples required to be analyzed with each batch of samples for VOC and SVOC analyses include a method blank, laboratory control sample (AKA standard), laboratory duplicate sample, matrix spiked sample, and the addition of surrogate compound(s) to each regular sample and QC sample. Radiological analyses will be performance based and evaluated by the USDOE Mixed Analyte Performance Evaluation Program. Laboratory developed radionuclide methods are typically based on USEPA or USDOE methods, and specify the laboratory quality control standards to be included in each analytical batch. Typical laboratory QC samples analyzed with each batch of samples for tritium analyses include a method blank, laboratory control sample (AKA standard), laboratory duplicate sample, and a matrix spiked sample.

MCLs will be the primary point of comparison for groundwater constituent concentrations according to the protocols established in the Federal Facility Agreement (FFA 1993). In the absence of an MCL for a constituent, the USEPA tap water RSLs will be the primary point of comparison for an Action Level. The RSLs specify a $1xE10^{-06}$ or an HQ of 1 human health risk-based threshold value for constituents.

The EPA RSLs have divided TPH into the following six categories: Total Petroleum Hydrocarbons (Aliphatic High); Total Petroleum Hydrocarbons (Aliphatic Medium); Total Petroleum Hydrocarbons (Aliphatic Low); Total Petroleum Hydrocarbons (Aromatic High); Total Petroleum Hydrocarbons (Aromatic Medium); and Total Petroleum Hydrocarbons (Aromatic Low). Indicator compounds for each EPA RSL TPH category are listed in Table 4 (USDHHS 1999). The high, medium and low aromatic compounds can be analyzed by EPA methods for VOCs (EPA 8260B) and SVOCs (EPA 8270D), –but none of the commercial laboratories under contract to SRS are currently certified to perform analyses for any of the TPH aliphatic compounds in groundwater samples for Phase 1 of this SAP Addendum. SRS proposes to have the Savannah River National Laboratory (SRNL) develop screening level research and development (R&D) methods using gas chromatography - mass spectrometry (GC-MS) instrumentation and analyze for the following low and medium aliphatic compounds: heptane, nonane, decane, undecane, dodecane. The development effort occurred in ~~will take place during~~ 2017. SRNL can not currently develop a method to analyze for the aliphatic high category compounds, but the compounds in this category have the lowest solubility, so they are unlikely to migrate into the groundwater, and these compounds have the lowest associated health risks (USDHHS 1999). The MDLs and SQLs for the low and medium aliphatic compounds will not be known until the methods have been developed by SRNL, but SRS anticipates MDLs of approximately 1,000 µg/L. ~~However, t~~The EPA RSLs for the TPH low~~,~~ and medium ~~and high~~ aliphatic compound categories are 1,300 µg/L and~~,~~ 100 µg/L~~, and 60,000 µg/L, which SRS believes are achievable for SQLs for the R&D methods for Phase 1 of this SAP Addendum~~. Also the solubility of the aliphatic compounds is much lower than that of the aromatic compounds, making them less likely to migrate into the groundwater, but requiring lower MDLs to detect their presence in groundwater (USDHHS 1999). A method blank, laboratory control standard, and a laboratory duplicate sample will be run with each batch of samples. If the analytical development method is unsuccessful, and/or these data are not deemed of reliable quality and reproducibility, then these data will not be used or reported as part of this project, and monitoring options will be discussed with the core team.

3.6 Specify Performance or Acceptance Criteria

The USEPA guidance (USEPA 2006) states "The U.S. Environmental Protection Agency (EPA) has developed the Data Quality Objectives (DQO) Process as the Agency's recommended planning process when environmental data are used to select between two alternatives or derive an estimate of contamination. The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions."

USEPA SW-846 methods are analytical specifications for the Target Compound List (TCL) VOC and SVOC constituents (Tables 5 and 6), while tritium methods are generally modified EPA/DOE methods or performance based methods by each laboratory (Tables 5 and 6). Additional analytical details are presented in the Analytical Plan, Section 5. Table 7 is the DQO worksheet developed for the CAGW OU Groundwater Subunit and Surface Water Subunit, which specifies the quantity, type, and quality of data. None of the SRS contracted laboratories are certified to analyze for the aliphatic compounds. Instead, screening level analyses will be performed by to determine if these aliphatic compounds are present. The analysis does not quantify the concentrations, so only estimated values will be reported.

Total study error is the additive impact of sampling error and measurement error. Sampling error is responsible for the vast majority of the total error. "As much as 90% or more of the uncertainty in environmental data sets is due to sampling variability as a direct consequence of the heterogeneity of the environmental matrices" as stated by Deana M. Crumbling, USEPA (Crumbling 2001), and the method best suited to reduce sampling error is to gather representative samples.

It is incorrect to assume that randomly collected, non-representative samples, plus perfect analytical chemistry will always lead risk managers to correct risk management decisions. In order to avoid incorrect risk management decisions, it is more important to develop Decision Quality Data (DQD). DQD is defined as data of known quality that can logically be demonstrated to be effective for making the specified decision because both the sampling and analytical uncertainties are managed to the degree necessary to meet clearly defined and stated data needs (Crumbling 2001). Therefore, it is more important for the risk managers to use decision quality data, emphasizing representative sampling with a specified percentage of definitive data, in order to make a correct decision and should not be confused by emphasizing data quality which does not necessarily equate to a correct risk management decision.

Because the SRS possesses significant process and historical knowledge of C-Area, this sampling plan will largely control sampling error (the cause of greatest total error) and set tolerable limits on decision errors by gathering data using proven procedures for obtaining representative groundwater and surface water samples to generate decision quality data. Judgmental sampling will be used to control decision errors, since sample collection will be focused on known source areas of contamination and areas of groundwater discharge, rather than using a sampling design intended to search for contamination. This approach is a very conservative sampling strategy, and in conjunction with using methods to ensure representative sampling, it will yield a high bias for detecting maximum contaminant concentrations. Specific performance objectives include the following:

- 90% collection of proposed groundwater locations;
- 90% collection of proposed seepline locations; and
- Trip blanks sent with every volatile organic analysis (VOA) sample shipment.

3.7 Develop the Plan for Obtaining the Data

The SAP addendum has been developed based on evaluation of data collected during 2011-2016 from the monitoring network at the CAGW OU._ Groundwater samples will be collected from established monitoring wells that comprise the CAGW OU monitoring network. DPT groundwater samples will provide data on changes in the TCE and tritium plumes near Castor Creek, which will be used to install two new monitoring wells. Surface water stations with an established monitoring history will continue to be sampled as part of the CAGW OU monitoring network. DPT soil samples will be collected near the C-Reactor Building (105-C), which will be used to determine changes in the TCE groundwater plume for future remediation efforts. The specific characterization plan for groundwater and surface water are provided in Section 4 of this SAP addendum for both Phase 1 and Phase 2.

4.0 SAMPLE DESIGN AND RATIONALE

Implementation of the SAP addendum to obtain decision quality data for CAGW OU is documented in the remaining sections of this SAP addendum. The following section describes how the plan is implemented to collect the physical data to meet the criteria developed during the DQO process.

As part of this SAP addendum, the additional scope is divided into two phases. Phase 1 will include expanded surface water sampling locations (CCT-02 & CCT-03) on the unnamed tributary, and the installation of three additional seepline stations down stream of Castor Creek surface water station CC-05 to better define the profiles of TCE and tritium discharging along Castor Creek (Table 3 and Figure 18). The additional surface water and seepline stations will be sampled and analyzed for tritium and VOCs as part of Phase 1 of this SAP Addendum. Phase 1 will also include the installation of one new monitoring well downgradient of the Fuel Unloading Facilities Power (108-3C), based on DPT groundwater sample results (Table 3 and Figure 6). The Fuel Unloading Facilities Power (108-3C) DPT groundwater samples and monitoring well samples will be analyzed for VOCs, semi-VOCs, TPH-DRO, and R&D analyses for TPH aliphatic compounds.

Phase 2 will include 5 DPT soil sampling locations in the UAZ to better define the area of elevated TCE in groundwater near the C Reactor (Figure 19). Soil plugs will be collected at 3-m (10 ft) intervals for VOCs from the water table to the lower clay of the tan clay, a vertical depth of about 18.3 m (60 ft) in the UAZ. Phase 2 will also include the installation of 10 DPTs for groundwater sampling and two new monitoring wells in order to better define tritium and TCE plume concentrations discharging into an unnamed tributary of Castor Creek (Table 3 and Figure 20). These data will support the scope of a remediation alternative to address the TCE contamination prior to its discharge into the unnamed tributary. The DPT groundwater samples and new well samples upgradient of the unnamed tributary will be analyzed for tritium and VOCs.

~~In the annual CAGW OU groundwater data reports, a~~A monitoring network of 74 existing wells, seepline stations, and surface water stations currently provide~~d~~ data for the annual CAGW OU groundwater data reports~~currently~~ (Table 2). In addition, pertinent groundwater and surface water data collected for the C-Area Burning Rubble Pit (CBRP) OU are evaluated with the CAGW OU groundwater data for an overall understanding of groundwater conditions. Likewise, selected F- and H-Areas surface water data are evaluated with the CAGW OU surface water data for an overall understanding of surface water conditions. F- and H-Area groundwater plumes contribute the majority of tritium to FMB. Both practices will continue for a better overall understanding of groundwater and surface water conditions of the CAGW OU.

The Fuel Unloading Facilities Power (108-3C) well installed as part of Phase 1 of this SAP Addendum will be included with the CAGW OU wells monitoring the TCE and tritium source zone areas near the C-Reactor Building (105-C) and it will be sampled semi-annually. The new seepline locations installed in Phase 1 of this SAP Addendum and the distal new well(s) installed in Phase 2 of this SAP Addendum will be included with the other CAGW OU seepline and surface water stations and they will be sampled semi-annually. Two surface water stations (CCT-02 and CCT-03) will also be added for semi-annual sampling and analyses (VOCs and tritium) as part of Phase 1 of this SAP Addendum. No changes are planned for the mid-plume wells so they will continue to be sampled annually (Table 2). Samples will be collected per procedures in the Savannah River Nuclear Solutions (SRNS), LLC 3Q1 Manual, Section 9000, *Hydrogeologic Data Collection Procedures and Specifications (*SRNS 2010c*).* Samples will be analyzed for VOCs and tritium using standard USEPA methods, or approved equivalents, at SCDHEC certified laboratories, which have also been approved through the DOECAP audit process. The exception will be for the R&D analyses on the TPH aliphatic compounds. Method Detection Limits (MDLs) and Sample Quantitation Limits (SQLs) will be less than the MCLs for TCE (5 µg/L) and tritium (20 pCi/mL).

Data will be received electronically from the labs, loaded into, and managed with the Environmental Restoration Data Management System (ERDMS).

5.0 DATA VALIDATION

The data quality level for the permanent well and seepline stations will be Verified and Validated (V&V) data level (SRNS 2010a and SRNS 2010b), except the TPH aliphatic compounds, which will be Unverified and Unvalidated (U&U) data quality level. The data quality level for the DPT station samples will be Verified and Unvalidated (V&U) data level (SRNS 2010a and SRNS 2010b), again except for the TPH aliphatic compounds, which will be Unverified and Unvalidated (U&U) data quality level. Water samples may be analyzed using USEPA approved methods for constituent analysis or screening methods to determine field results (i.e., dissolved oxygen, pH, turbidity, etc.), except for the TPH aliphatic compounds which will be R&D methods. Data will be qualified by the SRNS auto-validation software module for the following aspects of USEPA Functional Guideline Criteria to achieve the V&V quality level: Quantitation Limits, surrogate or tracer recoveries, blanks (method/lab/prep, trip, field, rinsate), lab control sample recoveries, matrix spike recoveries/duplicates, lab replicates, field duplicates, cooler temperatures, chemical preservation, holding times. The laboratory will provide an electronic data deliverable and case narrative, and respond to inquiries about the analytical data package in order for SRNS to run the auto-validation software. All fatal errors, data errors, and warnings will be fixed during the verification process, and the data set will be reviewed for completeness.

The auto-validation routines will be conducted and the data qualified accordingly. Data usability will be assessed using the following PARCC parameters:

1. **Precision** is the mutual agreement between individual measurements of the same property under similar conditions. Precision is determined from the field and laboratory duplicate analyses and indicates the consistency of field and laboratory techniques.
2. **Accuracy** is determined from the laboratory control samples; matrix spikes; serial dilutions; surrogates/tracers; internal standards/carriers; and the results of the method, field, trip, and equipment rinsate blanks. Accuracy indicates the ability of the field and laboratory process to generate correct results. Blank results specifically monitor for any contamination from sample processing. Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters, Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.
3. **Representativeness** of data will also be ensured through consistent application of established field and laboratory procedures. Laboratory, field, and trip blank samples will be evaluated for the presence of contaminants to aid in evaluating the representativeness of sample results. Data determined to be nonrepresentative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.
4. **Completeness** is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with sampling matrix table and Quality Control (QC) procedures outlined in this SAP and other documents, and none of the QC criteria that affect data usability are exceeded. When all data validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

5. **Comparability** expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Field procedures are standardized and field operations will adhere to SOPs to ensure comparability. The comparability of laboratory data will be assured by use of established and approved analytical methods and by certified laboratories, consistency in the basis of analysis (wet weight, volume, or similar units), and consistency in reporting units (ppm, pCi/mL, etc.). Comparability will be determined from split and duplicate sample comparisons or screening level and definitive level comparisons. Comparability is an indicator of both precision and accuracy.

6.0 FIELD IMPLEMENTATION

The following sections outline the field implementation procedures and processes for the CAGW OU SAP addendum effort. Additional implementing documents such as the environmental checklist, automated hazard analysis, radiological work instructions, and site-specific health and safety plan are internal to SRS, and detail day-to-day sampling operations and safety requirements.

6.1 Sample Collection Procedures and Processes

The CAGW OU monitoring effort will include soil, surface water and groundwater sampling as part of Phase 1 and Phase 2 of this SAP Addendum. The following specific procedures will be followed:

- Technical Oversight (TO) Requirements for Groundwater Monitoring Wells and Soil Borings, SRNS Manual 3Q1, Section 9004
- Sampling Groundwater Monitoring Wells, Tanks/Vessels (Sample Ports or Spigots) and Surface Water, SRNS Manual 3Q1, Section 9015
- Liquid Effluent and Surface Water Surveillance Sampling, SRNS Manual 3Q1, Section 3001

These procedures are consistent with the USEPA Region 4 Field Branches Quality System and Technical Procedures sampling procedures. Prior to beginning all field activities, all field crews will be required to read the procedures listed above and the TO will have had experience with those activities.

6.2 Sample Documentation

Overall documentation will be done in accordance with the *Quality Assurance Project Plan for Environmental Data Collection and Management* (SRNS 2009a). Sample documentation will be conducted according to ER-SOP-043, *Standard Operating Procedure for Obtaining and Managing Environmental Data*, which provide the general requirements and guidelines that are necessary for the documentation, record-keeping, mobilization, collection, processing, reporting and storage of environmental data. Data Management Plan Q-DMP-B-00001, Environmental Restoration Data Management System, requires sampling information, such as bar-coded dates, times, sample IDs, weather, etc., to be recorded and maintained in log books and chain-of-custody documents included in the sampling package delivered to the project. Sampling documentation is tracked through a series of documents including:

- Mobilization Report
- Chain-of-Custody Forms
- Field Log Books
- Analytical Data Packages
- SCDHEC and SRS required logs and forms

A logbook for recording sample collection activities will be kept for this project. The TO will ensure the logbook is correctly filled out and returned within two weeks after completion of sampling. Essential field information is: sample name, date of collection, time of collection, depth of sample and sampler’s name. Space should be provided for any field observations or comments relating to the quality or representativeness of the sample. If the actual sample location differs from the planned sample location specified by the Chain-of-Custody (COC), the revised sample location should be indicated in the sample logbook. Information on the parent sample of each field duplicate should be recorded in the logbook.

6.3 Chain-of-Custody

COC procedures establish requirements for sample custody and documenting custody from the time of collection through laboratory analysis. COC demonstrates that samples obtained in the field have been securely collected and transported and have reached the analytical laboratory without alteration. COC requirements are established by SRNS Manual 3Q, Procedure ECM 21.1. At a minimum, COC documents will include the following information which is compliant with USEPA requirements:

- Project name - i.e., monitoring well name, stream name, RFI/RI project name, etc.
- Sample identification
- Sampler's signature for each sample, the sampler indicates:
- Date of sample collection
- Time of sample collection
- Sample identifiers (bar coded labels)
- Sample description
- Whether a sample is preserved or unpreserved
- Analyses to be performed

A COC record is used as physical and legal evidence of sample custody to trace the sample from collection through delivery to the analyzing laboratory and where the samples were stored. The COC record must originate with the responsible organization or the person collecting the sample. Every sample is assigned a unique identification number that is entered on the COC document. The COC records each transfer of custody of the samples by a relinquishing party to a receiving organization whose name and identifying contact information is located on the form.

6.4 Sample Management and Shipping

Samples will be collected in accordance with SRNS Manual 3Q1, Section 9000, *Hydrogeologic Data Collection Procedures and Specifications* (SRNS 2010c). Sample management for analytical laboratories and intra-SRS facilities is primarily controlled by SRNS Quality Assurance Manual 1Q, Procedure 13-1, Packaging, Handling, Storage and Shipping. The purpose of this procedure is to define the requirements and specify the responsible parties and their roles for the packaging, handling, shipping, and storage (PHSS) of items to ensure that they are properly controlled to prevent damage or loss and to minimize their deterioration. Sample shipment is also regulated by SRNS Manual 19Q, General Transportation Requirements Approved for Radioactive and Non-Radioactive Hazardous Materials. These manuals provide specific requirements to sampler personnel for the safe offsite shipment or onsite transfer of radioactive and non-radioactive hazardous materials and hazardous substances, mixed waste (rad/nonrad hazmat) and empty packaging that have previously contained rad/nonrad hazmat. It specifies the required packaging, labeling, record-keeping, selection of appropriate transportation carrier, and appropriate transport container based on the analytically pre-tested nature of a sample. Radiological samples must meet US Department of Transportation shipping regulations as well.

Water samples will be stored in coolers with blue ice, if applicable, in the custody of the sampler, or designee, until delivered to the Environmental Compliance & Area Completion Projects (EC&ACP) Sample Packaging personnel in F-Area. If samples need to be stored over-night prior to delivery to the F-Area sample packaging group, then they will be stored in a locked facility with the COC, and in refrigerator (4° C ± 2° C) if required for sample preservation. EC&ACP Sample Packaging personnel in F-Area will manage, package, and ship samples to the laboratories in accordance with procedure ER-SOP-803 (SRNS 2015b). Table 8 lists proper preservatives, holding times, and sample containers for samples collected in the field, stored, and transported to the analytical laboratories.

6.5 Data Validation and Data Management

Requirements for data validation/verification and data management procedures are found in SRNS Procedures and Standard Operating Procedures, the USEPA Functional Guidelines (USEPA 2008, USEPA 2010, and USEPA 2011), and two Department of Energy National Policies and Procedures:

- ER-AP-305 – Use of Field-Generated Blanks (SRNS 2009c)
- ER-AP-306 – Laboratory Data Records Review (SRNS 2009d)
- ER-SOP-033 – Analytical Data Qualification (SRNS 2011)
- ER-SOP-043 - Obtaining And Managing Environmental Data For Area Completion Projects (SRNS 2009e)
- Data Management Plan, Q-DMP-B-00001, Environmental Restoration Data Management System (WSRC 2006)

- Department of Energy Consolidated Audit Program, Policies and Practices, Procedure AD-1, Revision 2, November 10, 2009 (USDOE 2009)
- Quality Systems for Analytical Services, Revision 2.5, Department of Energy, November 9, 2009 (USDOE 2010)

In addition, SRS procedures incorporate the criteria found in the USEPA National Functional Guidelines to verify, validate, and qualify analytical data to assess its usability for risk and remedial management decisions. Adherence to this complex list of procedures and guidelines establishes: (a) if data meets the specific technical and QC criteria established by the DQOs and laboratory Quality Assurance (QA) project plans; and (b) the usability of any data not meeting the specific technical and QC criteria. All data is qualified for usability using USEPA Functional Guidelines. Adherence to the guideline requirements and the DOE Audit Program for analytical laboratories allows the data to be qualified based upon a set of nationally established functional guideline qualifiers for uniformity.

Depending upon the Project Quality Objectives, data will be verified and/or validated according to the following criteria.

Verification – Confirmation by examination and provision of objective evidence that the specified analytical requirements have been met. This is to be an electronic data deliverable completeness check for all required fields. Data verification consists of a completeness check to confirm that all sampling data and data fields requested from the laboratory have been received and comply with specified requirements.

Validation – Confirmation by manual examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled. Data validation consists of any analyte and sample specific process for evaluating compliance of the laboratory data received with methods, procedures, or contract requirements.

The EC&ACP Data Management group will enter sample collection and laboratory data into the ERDMS in accordance with procedure ER-SOP-043 (SRNS 2009e). Properly completed and qualified data is entered into the ERDMS database. Data records are updated, re-qualified, and continuously corrected for usability based on the results of electronic verification and manual validation evaluations as corrective actions are resolved with the analytical laboratories.

6.6 Investigation Derived Waste

Sampling activities associated with monitoring of the CAGW OU may generate aqueous and non-aqueous Investigative Derived Waste (IDW). IDW will be managed in accordance with the *IDW Management Plan* (WSRC 1994). Aqueous IDW may consist of purge water prior to sample collection. Non-aqueous waste IDW may consist of drill cuttings and personal protection equipment. IDW-specific information will be documented in the IDW management strategy plan that will be maintained in the project record file.

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Figure 1. CAGW OU Location

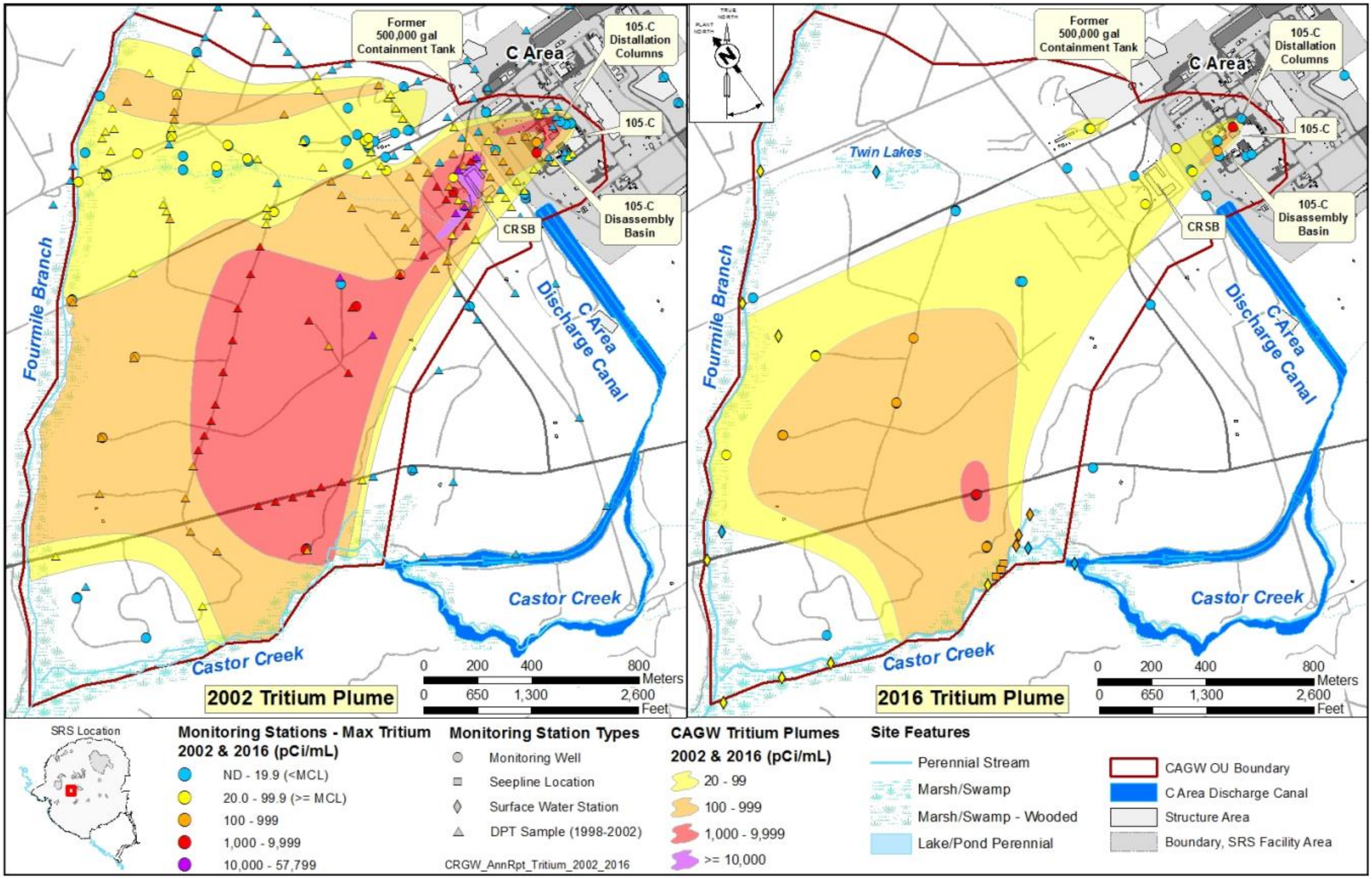

Figure 2. CAGW Tritium Plume 2002 and 2016

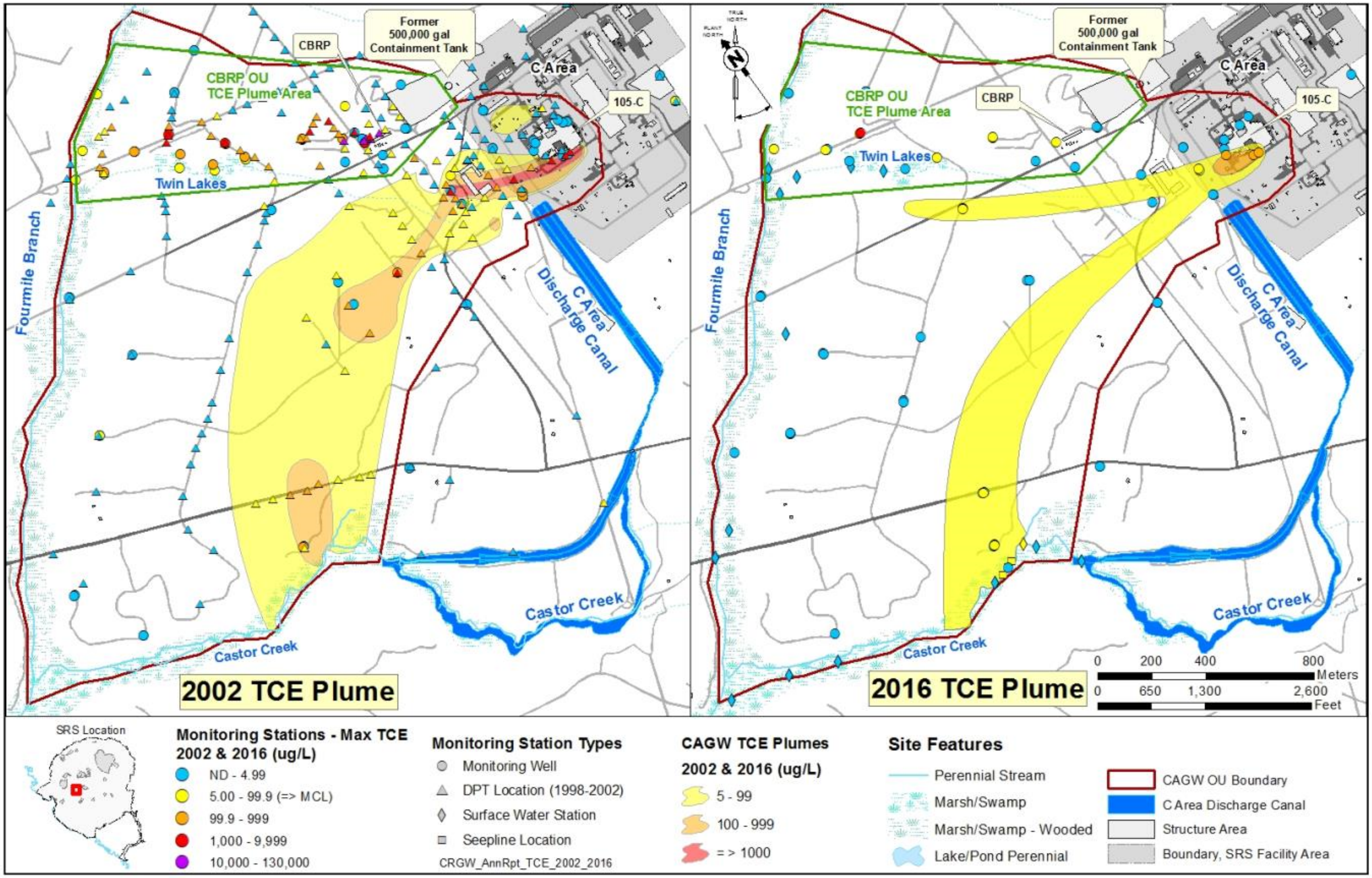

Figure 3. CAGW TCE Plume 2002 and 2016

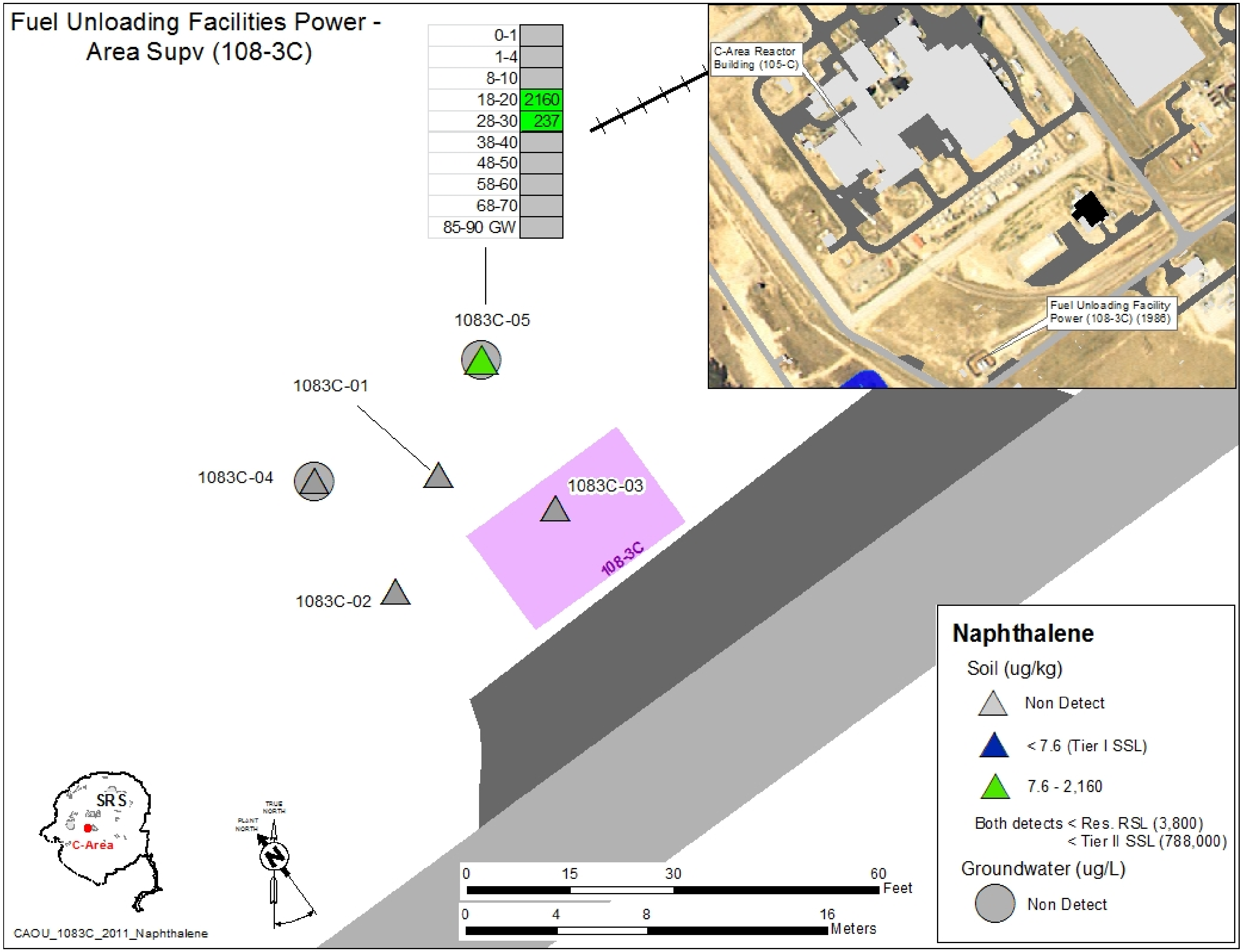

Figure 4. Fuel Unloading Facilities Power (108-3C) Naphthalene (2011)

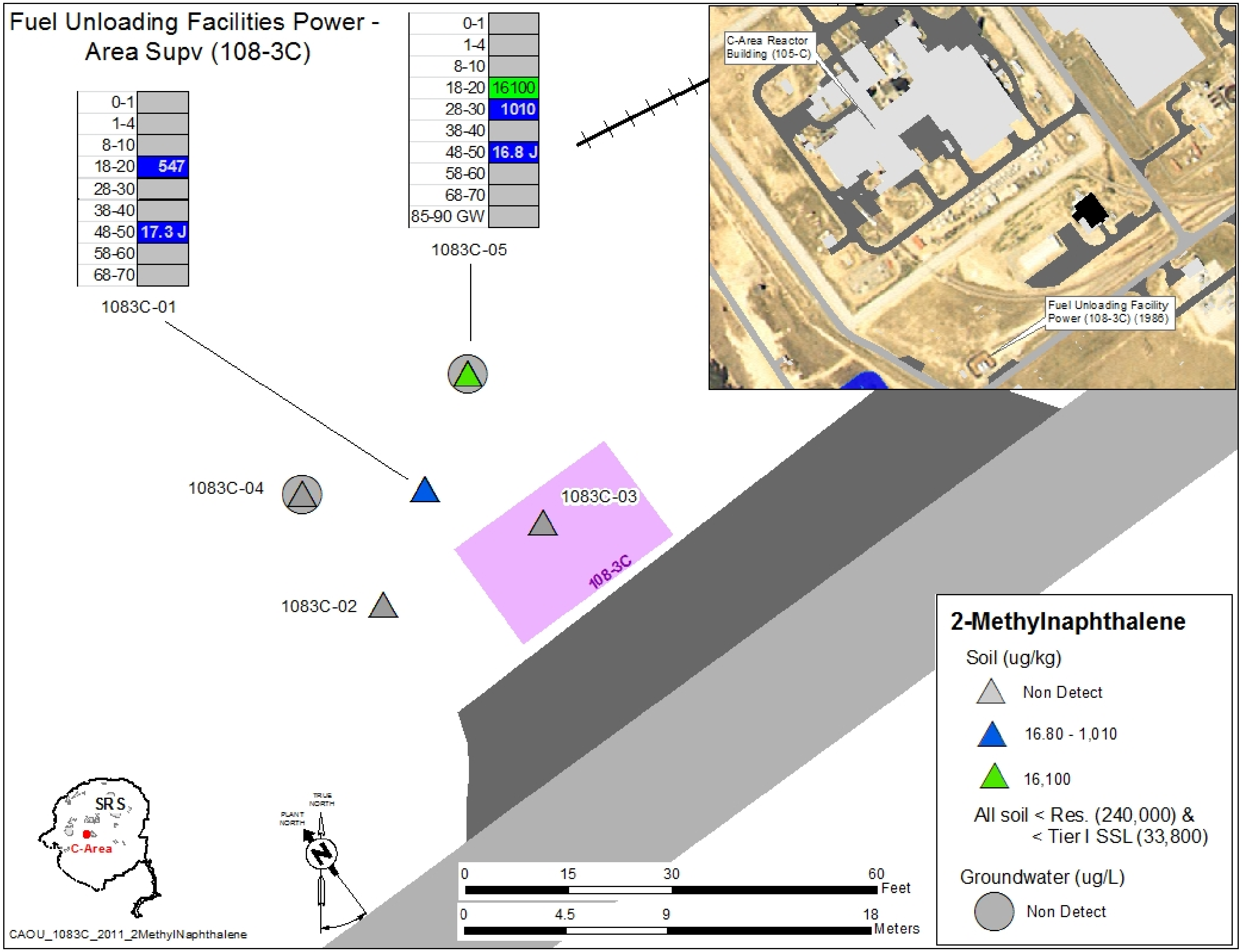

Figure 5. Fuel Unloading Facilities Power (108-3C) 2-Methylnaphthalene (2011)

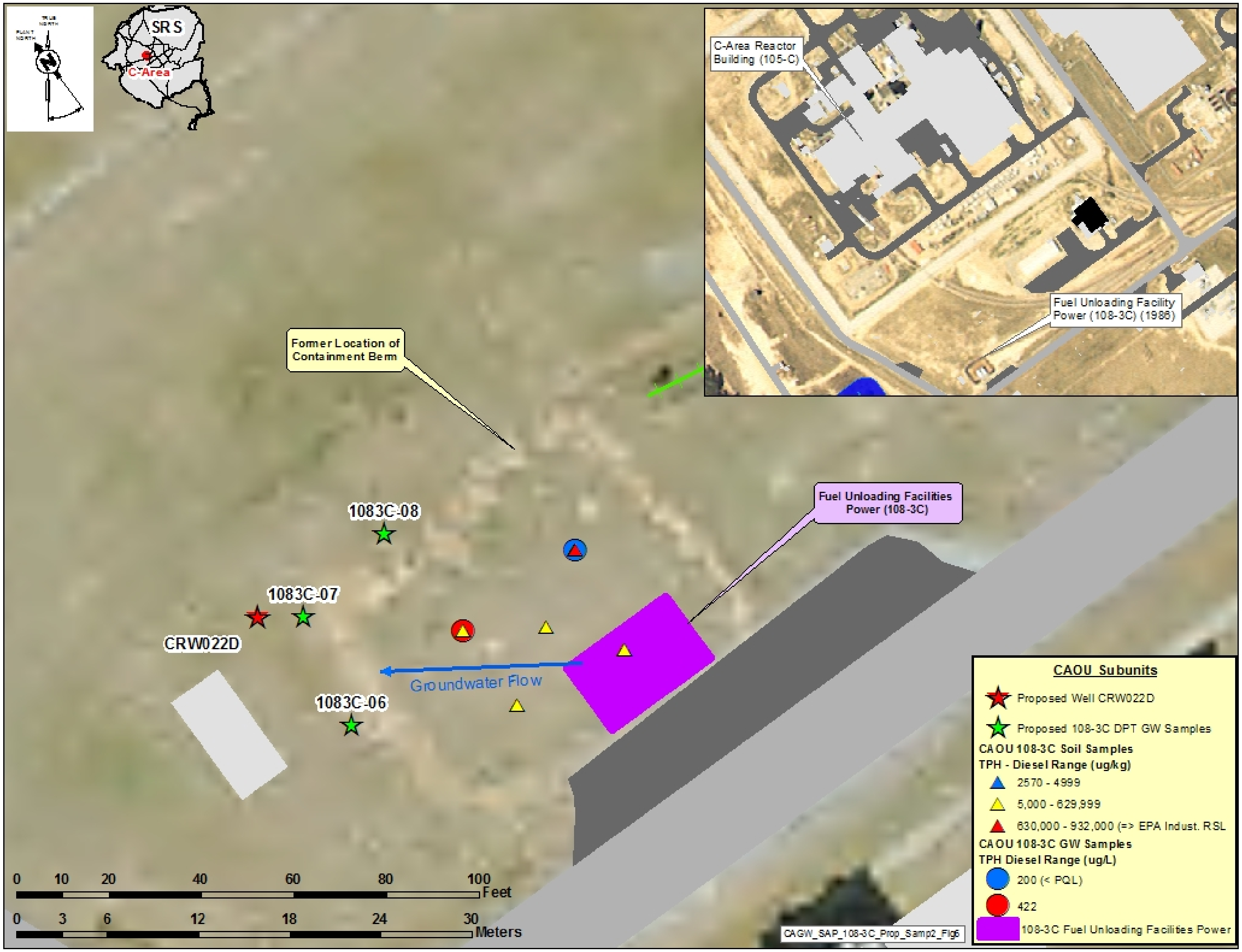

Figure 6. Fuel Unloading Facilities Power (108-3C) TPH and Proposed DPT and Well Locations

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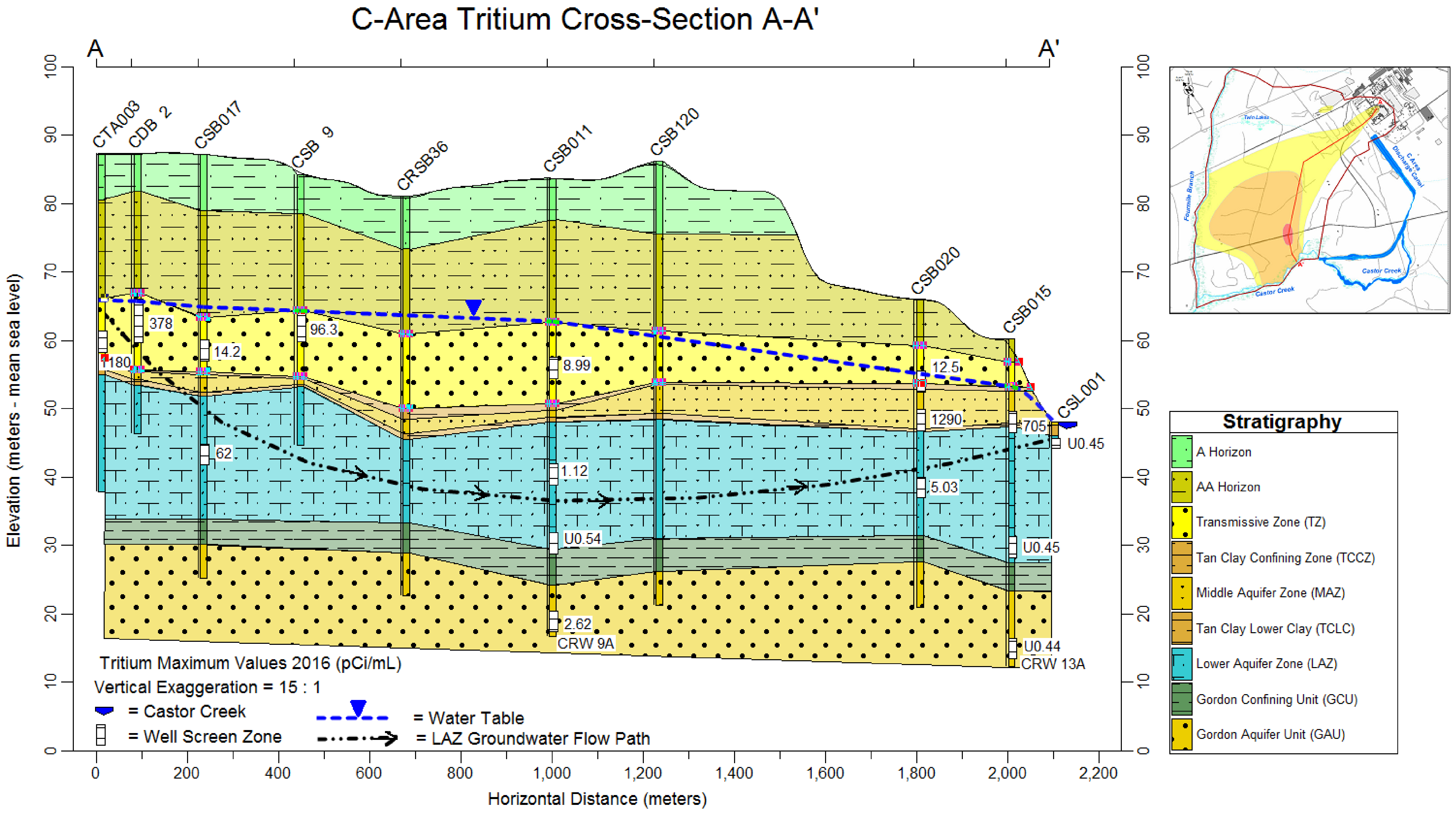

Figure 7. **CAGW OU Cross Section A – A' with 2016 Tritium Values (pCi/mL) at Well Screen Zones**

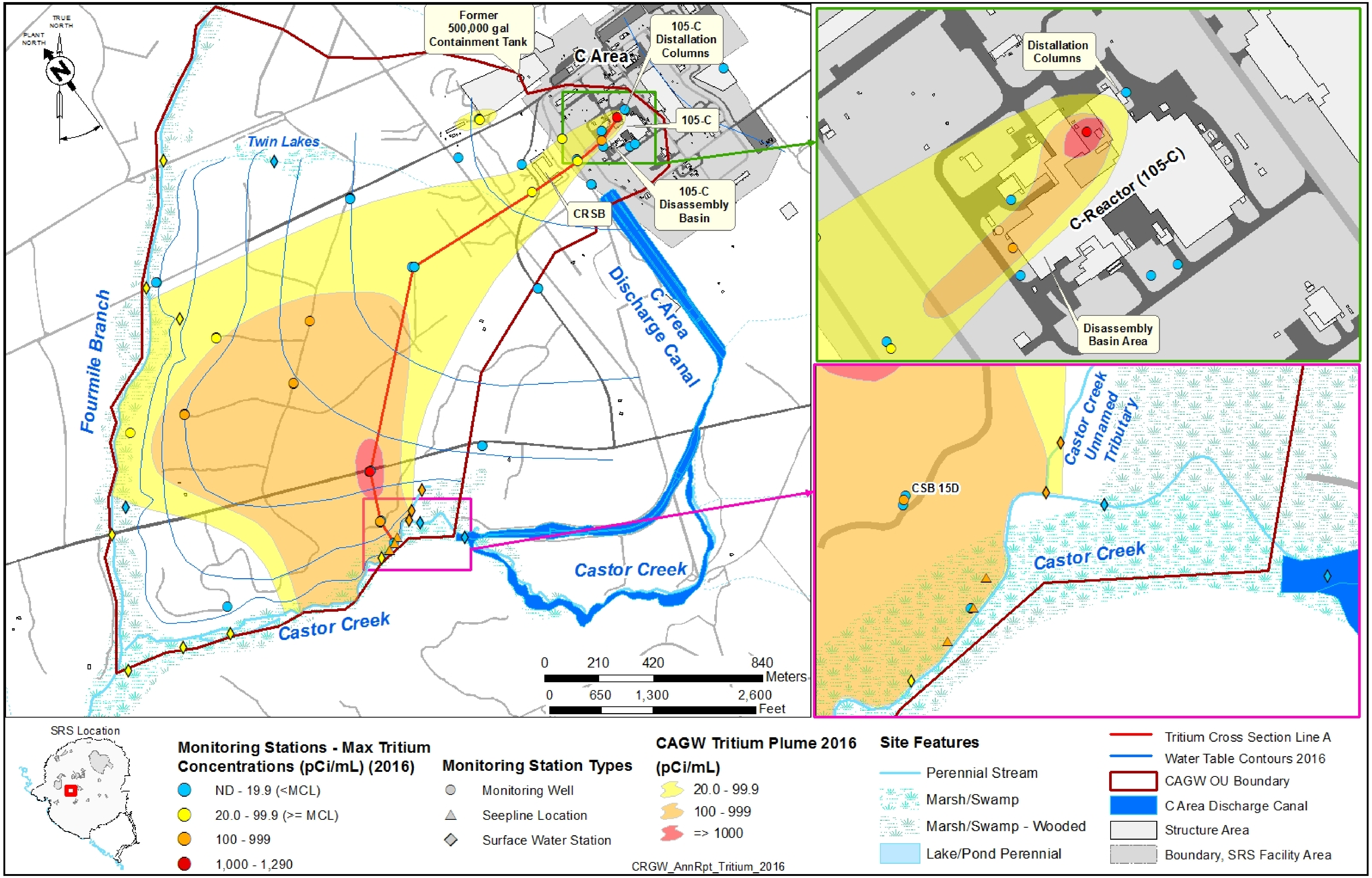

Figure 8. CAGW OU Tritium Plume (2016)

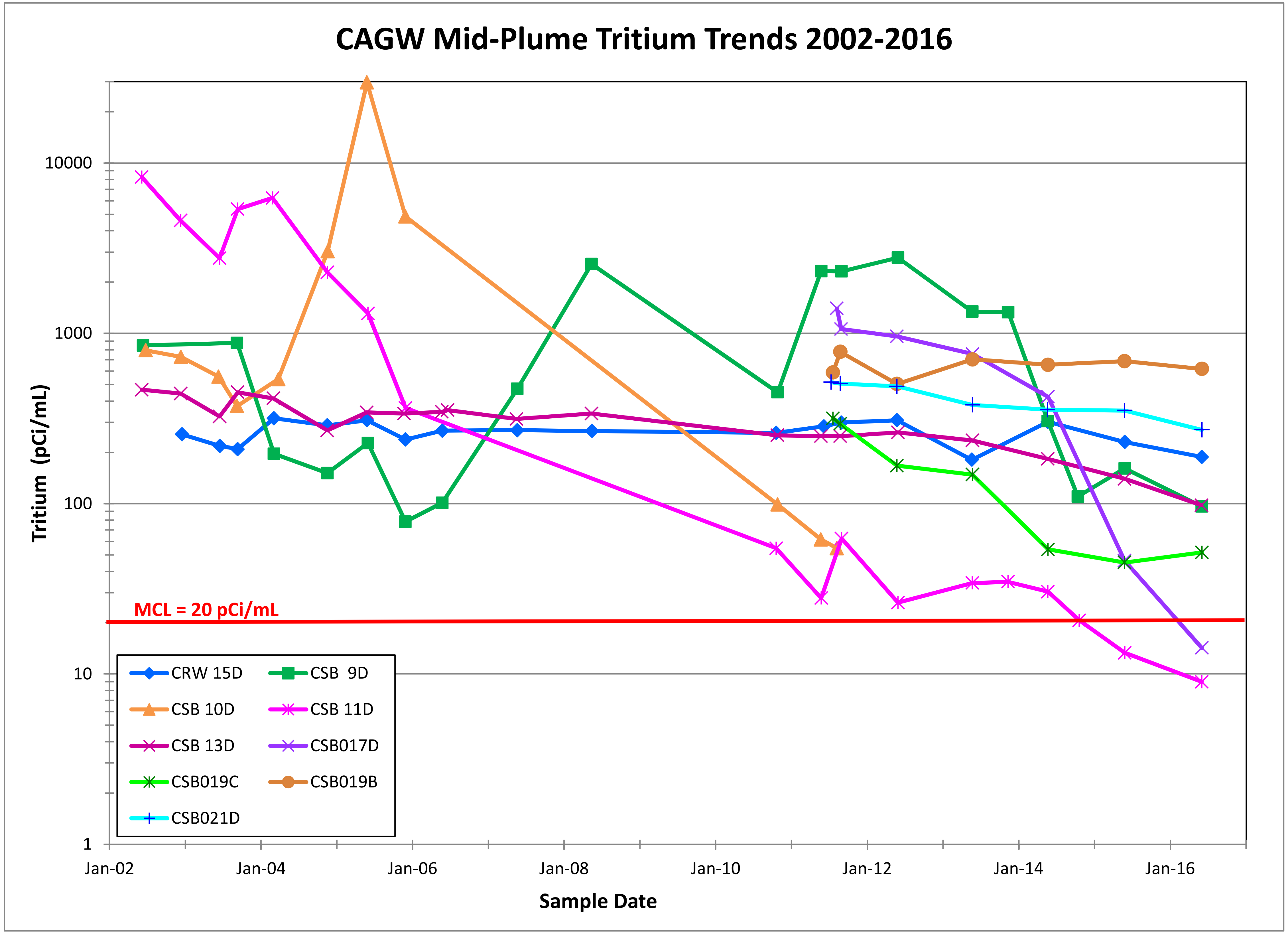

Figure 9. CAGW OU Tritium Mid-Plume Well Trends

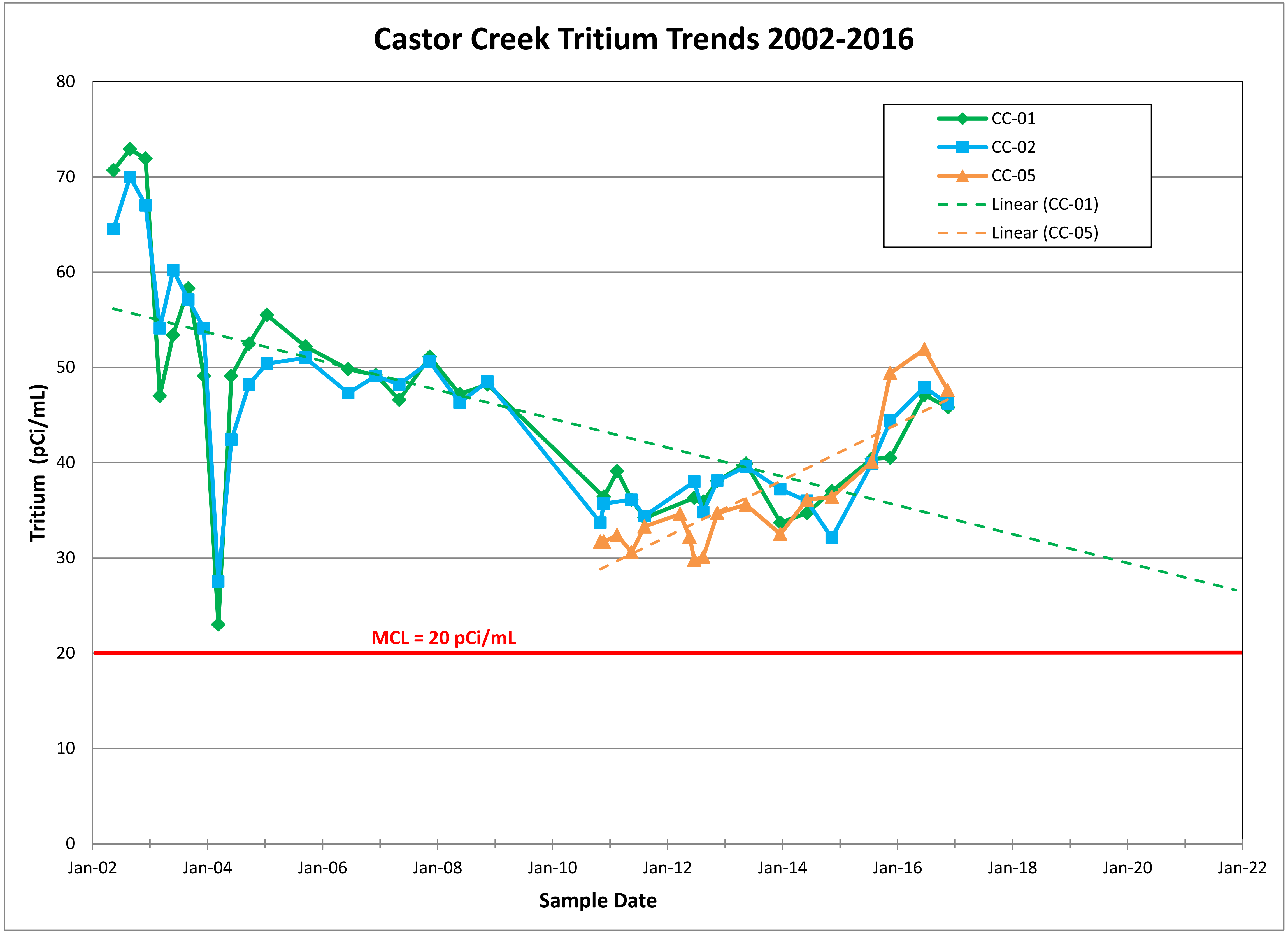

Figure 10. Tritium Time Series for Surface Water in Castor Creek

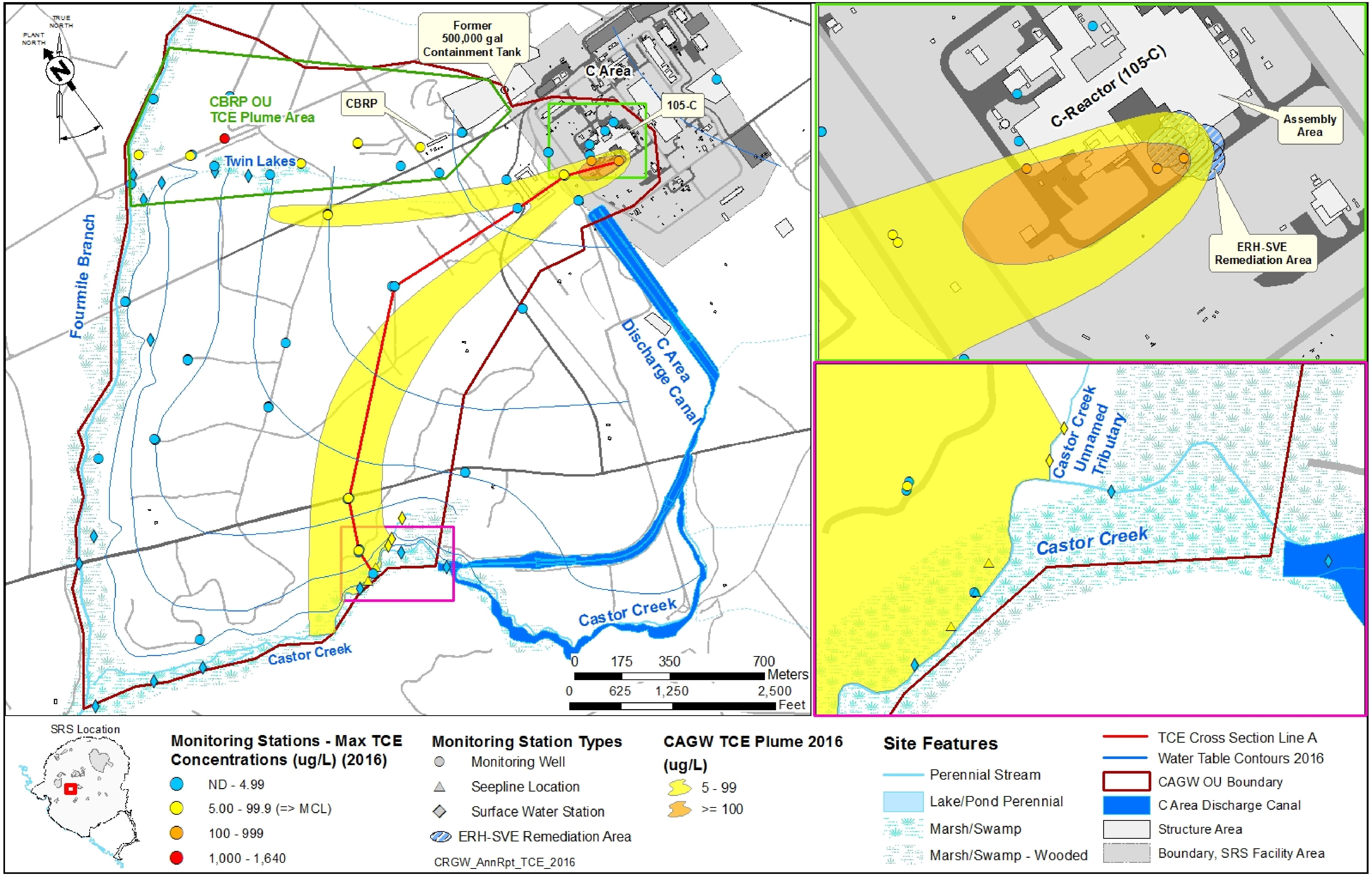

Figure 11. CAGW OU TCE Plume (2016)

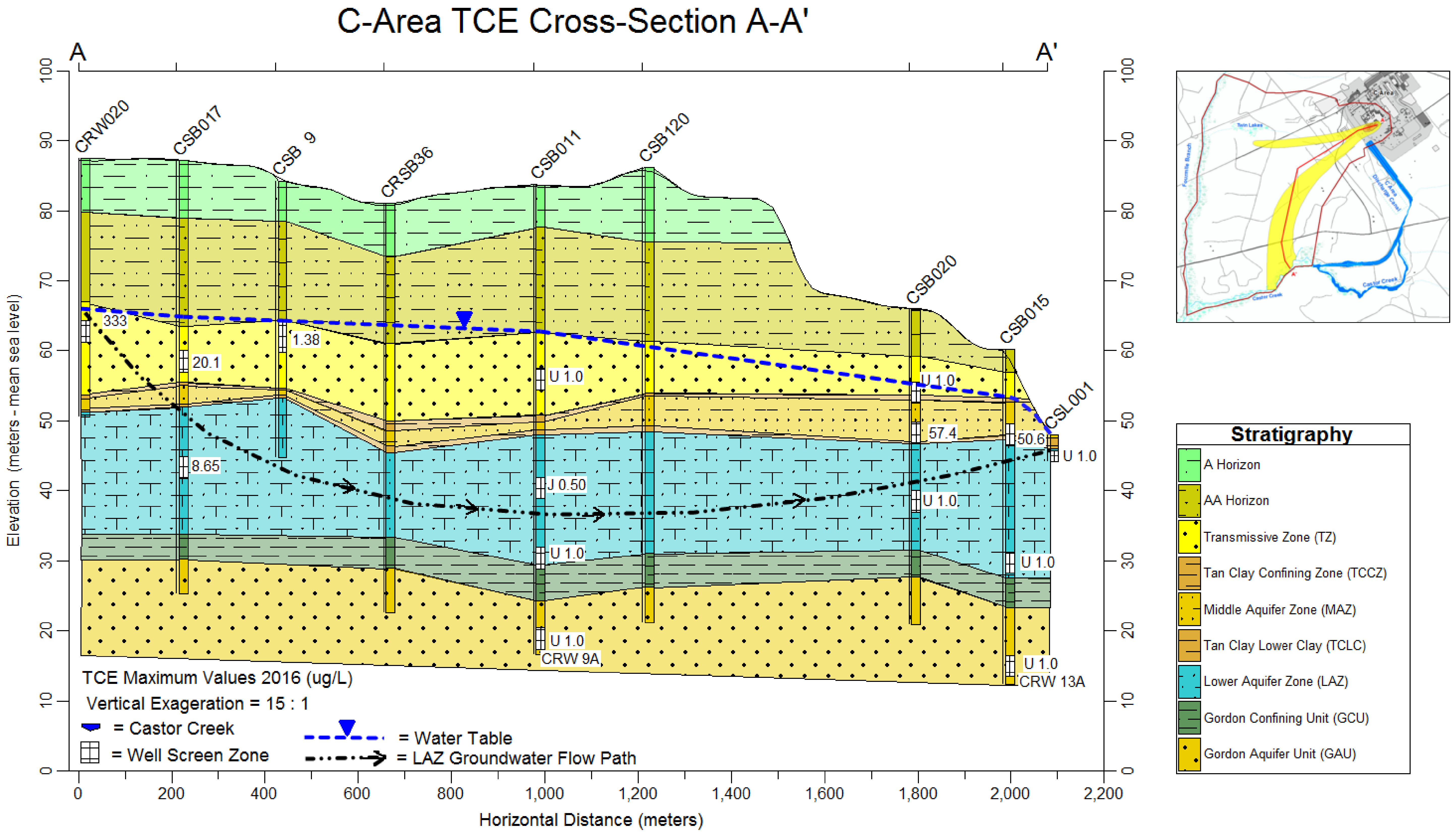

Figure 12. CAGW OU Cross Section A – A' with 2016 TCE Values (µg/L) at Well Screen Zones

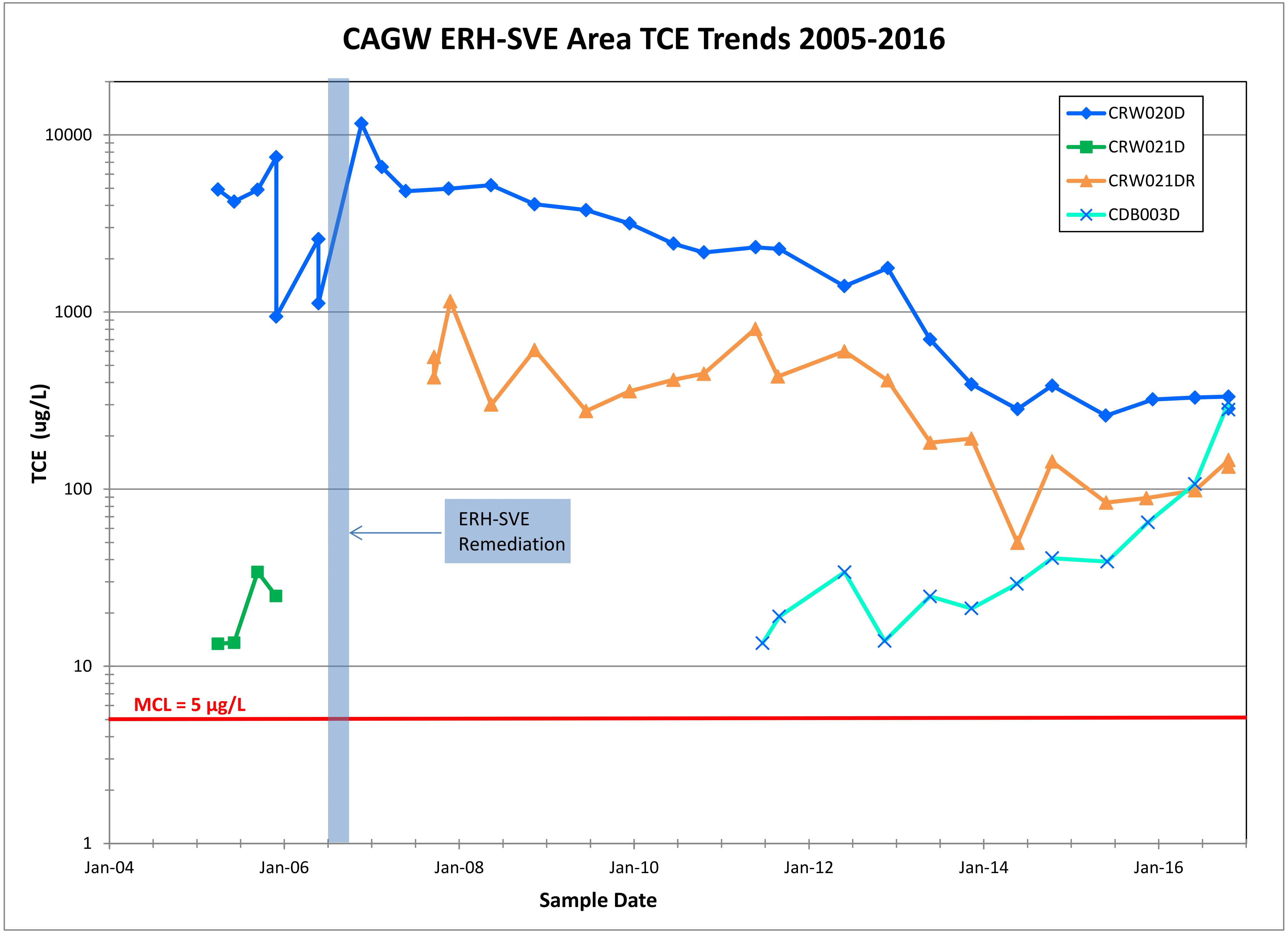

Figure 13. CAGW OU TCE Source Area (ERH-SVE Area) Well Trends

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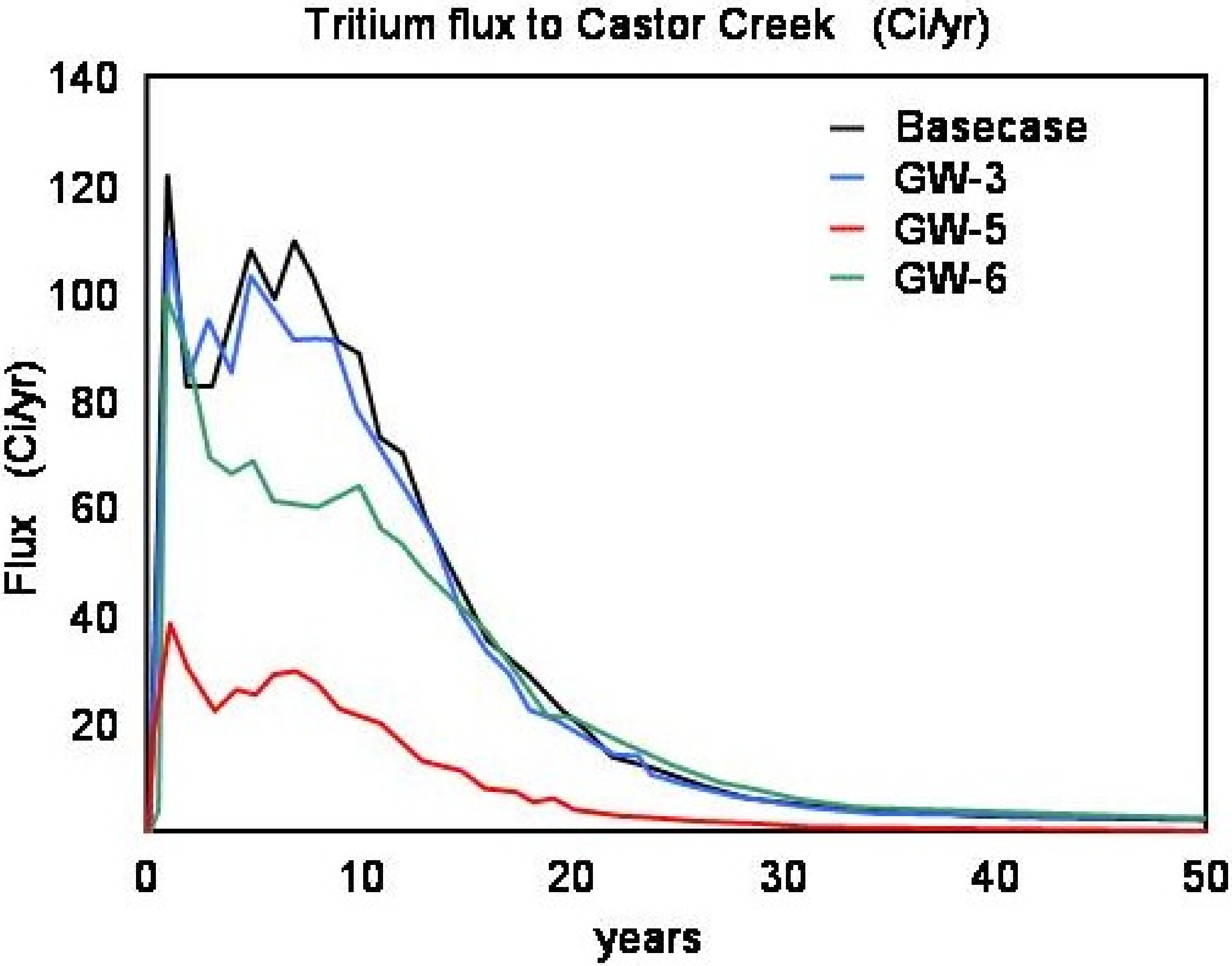

Figure 14. Model Predictions of Tritium ~~m~~Mass Flux to Castor Creek (2001)

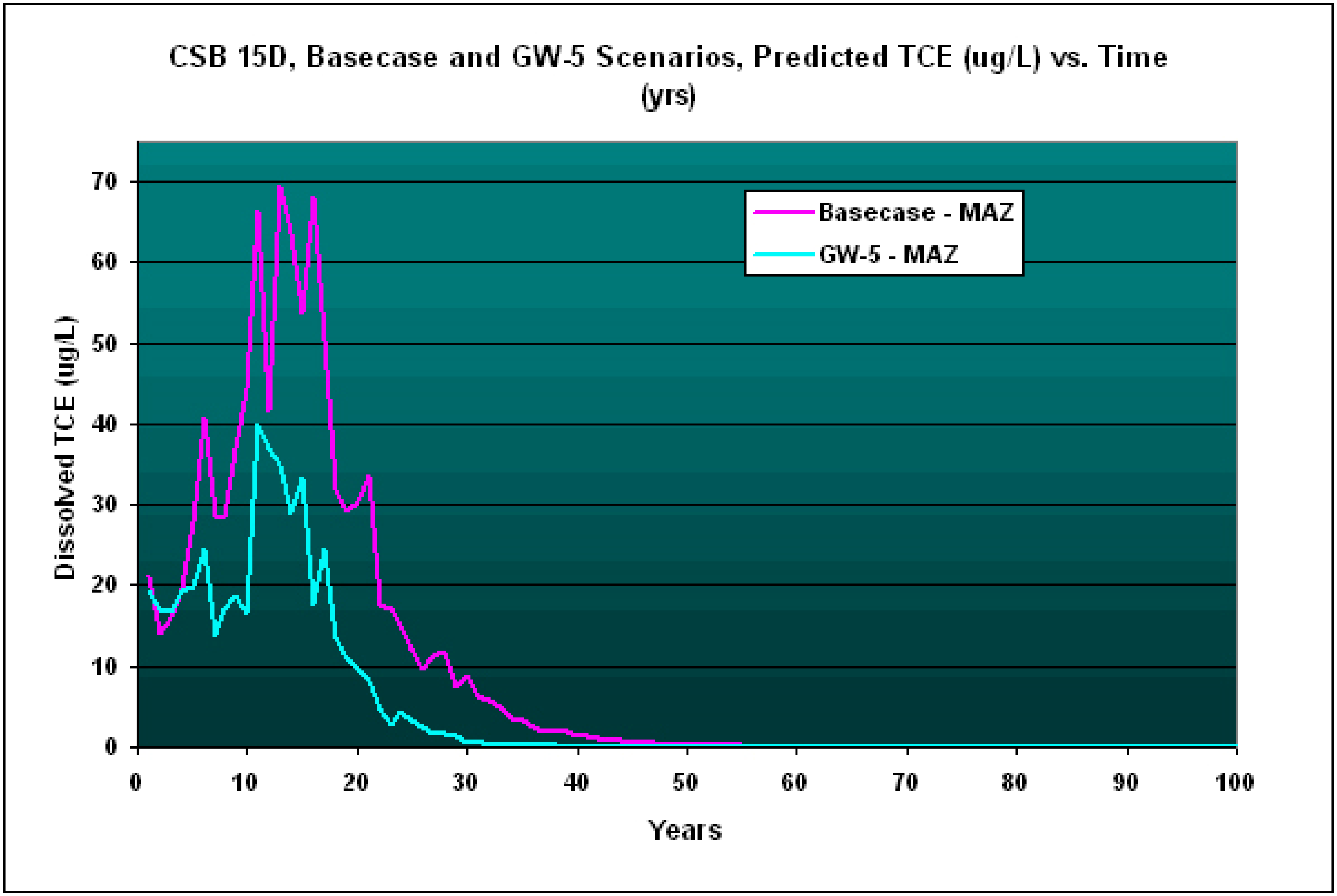

Figure 15. Model Predictions of TCE Groundwater Concentrations Near CSB 15D (2001)

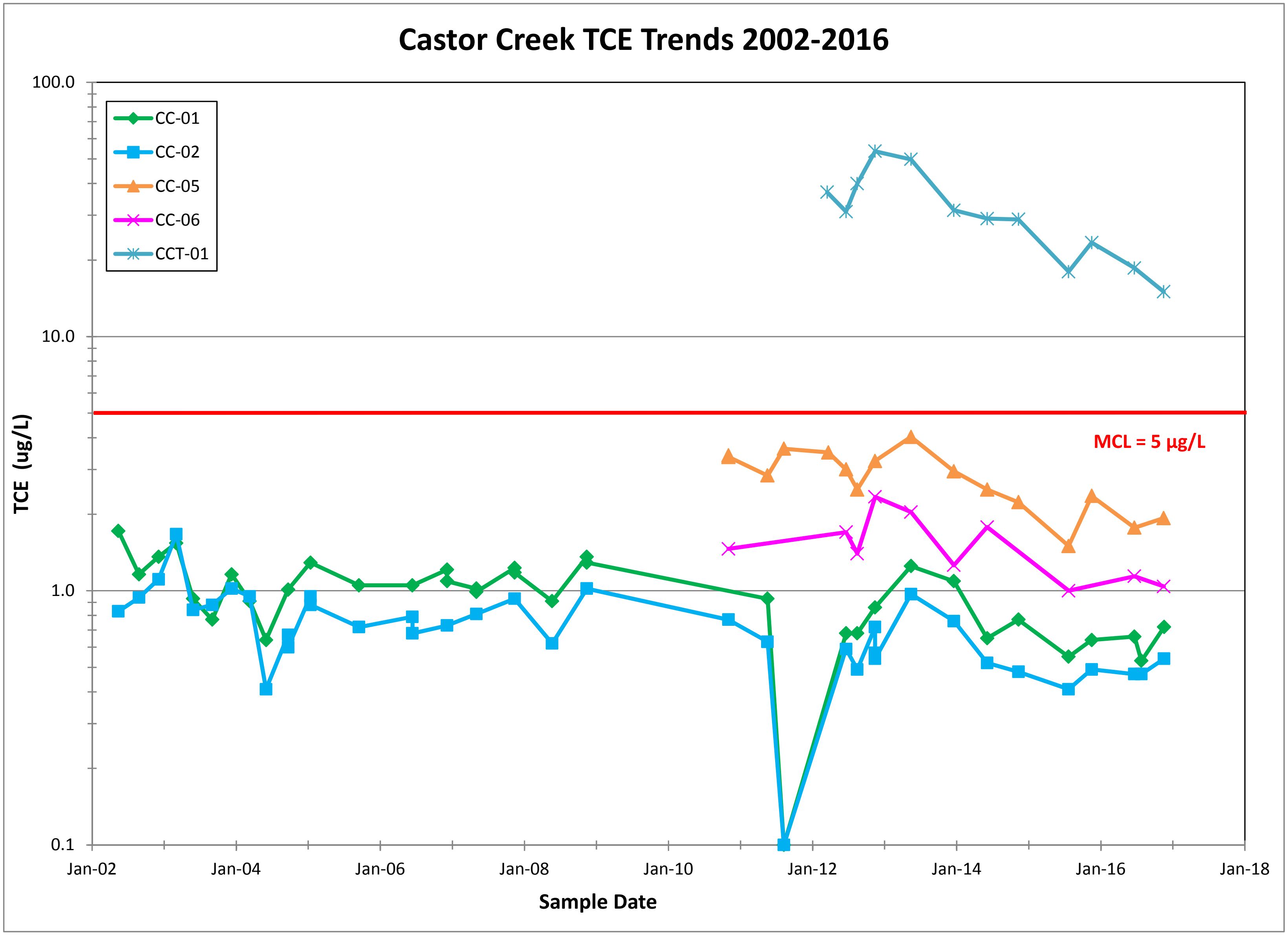

Figure 16. Caster Creek TCE Trends

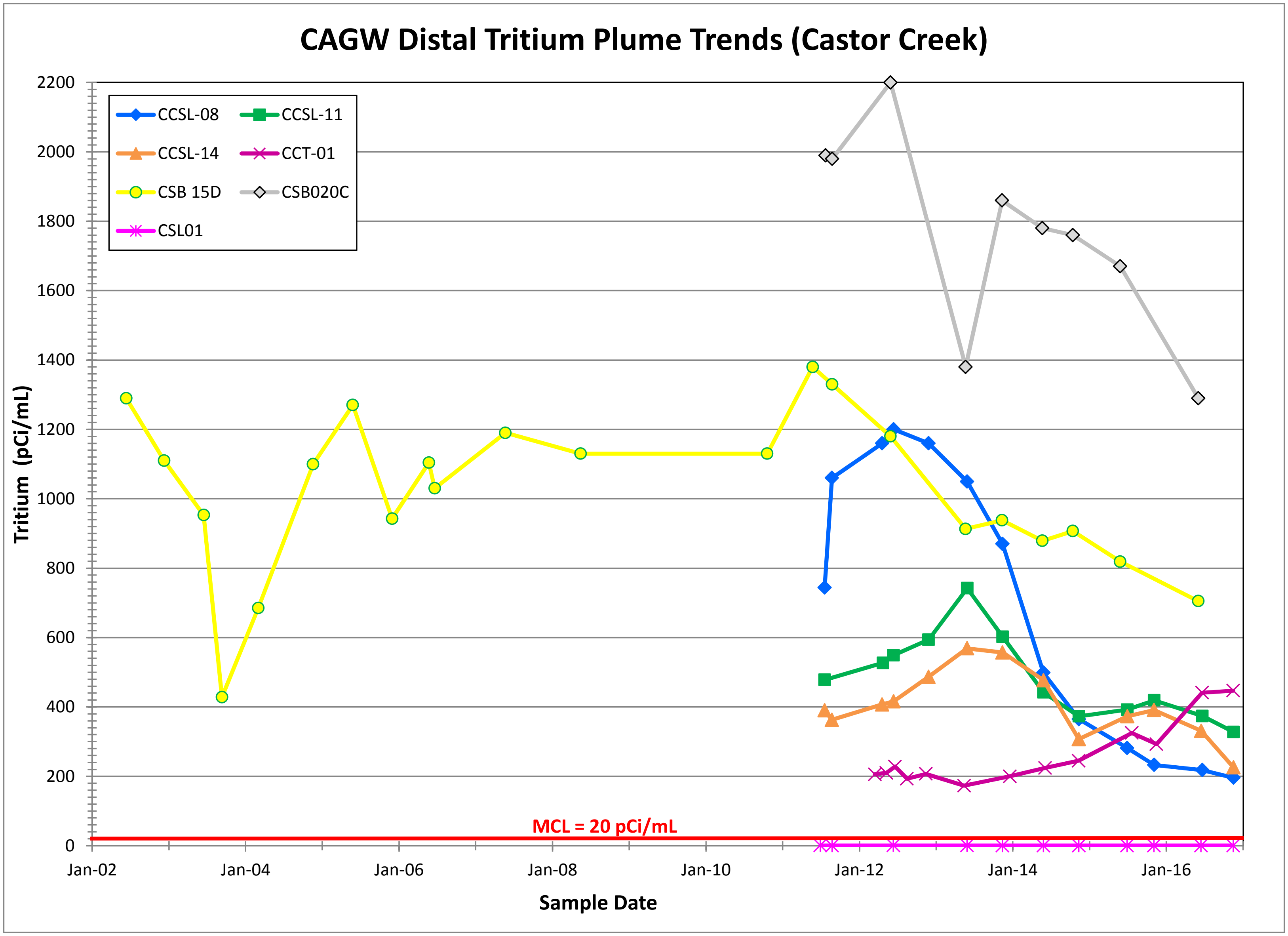

Figure 17. **Castor Creek Tributary (CCT-01) Tritium Trends**

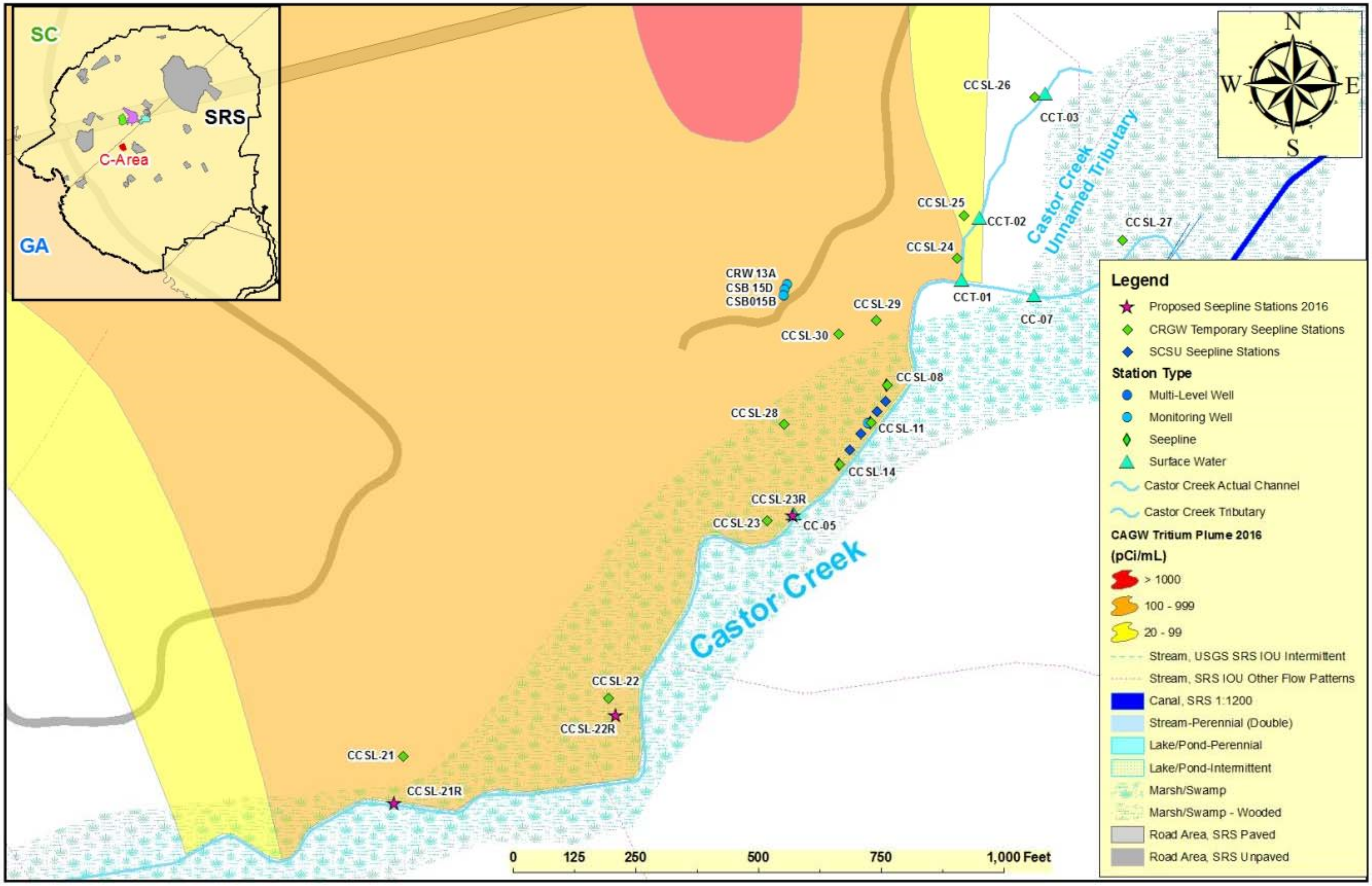

Figure 18. Phase 1 Castor Creek Proposed Seepline Stations

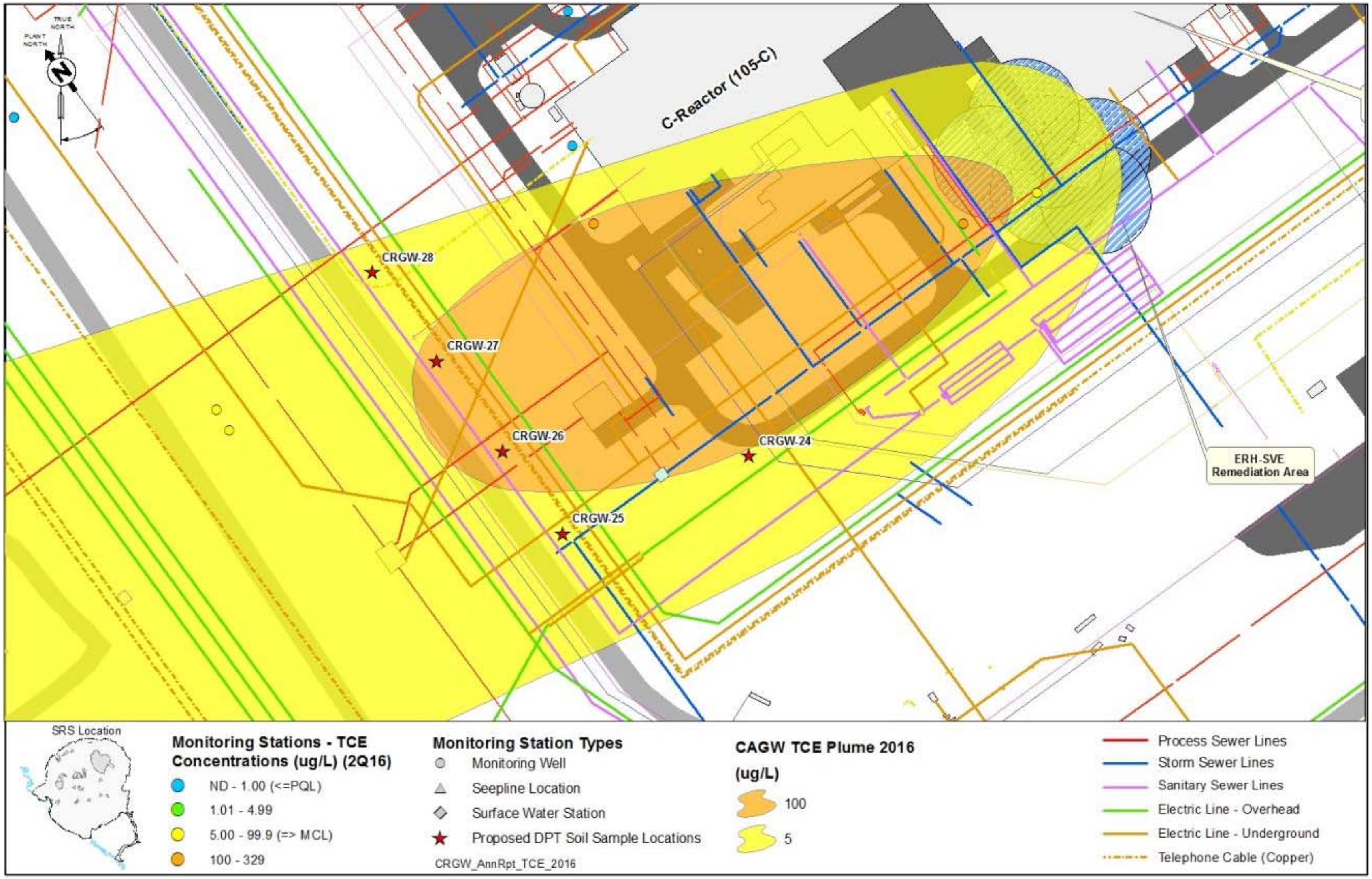

Figure 19. Phase 2 Proposed Saturated Zone (UAZ) VOC Soil Sample Locations

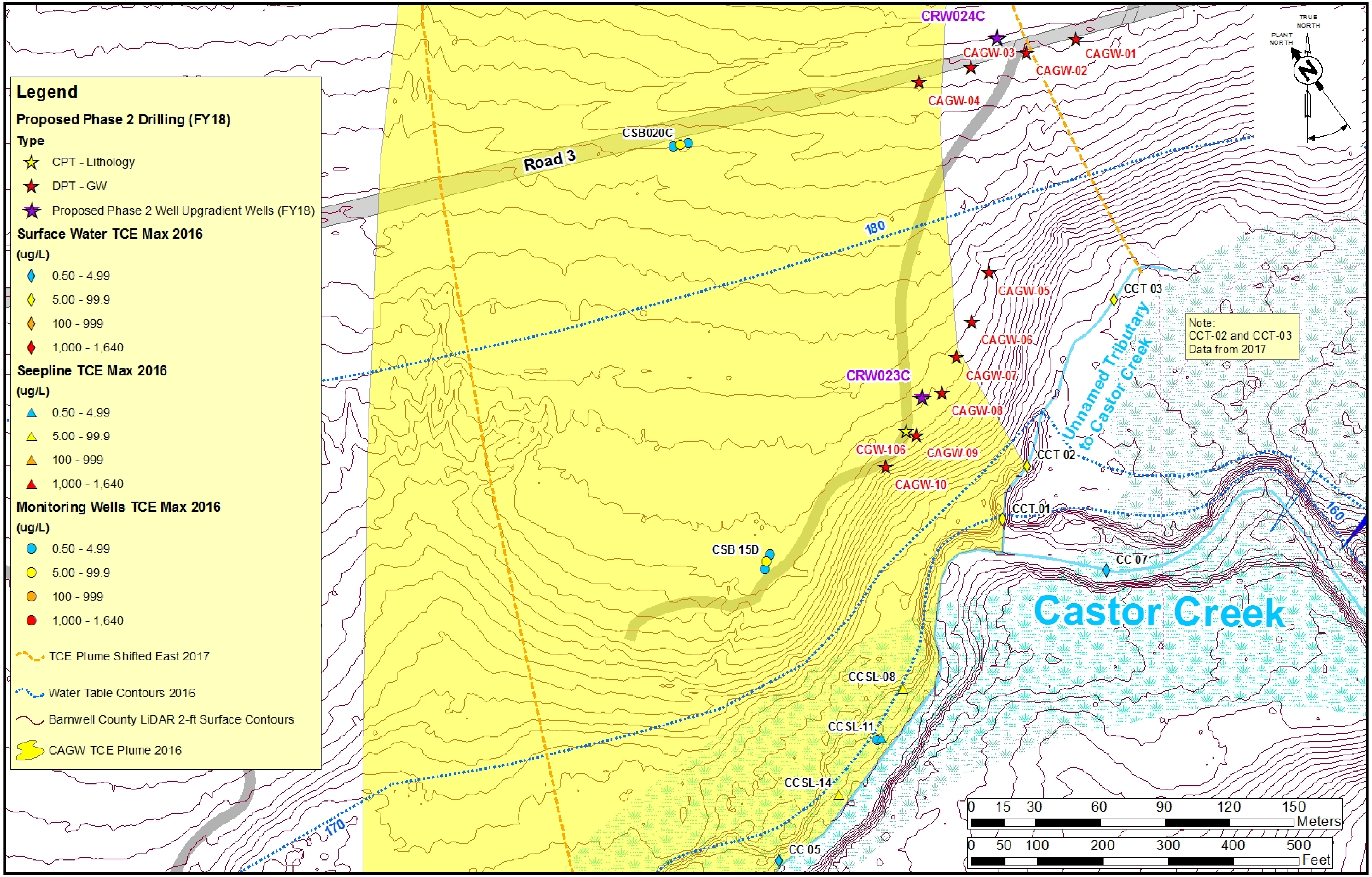

Figure 20. Phase 2 Castor Creek Proposed DPT Groundwater Samples and Wells

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Table 1. C-Area Groundwater Data Exceeding MCLs (July 2015 – December 2016)

STATION	STATION TYPE	DATE	ANALYTE	MDL	SQL	LAB QUALIFIER	REVIEW QUALIFIER	RESULT	MCL	UNITS
CC 01	SURFACE WATER	11/17/16	TRITIUM	0.44	3.05			45.80	20	pCi/mL
CC 02	SURFACE WATER	11/17/16	TRITIUM	0.45	3.07			46.20	20	pCi/mL
CC 03	SURFACE WATER	11/15/16	TRITIUM	0.49	3.01			39.40	20	pCi/mL
CC 04	SURFACE WATER	11/17/16	TRITIUM	0.45	2.96			41.50	20	pCi/mL
CC 05	SURFACE WATER	11/15/16	TRITIUM	0.46	3.11			47.60	20	pCi/mL
CCSL-08	SEEPLINE	11/16/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			5.62	5	µg/L
CCSL-08	SEEPLINE	11/16/16	TRITIUM	0.43	5.74			196.00	20	pCi/mL
CCSL-11	SEEPLINE	11/16/16	TRITIUM	0.43	7.31			328.00	20	pCi/mL
CCSL-14	SEEPLINE	11/16/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			7.08	5	µg/L
CCSL-14	SEEPLINE	11/16/16	TRITIUM	0.43	6.17			226.00	20	pCi/mL
CCT 01	SURFACE WATER	11/15/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			15.00	5	µg/L
CCT 01	SURFACE WATER	11/15/16	TRITIUM	0.45	8.56			447.00	20	pCi/mL
CDB 2	MONITORING WELL	10/19/16	TRITIUM	0.44	6.66		J	268.00	20	pCi/mL
CDB003D	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	1.67	5.00			308.00	5	µg/L
CDB003D	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			281.00	5	µg/L
CRP 5C	MONITORING WELL	11/16/16	TETRACHLOROETHYLENE (PCE)	0.33	1.00			8.15	5	µg/L
CRW 10C	ML MONITOR WELL	11/21/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			7.10	5	µg/L
CRW010CU	MONITORING WELL	11/21/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			11.90	5	µg/L
CRW020D	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	1.67	5.00			333.00	5	µg/L
CRW020D	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			285.00	5	µg/L
CRW021DR	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	0.67	2.00			146.00	5	µg/L
CRW021DR	MONITORING WELL	10/19/16	TRICHLOROETHYLENE (TCE)	0.33	1.00			134.00	5	µg/L
CTA003D	MONITORING WELL	10/19/16	TRITIUM	0.44	13.40			1180.00	20	pCi/mL

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Table 2. C-Area Groundwater Monitoring Network

STATION	UTM EAST	UTM NORTH	STATION TYPE	MONITORING QUARTERS	2012 ANALYTES
CC 01	435446.02	3677043.03	Surface Water	2Q & 4Q	H-3, VOC
CC 02	435264.92	3676989.97	Surface Water	2Q & 4Q	H-3, VOC
CC 03	434990.09	3677424.98	Surface Water	2Q & 4Q	H-3, VOC
CC 04	435029.02	3676877.04	Surface Water	2Q & 4Q	H-3, VOC
CC 05	436028.30	3677333.30	Surface Water	2Q & 4Q	H-3, VOC
CC 06	436374.00	3677415.00	Surface Water	2Q & 4Q	H-3, VOC
CC-07	436239.23	3677496.63	Surface Water	2Q & 4Q	H-3, VOC
CC-08	436078.99	3677453.11	Surface Water	2Q & 4Q	H-3, VOC
CCSL-08	436085.66	3677412.94	Seepline	2Q & 4Q	H-3, VOC, MNA
CCSL-11	436075.77	3677389.79	Seepline	2Q & 4Q	H-3, VOC, MNA
CCSL-14	436056.01	3677363.74	Seepline	2Q & 4Q	H-3, VOC, MNA
CCT 01	436116.27	3677478.93	Surface Water	2Q & 4Q	H-3, VOC
CCT 02	436133.40	3677523.15	Surface Water	2Q & 4Q	H-3, VOC
CCT 03	436174.79	3677590.52	Surface Water	2Q & 4Q	H-3, VOC
CDB 1	436874.55	3678974.89	Monitoring Well	2Q & 4Q	H-3, VOC
CDB 2	436875.65	3678938.27	Monitoring Well	2Q & 4Q	H-3, VOC
CDB003D	436881.67	3678916.91	Monitoring Well	2Q & 4Q	H-3, VOC
CRP 5C	436406.22	3679018.78	Monitoring Well	2Q	H-3, VOC
CRP 5D	436400.67	3679019.83	Monitoring Well	2Q	H-3, VOC
CRP 6DR	436320.72	3678872.08	Monitoring Well	2Q	H-3, VOC
CRW 1D	437344.33	3679215.94	Multi-Level Well	2Q	H-3, VOC
CRW 4A	436723.42	3678946.00	Multi-Level Well	2Q	H-3, VOC
CRW 4C	436723.42	3678946.00	Multi-Level Well	2Q	H-3, VOC
CRW 4D	436723.42	3678946.00	Multi-Level Well	2Q	H-3, VOC
CRW 5A	436833.61	3678770.45	Multi-Level Well	2Q	H-3, VOC
CRW 5D	436833.61	3678770.45	Multi-Level Well	2Q	H-3, VOC
CRW 7A	436628.51	3678370.01	Multi-Level Well	2Q	H-3, VOC
CRW 7D	436628.51	3678370.01	Multi-Level Well	2Q	H-3, VOC
CRW 9A	436151.46	3678452.82	Monitoring Well	2Q	H-3, VOC
CRW 10A	435905.56	3678718.33	Multi-Level Well	2Q	H-3, VOC
CRW 10C	435905.56	3678718.33	Multi-Level Well	2Q	H-3, VOC
CRW 11A	436414.36	3677763.77	Multi-Level Well	2Q	H-3, VOC
CRW 11D	436414.36	3677763.77	Multi-Level Well	2Q	H-3, VOC
CRW 13A	436023.80	3677475.31	Monitoring Well	2Q	H-3, VOC
CRW 14A	435159.25	3678394.41	Monitoring Well	2Q	H-3, VOC
CRW 15A	435268.02	3677884.68	Multi-Level Well	2Q	H-3, VOC
CRW 15C	435268.02	3677884.68	Multi-Level Well	2Q	H-3, VOC
CRW 15D	435268.02	3677884.68	Multi-Level Well	2Q	H-3, VOC
CRW 16D	435431.97	3677144.70	Multi-Level Well	2Q	H-3, VOC
CRW010CU	435906.13	3678715.34	Monitoring Well	2Q	H-3, VOC
CRW015B	435266.81	3677887.44	Monitoring Well	2Q	H-3, VOC
CRW020D	436982.50	3678917.01	Monitoring Well	2Q & 4Q	H-3, VOC
CRW021DR	437002.59	3678925.26	Monitoring Well	2Q & 4Q	H-3, VOC
CSB 3C	436566.99	3678844.58	Monitoring Well	2Q	H-3, VOC
CSB 9D	436608.02	3678739.89	Monitoring Well	2Q	H-3, VOC

Table 2. C-Area Groundwater Monitoring Network (*continued/end*)

STATION	UTM EAST	UTM NORTH	STATION TYPE	MONITORING QUARTERS	ANALYTES
CSB 11D	436209.12	3678369.49	Monitoring Well	2Q	H-3, VOC
CSB 12D	435156.25	3678393.18	Monitoring Well	2Q	H-3, VOC
CSB 13D	435389.19	3678181.16	Monitoring Well	2Q	H-3, VOC
CSB 15D	436022.46	3677472.15	Monitoring Well	2Q	H-3, VOC
CSB011B	436144.11	3678453.03	Monitoring Well	2Q	H-3, VOC
CSB011C	436154.60	3678453.04	Monitoring Well	2Q	H-3, VOC
CSB013B	435390.26	3678178.07	Monitoring Well	2Q	H-3, VOC
CSB015B	436021.64	3677468.50	Monitoring Well	2Q	H-3, VOC
CSB017B	436728.28	3678934.50	Monitoring Well	2Q	H-3, VOC
CSB017D	436778.62	3678866.06	Monitoring Well	2Q	H-3, VOC
CSB019B	435688.03	3678006.31	Monitoring Well	2Q	H-3, VOC
CSB019C	435686.91	3678002.48	Monitoring Well	2Q	H-3, VOC
CSB020B	435978.85	3677665.11	Monitoring Well	2Q	H-3, VOC
CSB020C	435982.26	3677665.87	Monitoring Well	2Q	H-3, VOC
CSB020D	435985.72	3677666.71	Monitoring Well	2Q	H-3, VOC
CSB021D	435750.95	3678243.43	Monitoring Well	2Q	H-3, VOC
CSL001	436073.92	3677389.12	Monitoring Well	2Q	H-3, VOC, MNA
CSL002	435059.84	3677812.50	Monitoring Well	2Q	H-3, VOC, MNA
CTA003D	436934.23	3679028.30	Monitoring Well	2Q & 4Q	H-3, VOC
CTA004D	436963.07	3679057.78	Monitoring Well	2Q & 4Q	H-3, VOC
FMT 01	435251.60	3678254.80	Surface Water	2Q & 4Q	H-3, VOC
FMT 02	435043.20	3677528.70	Surface Water	2Q & 4Q	H-3, VOC
FM-TL	435218.70	3679005.89	Surface Water	2Q & 4Q	H-3, VOC
TL 01	435614.00	3678860.00	Surface Water	2Q & 4Q	H-3, VOC
TL 03	435187.85	3678863.96	Surface Water	2Q & 4Q	H-3, VOC

Table 3. C-Area Proposed New Stations

STATION	UTM EAST	UTM NORTH	STATION TYPE	MONITORING QUARTERS	Phase	ANALYTES
1083C-06	437009.18	3678749.17	DPT	One Time Only	Phase 1	SVOC, VOC, Aliphatics
1083C-07	437006.10	3678755.56	DPT	One Time Only	Phase 1	SVOC, VOC, Aliphatics
1083C-08	437009.97	3678762.08	DPT	One Time Only	Phase 1	SVOC, VOC, Aliphatics
CRW022D	437003.60	3678757.19	Monitoring Well	1Q, 2Q & 4Q	Phase 1	SVOC, VOC, Aliphatics
CCSL-21R	435792.50	3677183.70	Seepline	1Q, 2Q & 4Q	Phase 1	H-3, VOC, MNA
CCSL-22R	435917.33	3677208.45	Seepline	1Q, 2Q & 4Q	Phase 1	H-3, VOC, MNA
CCSL-23R	436027.69	3677332.09	Seepline	1Q, 2Q & 4Q	Phase 1	H-3, VOC, MNA
CAGW-01	436126.63	3677702.54	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-02	436090.88	3677693.76	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-03	436054.25	3677682.98	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-04	436019.87	3677674.51	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-05	436118.75	3677530.45	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-06	436103.29	3677530.37	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-07	436087.28	3677530.57	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-08	436078.36	3677519.88	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-09	436066.17	3677513.95	DPT	One Time Only	Phase 2	H-3, VOC
CAGW-10	436052.18	3677508.85	DPT	One Time Only	Phase 2	H-3, VOC
CRW023C	436070.93	3677520.22	Monitoring Well	2Q & 4Q	Phase 2	H-3, VOC
CRW024C	436074.31	3677688.54	Monitoring Well	2Q & 4Q	Phase 2	H-3, VOC
CRGW-24	436924.04	3678853.66	DPT	One Time Only	Phase 2	VOCs
CRGW-25	436873.19	3678832.45	DPT	One Time Only	Phase 2	VOCs
CRGW-26	436856.75	3678854.90	DPT	One Time Only	Phase 2	VOCs
CRGW-27	436838.86	3678879.48	DPT	One Time Only	Phase 2	VOCs
CRGW-28	436821.21	3678903.79	DPT	One Time Only	Phase 2	VOCs

Table 4. EPA RSL TPH Categories and Indicator Compounds

Category	Indicator compounds	EPA Tapwater RSL (May 2016) (µg/L)
Total Petroleum Hydrocarbons (Aliphatic Low)	n-pentane, n-Hexane, n-Heptane, dimethylbutanes, methylpentanes, cyclopentane, n-octane, trimethylpentanes, cycloalkanes, cyclohexane, methylcyclopentane, methylcyclohexane.	1,300.0
Total Petroleum Hydrocarbons (Aliphatic Medium)	Jet Fuels (**JP-4**, JP-5, JP-7, JP-8), kerosene. n-nonane, n-decane, n-undecane, n-dodecane, pentylcyclopentane,n-tridecane, tetradecane, pentadecane, hexadecane.	100.0
Total Petroleum Hydrocarbons (Aliphatic High)	Mineral oils. n-heptadecane, n-octadecane, n-nonadecane, n-eicosadecane, n-heneicosane, n-docosane, n-tetracosane, n-hexacosane.	60,000.0
Total Petroleum Hydrocarbons (Aromatic Low)	Benzene, toluene, ethylbenzene, xylenes, styrene	33.0
Total Petroleum Hydrocarbons (Aromatic Medium)	n-butylbenzene, trimethylbenzene, alkylbenzenes, Isopropyl benzene, naphthalene, 2-methylnaphthalene, Acenphthene, Biphenyl	5.5
Total Petroleum Hydrocarbons (Aromatic High)	fluorene, phenanthrene, Anthracene, fluoranthene, benzo(a,e)pyrene, pyrene, benz(a)anthracene, benzo(b,j,k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenz(a,h)anthracene.	800.0

Table 5. CRDLs Compared to RSLs for Surface Water and Groundwater

Analyte	CAS	Analysis	Tap Water RSL	MCL	CRDL	CRDL> MCL/RSL
			(µg/L)	(µg/L)	(µg/L)	
1,1,1-Trichloroethane	71-55-6	VOC	8000	2.0E+02	2.0E+00	No
1,1,2,2-Tetrachloroethane	79-34-5	VOC	0.076	N/A	2.0E+00	>RSL
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	VOC	55000	N/A	1.0E+01	No
1,1,2-Trichloroethane	79-00-5	VOC	0.28	5.0E+00	1.0E+00	>RSL
1,1-Dichloroethane	75-34-3	VOC	2.8	N/A	1.0E+00	No
1,1-Dichloroethylene	75-35-4	VOC	280	7.0E+00	1.9E+01	>MCL
1,2,3-Trichlorobenzene	87-61-6	VOC	7	N/A	8.8E-01	No
1,2,4-Trichlorobenzene	120-82-1	VOC	1.2	7.0E+01	1.4E-01	No
1,2-Dibromo-3-chloropropane	96-12-8	VOC	0.00033	2.0E-01	1.0E+00	>RSL/MCL
1,2-Dibromoethane	106-93-4	VOC	0.0075	5.0E-02	2.0E+00	>RSL/MCL
1,2-Dichlorobenzene	95-50-1	VOC	300	6.0E+02	1.0E+00	No
1,2-Dichloroethane (EDC)	107-06-2	VOC	0.17	5.0E+00	4.0E-01	>RSL
1,2-Dichloropropane	78-87-5	VOC	0.44	5.0E+00	1.0E+01	>RSL/MCL
1,3-Dichlorobenzene	541-73-1	VOC	N/A	N/A	2.0E+00	No
1,4-Dichlorobenzene	106-46-7	VOC	0.48	7.5E+01	8.0E+00	>RSL
1,4-Dioxane	123-91-1	VOC	0.46	N/A	6.0E+00	No
2-Hexanone	591-78-6	VOC	38	N/A	2.0E+00	No
Acetone	67-64-1	VOC	14000	N/A	2.0E+00	No
Benzene	71-43-2	VOC	0.46	5.0E+00	2.0E+00	>RSL
Bromochloromethane	74-97-5	VOC	83	N/A	1.0E+01	No
Bromodichloromethane	75-27-4	VOC	0.13	N/A	1.0E+00	>RSL
Bromoform (Tribromomethane)	75-25-2	VOC	3.3	N/A	1.0E+00	No
Bromomethane (Methyl bromide)	74-83-9	VOC	7.5	N/A	9.6E-03	No
Carbon disulfide	75-15-0	VOC	810	N/A	C	No
Carbon tetrachloride	56-23-5	VOC	0.46	5.0E+00	2.0E+00	>RSL
Chlorobenzene	108-90-7	VOC	78	1.0E+02	1.0E+01	No
Chloroethane -(Ethyl chloride)	75-00-3	VOC	21000	N/A	2.0E+00	No
Chloroethene (Vinyl chloride)	75-01-4	VOC	0.019	2.0E+00	1.0E+00	>RSL
Chloroform	67-66-3	VOC	0.22	N/A	6.5E+00	>RSL
Chloromethane (Methyl chloride)	74-87-3	VOC	190	N/A	2.0E+00	No
cis-1,2-Dichloroethylene	156-59-2	VOC	36	7.0E+01	2.0E-01	No
cis-1,3-Dichloropropene	10061-01-5	VOC	N/A	N/A	6.0E-01	No
Cumene (Isopropylbenzene)	98-82-8	VOC	450	N/A	1.0E+00	No
Cyclohexane	110-82-7	VOC	13000	N/A	1.5E+01	No
Dibromochloromethane	124-48-1	VOC	0.87	N/A	2.0E+00	>RSL
Dichlorodifluoromethane	75-71-8	VOC	200	N/A	7.5E-04	No
Dichloromethane (Methylene chloride)	75-09-2	VOC	11	5.0E+00	1.0E+00	No
Ethylbenzene	100-41-4	VOC	1.5	7.0E+02	6.0E+00	>RSL
m,p-Xylene	1330-20-7	VOC	190	1.0E+04	4.0E-01	No
Methyl acetate	79-20-9	VOC	20000	N/A	1.0E+00	No
Methyl ethyl ketone	78-93-3	VOC	5600	N/A	2.0E+01	No

Table 5. CRDLs Compared to RSLs for Surface Water and Groundwater (*Continued*)

Analyte	CAS	Analysis	Tap Water RSL (µg/L)	MCL (µg/L)	CRDL (µg/L)	CRDL> MCL/RSL
Methyl isobutyl ketone	108-10-1	VOC	6300	N/A	1.0E+01	No
Methyl tertiary butyl ether (MTBE)	1634-04-4	VOC	14	N/A	2.0E+00	No
Methylcyclohexane	108-87-2	VOC	N/A	N/A	1.5E+02	No
o-Xylenes	95-47-6	VOC	190	N/A	1.0E+00	No
Styrene	100-42-5	VOC	1200	1.0E+02	5.0E+01	No
Tetrachloroethylene (PCE)	127-18-4	VOC	11	5.0E+00	2.0E+00	>RSL
Toluene	108-88-3	VOC	1100	1.0E+03	1.0E+01	No
trans-1,2-Dichloroethylene	156-60-5	VOC	360	1.0E+02	2.0E-01	No
trans-1,3-Dichloropropene	10061-02-6	VOC	N/A	N/A	8.0E+00	No
Trichloroethylene (TCE)	79-01-6	VOC	0.49	5.0E+00	1.0E+00	No
Trichlorofluoromethane	75-69-4	VOC	5200	N/A	2.0E-01	No
1,1'-BIPHENYL	92-52-4	SVOC	0.83	N/A	10	>RSL
1,2,4,5-TETRACHLOROBENZENE	95-94-3	SVOC	1.7	N/A	10	>RSL
1,2,4-TRICHLOROBENZENE	120-82-1	SVOC	1.2	70	10	>RSL
1,2-DICHLOROBENZENE	95-50-1	SVOC	300	600	10	No
1,2-DIPHENYLHYDRAZINE	122-66-7	SVOC	0.078	N/A	10	>RSL
1,3,5-TRINITROBENZENE	99-35-4	SVOC	590	N/A	29	No
1,3-DICHLOROBENZENE	541-73-1	SVOC	N/A	N/A	10	No
1,3-DINITROBENZENE	99-65-0	SVOC	2	N/A	10	>RSL
1,4-DICHLOROBENZENE	106-46-7	SVOC	0.48	75	10	>RSL
1,4-DINITROBENZENE	100-25-4	SVOC	2	N/A	10	>RSL
1,4-DIOXANE	123-91-1	SVOC	0.46	N/A	10	>RSL
1,4-NAPHTHOQUINONE	130-15-4	SVOC	N/A	N/A	29	No
1-NAPHTHYLAMINE	134-32-7	SVOC	N/A	N/A	10	No
2,3,4,6-TETRACHLOROPHENOL	58-90-2	SVOC	240	N/A	23	No
2,4,5-TRICHLOROPHENOL	95-95-4	SVOC	1200	N/A	10	No
2,4,6-TRICHLOROPHENOL	88-06-2	SVOC	4.1	N/A	10	>RSL
2,4-DICHLOROPHENOL	120-83-2	SVOC	46	N/A	10	No
2,4-DIMETHYLPHENOL	105-67-9	SVOC	360	N/A	10	No
2,4-DINITROPHENOL	51-28-5	SVOC	39	N/A	30	No
2,4-DINITROTOLUENE	121-14-2	SVOC	0.24	N/A	10	>RSL
2,6-DICHLOROPHENOL	87-65-0	SVOC	N/A	N/A	10	No
2,6-DINITROTOLUENE	606-20-2	SVOC	0.049	N/A	10	>RSL
2-ACETYLAMINOFLUORENE	53-96-3	SVOC	0.016	N/A	54	>RSL
2-CHLORONAPHTHALENE	91-58-7	SVOC	750	N/A	4	No
2-CHLOROPHENOL	95-57-8	SVOC	91	N/A	10	No
2-METHYLANILINE (O-TOLUIDINE)	95-53-4	SVOC	4.7	N/A	15	>RSL
2-METHYLNAPHTHALENE	91-57-6	SVOC	36	N/A	4	No
2-NAPHTHYLAMINE	91-59-8	SVOC	0.039	N/A	10	>RSL

Table 5. CRDLs Compared to RSLs for Surface Water and Groundwater *(Continued)*

Analyte	CAS	Analysis	Tap Water RSL (µg/L)	MCL (µg/L)	CRDL (µg/L)	CRDL> MCL/RSL
2-NITROANILINE	88-74-4	SVOC	190	N/A	10	No
2-NITROPHENOL	88-75-5	SVOC	N/A	N/A	10	No
2-PICOLINE	109-06-8	SVOC	N/A	N/A	16	No
3,3-DICHLOROBENZIDINE	91-94-1	SVOC	0.13	N/A	23	>RSL
3,3'-DIMETHYLBENZIDINE	119-93-7	SVOC	0.0065	N/A	29	>RSL
3-METHYLCHOLANTHRENE	56-49-5	SVOC	0.0011	N/A	15	>RSL
4-AMINOBIPHENYL	92-67-1	SVOC	0.003	N/A	29	>RSL
4-BROMOPHENYL PHENYL ETHER	101-55-3	SVOC	N/A	N/A	10	No
4-CHLOROANILINE	106-47-8	SVOC	0.37	N/A	10	>RSL
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	SVOC	N/A	N/A	10	No
4-NITROPHENOL	100-02-7	SVOC	N/A	N/A	10	No
4-NITROQUINOLINE-1-OXIDE	56-57-5	SVOC	N/A	N/A	63	No
5-NITRO-O-TOLUIDINE	99-55-8	SVOC	8.2	N/A	15	>RSL
7,12-DIMETHYLBENZ(A)ANTHRACENE	57-97-6	SVOC	0.0001	N/A	15	>RSL
A,A-DIMETHYLPHENETHYLAMINE	122-09-8	SVOC	N/A	N/A	29	No
ACENAPHTHENE	83-32-9	SVOC	530	N/A	4	No
ACENAPHTHYLENE	208-96-8	SVOC	N/A	N/A	4	No
ACETOPHENONE	98-86-2	SVOC	1900	N/A	10	No
ANILINE	62-53-3	SVOC	13	N/A	10	No
ANTHRACENE	120-12-7	SVOC	1800	N/A	4	No
ARAMITE	140-57-8	SVOC	1.3	N/A	16	>RSL
ATRAZINE	1912-24-9	SVOC	0.3	3	10	>RSL/MCL
BENZALDEHYDE	100-52-7	SVOC	19	N/A	10	No
BENZIDINE	92-87-5	SVOC	0.00011	N/A	53	>RSL
BENZO(G,H,I)PERYLENE	191-24-2	SVOC	N/A	N/A	4	No
BENZO[A]ANTHRACENE	56-55-3	SVOC	0.012	N/A	4	>RSL
BENZO[A]PYRENE	50-32-8	SVOC	0.0034	0.2	4	>RSL/MCL
BENZO[B]FLUORANTHENE	205-99-2	SVOC	0.034	N/A	4	>RSL
BENZO[K]FLUORANTHENE	207-08-9	SVOC	0.34	N/A	4	>RSL
BENZOIC ACID	65-85-0	SVOC	75000	N/A	29	No
BENZYL ALCOHOL	100-51-6	SVOC	2000	N/A	10	No
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	SVOC	710	N/A	10	No
BIS(2-CHLOROETHOXY)METHANE	111-91-1	SVOC	59	N/A	10	No
BIS(2-CHLOROETHYL)ETHER	111-44-4	SVOC	0.014	N/A	10	>RSL
BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	117-81-7	SVOC	5.6	6	10	>RSL/MCL
BUTYL BENZYL PHTHALATE	85-68-7	SVOC	16	N/A	10	No
CAPROLACTAM	105-60-2	SVOC	9900	N/A	10	No
CARBAZOLE	86-74-8	SVOC	N/A	N/A	3	No
CHLOROBENZILATE	510-15-6	SVOC	0.31	N/A	10	>RSL
CHRYSENE	218-01-9	SVOC	3.4	N/A	4	>RSL
DIALLATE	2303-16-4	SVOC	0.54	N/A	15	>RSL
DIBENZ[AH]ANTHRACENE	53-70-3	SVOC	0.0034	N/A	4	>RSL

Table 5. CRDLs Compared to RSLs for Surface Water and Groundwater *(Continued)*

Analyte	CAS	Analysis	Tap Water RSL (µg/L)	MCL (µg/L)	CRDL (µg/L)	CRDL> MCL/RSL
DIBENZOFURAN	132-64-9	SVOC	7.9	N/A	10	>RSL
DIETHYL PHTHALATE	84-66-2	SVOC	15000	N/A	10	No
DIMETHOATE	60-51-5	SVOC	4	N/A	15	>RSL
DIMETHYL PHTHALATE	131-11-3	SVOC	N/A	N/A	10	No
DI-N-BUTYL PHTHALATE	84-74-2	SVOC	900	N/A	10	No
DINITRO-O-CRESOL	534-52-1	SVOC	1.5	N/A	10	>RSL
DIPHENYLAMINE	122-39-4	SVOC	310	N/A	10	No
DISULFOTON	298-04-4	SVOC	0.5	N/A	29	>RSL
ETHYL METHACRYLATE	97-63-2	SVOC	630	N/A	10	No
ETHYL METHANESULFONATE	62-50-0	SVOC	N/A	N/A	10	No
FAMPHUR	52-85-7	SVOC	N/A	N/A	54	No
FLUORANTHENE	206-44-0	SVOC	800	N/A	4	No
FLUORENE	86-73-7	SVOC	290	N/A	4	No
HEXACHLOROBENZENE	118-74-1	SVOC	0.0098	1	10	>RSL/MCL
HEXACHLOROBUTADIENE	87-68-3	SVOC	0.14	N/A	10	>RSL
HEXACHLOROCYCLOPENTADIENE	77-47-4	SVOC	0.41	50	10	>RSL
HEXACHLOROETHANE	67-72-1	SVOC	0.33	N/A	10	>RSL
HEXACHLOROPHENE	70-30-4	SVOC	6	N/A	439	>RSL
HEXACHLOROPROPENE	1888-71-7	SVOC	N/A	N/A	54	No
INDENO[1,2,3-CD]PYRENE	193-39-5	SVOC	0.034	N/A	4	>RSL
ISODRIN	465-73-6	SVOC	N/A	N/A	10	No
ISOPHORONE	78-59-1	SVOC	78	N/A	10	No
ISOSAFROLE	120-58-1	SVOC	N/A	N/A	15	No
KEPONE	143-50-0	SVOC	0.0035	N/A	31	>RSL
M/P-CRESOL	1319-77-3	SVOC	1500	N/A	13	No
METHAPYRILENE	91-80-5	SVOC	N/A	N/A	29	No
METHYL METHANESULFONATE	66-27-3	SVOC	0.79	N/A	10	>RSL
METHYL PARATHION	298-00-0	SVOC	4.5	N/A	10	>RSL
M-NITROANILINE	99-09-2	SVOC	N/A	N/A	10	No
NAPHTHALENE	91-20-3	SVOC	0.17	N/A	4	>RSL
N-DIOCTYL PHTHALATE	117-84-0	SVOC	200	N/A	10	No
NITROBENZENE	98-95-3	SVOC	0.14	N/A	10	>RSL
N-NITROSODIETHYLAMINE	55-18-5	SVOC	0.00017	N/A	10	>RSL
N-NITROSODIMETHYLAMINE	62-75-9	SVOC	0.00011	N/A	10	>RSL
N-NITROSODI-N-BUTYLAMINE	924-16-3	SVOC	0.0027	N/A	10	>RSL
N-NITROSODIPHENYLAMINE+ DIPHENYLAMINE	NNDPDP	SVOC	N/A	N/A	10	No
N-NITROSODIPROPYLAMINE	621-64-7	SVOC	0.011	N/A	10	>RSL
N-NITROSOMORPHOLINE	59-89-2	SVOC	0.012	N/A	10	>RSL
N-NITROSO-N-METHYLETHYLAMINE	10595-95-6	SVOC	0.00071	N/A	10	>RSL
N-NITROSOPIPERIDINE	100-75-4	SVOC	0.0082	N/A	10	>RSL
N-NITROSOPYRROLIDINE	930-55-2	SVOC	0.037	N/A	10	>RSL
O,O,O-TRIETHYL PHOSPHOROTHIOATE	126-68-1	SVOC	N/A	N/A	29	No
O-CRESOL (2-METHYLPHENOL)	95-48-7	SVOC	930	N/A	10	No

Table 5. CRDLs Compared to RSLs for Surface Water and Groundwater *(Continued/end)*

Analyte	CAS	Analysis	Tap Water RSL (µg/L)	MCL (µg/L)	CRDL (µg/L)	CRDL> MCL/RSL
PARATHION	56-38-2	SVOC	86	N/A	29	No
P-CHLORO-M-CRESOL	59-50-7	SVOC	1400	N/A	10	No
P-DIMETHYLAMINOAZOBENZENE	60-11-7	SVOC	0.005	N/A	10	>RSL
PENTACHLOROBENZENE	608-93-5	SVOC	3.2	N/A	10	>RSL
PENTACHLOROETHANE	76-01-7	SVOC	0.65	N/A	29	>RSL
PENTACHLORONITROBENZENE	82-68-8	SVOC	0.12	N/A	29	>RSL
PENTACHLOROPHENOL	87-86-5	SVOC	0.041	1	23	>RSL/MCL
PHENACETIN	62-44-2	SVOC	34	N/A	15	No
PHENANTHRENE	85-01-8	SVOC	N/A	N/A	4	No
PHENOL	108-95-2	SVOC	5800	N/A	10	No
PHORATE	298-02-2	SVOC	3	N/A	29	>RSL
P-NITROANILINE	100-01-6	SVOC	3.8	N/A	10	>RSL
P-PHENYLENEDIAMINE	106-50-3	SVOC	3800	N/A	299	No
PRONAMIDE	23950-58-5	SVOC	1200	N/A	15	No
PYRENE	129-00-0	SVOC	120	N/A	4	No
PYRIDINE	110-86-1	SVOC	20	N/A	16	No
SAFROLE	94-59-7	SVOC	0.096	N/A	15	>RSL
SULFOTEPP	3689-24-5	SVOC	7.1	N/A	34	>RSL
THIONAZIN	297-97-2	SVOC	N/A	N/A	29	No
N-Heptane[1]	142-82-5	GC-MS	1,300	N/A	TBD	TBD
N-Nonane	111-84-2	GC-MS	5.30	N/A	TBD	TBD
N-Decane[2]	124-18-5	GC-MS	100	N/A	TBD	TBD
N-Undecane[2]	1120-21-4	GC-MS	100	N/A	TBD	TBD
N-Dodecane[2]	112-40-3	GC-MS	100	N/A	TBD	TBD
Tritium[3]	10028-17-8	Radio-logical	N/A	20 pCi/mL	15.00	No

Table 4 Notes:
C = Laboratories instructed to obtain lowest DL
N/A = Not Available
>RSL = CRDL is greater than the RSL
>MCL = CRDL is greater than the MCL
>RSL/MCL = CRDL is greater than both the RSL and MCL
TBD = To Be Decided
RSLs from May 2016
1) TPH Aliphatic Low group RSL used for constituent.
2) TPH Aliphatic Medium group RSL used for constituent.
3)Tritium units are pCi/mL.

Table 6. Analytical Specifications for VOCs, SVOCs and Tritium in Water

Analyte	Analyte ID	Preparation B Method	Analytical B Method	CRDL A (µg/L)
Volatiles				
1,1,1-Trichloroethane	71-55-6	5021A,5030C,5031,5032	EPA8260B	1
1,1,2,2-Tetrachloroethane	79-34-5	5021A,5030C,5031,5032	EPA8260B	1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5021A,5030C,5031,5032	EPA8260B	C
1,1,2-Trichloroethane	79-00-5	5021A,5030C,5031,5032	EPA8260B	1
1,1-Dichloroethane	75-34-3	5021A,5030C,5031,5032	EPA8260B	1
1,1-Dichloroethylene	75-35-4	5021A,5030C,5031,5032	EPA8260B	1
1,2,4-Trichlorobenzene	120-82-1	5021A,5030C,5031,5032	EPA8260B	19.4
1,2-Dibromo-3-chloropropane	96-12-8	5021A,5030C,5031,5032	EPA8260B	0.2
1,2-Dibromoethane	106-93-4	5021A,5030C,5031,5032	EPA8260B	0.00075
1,2-Dichlorobenzene	95-50-1	5021A,5030C,5031,5032	EPA8260B	10
1,2-Dichloroethane (EDC)	107-06-2	5021A,5030C,5031,5032	EPA8260B	1
1,2-Dichloropropane	78-87-5	5021A,5030C,5031,5032	EPA8260B	1
1,3-Dichlorobenzene	541-73-1	5021A,5030C,5031,5032	EPA8260B	10
1,4-Dichlorobenzene	106-46-7	5021A,5030C,5031,5032	EPA8260B	10
2-Hexanone	591-78-6	5021A,5030C,5031,5032	EPA8260B	10
Acetone	67-64-1	5021A,5030C,5031,5032	EPA8260B	20
Benzene	71-43-2	5021A,5030C,5031,5032	EPA8260B	1
Bromodichloromethane	75-27-4	5021A,5030C,5031,5032	EPA8260B	1
Bromoform (Tribromomethane)	75-25-2	5021A,5030C,5031,5032	EPA8260B	1
Bromomethane (Methyl bromide)	74-83-9	5021A,5030C,5031,5032	EPA8260B	2
Carbon disulfide	75-15-0	5021A,5030C,5031,5032	EPA8260B	1
Carbon tetrachloride	56-23-5	5021A,5030C,5031,5032	EPA8260B	1
Chlorobenzene	108-90-7	5021A,5030C,5031,5032	EPA8260B	1
Chloroethane	75-00-3	5021A,5030C,5031,5032	EPA8260B	2
Chloroethene (Vinyl chloride)	75-01-4	5021A,5030C,5031,5032	EPA8260B	2
Chloroform	67-66-3	5021A,5030C,5031,5032	EPA8260B	1
Chloromethane (Methyl chloride)	74-87-3	5021A,5030C,5031,5032	EPA8260B	1.5
cis-1,2-Dichloroethylene	156-59-2	5021A,5030C,5031,5032	EPA8260B	1
cis-1,3-Dichloropropene	10061-01-5	5021A,5030C,5031,5032	EPA8260B	1
Cumene (Isopropylbenzene)	98-82-8	5021A,5030C,5031,5032	EPA8260B	0.875
Cyclohexane	110-82-7	5021A,5030C,5031,5032	EPA8260B	1
Dibromochloromethane	124-48-1	5021A,5030C,5031,5032	EPA8260B	1
Dichlorodifluoromethane	75-71-8	5021A,5030C,5031,5032	EPA8260B	1
Dichloromethane (Methylene chloride)	75-09-2	5021A,5030C,5031,5032	EPA8260B	1
Ethylbenzene	100-41-4	5021A,5030C,5031,5032	EPA8260B	1
Methyl acetate	79-20-9	5021A,5030C,5031,5032	EPA8260B	10
Methyl ethyl ketone	78-93-3	5021A,5030C,5031,5032	EPA8260B	20
Methyl isobutyl ketone	108-10-1	5021A,5030C,5031,5032	EPA8260B	10
Methyl tertiary butyl ether (MTBE)	1634-04-4	5021A,5030C,5031,5032	EPA8260B	10
Methylcyclohexane	108-87-2	5021A,5030C,5031,5032	EPA8260B	10
Styrene	100-42-5	5021A,5030C,5031,5032	EPA8260B	1
Tetrachloroethylene (PCE)	127-18-4	5021A,5030C,5031,5032	EPA8260B	1
Toluene	108-88-3	5021A,5030C,5031,5032	EPA8260B	1

Table 6. Analytical Specifications for VOCs, SVOCs and Tritium in Water *(Continued)*

Analyte	Analyte ID	Preparation B Method	Analytical B Method	CRDL A (µg/L)
Volatiles (Continued)				
trans-1,2-Dichloroethylene	156-60-5	5021A,5030C,5031,5032	EPA8260B	1
trans-1,3-Dichloropropene	10061-02-6	5021A,5030C,5031,5032	EPA8260B	1
Trichloroethylene (TCE)	79-01-6	5021A,5030C,5031,5032	EPA8260B	1
Trichlorofluoromethane	75-69-4	5021A,5030C,5031,5032	EPA8260B	1
o-Xylenes	95-47-6	5021A,5030C,5031,5032	EPA8260B	1
m,p-Xylene	MPXYL	5021A,5030C,5031,5032	EPA8260B	1
Bromochloromethane	74-97-5	5021A,5030C,5031,5032	EPA8260B	1
1,4-Dioxane	123-91-1	5021A,5030C,5031,5032	EPA8260B	100
1,2-Dichlorobenzene	95-50-1	5021A,5030C,5031,5032	EPA8260B	1
1,2,3-Trichlorobenzene	87-61-6	5021A,5030C,5031,5032	EPA8260B	1
Semi-Volatiles				
1,1'-BIPHENYL	92-52-4	3510 and 3520	EPA8270D	10
1,2,4,5-TETRACHLOROBENZENE	95-94-3	3510 and 3520	EPA8270D	10
1,2,4-TRICHLOROBENZENE	120-82-1	3510 and 3520	EPA8270D	10
1,2-DICHLOROBENZENE	95-50-1	3510 and 3520	EPA8270D	10
1,2-DIPHENYLHYDRAZINE	122-66-7	3510 and 3520	EPA8270D	10
1,3,5-TRINITROBENZENE	99-35-4	3510 and 3520	EPA8270D	29
1,3-DICHLOROBENZENE	541-73-1	3510 and 3520	EPA8270D	10
1,3-DINITROBENZENE	99-65-0	3510 and 3520	EPA8270D	10
1,4-DICHLOROBENZENE	106-46-7	3510 and 3520	EPA8270D	10
1,4-DINITROBENZENE	100-25-4	3510 and 3520	EPA8270D	10
1,4-DIOXANE	123-91-1	3510 and 3520	EPA8270D	10
1,4-NAPHTHOQUINONE	130-15-4	3510 and 3520	EPA8270D	29
1-NAPHTHYLAMINE	134-32-7	3510 and 3520	EPA8270D	10
2,3,4,6-TETRACHLOROPHENOL	58-90-2	3510 and 3520	EPA8270D	23
2,4,5-TRICHLOROPHENOL	95-95-4	3510 and 3520	EPA8270D	10
2,4,6-TRICHLOROPHENOL	88-06-2	3510 and 3520	EPA8270D	10
2,4-DICHLOROPHENOL	120-83-2	3510 and 3520	EPA8270D	10
2,4-DIMETHYLPHENOL	105-67-9	3510 and 3520	EPA8270D	10
2,4-DINITROPHENOL	51-28-5	3510 and 3520	EPA8270D	30
2,4-DINITROTOLUENE	121-14-2	3510 and 3520	EPA8270D	10
2,6-DICHLOROPHENOL	87-65-0	3510 and 3520	EPA8270D	10
2,6-DINITROTOLUENE	606-20-2	3510 and 3520	EPA8270D	10
2-ACETYLAMINOFLUORENE	53-96-3	3510 and 3520	EPA8270D	54
2-CHLORONAPHTHALENE	91-58-7	3510 and 3520	EPA8270D	4
2-CHLOROPHENOL	95-57-8	3510 and 3520	EPA8270D	10
2-METHYLANILINE (O-TOLUIDINE)	95-53-4	3510 and 3520	EPA8270D	15
2-METHYLNAPHTHALENE	91-57-6	3510 and 3520	EPA8270D	4
2-NAPHTHYLAMINE	91-59-8	3510 and 3520	EPA8270D	10
2-NITROANILINE	88-74-4	3510 and 3520	EPA8270D	10
2-NITROPHENOL	88-75-5	3510 and 3520	EPA8270D	10
2-PICOLINE	109-06-8	3510 and 3520	EPA8270D	16
3,3-DICHLOROBENZIDINE	91-94-1	3510 and 3520	EPA8270D	23
3,3'-DIMETHYLBENZIDINE	119-93-7	3510 and 3520	EPA8270D	29
3-METHYLCHOLANTHRENE	56-49-5	3510 and 3520	EPA8270D	15
4-AMINOBIPHENYL	92-67-1	3510 and 3520	EPA8270D	29
4-BROMOPHENYL PHENYL ETHER	101-55-3	3510 and 3520	EPA8270D	10
4-CHLOROANILINE	106-47-8	3510 and 3520	EPA8270D	10

Table 6. Analytical Specifications for VOCs, SVOCs and Tritium in Water *(Continued)*

Analyte	Analyte ID	Preparation [B] Method	Analytical [B] Method	CRDL [A] (µg/L)
Semi-Volatiles (Continued)				
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	3510 and 3520	EPA8270D	10
4-NITROPHENOL	100-02-7	3510 and 3520	EPA8270D	10
4-NITROQUINOLINE-1-OXIDE	56-57-5	3510 and 3520	EPA8270D	63
5-NITRO-O-TOLUIDINE	99-55-8	3510 and 3520	EPA8270D	15
7,12-DIMETHYLBENZ(A)ANTHRACENE	57-97-6	3510 and 3520	EPA8270D	15
A,A-DIMETHYLPHENETHYLAMINE	122-09-8	3510 and 3520	EPA8270D	29
ACENAPHTHENE	83-32-9	3510 and 3520	EPA8270D	4
ACENAPHTHYLENE	208-96-8	3510 and 3520	EPA8270D	4
ACETOPHENONE	98-86-2	3510 and 3520	EPA8270D	10
ANILINE	62-53-3	3510 and 3520	EPA8270D	10
ANTHRACENE	120-12-7	3510 and 3520	EPA8270D	4
ARAMITE	140-57-8	3510 and 3520	EPA8270D	16
ATRAZINE	1912-24-9	3510 and 3520	EPA8270D	10
BENZALDEHYDE	100-52-7	3510 and 3520	EPA8270D	10
BENZIDINE	92-87-5	3510 and 3520	EPA8270D	53
BENZO(G,H,I)PERYLENE	191-24-2	3510 and 3520	EPA8270D	4
BENZO[A]ANTHRACENE	56-55-3	3510 and 3520	EPA8270D	4
BENZO[A]PYRENE	50-32-8	3510 and 3520	EPA8270D	4
BENZO[B]FLUORANTHENE	205-99-2	3510 and 3520	EPA8270D	4
BENZO[K]FLUORANTHENE	207-08-9	3510 and 3520	EPA8270D	4
BENZOIC ACID	65-85-0	3510 and 3520	EPA8270D	29
BENZYL ALCOHOL	100-51-6	3510 and 3520	EPA8270D	10
BIS(2-CHLORO-1-METHYLETHYL)ETHER	108-60-1	3510 and 3520	EPA8270D	10
BIS(2-CHLOROETHOXY)METHANE	111-91-1	3510 and 3520	EPA8270D	10
BIS(2-CHLOROETHYL)ETHER	111-44-4	3510 and 3520	EPA8270D	10
BIS(2-ETHYLHEXYL)PHTHALATE (DEHP)	117-81-7	3510 and 3520	EPA8270D	10
BUTYL BENZYL PHTHALATE	85-68-7	3510 and 3520	EPA8270D	10
CAPROLACTAM	105-60-2	3510 and 3520	EPA8270D	10
CARBAZOLE	86-74-8	3510 and 3520	EPA8270D	3
CHLOROBENZILATE	510-15-6	3510 and 3520	EPA8270D	10
CHRYSENE	218-01-9	3510 and 3520	EPA8270D	4
DIALLATE	2303-16-4	3510 and 3520	EPA8270D	15
DIBENZ[AH]ANTHRACENE	53-70-3	3510 and 3520	EPA8270D	4
DIBENZOFURAN	132-64-9	3510 and 3520	EPA8270D	10
DIETHYL PHTHALATE	84-66-2	3510 and 3520	EPA8270D	10
DIMETHOATE	60-51-5	3510 and 3520	EPA8270D	15
DIMETHYL PHTHALATE	131-11-3	3510 and 3520	EPA8270D	10
DI-N-BUTYL PHTHALATE	84-74-2	3510 and 3520	EPA8270D	10
DINITRO-O-CRESOL	534-52-1	3510 and 3520	EPA8270D	10
DIPHENYLAMINE	122-39-4	3510 and 3520	EPA8270D	10
DISULFOTON	298-04-4	3510 and 3520	EPA8270D	29
ETHYL METHACRYLATE	97-63-2	3510 and 3520	EPA8270D	10
ETHYL METHANESULFONATE	62-50-0	3510 and 3520	EPA8270D	10
FAMPHUR	52-85-7	3510 and 3520	EPA8270D	54
FLUORANTHENE	206-44-0	3510 and 3520	EPA8270D	4
FLUORENE	86-73-7	3510 and 3520	EPA8270D	4
HEXACHLOROBENZENE	118-74-1	3510 and 3520	EPA8270D	10

Table 6. Analytical Specifications for VOCs, SVOCs and Tritium in Water *(Continued)*

Analyte	Analyte ID	Preparation [B] Method	Analytical [B] Method	CRDL [A] (µg/L)
Semi-Volatiles (Continued)				
HEXACHLOROBUTADIENE	87-68-3	3510 and 3520	EPA8270D	10
HEXACHLOROCYCLOPENTADIENE	77-47-4	3510 and 3520	EPA8270D	10
HEXACHLOROETHANE	67-72-1	3510 and 3520	EPA8270D	10
HEXACHLOROPHENE	70-30-4	3510 and 3520	EPA8270D	439
HEXACHLOROPROPENE	1888-71-7	3510 and 3520	EPA8270D	54
INDENO[1,2,3-CD]PYRENE	193-39-5	3510 and 3520	EPA8270D	4
ISODRIN	465-73-6	3510 and 3520	EPA8270D	10
ISOPHORONE	78-59-1	3510 and 3520	EPA8270D	10
ISOSAFROLE	120-58-1	3510 and 3520	EPA8270D	15
KEPONE	143-50-0	3510 and 3520	EPA8270D	31
M/P-CRESOL	1319-77-3	3510 and 3520	EPA8270D	13
METHAPYRILENE	91-80-5	3510 and 3520	EPA8270D	29
METHYL METHANESULFONATE	66-27-3	3510 and 3520	EPA8270D	10
METHYL PARATHION	298-00-0	3510 and 3520	EPA8270D	10
M-NITROANILINE	99-09-2	3510 and 3520	EPA8270D	10
NAPHTHALENE	91-20-3	3510 and 3520	EPA8270D	4
N-DIOCTYL PHTHALATE	117-84-0	3510 and 3520	EPA8270D	10
NITROBENZENE	98-95-3	3510 and 3520	EPA8270D	10
N-NITROSODIETHYLAMINE	55-18-5	3510 and 3520	EPA8270D	10
N-NITROSODIMETHYLAMINE	62-75-9	3510 and 3520	EPA8270D	10
N-NITROSODI-N-BUTYLAMINE	924-16-3	3510 and 3520	EPA8270D	10
N-NITROSODIPHENYLAMINE+ DIPHENYLAMINE	NNDPDP	3510 and 3520	EPA8270D	10
N-NITROSODIPROPYLAMINE	621-64-7	3510 and 3520	EPA8270D	10
N-NITROSOMORPHOLINE	59-89-2	3510 and 3520	EPA8270D	10
N-NITROSO-N-METHYLETHYLAMINE	10595-95-6	3510 and 3520	EPA8270D	10
N-NITROSOPIPERIDINE	100-75-4	3510 and 3520	EPA8270D	10
N-NITROSOPYRROLIDINE	930-55-2	3510 and 3520	EPA8270D	10
O,O,O-TRIETHYL PHOSPHOROTHIOATE	126-68-1	3510 and 3520	EPA8270D	29
O-CRESOL (2-METHYLPHENOL)	95-48-7	3510 and 3520	EPA8270D	10
PARATHION	56-38-2	3510 and 3520	EPA8270D	29
P-CHLORO-M-CRESOL	59-50-7	3510 and 3520	EPA8270D	10
P-DIMETHYLAMINOAZOBENZENE	60-11-7	3510 and 3520	EPA8270D	10
PENTACHLOROBENZENE	608-93-5	3510 and 3520	EPA8270D	10
PENTACHLOROETHANE	76-01-7	3510 and 3520	EPA8270D	29
PENTACHLORONITROBENZENE	82-68-8	3510 and 3520	EPA8270D	29
PENTACHLOROPHENOL	87-86-5	3510 and 3520	EPA8270D	23
PHENACETIN	62-44-2	3510 and 3520	EPA8270D	15
PHENANTHRENE	85-01-8	3510 and 3520	EPA8270D	4
PHENOL	108-95-2	3510 and 3520	EPA8270D	10
PHORATE	298-02-2	3510 and 3520	EPA8270D	29
P-NITROANILINE	100-01-6	3510 and 3520	EPA8270D	10
P-PHENYLENEDIAMINE	106-50-3	3510 and 3520	EPA8270D	299
PRONAMIDE	23950-58-5	3510 and 3520	EPA8270D	15
PYRENE	129-00-0	3510 and 3520	EPA8270D	4
PYRIDINE	110-86-1	3510 and 3520	EPA8270D	16
SAFROLE	94-59-7	3510 and 3520	EPA8270D	15
SULFOTEPP	3689-24-5	3510 and 3520	EPA8270D	34

Table 6. Analytical Specifications for VOCs, SVOCs and Tritium in Water *(Continued/end)*

Analyte	Analyte ID	Preparation [B] Method	Analytical [B] Method	CRDL [A] (µg/L)
Semi-Volatiles (Continued)				
THIONAZIN	297-97-2	3510 and 3520	EPA8270D	29
TPH - DRO				
TPH by GC/FID Diesel Range Organics	TPHDRO	3510, 3535 and 3550	EPA8015C	200
R&D Analyses Aliphatic Compounds				
N-Heptane	142-82-5	TBD	GC-MS	~1,000 ~~TBD~~
N-Nonane	111-84-2	TBD	GC-MS	~1,000 ~~TBD~~
N-Decane	124-18-5	TBD	GC-MS	~1,000 ~~TBD~~
N-Undecane	1120-21-4	TBD	GC-MS	~1,000 ~~TBD~~
N-Dodecane	112-40-3	TBD	GC-MS	~1,000 ~~TBD~~
Radionuclides				
Tritium	10028-17-8	EPA900.0MOD	EPA900.0MOD	15[D]

Table 5 Notes:

A) CRDL is the Contract Required Detection Limit and is not always attainable.
B) Extraction and preparation methods differ depending upon media, concentration, instrument, laboratory, and analytical method. Preparation methods will also influence detection limits.
C) Laboratory instructed to obtain the lowest possible method detection limit.
D) Units for tritium are pCi/mL.

Table 7. Data Quality Objectives for CAGW OU Groundwater and Surface Water

Pathway (Media)	Probable Conditions	Exposure Pathway and/or Release Mechanisms	Data Needs and DQOs Including Engineering/ Physical Processes	Field Activities Including Removal and Characterization	Parameters	Potential Remedial Action Alternatives
Groundwater and surface water	TCE and Tritium exceeds MCLs in groundwater. TPH diesel range organics exceed 100 µg/L in the groundwater Tritium and TCE exceeds MCL in surface water.	Ingestion, inhalation, absorption, or direct exposure with water.	Collect data to support the CMS/FS. Determine the changing size and concentrations of the TCE and Tritium groundwater plumes discharging to Castor Creek and its tributary. Provide data to implement a removal action on the TCE plume discharging to the unnamed tribu~~a~~tary of Castor Creek. Determine -changes in the TCE plume near the C-Reactor Building (105-C) Establish a groundwater monitoring station downgradient of the Fuel Unloading Facilities Power (108-3C) ~~Determine TPH diesel range organics impact~~	Collect ground-water and surface water samples at 69 locations with existing history throughout C-Area. Establish groundwater monitoring well at Fuel Unloading Facility (108-3C). Establish 3 Seepline stations along Castor Creek based on 2011 temporary seepline stations. Establish 1-2 monitoring well locations upgradient of the unnamed tributary to Castor Creek based on new DPT groundwater samples. Collect soil cores for VOC analyses in the UAZ downgradient of C-Reactor (105-C) to determine variations in the TCE plume near the former source area.	TCL-VOC and tritium for ground-water and surface samples. TCL VOC, TCL SVOC and R&D analyses for aliphatic compounds. All data validated to SRS electronic V&V level.	No Action. Monitored Natural Attenuation (MNA) with Land Use Controls. Phytoremediation (evapotranspiration) for TCE and tritium in groundwater. Anaerobic bioremediation of TCE

			~~to groundwater.~~ ~~Determine the change in surface water tritium concentrations.~~			

Table 8. Preservative, Holding Times, and Sample Containers[1]

	Preservatives[2]		**Holding Time**		**Containers[3]**	
Parameter	**Aqueous**	**Solid**	**Aqueous**	**Solid**	**Aqueous**	**Solid**
VOC Organics[4] Including:						
• 8260- VOCs, • 8021 – Aromatic VOCs, • 8021 Halogenated VOCs, • 8015 –Nonhalogenated VOCs, • 8032 - Acrylamide	No Residual Chlorine ~~p~~Present Adjust pH to <2 with H_2SO_4, HCL, or solid sodium bisulfate ($NaHSO_4$). Cool to 4° C	Low-level soil[5] Add ~5 g soil to 40 mL VOA vial preserved with 1 g of $NaHSO_4$/5 mL water	14 days	Low/High Level 14 days	3 x 40-mL glass VOC vial, PTFE septa cap	3 x 40 (or 60) mL glass VOA vial(s) (with stir bar for low-level soil), Teflon-lined septa cap(s)[6]
• 8033 – Acetonitrile, • 8315 – Carbonyl Compounds[7] Prepared by: • 5030 – Purge and trap (aqueous) • 5035 – Closed system purge and trap (solid)	Residual Chlorine Present Collect sample in a 125-mL container, preserved with 4 drops of 10% sodium thiosulfate (Na2S2O3) solution. Gently swirl to mix and transfer to 40 mL VOC vials. Adjust pH to <2 with H2SO4, HCL, or solid NaHSO4. Cool to 4° C, no headspace					
Prepared by: • 5021 – Automated Headspace	NA	Soil Only Add ~2 g soil to 22 mL soil vial. Cool to 4° C. Soil/Matrix Modifier[8] Add ~2 g soil to 22 mL soil vial preserved with 10 mL matrix modifier. Cool to 4° C. Soil/Water Add ~2 g soil to 22 mL soil vial preserved with 10 mL water. Cool to 4° C.	NA	14 days	NA	2 x 22 mL glass soil headspace vial, Teflon-lined septa with crimp or screw–top cap[6]
Prepared by: • 5032 – Vacuum Distillation	Same as VOC – purge and trap	Cool to 4° C. No headspace	14 days	14 days	2 x-40 mL glass vial, PTFE septa cap	2 x 125-mL clear wide-mouth glass jar(s) with Teflon–lined lid(s) (CWM)
Nonpurgeable Water-Soluble VOCs Prepared by: • 5031 - Azeotropic Distillation	Same as VOC – purge and trap	Cool to 4° C. No headspace	14 days	14 days	2 x 40 mL glass vial, Teflon-lined septa cap	2 x 2125 mL CWM
Prepared by: • 3585 – Solvent Dilution	NA	Oily Waste Cool to 4° C.	NA	14 days	NA	125 mL CWM
• 8031 – Acrylonitrile, • 8316 – Acrolein, Acrylamide, Acrylonitrile	Adjust pH to 4-5 with H_2SO_4, HCL, or solid $NaHSO_4$. Cool to4° C.	NA	14 days	NA	2 x 40-mL glass vial, Teflon-lined septa cap	250 mL CWM

Table 8. Preservative, Holding Times, and Sample Containers[1] *(Continued)*

Parameter	**Preservatives[2]**		**Holding Time**		**Containers[3]**	
	Aqueous	**Solid**	**Aqueous**	**Solid**	**Aqueous**	**Solid**
SVOC Organics[4] Including: EPA 8270D						
3510 – Seperatory Funnel Liquid-Liquid Extraction SVOCs (PAHs) EPA – 8270D Semivolatile organic compounds by gas chromatography/ mass spectrometry	Aqueous samples with no residual chlorine present: Cool to 0 6 °C.	N/A	Samples extracted within 7 days and extracts analyzed within 40 days following extraction.	N/A	4 x 1L amber glass container with PTFE-lined lid	N/A
3520 – Continuous Liquid-Liquid Extraction SVOCs EPA – 8270D Semivolatile organic compounds by gas chromatography/ mass spectrometry	Aqueous samples with no residual chlorine present: Cool to 0 6 °C.	N/A	Samples extracted within 7 days and extracts analyzed within 40 days following extraction.	N/A	4 x 1L amber glass container with PTFE-lined lid	N/A
TPH Diesel Range Organics Including: EPA 8270D						
3510C – Seperatory Funnel Liquid-Liquid Extraction SVOCs (PAHs) EPA – 8015C Nonhalogenated Organics Using GC/FID	Aqueous samples with no residual chlorine present: Cool to 0 6 °C.	N/A	Samples extracted within 7 days and extracts analyzed within 40 days following extraction.	N/A	4 x 1L amber glass container with PTFE-lined lid	N/A
3535A – Solid-Phase Extr~~e~~action (SPE)s EPA – 8015C Nonhalogenated Organics Using GC/FID	Aqueous samples with no residual chlorine present: Cool to 0 6 °C.	N/A	Samples extracted within 7 days and extracts analyzed within 40 days following extraction.	N/A	4 x 1L amber glass container with PTFE-lined lid	N/A
Radionuclides						
• Tritium	NA	NA	6 months	6 months	125 mL or 250 mL glass bottle	250 mL or 500 mL glass jar.
SRNL Aliphatic Compounds						

Headspace analysis for Aliphatic organic compounds by gas chromatography/ mass spectrometry.	Aqueous samples with no residual chlorine present: Cool to 0 - 6 °C.	N/A	Samples extracted within 7 days and extracts analyzed within 40 days following extraction.	N/A	2 x-40 mL glass vial, PTFE septa cap	N/A

Table 8~~7~~ NOTES:
1 – Additional standard method manuals may be applicable. Refer to individual methods employed for details.
2 – Reagents should be of appropriate grade or quality as identified within the analytical method.
3 – All containers must have PTFE (Teflon)-lined seals (Teflon-lined septa for volatile organic analytes [VOA] vials).
4 – VOC section is segregated based on prepatory procedures employed. Refer to SW-846 Method 5000 for details on determinative methods application to appropriate preparatory procedures.
5 – Refer to SW-846 Method 5035 for additional preservation options.
6 – Actual number of sample containers necessary for each location is based on project information.
7 – Samples must be derivatized and extracted within 3 days of collection and analyzed within 3 days of extraction.
8 – Refer to SW-846 Method 5021 for details on the matrix modifying solution needed.
9 – Extracts must be stored at -10ºC and in the dark until analysis.
10 – Extracts should be methylated within 48 hours of extraction and analyzed immediately thereafter.
11 – Extracts must be stored at 4ºC and in the dark until analysis
12 – The subset chemical parameters under Extractable Organics may be collected in the same container for soils.
13 – High-concentration waste samples does not need cooling.
14 – Metals and cyanide may be collected in the same container for soils.

Abbreviations used in Table 8~~7~~:

- H_2SO_4 – Sulfuric acid
- HCL – Hydrochloric acid
- $NaHSO_4$ – Sodium bisulfate
- PTFE – Teflon lined seals
- $Na_2S_2O_3$ – Sodium Thiosulfate
- CWM – Clear Wide-Mouth Glass Jar with Teflon-lined Lid
- AG – Amber Glass Bottle with Teflon-lined Lid
- HNO_3 – Nitric acid
- HDPE – High-Density Polyethylene Bottle with Teflon-lined Lid
- BR – Boston Round bottle
- NA – Not Applicable